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USGS/ FEMA Region VI – Bayou Meto, AR LiDAR

Report Produced for U.S. Geological Survey

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Executive Summary

The primary purpose of this project was to develop a consistent and accurate surface elevation dataset derived from high-accuracy Light Detection and Ranging (LiDAR) technology for the USGS FEMA VI Bayou Meto, Arkansas Project Area.

The LiDAR data were processed to a bare-earth digital terrain model (DTM). Detailed breaklines and bare-earth Digital Elevation Models (DEMs) were produced for the project area. Data was formatted according to tiles with each tile covering an area of 1500m by 1500m. A total of 893 tiles were produced for the project encompassing an area of approximately 696 sq. miles.

THE PROJECT TEAM

Dewberry served as the prime contractor for the project. In addition to project management, Dewberry was responsible for LAS classification, all LiDAR products, breakline production, Digital Elevation Model (DEM) production, and quality assurance.

Dewberry's Steven A. Wood completed ground surveying for the project and delivered surveyed checkpoints. His task was to acquire surveyed checkpoints for the project to use in independent testing of the vertical accuracy of the LiDAR-derived surface model. He also verified the GPS base station coordinates used during LiDAR data acquisition to ensure that the base station coordinates were accurate. Please see Appendix A to view the separate Survey Report that was created for this portion of the project.

Laser Mapping Specialist, Inc completed LiDAR data acquisition and data calibration for the project area.

SURVEY AREA

The project area addressed by this report falls within the Arkansas counties of Arkansas, Faulkner, Jefferson, Lonoke, Prairie, and Pulaski.

DATE OF SURVEY

The LiDAR aerial acquisition was conducted from March 26, 2012 thru March 27, 2012.

DATUM REFERENCE

Data produced for the project were delivered in the following reference system.

Horizontal Datum: The horizontal datum for the project is North American Datum of 1983 (NAD 83)
Vertical Datum: The Vertical datum for the project is North American Vertical Datum of 1988 (NAVD88)
Coordinate System: UTM Zone 15
Units: Horizontal units are in meters, Vertical units are in meters.
Geiod Model: Geoid09 (Geoid 09 was used to convert ellipsoid heights to orthometric heights).

LIDAR VERTICAL ACCURACY

For the FEMA VI - Bayou Meto LiDAR Project, the tested $RMSE_z$ of the classified LiDAR data for checkpoints in open terrain equaled **0.05 m** compared with the 0.125 m specification; and the FVA of the classified LiDAR data computed using $RMSE_z$ x 1.9600 was equal to **0.10 m**, compared with the 0.245 m specification.

For the FEMA VI – Bayou Meto LiDAR Project, the tested CVA of the classified LiDAR data computed using the 95th percentile was equal to **0.13 m,** compared with the 0.363 m specification.

Additional accuracy information and statistics for the classified LiDAR data, raw swath data, and bare earth DEM data are found in the following sections of this report.

PROJECT DELIVERABLES

The deliverables for the project are listed below.

1. Raw Point Cloud Data (Swaths)
2. Classified Point Cloud Data (Tiled)
3. Bare Earth Surface (Raster DEM – IMG Format)
4. Intensity Images (8-bit gray scale, tiled, GeoTIFF format)
5. Breakline Data (File GDB)
6. Control & Accuracy Checkpoint Report & Points
7. Metadata
8. Project Report (Acquisition, Processing, QC)
9. Project Extents, Including a shapefile derived from the LiDAR Deliverable

PROJECT TILING FOOTPRINT

Eight hundred ninety three (893) tiles were delivered for the project. Each tile's extent is 1,500 meters by 1,500 meters (see Appendix B for a complete listing of delivered tiles).

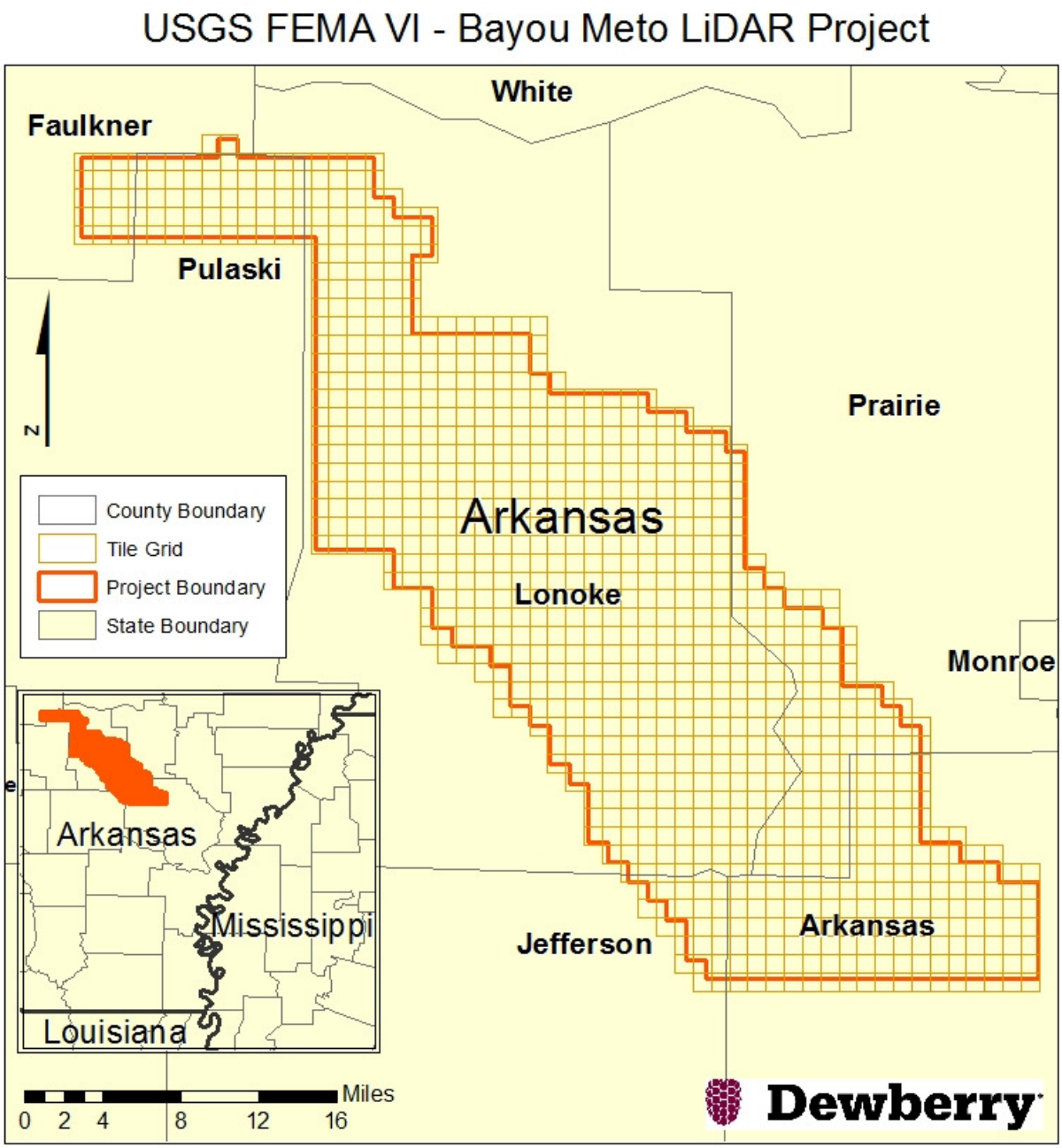


Figure 1 - Project Map

LiDAR Acquisition Report

LMSI provided high accuracy, calibrated multiple return LiDAR for roughly 725 square miles around the Bayou Meto, AR area. Data was collected and delivered in compliance with the "U.S. Geological Survey National Geospatial Program Base LiDAR Specifications, Version 13 – ILMF 2010."

The elevation data was verified internally prior to delivery to ensure it met fundamental accuracy requirements (vertical accuracy NSSDA RMSEz = 12.5 cm (NSSDA AccuracyZ 95% = 24.5cm) or better in open, non-vegetated terrain) when compared to static and kinematic GPS checkpoints. Below is a summary for the test:

The calibrated Bayou Meto LiDAR dataset was tested to 0.039m vertical accuracy at 95% confidence level based on consolidated RMSEz (0.0198m x 1.9600) when compared to 11 GPS static check points.

The calibrated LiDAR dataset was tested to 0.116m vertical accuracy at 95% confidence level based on consolidated RMSEz (0.059m x 1.9600) when compared to 5308 GPS kinematic checkpoints.

LIDAR ACQUISITION DETAILS

LIDAR acquisition began on March 26, 2012 (julian day 085) and was completed on March 27, 2012 (julian day 086). A total of 4 survey missions were flown to complete the project. LMSI utilized an Optech ALTM3100EA for the acquisition. The flight plan was flown as planned with no modifications. There were no unusual occurrences during the acquisition and the sensor performed within specifications. There were 65 flight lines required to complete the project.

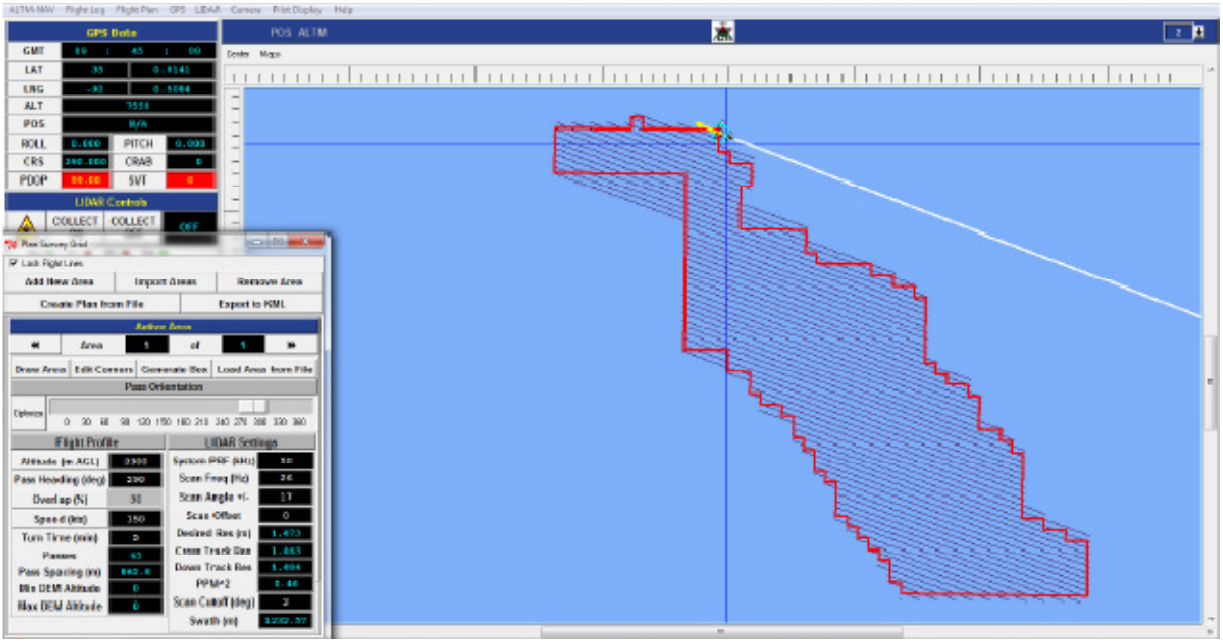


Figure 2 - Flight Layout

Laser Firing Rate: 50000
Altitude (mtr. AGL):2300
Swath Overlap (%): 30
Approx. Ground Speed (kts): 150
Scan Rate (Hz): 26
Scan Angle (°±): 17
Computed Along Track Spacing (mtr): 1.5
Computed Cross Track Spacing (mtr): 1.5
Computed Swath Width (mtr): 1233
Number of Lines Required: 65
Line Spacing (mtr): 863

AIRBORN GPS KINEMATIC

Airborne GPS data was processed using the PosPac kinematic On-The-Fly (OTF) software suite. Flights were flown with a minimum of 6 satellites in view (13° above the horizon) and with a PDOP of better than 4. Distances from base station to aircraft were kept to a maximum of 40km.

For all flights, the GPS data can be classified as excellent, with GPS residuals of 3cm average or better but no larger than 10cm being recorded.

GPS processing reports for each mission are included in Appendix C.

GENERATION AND CALIBRATION OF LASER POINTS (RAW DATA)

The initial step of calibration is to verify availability and status of all needed GPS and Laser data against field notes and compile any data if not complete.

Subsequently the mission points are output using Optech's Dashmap, initially with default values from Optech or the last mission calibrated for the system. The initial point generation for each mission calibration is verified within Microstation/Terrascan for calibration errors. If a calibration error greater than specification is observed within the mission, the roll, pitch and scanner scale corrections that need to be applied are calculated. The missions with the new calibration values are regenerated and validated internally once again to ensure quality.

All missions are validated against the adjoining missions for relative vertical biases and collected GPS validation points for absolute vertical accuracy purposes.

On a project level, a supplementary coverage check is carried out to ensure no data voids unreported by Field Operations are present.

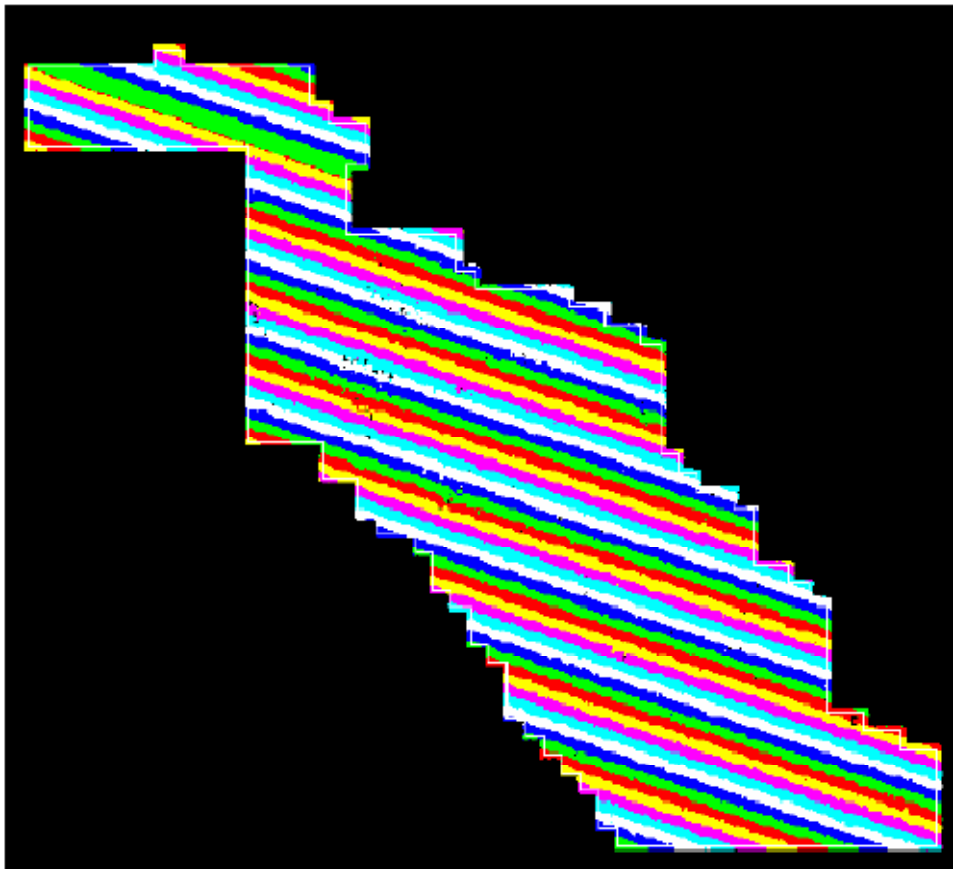


Figure 3 – LiDAR Swath output showing complete coverage.

A final calibration is performed in the office using Terramatch, and a control report is run to compare the data to static GPS control points to ensure accuracy. The following are the final GPS static control reports.

Number	Easting	Northing	Known Z	Laser Z	DZ
1	592127.096	3874124.754	74.686	74.690	+0.004
2	630602.483	3829742.412	66.112	66.120	+0.008
3	614096.449	3823080.107	60.524	60.520	-0.004
4	617445.154	3832043.330	63.910	63.910	-0.000
5	614217.252	3851176.316	72.245	72.250	+0.005
6	586060.661	3850556.514	74.102	74.110	+0.008
7	587800.635	3871286.218	87.554	87.570	+0.016
8	580432.137	3871189.256	103.125	103.130	+0.005
9	629707.438	3816214.395	61.010	61.020	+0.010
10	602901.383	3851870.442	72.773	72.800	+0.027
11	605058.121	3849523.284	70.856	70.870	+0.014

Table 1 - Static GPS Validation

Average dz	+0.008
Minimum dz	-0.004
Maximum dz	+0.027
Average magnitude	0.009
Root mean square	0.012
Std deviation	0.008

CALIBRATION SETUP AND DATA INVENTORY

Data collected by the LiDAR unit is reviewed for completeness, acceptable density and to make sure all data is captured without errors or corrupted values. In addition, all GPS, aircraft trajectory, mission information, and ground control files are reviewed and logged into a database.

BORESIGHT AND RELATIVE ACCURACY

The initial points for each mission calibration are inspected for flight line errors, flight line overlap, slivers or gaps in the data, point data minimums, or issues with the LiDAR unit or GPS. Roll, pitch and scanner scale are optimized during the calibration process until the relative accuracy is met.

Relative accuracy and internal quality are checked using at least 3 regularly spaced QC blocks in which points from all lines are loaded and inspected. Vertical differences between ground surfaces of each line are displayed. Color scale is adjusted so that errors greater than the specifications are flagged. Cross sections are visually inspected across each block to validate point to point, flight line to flight line and mission to mission agreement.

For this project the specifications used are as follow:
Relative accuracy <= 7cm RMSEZ within individual swaths and <=10 cm RMSEZ or within swath overlap (between adjacent swaths).

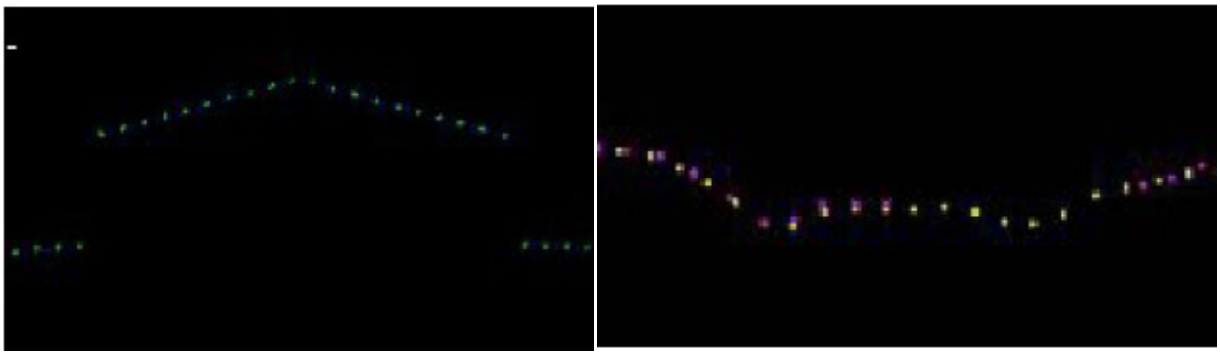


Figure 4 – Profile views showing correct roll and pitch adjustments.

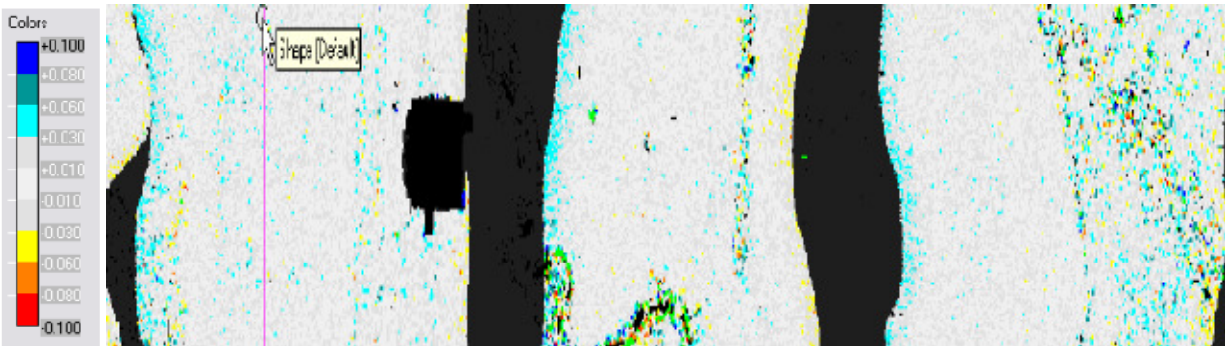


Figure 5 – QC block colored by distance to ensure accuracy at swath edges.

A different set of QC blocks are generated for final review after all transformations have been applied.

ABSOLUTE ACCURACY

A preliminary RMSEz error check is performed at this stage of the project life cycle in the raw LiDAR dataset against GPS static and kinematic data and compared to RMSEz project specifications. The LiDAR data is examined in open, flat areas away from breaks. LiDAR ground points for each flight line generated by an automatic classification routine are used.

Results:
Prior to delivery to Dewberry the elevation data was verified internally to ensure it met fundamental accuracy requirements of 24.5cm vertical accuracy at the 95% confidence level (2 sigma = RMSE x 1.96) in when compared to LMSI kinematic and static GPS checkpoints.

Data is compiled to meet 1m horizontal accuracy at the 95% confidence level (2 sigma = RMSE x 1.96)

- The LiDAR dataset was tested to 0.039m vertical accuracy at 95% confidence level on consolidates RMSEz (0.0198m x 1.9600) when compared to 11 GPS static check points.

- The LiDAR dataset was tested to 0.116m vertical accuracy at 95% confidence level based on consolidated RMSEz (0.059m x 1.60) when compared to 5308 GPS kinematic check points.

Overall the calibrated LiDAR data products collected by LMSI meet or exceed the requirements set out in the Statement of Work. The quality control requirements of LMSI's quality management program were adhered to throughout the acquisition stage for this project to ensure product quality.

SWATH ACCURACY RESULTS

Once Dewberry received the calibrated swath data from LMSI, Dewberry tested the vertical accuracy of the open terrain swath data prior to additional processing. Dewberry tested the vertical accuracy of the swath data using the twenty open terrain independent survey check points. The vertical accuracy is tested by comparing survey checkpoints in open terrain to a triangulated irregular network (TIN) that is created from the raw swath points. Only checkpoints in open terrain can be tested against raw swath data because the data has not undergone classification techniques to remove vegetation, buildings, and other artifacts from the ground surface. Checkpoints are always compared to interpolated surfaces from the LiDAR point cloud because it is unlikely that a survey checkpoint will be located at the location of a discrete LiDAR point. Project specifications require a FVA of 0.245 m based on the RMSEz (0.125 m) x 1.96. The dataset for the FEMA VI – Bayou Meto LiDAR Project satisfies the criteria. The raw LiDAR swath data tested 0.094 m vertical accuracy at 95% confidence level in open terrain, based on RMSEz (0.05m) x 1.9600.

LiDAR Processing & Qualitative Assessment

DATA CLASSIFICATION AND EDITING

LiDAR mass points were produced to LAS 1.2 specifications, including the following LAS classification codes:

- Class 1 = Unclassified, used for all other features that do not fit into the Classes 2, 7, 9, 10, or 11, including vegetation, buildings, etc.
- Class 2 = Bare-Earth Ground
- Class 7 = Noise, low and high points
- Class 9 = Water, points located within collected breaklines
- Class 10 = Ignored Ground due to breakline proximity.
- Class 11 = Withheld, Points with scan angles exceeding +/- 20 degrees.

The data was processed using GeoCue and TerraScan software. The initial step is the setup of the GeoCue project, which is done by importing a project defined tile boundary index encompassing the entire project area. The acquired 3D laser point clouds, in LAS binary format, were imported into the GeoCue project and tiled according to the project tile grid. Once tiled, the laser points were classified using a proprietary routine in TerraScan. This routine classifies any obvious outliers in the dataset to class 7 and points with scan angles exceeding +/- 20 degrees to class 11. After points that could negatively affect the ground are removed from class

1, the ground layer is extracted from this remaining point cloud. The ground extraction process encompassed in this routine takes place by building an iterative surface model.

This surface model is generated using three main parameters: building size, iteration angle and iteration distance. The initial model is based on low points being selected by a "roaming window" with the assumption that these are the ground points. The size of this roaming window is determined by the building size parameter. The low points are triangulated and the remaining points are evaluated and subsequently added to the model if they meet the iteration angle and distance constraints. This process is repeated until no additional points are added within iterations. A second critical parameter is the maximum terrain angle constraint, which determines the maximum terrain angle allowed within the classification model.

The following fields within the LAS files are populated to the following precision: GPS Time (0.000001 second precision), Easting (0.003 meter precision), Northing (0.003 meter precision), Elevation (0.003 meter precision), Intensity (integer value - 12 bit dynamic range), Number of Returns (integer - range of 1-4), Return number (integer range of 1-4), Scan Direction Flag (integer - range 0-1), Classification (integer), Scan Angle Rank (integer), Edge of flight line (integer, range 0-1), User bit field (integer - flight line information encoded). The LAS file also contains a Variable length record in the file header that defines the projection, datums, and units.

Once the initial ground routine has been performed on the data, Dewberry creates Delta Z (DZ) orthos to check the relative accuracy of the LiDAR data. These orthos compare the elevations of LiDAR points from overlapping flight lines on a 1 meter pixel cell size basis. If the elevations of points within each pixel are within 10 cm of each other, the pixel is colored green. If the elevations of points within each pixel are between 10 cm and 20 cm of each other, the pixel is colored yellow, and if the elevations of points within each pixel are greater than 20 cm in difference, the pixel is colored red. Pixels that do not contain points from overlapping flight lines are colored according to their intensity values. DZ orthos can be created using the full point cloud or ground only points and are used to review and verify the calibration of the data is acceptable. Some areas are expected to show sections or portions of red, including terrain variations, slope changes, and vegetated areas or buildings if the full point cloud is used. However, large or continuous sections of yellow or red pixels can indicate the data was not calibrated correctly or that there were issues during acquisition that could affect the usability of the data. The DZ orthos for FEMA VI – Bayou Meto showed that the data was calibrated correctly with no issues that would affect its usability. The figure below shows an example of the DZ orthos.

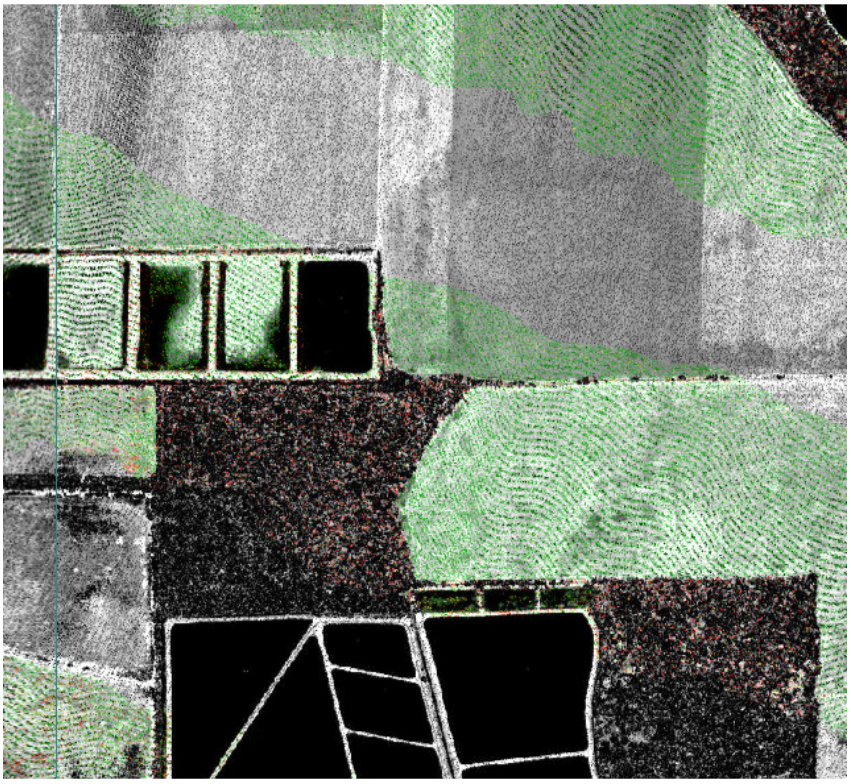


Figure 6 - DZ orthos created from the full point cloud. Some red pixels are visible along embankments, sloped terrain, and in vegetated land cover, as expected. Open, flat areas are green indicating the calibration and relative accuracy of the data is acceptable.

Dewberry utilized a variety of software suites for data processing. The LAS dataset was received and imported into GeoCue task management software for processing in Terrascan. Each tile was imported into Terrascan and a surface model was created to examine the ground classification. Dewberry analysts visually reviewed the ground surface model and corrected errors in the ground classification such as vegetation, buildings, and bridges that were present following the initial processing conducted by Dewberry. Dewberry analysts employ 3D visualization techniques to view the point cloud at multiple angles and in profile to ensure that non-ground points are removed from the ground classification. After the ground classification corrections were completed, the dataset was processed through a water classification routine that utilizes breaklines compiled by Dewberry to automatically classify hydro features. The water classification routine selects ground points within the breakline polygons and automatically classifies them as class 9, water. The final classification routine applied to the dataset selects ground points within a specified distance of the water breaklines and classifies them as class 10, ignored ground due to breakline proximity.

QUALITATIVE ASSESSMENT

Dewberry's qualitative assessment utilizes a combination of statistical analysis and interpretative methodology to assess the quality of the data for a bare-earth digital terrain model (DTM). This process looks for anomalies in the data and also identifies areas where man-made structures or vegetation points may not have been classified properly to produce a bare-earth model.

Within this review of the LiDAR data, two fundamental questions were addressed:

- Did the LiDAR system perform to specifications?
- Did the vegetation removal process yield desirable results for the intended bare-earth terrain product?

Mapping standards today address the quality of data by quantitative methods. If the data are tested and found to be within the desired accuracy standard, then the data set is typically accepted. Now with the proliferation of LiDAR, new issues arise due to the vast amount of data. Unlike photogrammetrically-derived DEMs where point spacing can be eight meters or more, LiDAR nominal point spacing for this project is 1 point per 2 square meters. The end result is that millions of elevation points are measured to a level of accuracy previously unseen for traditional elevation mapping technologies and vegetated areas are measured that would be nearly impossible to survey by other means. The downside is that with millions of points, the dataset is statistically bound to have some errors both in the measurement process and in the artifact removal process.

As previously stated, the quantitative analysis addresses the quality of the data based on absolute accuracy. This accuracy is directly tied to the comparison of the discreet measurement of the survey checkpoints and that of the interpolated value within the three closest LiDAR points that constitute the vertices of a three-dimensional triangular face of the TIN. Therefore, the end result is that only a small sample of the LiDAR data is actually tested. However there is an increased level of confidence with LiDAR data due to the relative accuracy. This relative accuracy in turn is based on how well one LiDAR point "fits" in comparison to the next contiguous LiDAR measurement, and is verified with DZ orthos. Once the absolute and relative accuracy has been ascertained, the next stage is to address the cleanliness of the data for a bare-earth DTM.

By using survey checkpoints to compare the data, the absolute accuracy is verified, but this also allows us to understand if the artifact removal process was performed correctly. To reiterate the quantitative approach, if the LiDAR sensor operated correctly over open terrain areas, then it most likely operated correctly over the vegetated areas. This does not mean that the entire bare-earth was measured; only that the elevations surveyed are most likely accurate (including elevations of treetops, rooftops, etc.). In the event that the LiDAR pulse filtered through the vegetation and was able to measure the true surface (as well as measurements on the surrounding vegetation) then the level of accuracy of the vegetation removal process can be tested as a by-product.

To fully address the data for overall accuracy and quality, the level of cleanliness (or removal of above-ground artifacts) is paramount. Since there are currently no effective automated testing procedures to measure cleanliness, Dewberry employs a combination of statistical and visualization processes. This includes creating pseudo image products such as LiDAR orthos produced from the intensity returns, Triangular Irregular Network (TIN)'s, Digital Elevation Models (DEM) and 3-dimensional models. By creating multiple images and using overlay techniques, not only can potential errors be found, but Dewberry can also find where the data meets and exceeds expectations. This report will present representative examples where the LiDAR and post processing had issues as well as examples of where the LiDAR performed well.

ANALYSIS

Dewberry utilizes GeoCue software as the primary geospatial process management system. GeoCue is a three tier, multi-user architecture that uses .NET technology from Microsoft. .NET technology provides the real-time notification system that updates users with real-time project status, regardless of who makes changes to project entities. GeoCue uses database technology for sorting project metadata. Dewberry uses Microsoft SQL Server as the database of choice. Specific analysis is conducted in Terrascan and QT Modeler environments.

Following the completion of LiDAR point classification, the Dewberry qualitative assessment process flow for the USGS FEMA VI – Bayou Meto LiDAR project incorporated the following reviews:

1. *Format:* The LAS files are verified to meet project specifications. The LAS files for the USGS FEMA VI – Bayou Meto LiDAR project conform to the specifications outlined below.

- Format, Echos, Intensity
    - LAS format 1.2
    - Point data record format 1
    - Multiple returns (echos) per pulse
    - Intensity values populated for each point
- ASPRS classification scheme
    - Class 1 – unclassified
    - Class 2 – Bare-earth ground
    - Class 7 – Noise
    - Class 9 – Water
    - Class 10 – Ignored Ground due to breakline proximity
    - Class 11 – Withheld due to scan angles exceeding +/- 20 degrees
- Projection
    - Datum – North American Datum 1983
    - Projected Coordinate System – UTM Zone 15
    - Units – Meters
    - Vertical Datum – North American Vertical Datum 1988, Geoid 09
    - Vertical Units - Meters
- LAS header information:
    - Class (Integer)
    - GPS Week Time (0.0001 seconds)
    - Easting (0.003 meters)
    - Northing (0.003 meters)
    - Elevation (0.003 meters)
    - Echo Number (Integer 1 to 4)
    - Echo (Integer 1 to 4)
    - Intensity (8 bit integer)
    - Flight Line (Integer)
    - Scan Angle (Integer degree)

2. *Data density, data voids:* The LAS files are used to produce Digital Elevation Models using the commercial software package "QT Modeler" which creates a 3-dimensional data model derived from Class 2 (ground points) in the LAS files. Grid spacing is based on the project density deliverable requirement for un-obscured areas. For the USGS FEMA VI – Bayou Meto LiDAR project it is stipulated that the minimum post spacing in un-obscured areas should be 1 point per 2 square meters.

    a. Acceptable voids (areas with no LiDAR returns in the LAS files) that are present in the majority of LiDAR projects include voids caused by bodies of water. These are considered to be acceptable voids.

3. *Bare earth quality:* Dewberry reviewed the cleanliness of the bare earth to ensure the ground has correct definition, meets the project requirements, there is correct classification of points, and there are less than 5% residual artifacts.

    a. *Artifacts:* Artifacts are caused by the misclassification of ground points and usually represent vegetation and/or man-made structures. The artifacts identified are usually low lying structures, such as porches or low vegetation used as landscaping in neighborhoods and other developed areas. These low lying features are extremely difficult for the automated algorithms to detect as non-ground and must be removed manually. The vast majority of these features have been removed but a small number of these features are still in the ground classification. The limited numbers of features remaining in the ground are usually 0.3 meters or less above the actual ground surface, and should not negatively impact the usability of the dataset.

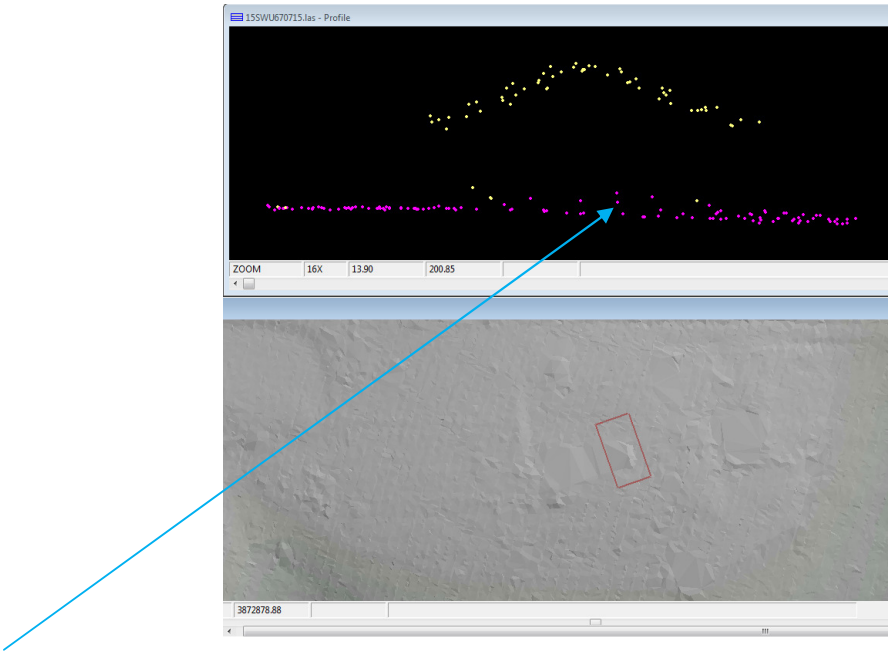


Figure 7 – Tile number 15WU670715. Profile with points colored by class (class 1=yellow, class 2=pink) is shown in the top view and a TIN of the surface is shown in the bottom view. The arrow identifies low vegetation points. A limited number of these small features are still classified as ground but do not impact the usability of the dataset.

b. *Bridge Removal Artifacts:* The DEM surface models are created from TINs or Terrains. TIN and Terrain models create continuous surfaces from the inputs. Because a continuous surface is being created, the TIN or Terrain will use interpolation to triangulate across a bridge opening from legitimate ground points on either side of the actual bridge. This can cause visual artifacts or "saddles." These "artifacts" are only visual and do not exist in the LiDAR points or breaklines.

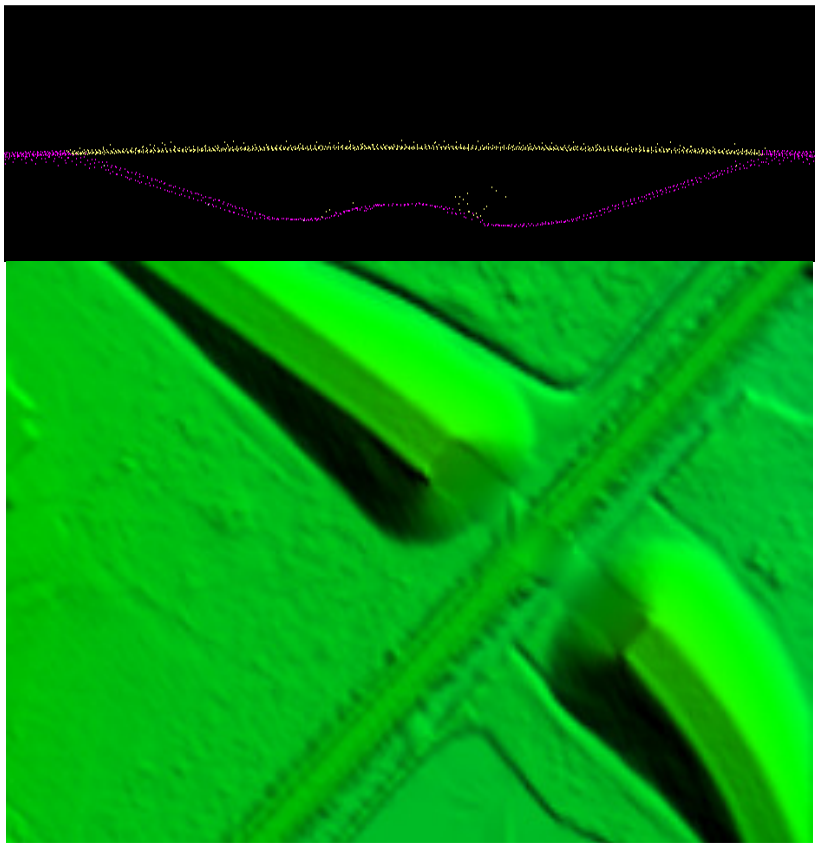


Figure 8 – Tile number 15SWU910715. The DEM in the bottom view shows a visual artifact because the surface model is interpolating from the slope leading to the bridge to the lower ground points on either side of the bridge points that were removed. The surface model must make a continuous model and in order to do so, points are connected through interpolation. This can cause visual artifacts when there are features with large elevation differences. The profile in the top view shows the LiDAR points of this particular feature colored by class. All bridge points have been removed from ground (pink) and are unclassified (yellow). There are no ground points that can be modified to correct this visual artifact.

c. *Culverts and Bridges:* Bridges have been removed from the bare earth surface while culverts remain in the bare earth surface. In instances where it is difficult to determine if the feature is a culvert or bridge, such as with some small bridges, Dewberry erred on assuming they would be culverts especially if they are on secondary or tertiary roads. Below is an example of a culvert that has been left in the ground surface.

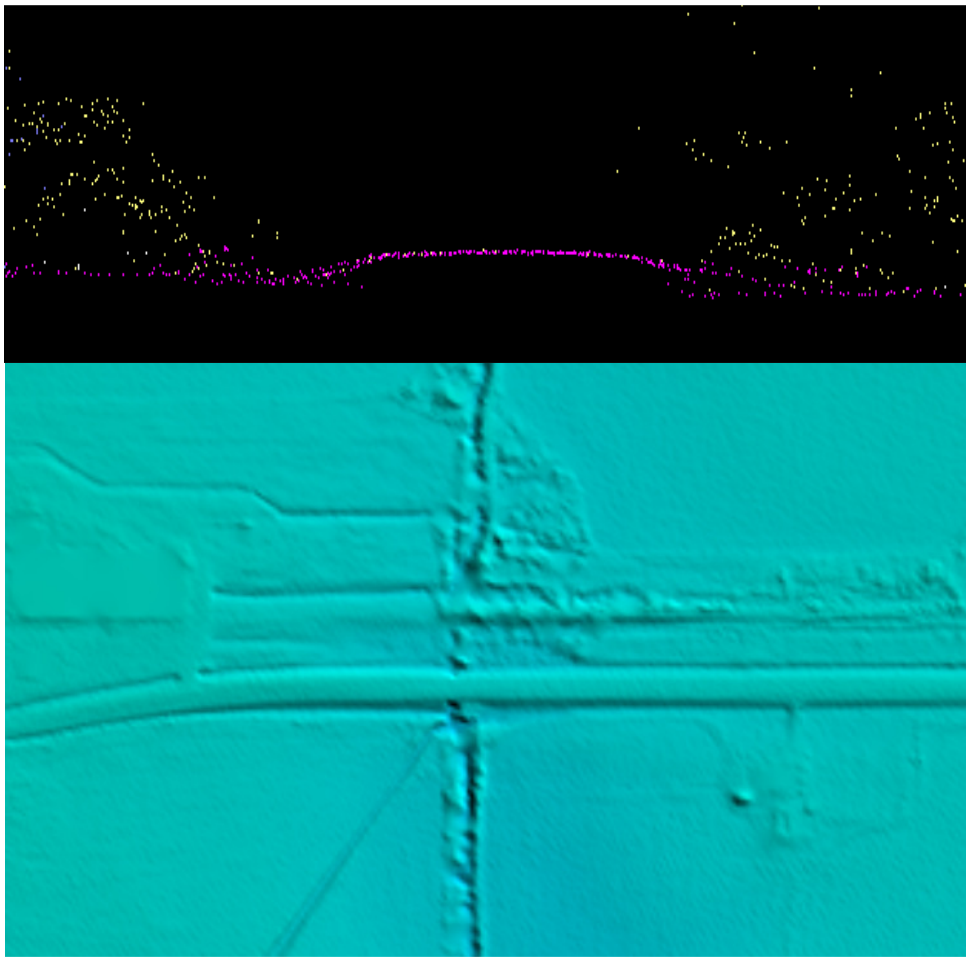


Figure 9– Tile number 15SXU150490. Profile with points colored by class (class 1=yellow, class 2=pink) is shown in the top view and the DEM is shown in the bottom view. This culvert remains in the bare earth surface. Bridges have been removed from the bare earth surface and classified to class 1.

d. *In Ground Structures:* In ground structures exist within the project area. These types of structures occur mainly on military bases and in facilities designed for munitions testing and storage. These features are correctly included in the ground classification.

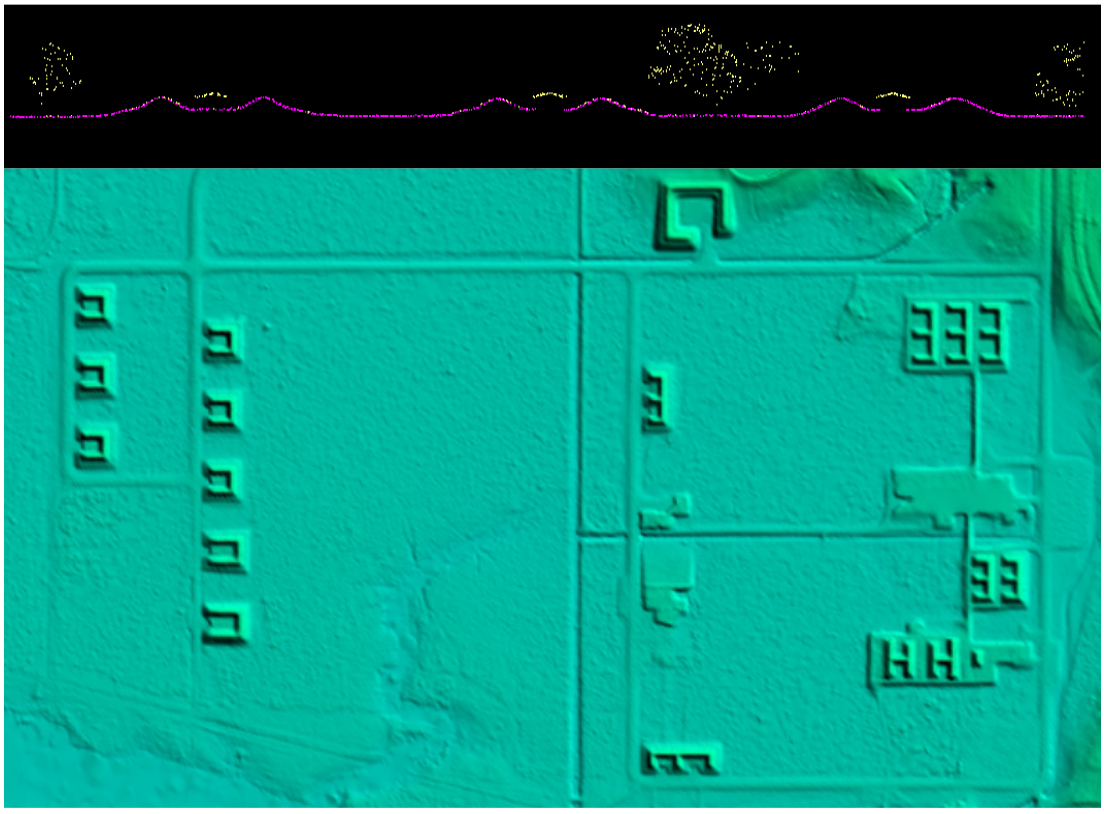


Figure 10 – Tiles 15SWU895490, 15SWU910490, 15SWU895505, and 15SWU910505. Profile with the points colored by class (class 1=yellow, class 2=pink) is shown in the top view and a DEM of the surface is shown in the bottom view. These features are correctly included in the ground classification.

e. *Dirt Mounds*: Irregularities in the natural ground exist and may be interpreted as artifacts that should be removed. Small hills and dirt mounds are present throughout the project area. These features are correctly included in the ground.

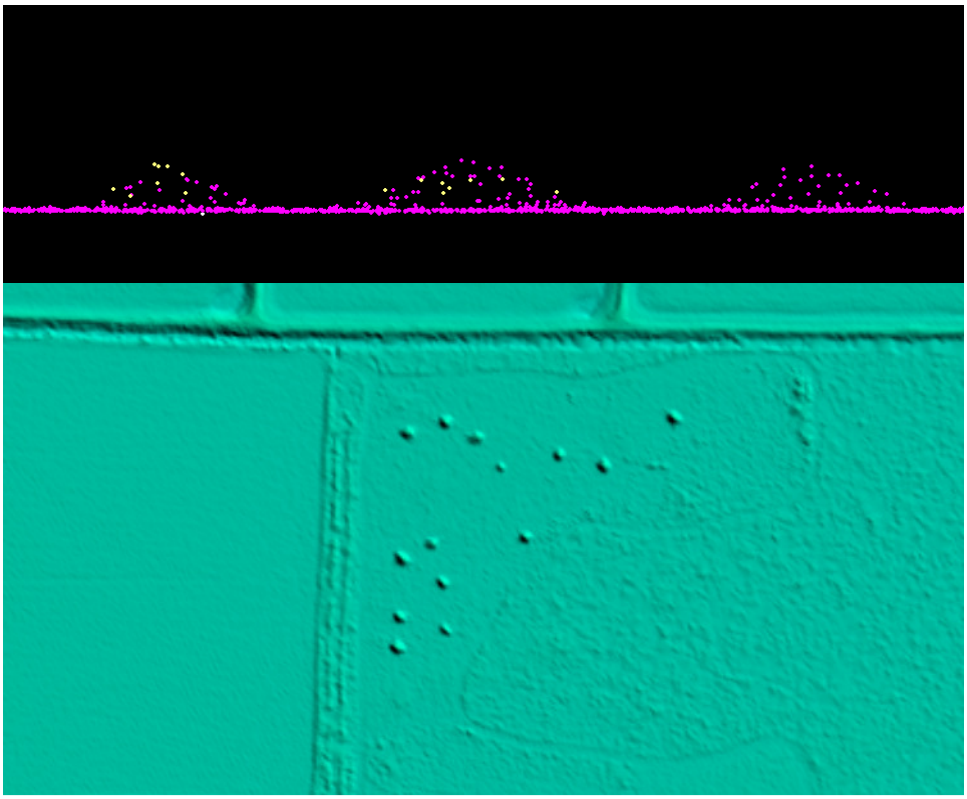


Figure 11 - Tile 15SWU865475. Profile with the points colored by class (class 1=yellow, class 2=pink) is shown in the top view and a DEM of the surface is shown in the bottom view. These features are correctly included in the ground classification.

f. *Elevation Change Within Breaklines:* While water bodies are flattened in the final DEMs, other features such as linear hydrographic features can have significant changes in elevation within a small distance. In linear hydrographic features, this is often due to the presence of a structure that affects flow such as a dam or spillway. Dewberry has reviewed the DEMs to ensure that changes in elevation are shown from bank to bank. These changes are often shown as steps to reduce the presence of artifacts while ensuring consistent downhill flow. An example is shown below.

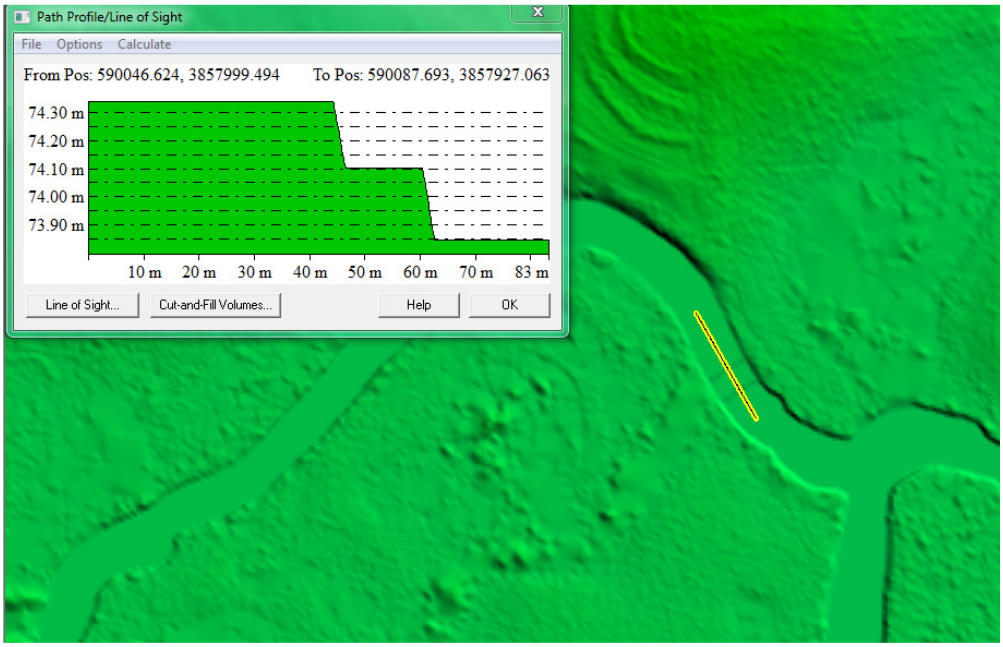


Figure 12 – Tile number 15SWU895565. Elevation change has been stair stepped. The steps are flat from bank to bank and flow consistently downhill.

g. *Fish Farms and Irrigated Agricultural Areas*: The Bayou Meto Watershed is a highly productive fish farming and agricultural area. This is apparent throughout the project area due to the numerous small areas of standing water present at the time the LiDAR was acquired. Dewberry collected all areas of standing water greater than or equal to 2 acres. Areas of standing water that did not meet the 2 acre size criteria were not collected. Examples are shown below.

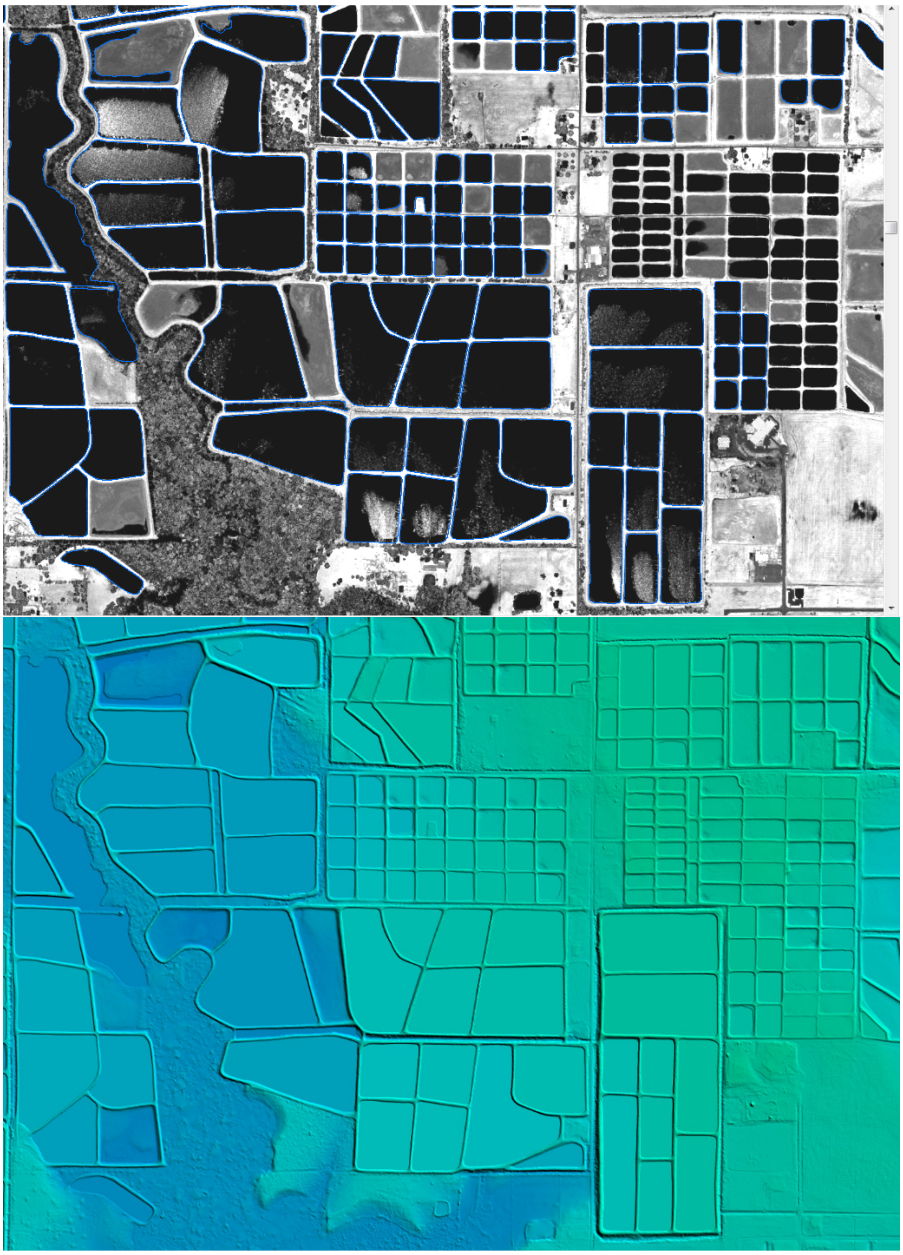


Figure 13 – Tiles15SWU985520, 15SXU000520, 15SXU015520, 15SWU985535, 15SXU000535, and 15SXU015535. All lakes, ponds, irrigated agricultural fields, aquaculture areas and other areas of standing water greater than or equal to 2 acres are included in the delivered breaklines.

h. *Marsh Areas*: It is sometimes difficult to determine true ground in low wet areas. Marsh areas are present throughout the project area and were not interpreted as standing water. These areas are not included in the collected breaklines and were not flattened in the final DEMs. An example is shown below.

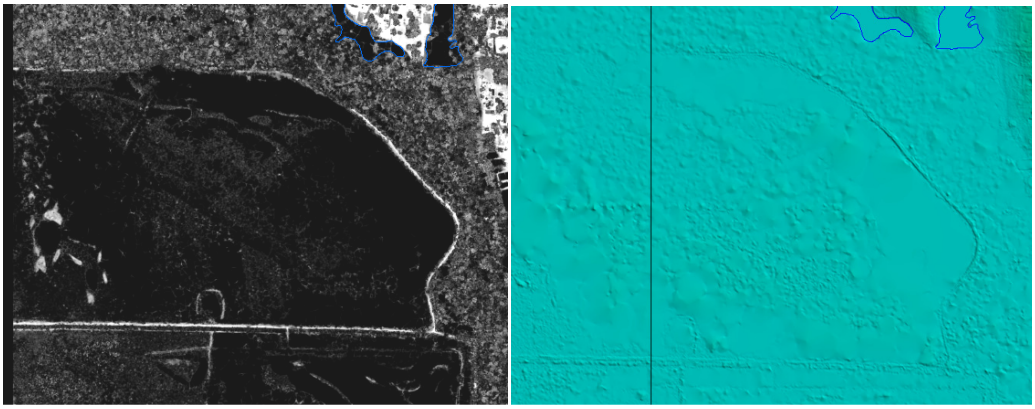


Figure 14 - Tiles 15SWU850535 and 15SWU850550. The intensity on the left shows a marsh area that was not included in the collected breaklines. The same area is shown in the DEM on the right.

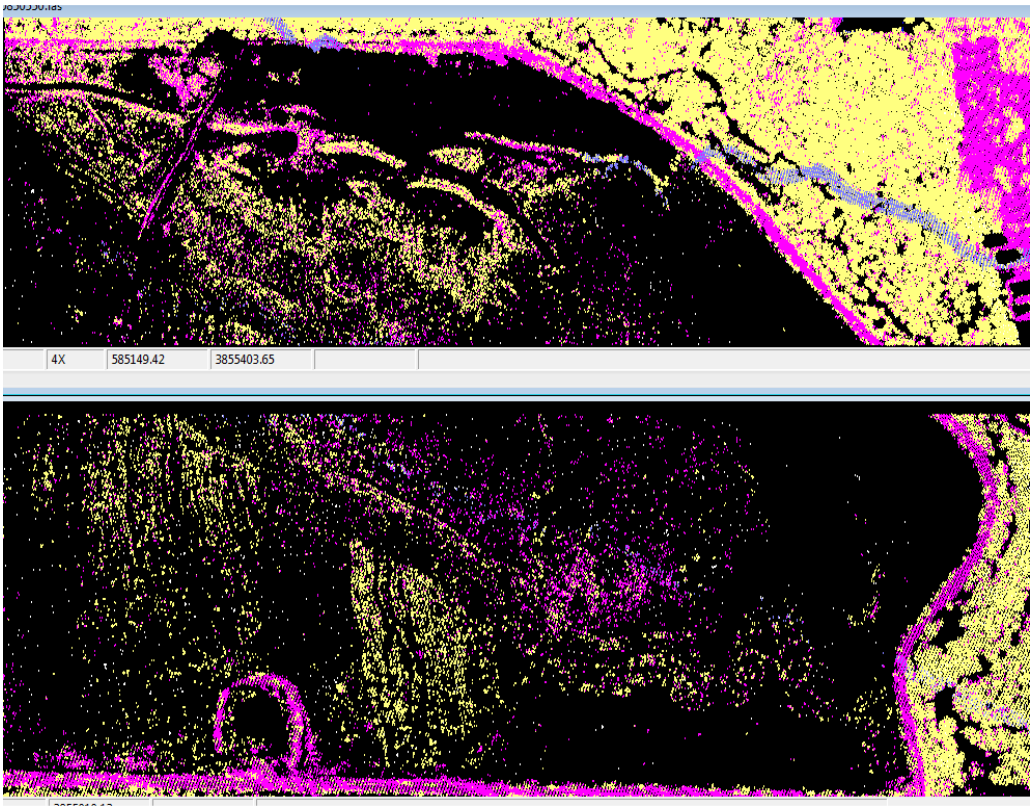


Figure 15 - Tiles 15SWU850535 and 15SWU850550. The same marsh area is shown in the figure above but this image shows the points colored by class (class 1=yellow, class 2=pink). Though ground points are sparse they are present, indicating that the area is wet but should not be classified as water (class 9). Doing so would strip the detail from this area and result in incorrectly flattening ground as part of the hydro mask.

i. *Flight line Ridges:* Ridges occur when there is a difference between the elevations of adjoining flightlines or swaths. Some flight line ridges are visible in the final DEMs but they do not exceed the project specifications and the overall relative accuracy requirements for the project area have been met. An example of a visible ridge that is within tolerance is shown below.

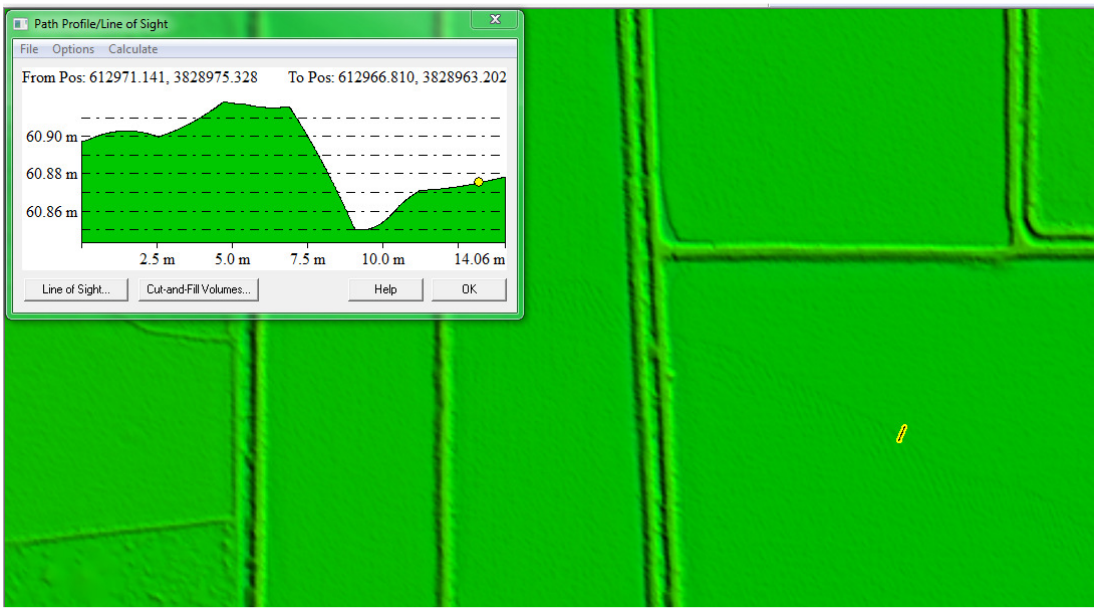


Figure 16– Tile number 15SXU120280. The flight line ridge is less than 10 cm. Overall, the FEMA VI – Bayou Meto LiDAR data meets the project specifications for 10 cm RMSE relative accuracy.

CONCLUSION

Overall the data meets project specifications. The dataset conforms to project requirements for format, header values, and spatial projection information. The classification of points is correct and the final ground points accurately represent the bare earth surface. Minor artifacts and small areas of misclassification are isolated and have minimal impact on the usability of the dataset.

Survey Vertical Accuracy Checkpoints

PT. #	EASTING	NORTHING	ELEVS.
	UTM North Zone 15		
POINT ID	**EASTING (M)**	**NORTHING (M)**	**ELEVATION (M)**
301	614685.092	3850004.01	70.666
302	608898.444	3849262.001	69.471
303	614031.83	3826905.695	61.134
304	614027.994	3822903.587	60.637
305	611475.766	3822698.752	62.339
306	600615.747	3849899.332	72.797
307	630971.942	3816424.264	62.965
308	632415.231	3820636.756	63.157

309	635615.631	3816277.303	65.25
310	638821.085	3813543.479	64.594
311	618701.428	3809729.602	57.843
BM97	630636.578	3829205.311	67.415
313	593187.21	3854791.97	79.12
314	591085.68	3852039.59	79.30
315	588768.18	3856225.04	79.93
316	591199.84	3864793.74	94.87
317	590562.53	3869501.67	96.47
318	585325.80	3874521.76	89.59
319	578952.92	3873709.96	180.99
320	572668.66	3870981.79	109.21
401	625318.545	3837429.157	67.756
402	617333.684	3834231.496	62.965
403	617388.762	3837427.571	65.299
404	609083.182	3840597.054	69.82
405	614173.217	3845589.861	68.363
406	611614.8	3829519.971	62.147
407	606958.2	3829517.639	64.754
408	596667.44	3839976.76	69.65
409	598758.374	3842584.564	69.131
410	590922.365	3845070.132	72.018
411	634034.91	3825944.643	66.6
412	634026.603	3822688.958	64.498
413	643000.836	3812753.15	63.704
414	629013.746	3810544.026	60.658
415	607639.711	3855316.811	71.925
416	591654.31	3862684.01	96.22
417	584875.52	3871531.32	97.84
418	588711.35	3872237.25	110.03
419	568023.42	3873376.66	177.00
420	569359.50	3870935.97	127.09
501	627430.669	3834113.736	69.547
502	614052.267	3835868.873	63.939
503	610802.272	3837313.725	69.372
504	614127.16	3840650.224	67.26
505	619995.876	3826758.634	59.258
506	614009.534	3817298.107	60.046
507	618866.115	3814055.465	59.821
508	599125.407	3837119.375	69.202
509	604008.073	3845664.164	71.414
510	595980.833	3847261.712	69.424
511	630664.042	3826025.382	67.367
512	643816.897	3810246.234	62.688
513	633288.196	3812996.522	60.933
514	622908.626	3810554.08	59.238
515	628040.334	3819493.273	61.031

516	592867.201	3858610.285	79.316
517	589689.816	3860204.526	83.82
518	591815.503	3866787.815	92.097
519	587849.472	3869980.839	85.84
520	571940.579	3873373.148	181.335
601	619110.207	3849613.99	71.874
602	618582.936	3840630.476	66.841
603	620840.035	3834213.887	60.706
604	609175.73	3846212.474	70.307
605	617398.166	3830132.892	61.055
606	618788.545	3822748.096	60.586
607	610021.185	3825141.335	63.398
608	589254.69	3848550.263	72.223
609	624072.892	3825549.404	60.523
610	624108.507	3823230.721	59.967
611	629043.537	3822678.364	58.65
612	630721.801	3813423.251	63.786
613	628377.261	3814526.458	60.905
614	611103.223	3854342.531	73.64
615	601199.845	3858561.914	76.02
616	597597.78	3858580.93	73.513
617	597662.382	3855132.461	74.114
618	586631.177	3856611.409	80.127
619	588167.825	3866802.183	79.598
620	579585.92	3870938.113	100.309
701	617573.359	3846365.629	65.391
702	622245.048	3837418.944	67.643
703	624624.429	3834198.604	61.513
704	611600.312	3832895.472	61.524
705	621678.981	3829286.507	59.922
706	604186.141	3832079.708	65.476
707	593729.012	3842351.22	69.96
708	605776.262	3836408.795	64.519
709	604879.846	3841858.856	71.25
710	626473.303	3826081.532	61.268
711	627255.941	3829930.799	66.319
712	633957.526	3818265.749	64.337
713	638884.139	3816933.829	64.623
714	638883.609	3810096.809	63.375
715	634009.835	3808949.785	62.049
716	602695.825	3855191.555	74.379
717	588925.585	3863459.03	82.01
718	593932.265	3869894.47	90.80
719	582320.628	3873720.08	167.77
720	576054.947	3870723.20	105.34

Table 2: USGS FEMA IV – Bayou Meto LiDAR surveyed accuracy checkpoints

LiDAR Vertical Accuracy Statistics & Analysis

BACKGROUND

Dewberry tests and reviews project data both quantitatively (for accuracy) and qualitatively (for usability).

For qualitative assessment (i.e. vertical accuracy assessment), One hundred (100) check points were surveyed for the project and are located within bare earth/open terrain, urban, tall weeds/crops, brush lands/tress, and forested/fully grown land cover categories. The checkpoints were surveyed for the project using RTK survey methods. Please see appendix A to view the survey report which details and validates how the survey was completed for this project.

Checkpoints were evenly distributed throughout the project area so as to cover as many flight lines as possible using the "dispersed method" of placement.

VERTICAL ACCURACY TEST PROCEDURES

FVA (Fundamental Vertical Accuracy) is determined with check points located only in the open terrain (grass, dirt, sand, and/or rocks) land cover category, where there is a very high probability that the LiDAR sensor will have detected the bare-earth ground surface and where random errors are expected to follow a normal error distribution. The FVA determines how well the calibrated LiDAR sensor performed. With a normal error distribution, the vertical accuracy at the 95% confidence level is computed as the vertical root mean square error (RMSEz) of the checkpoints x 1.9600. For the FEMA VI-Bayou Meto LiDAR project, vertical accuracy must be 0.245 meters or less based on an RMSEz of 0.125 meters x 1.9600.

CVA (Consolidated Vertical Accuracy) is determined with all checkpoints in all land cover categories combined where there is a possibility that the LiDAR sensor and post-processing may yield elevation errors that do not follow a normal error distribution. CVA at the 95% confidence level equals the 95th percentile error for all checkpoints in all land cover categories combined. The FEMA VI-Bayou Meto LiDAR Project CVA standard is 0.363 meters based on the 95th percentile. The CVA is accompanied by a listing of the 5% outliers that are larger than the 95th percentile used to compute the CVA; these are always the largest outliers that may depart from a normal error distribution. Here, Accuracy$_z$ differs from CVA because Accuracy$_z$ assumes elevation errors follow a normal error distribution where RMSE procedures are valid, whereas CVA assumes LiDAR errors may not follow a normal error distribution in vegetated categories, making the RMSE process invalid.

SVA (Supplemental Vertical Accuracy) is determined for each land cover category other than open terrain. SVA at the 95% confidence level equals the 95th percentile error for all checkpoints in each land cover category. The FEMA VI-Bayou Meto LiDAR Project SVA target is 0.363 meters based on the 95th percentile. Target specifications are given for SVA's as one individual land cover category may exceed this target value as long as the overall CVA is within specified tolerances. Again, Accuracy$_z$ differs from SVA because Accuracy$_z$ assumes elevation errors follow a normal error distribution where RMSE procedures are valid, whereas SVA assumes LiDAR errors may not follow a normal error distribution in vegetated categories, making the RMSE process invalid.

The relevant testing criteria are summarized in Table 3.

Quantitative Criteria	Measure of Acceptability
Fundamental Vertical Accuracy (FVA) in open terrain only using RMSEz *1.9600	0.245 meters (based on RMSEz (0.125 meters) * 1.9600)
Consolidated Vertical Accuracy (CVA) in all land cover categories combined at the 95% confidence level	0.363 meters (based on combined 95th percentile)
Supplemental Vertical Accuracy (SVA) in each land cover category separately at the 95% confidence level	0.363 meters (based on 95th percentile for each land cover category)

Table 3 – Acceptance Criteria

VERTICAL ACCURACY TESTING STEPS

The primary QA/QC vertical accuracy testing steps used by Dewberry are summarized as follows:

1. Dewberry's team surveyed QA/QC vertical checkpoints in accordance with the project's specifications.
2. Next, Dewberry interpolated the bare-earth LiDAR DTM to provide the z-value for each of the 100 checkpoints.
3. Dewberry then computed the associated z-value differences between the interpolated z-value from the LiDAR data and the ground truth survey checkpoints and computed FVA, CVA, and SVA values.
4. The data were analyzed by Dewberry to assess the accuracy of the data. The review process examined the various accuracy parameters as defined by the scope of work. The overall descriptive statistics of each dataset were computed to assess any trends or anomalies. This report provides tables, graphs and figures to summarize and illustrate data quality.

The figure below shows the location of the QA/QC checkpoints within the project area.

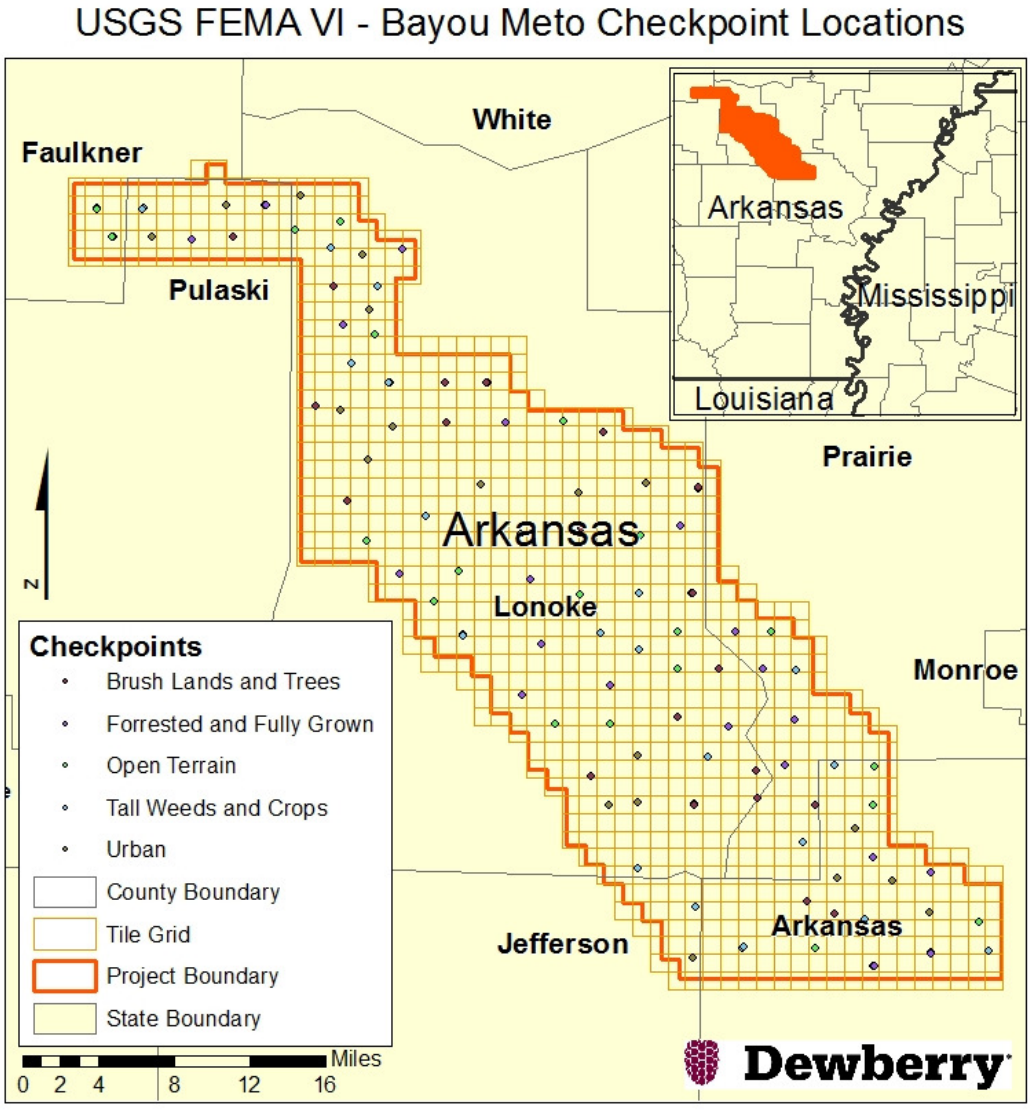


Figure 17 – Location of QA/QC Checkpoints

VERTICAL ACCURACY RESULTS

The table below summarizes the tested vertical accuracy resulting from a comparison of the surveyed checkpoints to the elevation values present within the LiDAR LAS files.

Land Cover Category	# of Points	FVA – Fundamental Vertical Accuracy (RMSEz x 1.9600) Spec=0.245 m	CVA – Consolidated Vertical Accuracy (95th Percentile) Spec=0.363 m	SVA – Supplemental Vertical Accuracy (95th Percentile) Target=0.363 m
Consolidated	100		0.13	
Bare Earth-Open Terrain	20	0.10		
Urban	20			0.13
Tall Weeds and Crops	20			0.15
Brush Lands and Trees	20			0.14
Forested and Fully Grown	20			0.21

Table 4 – FVA, CVA, and SVA Vertical Accuracy at 95% Confidence Level

The $RMSE_z$ for checkpoints in open terrain only tested 0.05 meters, within the target criteria of 0.125 meters. Compared with the 0.245 meters specification, the FVA tested 0.10 meters at the 95% confidence level based on $RMSE_z$ x 1.9600.

Compared with the 0.363 meters specification, CVA for all checkpoints in all land cover categories combined tested 0.13 meters a based on the 95th percentile.

Compared with target 0.363 specification, SVA for checkpoints in the urban land cover category tested 0.13 meters based on the 95th percentile, checkpoints in the tall weeds and crops land cover category tested 0.15 meters based on the 95th percentile, checkpoints in the forested and fully grown land cover category tested 0.21 meters based on the 95th percentile, and checkpoints in the brush and small trees land cover category tested 0.14 meters based on the 95th percentile.

The figure below illustrates the magnitude of the differences between the QA/QC checkpoints and LiDAR data. This shows that the majority of LiDAR elevations were within +/- 0.20 meters of the checkpoints elevations, but there were some outliers where LiDAR and checkpoint elevations differed by up to +0.70 meters.

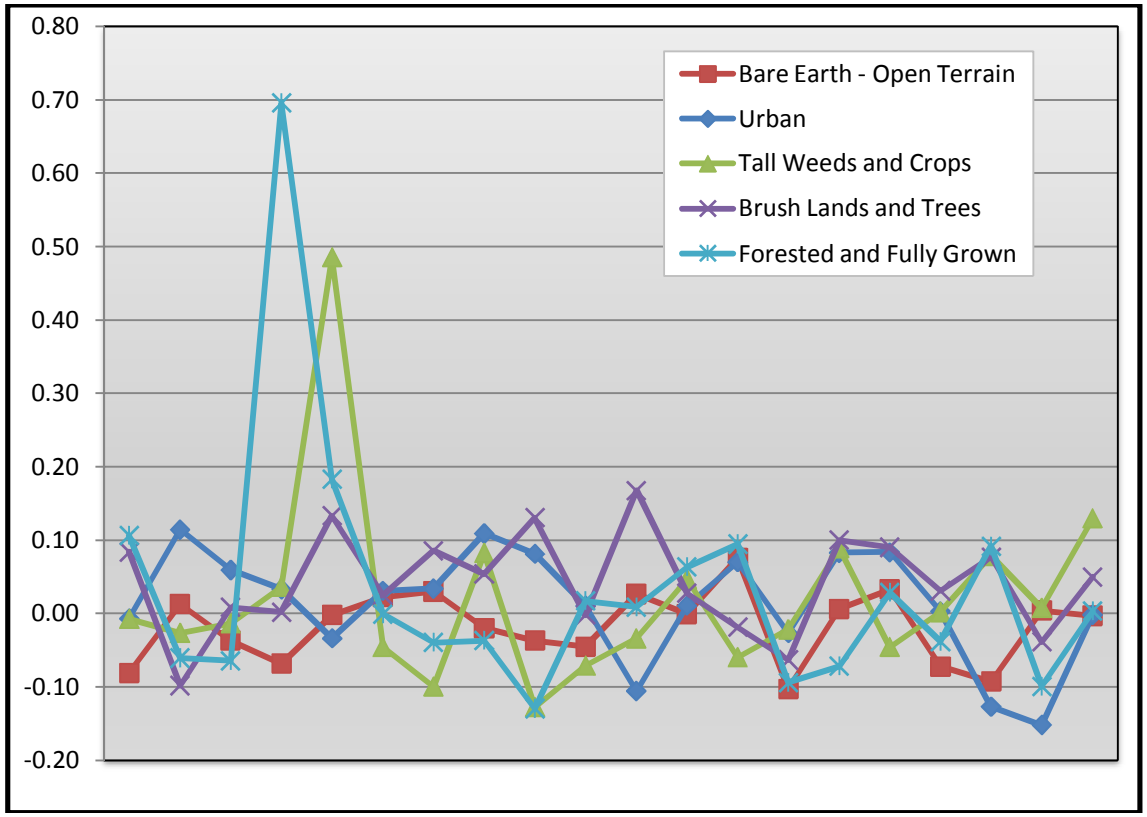


Figure 18 – Magnitude of Elevation Discrepancies

Table 5 lists the 5% outliers that are larger than the 95th percentile.

Point ID	NAD83 UTM North Zone 15		NAVD88	LiDAR Z (m)	Delta Z	AbsDeltaZ
	Easting X (m)	Northing Y (m)	Survey Z (m)			
319	578952.92	3873709.96	180.99	180.8411	-0.15	0.15
505	619995.876	3826758.634	59.258	59.7435	0.49	0.49
611	629043.537	3822678.364	58.65	58.8177	0.17	0.17
705	621678.981	3829286.507	59.922	60.1048	0.18	0.18

Table 5 – 5% Outliers

Table 6 provides overall descriptive statistics.

100 % of Totals	RMSE (m) Open Terrain Spec=0.125m	Mean (m)	Mean Absolute (m)	Median (m)	Skew	Std Dev (m)	# of Points	Min (m)	Max (m)
Consolidated		0.02	0.07	0.01	3.18	0.11	100	-0.15	0.70
Open Terrain	0.05	-0.02	0.04	0.00	-0.19	0.05	20	-0.10	0.08
Urban		0.01	0.06	0.02	-0.84	0.07	20	-0.15	0.11
Tall Weeds and Crops		0.02	0.08	0.04	-0.18	0.07	20	-0.10	0.17
Brush Lands and Trees		-0.18	0.06	0.04	-0.18	0.07	20	-0.10	0.17
Forested and Fully Grown		0.03	0.10	0.00	3.08	0.18	20	-0.13	0.70

Table 6 — Overall Descriptive Statistics

Figure 19 illustrates a histogram of the associated elevation discrepancies between the QA/QC checkpoints and elevations interpolated from the LiDAR triangulated irregular network (TIN). The frequency shows the number of discrepancies within each band of elevation differences. Although the discrepancies vary between a low of -0.15 meters and a high of +0.7 meters, the histogram shows that the majority of the discrepancies are skewed on the positive side. The vast majority of points are within the ranges of -0.05 meters to +0.05 meters.

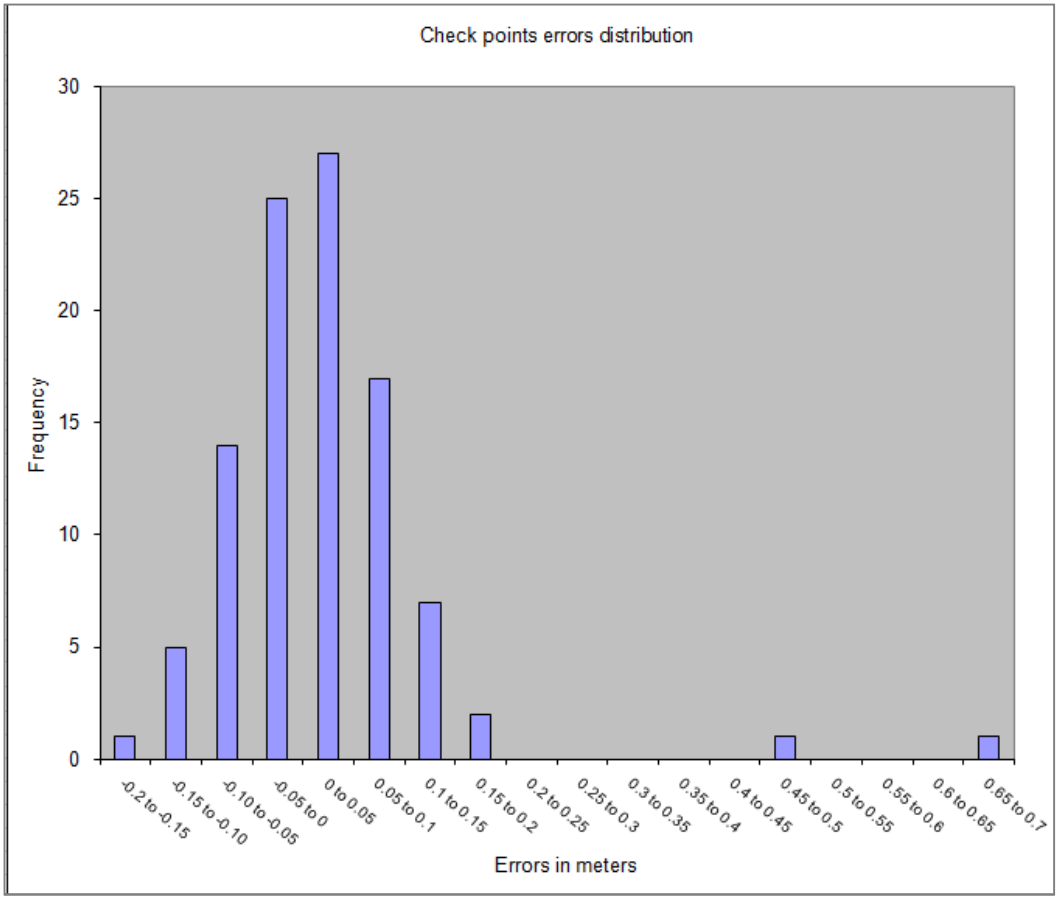


Figure 19 — Histogram of Elevation Discrepancies within errors in meters

CONCLUSION

Based on the vertical accuracy testing conducted by Dewberry, the LiDAR dataset for the USGS FEMA VI – Bayou Meto LiDAR Project satisfies the project's pre-defined vertical accuracy criteria.

Breakline Production & Qualitative Assessment Report

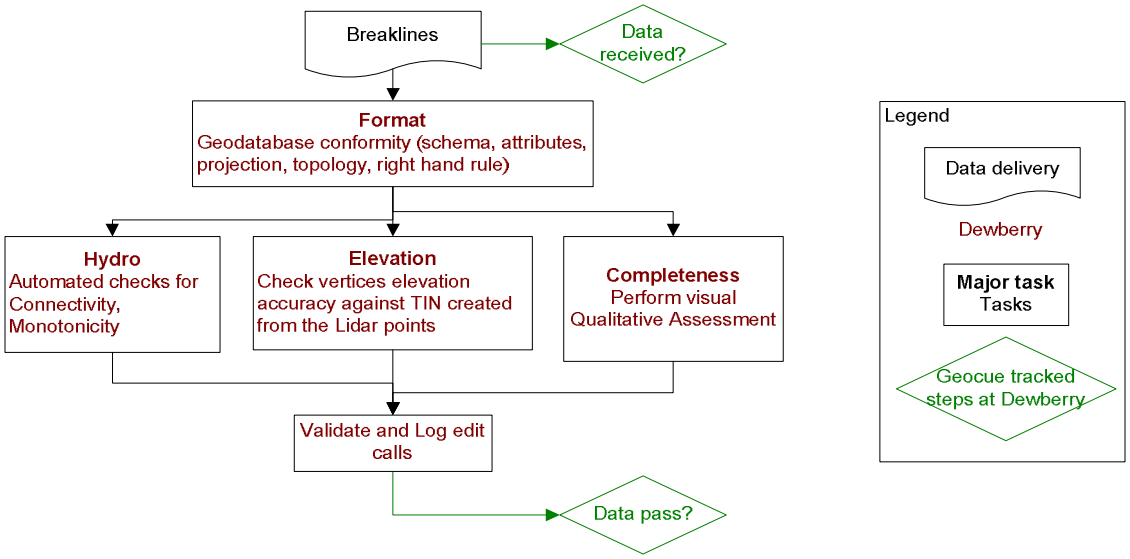
BREAKLINE PRODUCTION METHODOLOGY

Dewberry used GeoCue software to develop LiDAR stereo models of the USGS FEMA VI – Bayou Meto LiDAR Project area so the LiDAR derived data could be viewed in 3-D stereo using Socet Set softcopy photogrammetric software. Using LiDARgrammetry procedures with LiDAR intensity imagery, Dewberry used the stereo models developed by Dewberry to stereo-compile the three types of hard breaklines in accordance with the project's Data Dictionary.

All drainage breaklines are monotonically enforced to show downhill flow. Water bodies are reviewed in stereo and the lowest elevation is applied to the entire waterbody.

BREAKLINE QUALITATIVE ASSESSMENT

Dewberry completed breakline qualitative assessments according to a defined workflow. The following workflow diagram represents the steps taken by Dewberry to provide a thorough qualitative assessment of the breakline data.



BREAKLINE TOPOLOGY RULES

Automated checks are applied on hydro features to validate the 3D connectivity of the feature and the monotonicity of the hydrographic breaklines. Dewberry's major concern was that the hydrographic breaklines have a continuous flow downhill and that breaklines do not undulate. Error points are generated at each vertex not complying with the tested rules and these potential edit calls are then visually validated during the visual evaluation of the data. This step also helped validate that breakline vertices did not have excessive minimum or maximum elevations and that elevations are consistent with adjacent vertex elevations.

The next step is to compare the elevation of the breakline vertices against the elevation extracted from the ESRI Terrain built from the LiDAR ground points, keeping in mind that a discrepancy is expected because of the hydro-enforcement applied to the breaklines and because of the interpolated imagery used to acquire the breaklines. A given tolerance is used to validate if the elevations differ too much from the LiDAR.

Dewberry's final check for the breaklines was to perform a full qualitative analysis. Dewberry compared the breaklines against LiDAR intensity images to ensure breaklines were captured in the required locations. The quality control steps taken by Dewberry are outlined in the QA Checklist below.

BREAKLINE QA/QC CHECKLIST

Project Number/Description: TO G10PC00013 USGS FEMA VI – Bayou Meto LiDAR

Date:_____10/9/2012_____

Overview

☒ All Feature Classes are present in GDB

☒ All features have been loaded into the geodatabase correctly. Ensure feature classes with subtypes are domained correctly.

☒ The breakline topology inside of the geodatabase has been validated. See Data Dictionary for specific rules

☒ Projection/coordinate system of GDB is accurate with project specifications

Perform Completeness check on breaklines using either intensity or ortho imagery

☒ Check entire dataset for missing features that were not captured, but should be to meet baseline specifications or for consistency (See Data Dictionary for specific collection rules). Features should be collected consistently across tile bounds within a dataset as well as be collected consistently between datasets.

☒ Check to make sure breaklines are compiled to correct tile grid boundary and there is full coverage without overlap

☒ Check to make sure breaklines are correctly edge-matched to adjoining datasets if applicable. Ensure breaklines from one dataset join breaklines from another dataset that are coded the same and all connecting vertices between the two datasets match in X,Y, and Z (elevation). There should be no breaklines abruptly ending at dataset boundaries and no discrepancies of Z-elevation in overlapping vertices between datasets.

Compare Breakline Z elevations to LiDAR elevations

☒ Using a terrain created from LiDAR ground points and water points and GeoFIRM tools, drape breaklines on terrain to compare Z values. Breakline elevations should be at or below the elevations of the immediately surrounding terrain. This should be performed before other breakline checks are completed.

Perform automated data checks using PLTS

The following data checks are performed utilizing ESRI's PLTS extension. These checks allow automated validation of 100% of the data. Error records can either be written to a table for future correction, or browsed for immediate correction. PLTS checks should always be performed on the full dataset.

☒ Perform "adjacent vertex elevation change check" on the Inland Ponds feature class (Elevation Difference Tolerance=.001 meters). This check will return Waterbodies whose vertices are not all identical. This tool is found under "Z Value Checks."

☒ Perform "unnecessary polygon boundaries check" on Inland Ponds and Inland Streams feature classes. This tool is found under "Topology Checks."

☒ Perform "duplicate geometry check" on (inland streams to inland streams), (inland ponds to inland ponds), (inland ponds to inland streams). Attributes do not need to be checked during this tool. This tool is found under "Duplicate Geometry Checks."

☒ Perform "geometry on geometry check" on (inland ponds to inland streams). Spatial relationship is contains, attributes do not need to be checked. This tool is found under "Feature on Feature Checks."

☒ Perform "polygon overlap/gap is sliver check" (inland streams to inland streams), (inland ponds to inland ponds), (inland ponds to inland streams). Maximum Polygon Area is not required. This tool is found under "Feature on Feature Checks."

Perform Dewberry Proprietary Tool Checks

☒ Perform monotonicity check on inland streams features using "A3_checkMonotonicityStreamLines." This tool looks at line direction as well as elevation. Features in the output shapefile attributed with a "d" are correct monotonically, but were compiled from low elevation to high elevation. These errors can be ignored. Features in the output shapefile attributed with an "m" are not correct monotonically and need elevations to be corrected. Input features for this tool need to be in a geodatabase. Z tolerance is .01 meters. Polygons need to be exported as lines for the monotonicity tool.

☒ Perform connectivity check between (inland ponds to inland streams) using the tool "07_CheckConnectivityForHydro." The input for this tool needs to be in a geodatabase.

The output is a shapefile showing the location of overlapping vertices from the polygon features and polyline features that are at different Z-elevation. The unnecessary polygon boundary check must be run and all errors fixed prior to performing connectivity check. If there are exceptions to the polygon boundary rule then that feature class must be checked against itself, i.e. inland streams to inland streams.

Metadata

☒ Each XML file (1 per feature class) is error free as determined by the USGS MP tool

☒ Metadata content contains sufficient detail and all pertinent information regarding source materials, projections, datums, processing steps, etc. Content should be consistent across all feature classes.

Completion Comments: **Complete – Approved**

Data Dictionary

HORIZONTAL AND VERTICAL DATUM

The horizontal datum shall be North American Datum of 1983, Units in Meters. The vertical datum shall be referenced to the North American Vertical Datum of 1988 (NAVD 88), Units in Meters. Geoid09 shall be used to convert ellipsoidal heights to orthometric heights.

COORDINATE SYSTEM AND PROJECTION

All data shall be projected to UTM Zone 11, Horizontal Units in Meters and Vertical Units in Meters.

INLAND STREAMS AND RIVERS

Feature Dataset: BREAKLINES
Feature Class: STREAMS_AND_RIVERS
Feature Type: Polygon

Contains M Values: No
Contains Z Values: Yes
Annotation Subclass: None

XY Resolution: Accept Default Setting
Z Resolution: Accept Default Setting
XY Tolerance: 0.003
Z Tolerance: 0.001

Description

This polygon feature class will depict linear hydrographic features with a width greater than 100 feet.

Table Definition

Field Name	Data Type	Allow Null Values	Default Value	Domain	Precision	Scale	Length	Responsibility
OBJECTID	Object ID							Assigned by Software
SHAPE	Geometry							Assigned by Software
SHAPE_LENGTH	Double	Yes			0	0		Calculated by Software
SHAPE_AREA	Double	Yes			0	0		Calculated by Software

Feature Definition

Description	Definition	Capture Rules
Streams and Rivers	Linear hydrographic features such as streams, rivers, canals, etc. with an average width greater than 100 feet. In the case of embankments, if the feature forms a natural dual line channel, then capture it consistent with the capture rules.	Capture features showing dual line (one on each side of the feature). Average width shall be great than 100 feet to show as a double line. Each vertex placed should maintain vertical integrity and data is required to show "closed polygon". Generally both banks shall be collected to show consistent downhill flow. There are exceptions to this rule where a small branch or offshoot of the stream or river is present. The banks of the stream must be captured at the same elevation to ensure flatness of the water feature. If the elevation of the banks appears to be different see the task manager or PM for further guidance. Breaklines must be captured at or just below the elevations of the immediately surrounding terrain. Under no circumstances should a feature be elevated above the surrounding LiDAR points. Acceptable variance in the negative direction will be defined for each project individually. These instructions are only for docks or piers that follow the coastline or water's edge, not for docks or piers that extend perpendicular from the land into the water. If it can be reasonably determined where the edge of water most probably falls,

		beneath the dock or pier, then the edge of water will be collected at the elevation of the water where it can be directly measured. If there is a clearly-indicated headwall or bulkhead adjacent to the dock or pier and it is evident that the waterline is most probably adjacent to the headwall or bulkhead, then the water line will follow the headwall or bulkhead at the elevation of the water where it can be directly measured. If there is no clear indication of the location of the water's edge beneath the dock or pier, then the edge of water will follow the outer edge of the dock or pier as it is adjacent to the water, at the measured elevation of the water. Every effort should be made to avoid breaking a stream or river into segments. Dual line features shall break at road crossings (culverts). In areas where a bridge is present the dual line feature shall continue through the bridge. Islands: The double line stream shall be captured around an island if the feature is greater than ½ acre. The island feature will be represented as a "hole" in the hydrographic feature.

INLAND PONDS AND LAKES

Feature Dataset: BREAKLINES
Feature Class: PONDS_AND_LAKES
Feature Type: Polygon

Contains M Values: No
Contains Z Values: Yes
Annotation Subclass: None

XY Resolution: Accept Default Setting
Z Resolution: Accept Default Setting
XY Tolerance: 0.003
Z Tolerance: 0.001

Description

This polygon feature class will depict closed water body features that are at a constant elevation.

Table Definition

Field Name	Data Type	Allow Null Values	Default Value	Domain	Precision	Scale	Length	Responsibility
OBJECTID	Object ID							Assigned by Software
SHAPE	Geometry							Assigned by Software
SHAPE_LENGTH	Double	Yes			0	0		Calculated by Software
SHAPE_AREA	Double	Yes			0	0		Calculated by Software

Feature Definition

Description	Definition	Capture Rules
Ponds and Lakes	Land/Water boundaries of constant elevation water bodies such as lakes, reservoirs, ponds, etc. Features shall be defined as closed polygons and contain an elevation value that reflects the best estimate of the water elevation at the time of data capture. Water body features will be captured for features 2 acres in size or greater. "Donuts" will exist where there are islands within a	Water bodies shall be captured as closed polygons with the water feature to the right. The compiler shall take care to ensure that the z-value remains consistent for all vertices placed on the water body. Breaklines must be captured at or just below the elevations of the immediately surrounding terrain. Under no circumstances should a feature be elevated above the surrounding LiDAR points. Acceptable variance in the negative direction will be defined for each project individually. An Island within a Closed Water Body Feature

	closed water body feature greater than ½ acre in size.	will also have a "donut polygon" compiled. These instructions are only for docks or piers that follow the coastline or water's edge, not for docks or piers that extend perpendicular from the land into the water. If it can be reasonably determined where the edge of water most probably falls, beneath the dock or pier, then the edge of water will be collected at the elevation of the water where it can be directly measured. If there is a clearly-indicated headwall or bulkhead adjacent to the dock or pier and it is evident that the waterline is most probably adjacent to the headwall or bulkhead, then the water line will follow the headwall or bulkhead at the elevation of the water where it can be directly measured. If there is no clear indication of the location of the water's edge beneath the dock or pier, then the edge of water will follow the outer edge of the dock or pier as it is adjacent to the water, at the measured elevation of the water.

TIDAL WATERS

Feature Dataset: BREAKLINES
Feature Class: Tidal Waters
Feature Type: Polygon

Contains M Values: No
Contains Z Values: Yes
Annotation Subclass: None

XY Resolution: Accept Default Setting
Z Resolution: Accept Default Setting
XY Tolerance: 0.003
Z Tolerance: 0.001

Description

This polygon feature class will outline the land / water interface at the time of LiDAR acquisition.

Table Definition

Field Name	Data Type	Allow Null Values	Default Value	Domain	Precision	Scale	Length	Responsibility
OBJECTID	Object ID							Assigned by Software
SHAPE	Geometry							Assigned by Software

SHAPE_LENGTH	Double	Yes			0	0		Calculated by Dewberry
SHAPE_AREA	Double	Yes			0	0		Calculated by Dewberry

Feature Definition

Description	Definition	Capture Rules
TIDAL_WATERS	The coastal breakline will delineate the land water interface using LiDAR data as reference. In flight line boundary areas with tidal variation the coastal shoreline may show stair stepping as no feathering is allowed. Stair stepping is allowed to show as much ground as the collected data permits.	The feature shall be extracted at the apparent land/water interface, as determined by the LiDAR intensity data, to the extent of the tile boundaries. Differences caused by tidal variation are acceptable and breaklines delineated should reflect that change with no feathering. Breaklines must be captured at or just below the elevations of the immediately surrounding terrain. Under no circumstances should a feature be elevated above the surrounding LiDAR points. Acceptable variance in the negative direction will be defined for each project individually. If it can be reasonably determined where the edge of water most probably falls, beneath the dock or pier, then the edge of water will be collected at the elevation of the water where it can be directly measured. If there is a clearly-indicated headwall or bulkhead adjacent to the dock or pier and it is evident that the waterline is most probably adjacent to the headwall or bulkhead, then the water line will follow the headwall or bulkhead at the elevation of the water where it can be directly measured. If there is no clear indication of the location of the water's edge beneath the dock or pier, then the edge of water will follow the outer edge of the dock or pier as it is adjacent to the water, at the measured elevation of the water. Breaklines shall snap and merge seamlessly with linear hydrographic features.

CONTACT INFORMATION

Any questions regarding this document should be addressed to:

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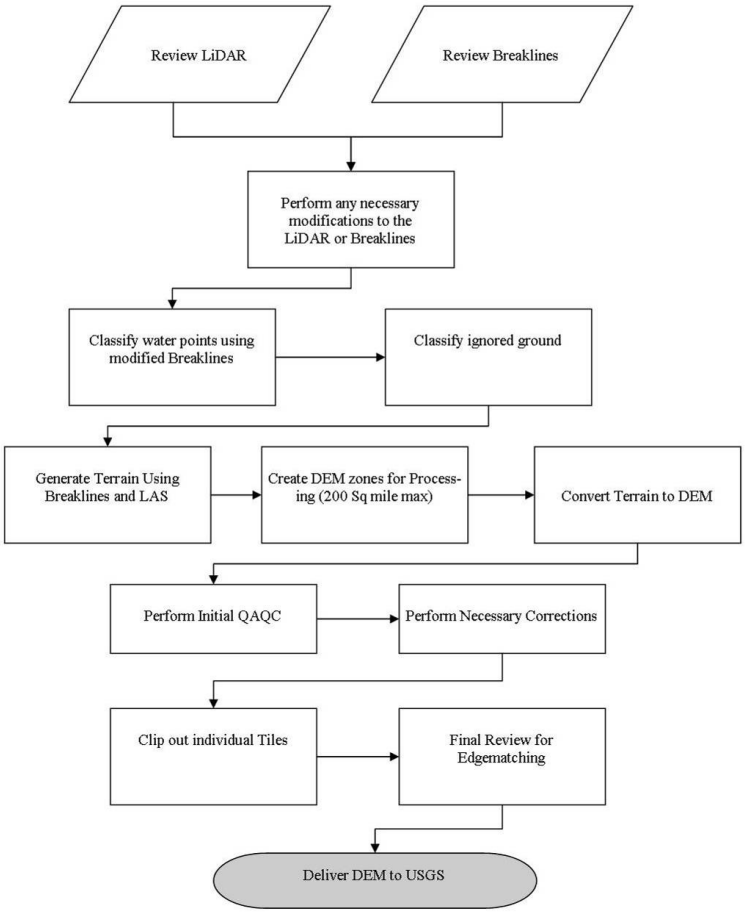
DEM Production & Qualitative Assessment

DEM PRODUCTION METHODOLOGY

Dewberry utilized ESRI software and Global Mapper for the DEM production and QC process. ArcGIS software is used to generate the products and the QC is performed in both ArcGIS and Global Mapper.

Dewberry Hydro-Flattening Workflow



1. Classify Water Points: LAS point falling within hydrographic breaklines shall be classified to ASPRS class 9 using TerraScan. Breaklines must be prepared correctly prior to performing this task.
2. Classify Ignored Ground Points: Classify points in close proximity to the breaklines from Ground to class 10 (Ignored Ground). Close proximity will be defined as no more than 1x the nominal point spacing on the landward side of the breakline. Breaklines will be buffered using this specification and the subsequent file will need to be prepared in the same manner as the water breaklines for classification. This process will be performed after the water points have been classified and only run on remaining ground points.
3. Terrain Processing: A Terrain will be generated using the Breaklines and LAS data that has been imported into Arc as a Multipoint File. If the final DEMs are to be clipped to a project boundary that boundary will be used during the generation of the Terrain.
4. Create DEM Zones for Processing: Create DEM Zones that are buffered around the edges. Zones should be created in a logical manner to minimize the number of zones without creating zones too large for processing. Dewberry will make zones no larger than 200 square miles (taking into account that a DEM will fill in the entire extent not just where LiDAR is present). Once the first zone is created it must be verified against the tile grid to ensure that the cells line up perfectly with the tile grid edge.
5. Convert Terrain to Raster: Convert Terrain to raster using the DEM Zones created in step 4. In the environmental properties set the extents of the raster to the buffered Zone. For each subsequent zone, the first DEM will be utilized as the snap raster to ensure that zones consistently snap to one another.
6. Perform Initial QAQC on Zones: During the initial QA process anomalies will be identified and corrective polygons will be created.
7. Correct Issues on Zones: Dewberry will perform corrections on zones following Dewberry's correction process.
8. Extract Individual Tiles: Dewberry will extract individual tiles from the zones utilizing the Dewberry created tool.
9. Final QA: Final QA will be performed on the dataset to ensure that tile boundaries are seamless.

DEM QUALITATIVE ASSESSMENT

Dewberry performed a comprehensive qualitative assessment of the DEM deliverables to ensure that all tiled DEM products were delivered with the proper extents, were free of processing artifacts, and contained the proper referencing information. This process was performed in ArcGIS software with the use of a tool set Dewberry has developed to verify that the raster extents match those of the tile grid and contain the correct projection information. The DEM data was reviewed at a scale of 1:5000 to review for artifacts caused by the DEM generation process and to review the hydro-flattened features. To perform this review Dewberry creates HillShade models and overlays a partially transparent colorized elevation model to review for these issues. Upon completion of this review the DEM data is loaded into Global Mapper to ensure that all files are readable and that no artifacts exist between tiles.

DEM VERTICAL ACCURACY RESULTS

The same 100 checkpoints that were used to test the vertical accuracy of the LiDAR were used to validate the vertical accuracy of the final DEM products as well. Accuracy results may vary between the source LiDAR and final DEM deliverable. DEMs are created by averaging several

LiDAR points within each pixel which may result in slightly different elevation values at each survey checkpoint when compared to the source LAS, which does not average several LiDAR points together but may interpolate (linearly) between two or three points to derive an elevation value.

Out of the 100 checkpoints received from the surveyor, one was determined to be located near a hydrographic feature that was collected and flattened in the final DEM. The resulting difference in elevation between the surveyed elevation and the elevation interpolated from the hydro flattened DEM, though only a few centimeters, was significant enough to justify the omission of this point from the DEM accuracy testing. This is likely due to different amounts of water being present at the time of the survey than at the time of LiDAR acquisition.

Table 7 lists the information for the omitted point.

Point ID	Easting	Northing	Elevation	zDEM	Land Cover Code	Land Cover Type	Delta Z	AbsDelta Z
707	593729.012	3842351.22	69.96	69.5914	F	Forested and Fully Grown	-0.37	0.37

Table 7 – Checkpoint omitted from the DEM accuracy testing.

Table 8 summarizes the tested vertical accuracy results from a comparison of the surveyed checkpoints to the elevation values present within the final DEM dataset.

Land Cover Category	# of Points	FVA – Fundamental Vertical Accuracy (RMSEz x 1.9600) Spec=0.245 m	CVA – Consolidated Vertical Accuracy (95th Percentile) Spec=0.363 m	SVA – Supplemental Vertical Accuracy (95th Percentile) Target=0.363 m
Consolidated	99		0.13	
Bare Earth-Open Terrain	20	0.09		
Tall Weeds and Crops	20			0.10
Forested and Fully Grown	19			0.24
Brush and Small Trees	20			0.14
Urban	20			0.13

Table 8 – FVA, CVA, and SVA Vertical Accuracy at 95% Confidence Level

The $RMSE_z$ for checkpoints in open terrain only tested 0.05 meters, within the target criteria of 0.125 meters. Compared with the 0.245 meters specification, the FVA tested 0.09 meters at the 95% confidence level based on $RMSE_z$ x 1.9600.

Compared with the 0.363 meters specification, CVA for all checkpoints in all land cover categories combined tested 0.13 meters based on the 95th percentile.

Compared with target 0.363 specification, SVA for checkpoints in the tall weeds and crops land cover category tested 0.10 meters based on the 95th percentile, checkpoints in the forested and fully grown land cover category tested 0.24 meters based on the 95th percentile, checkpoints in

the brush and small trees land cover category tested 0.14 meters based on the 95th percentile, and checkpoints in the urban land cover category tested 0.13 meters based on the 95th percentile.

Table 9 lists the 5% outliers that are larger than the 95th percentile.

Point ID	NAD83 UTM North Zone 15		NAVD88	DEM Z (m)	Delta Z	AbsDelta Z
	Easting - X (m)	Northing - Y (m)	Survey Z (m)			
319	578952.92	3873709.96	180.99	180.845419	-0.15	0.15
611	629043.537	3822678.364	58.65	58.792815	0.14	0.14
615	601199.845	3858561.914	76.02	76.164131	0.14	0.14
704	611600.312	3832895.472	61.524	62.258397	0.73	0.73
705	621678.981	3829286.507	59.922	60.108493	0.19	0.19

Table 9 — 5% Outliers

Table 10 provides overall descriptive statistics.

100 % of Totals	RMSE (m) Open Terrain Spec=0.125 m	Mean (m)	Mean Absolute (m)	Median (m)	Skew	Std Dev (m)	# of Points	Min (m)	Max (m)
Consolidated		0.02	0.06	0.01	3.66	0.10	99	-0.15	0.73
Open Terrain	0.05	-0.02	0.04	-0.03	0.16	0.04	20	-0.09	0.08
Urban		0.01	0.06	0.03	-0.66	0.08	20	-0.15	0.13
Tall Weeds and Crops		0.00	0.05	0.06	-0.56	0.07	20	-0.08	0.14
Brush Lands and Trees		-0.56	0.07	0.06	-0.56	0.07	20	-0.08	0.14
Forested and Fully Grown		0.04	0.10	0.00	3.07	0.19	19	-0.11	0.73

Table 10 — Overall Descriptive Statistics

DEM QA/QC CHECKLIST

Project Number/Description: TO G12PC00037 USGS FEMA – Bayou Meto LiDAR
Date:_____10/9/2012_____

Overview

☒ Correct number of files is delivered and all files are in ERDAS IMG format
☒ Verify Raster Extents
☒ Verify Projection/Coordinate System

Review

☒ Manually review bare-earth DEMs with a hillshade to check for issues with hydro-enforcement process or any general anomalies that may be present. Specifically, water should be flowing downhill, water features should NOT be floating above surrounding terrain and bridges should NOT be present in bare-earth DEM. Hydrologic breaklines should be overlaid during review of DEMs.
☒ Overlap points (in the event they are supplied to fill in gaps between adjacent flightlines) are not to be used to create the bare-earth DEMs

☒ DEM cell size is 1 meter
☒ Perform final overview in Global Mapper to ensure seamless product.

Metadata

☒ Project level DEM metadata XML file is error free as determined by the USGS MP tool

☒ Metadata content contains sufficient detail and all pertinent information regarding source materials, projections, datums, processing steps, etc.

Completion Comments: Complete – Approved

Appendix A: LIDAR QC Survey Control Report 2012

The scope of this project included control recovery and GPS surveying to establish x, y, & z positions of 100 plus locations divided into 5 unique ground cover classifications to be used as LIDAR imagery ground truthing quality control checking throughout the new project image area.

Locations were planned from office project limits layouts with some field adjustments. Control points classification points were located then measured by gps surveys for horizontal and vertical locations. Recovered NGS high Order horizontal and vertical monuments were used to establish the horizontal and vertical datum used for this survey. Five existing federal government geodetic control stations were incorporated to our primary control network. Surveyor positioned secondary base stations totaling five supplemented the NGS control stations to provide shorter vectors and a more dense overall network. Control was planned to be at least Second Order horizontal and Third Order vertical. The datum for this project was in NAD83 horizontal and NAVD88 vertical in meter units and the final adjusted data was reported in UTM North Zone 15 datum with orthometric elevations.

This project area is a combined agriculture and somewhat developed. The eastern and southern portion is made up of large mostly flat irrigated farm fields. The northern portion of the area is a little more hilly and more developed.

gps measurements commenced on May 22, 2012 and were completed on May 26, 2012 which is Julian days 143 thru 147 in year 2012. All measurements were made in a static mode. Each site was occupied for several minutes and the base stations ran for several hours. Control point sites were located with one dual frequency receiver running as a base station and a second and third (sometimes) dual frequency receiver as a rover to the various new locations.

The equipment configuration for this project consists of industry standard gps and conventional surveying equipment. The gps equipment used was a combination of Topcon dual frequency(L1/L2) receivers. The Topcon receivers are the Hiper GD and Hiper Plus type. Topcon Tools gps processing software was used to post process all observed data.

Each observation was logged for site id, receiver type, height of antenna, start time and date. Length of vector, time of day, SV configuration and site obstructions determined the length of observation at each site. Data was downloaded to the PC after each day's sessions. Initial processing was performed to verify we had good vector solutions between sites.

The horizontal and vertical datum for this survey was based on recovered high order NGS monuments NGS PID EH2124, EH3099, EH3129, EH3128 and DF7953

The Topcon Tools processing software reports the horizontal and vertical precision of every vector measured and summarizes the standard deviation in x, y and z position for each individual control point.

The final adjusted coordinate values are as listed herein. gps software adjustment summaries are included for your future reference. Photo references are attached in separate documents.

Steven A. Wood, L.S., C.P.,

Land Cover Classifications

NUMBER OF POINTS	LAND COVER CLASS	LAND COVER DESCRIPTION
20	Class 1	Bare Earth / Open Terrain
20	Class 2	Urban
20	Class 3	Tall Weeds and Crops
20	Class 4	Brush Lands and Trees
20	Class 5	Forested and Fully Grown

Daily gps Observation Survey Adjustments

Project Summary

Project name: Arkansas2_BaseNetwork.ttp
Surveyor:
Comment:
Linear unit: USFeet
Projection: SPC83-Arkansas (South)
Geoid: g2009u07
Adjustment Summary

Adjustment type: Plane + Height, Constraint
Confidence level: 95 %
Number of adjusted points: 10
Number of plane control points: 2
Number of used GPS vectors: 11
A posteriori plane UWE: 0.5533954 , Bounds: (0.4546061 , 1.551881)
Number of height control points: 2
A posteriori height UWE: 0.8581637 , Bounds: (0.2683282 , 1.766352)

Used GPS Observations					
Name	**dN (USft)**	**dE (USft)**	**dHt (USft)**	**Horz RMS (USft)**	**Vert RMS (USft)**

417–BM96	-2406.534	-28931.853	24.998	0.023	0.035
417–BM99	-67540.535	95541.568	-81.114	0.037	0.071
417–DF7953	8273.222	23883.768	-76.030	0.016	0.036
BM97–BM99	72853.551	-53237.191	16.769	0.033	0.054
BM97–EH3099	-65625.457	33071.932	-12.956	0.026	0.047
BM97–EH3128	0.776	-586.842	1.332	0.006	0.008
BM97–EH3129	1763.484	-94.311	-4.962	0.002	0.004
BM98–BM99	54859.054	8877.019	27.692	0.020	0.033
BM99–EH2124	-5344.996	-30029.478	-5.081	0.023	0.034
BM99–EH3128	-72852.816	52650.348	-15.501	0.143	0.244
BM99–EH3129	-71090.068	53142.854	-21.799	0.036	0.058

GPS Observation Residuals

Name	dN (USft)	dE (USft)	dHt (USft)	Horz RMS (USft)	Vert RMS (USft)
417–BM96	-2406.534	-28931.853	24.998	0.023	0.035
417–BM99	-67540.535	95541.568	-81.114	0.037	0.071
417–DF7953	8273.222	23883.768	-76.030	0.016	0.036
BM97–BM99	72853.551	-53237.191	16.769	0.033	0.054
BM97–EH3099	-65625.457	33071.932	-12.956	0.026	0.047
BM97–EH3128	0.776	-586.842	1.332	0.006	0.008
BM97–EH3129	1763.484	-94.311	-4.962	0.002	0.004
BM98–BM99	54859.054	8877.019	27.692	0.020	0.033
BM99–DF7953	75814.052	-71657.765	5.171	0.181	0.151
BM99–EH2124	-5344.996	-30029.478	-5.081	0.023	0.034
BM99–EH3128	-72852.816	52650.348	-15.501	0.143	0.244
BM99–EH3129	-71090.068	53142.854	-21.799	0.036	0.058

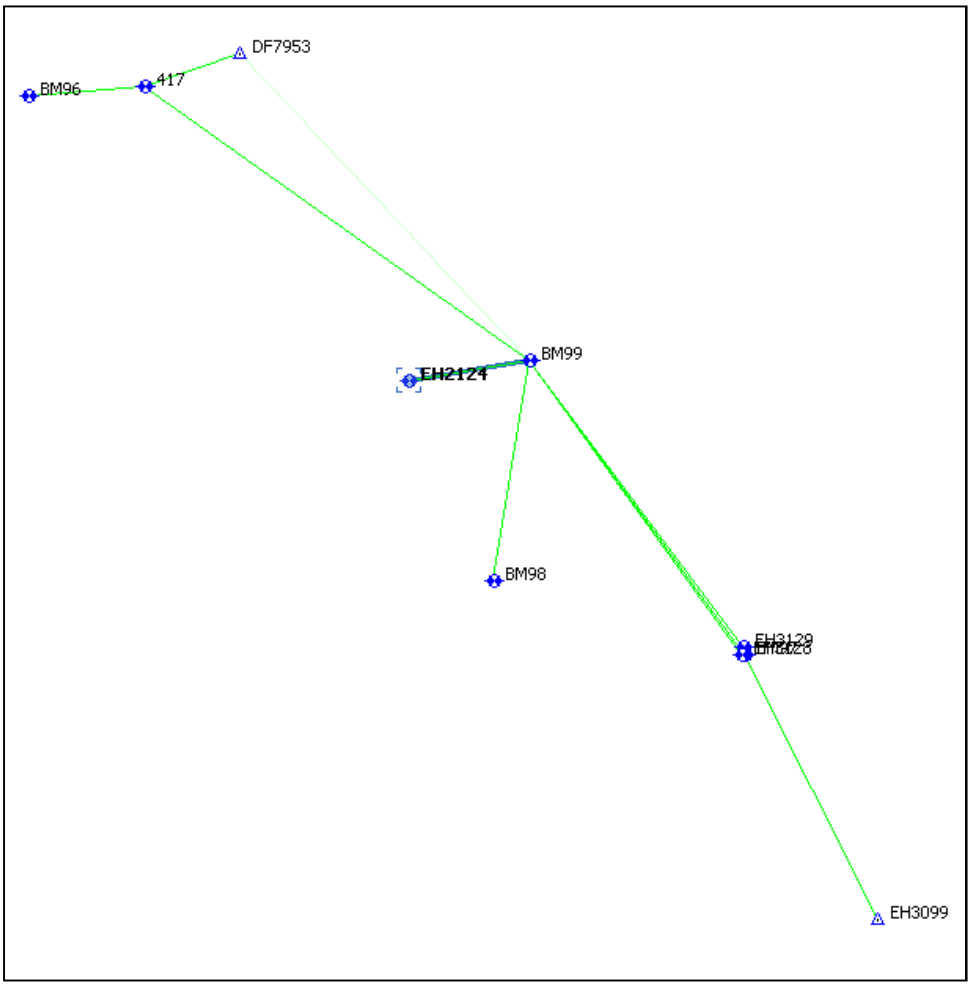
Control Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
DF7953	2163468.810	1315221.680	245.030	
EH3099	1949176.010	1473188.600	207.650	

Adjusted Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
417	2155195.584	1291337.913	321.001	
BM96	2152789.050	1262406.059	346.187	
BM97	2014801.474	1440116.665	221.176	
BM98	2032795.982	1378002.465	210.032	
BM99	2087655.036	1386879.484	238.636	

EH2124	2082310.040	1356850.006	233.307	
EH3128	2014802.250	1439529.824	222.505	
EH3129	2016564.957	1440022.354	216.232	



Project Summary

Project name: Arkansas2_05222012.ttp
Surveyor:
Comment:
Linear unit: USFeet
Projection: SPC83-Arkansas (South)
Geoid: g2009u07
Adjustment Summary

Adjustment type: Plane + Height, Minimal constraint
Confidence level: 95 %
Number of adjusted points: 33
Number of plane control points: 1
Number of used GPS vectors: 56
A posteriori plane UWE: 0.7084724 , Bounds: (0.8003278 , 1.199184)

Number of height control points: 1
A posteriori height UWE: 0.7782878 , Bounds: (0.7187953 , 1.280625)

Used GPS Observations					
Name	**dN (USft)**	**dE (USft)**	**dHt (USft)**	**Horz RMS (USft)**	**Vert RMS (USft)**
301–BM99	4083.396	-1577.071	6.740	0.021	0.035
302–BM99	6328.404	17436.095	10.517	0.024	0.033
401–501	-10947.973	6821.794	5.971	0.018	0.031
401–501A	-10992.992	6740.887	6.917	0.014	0.024
401–702	67.209	-10085.392	-0.302	0.027	0.051
401–703	-10577.603	-2383.420	-20.367	0.036	0.066
401–703A	-10570.378	-2322.751	-20.277	0.036	0.063
401–BM99	45695.045	-36056.817	15.911	0.021	0.036
402–403	10485.644	285.301	7.514	0.009	0.014
402–603	-172.483	11504.908	-7.508	0.006	0.011
402–603A	-132.070	11511.299	-7.749	0.021	0.034
402–BM99	55926.160	-9751.291	31.284	0.021	0.036
403–BM99	45440.464	-10036.575	23.903	0.054	0.088
404–504	9.389	16553.217	-8.534	0.019	0.035
404–BM99	34768.297	17113.682	8.976	0.044	0.095
405–BM99	18551.415	247.469	14.062	0.021	0.035
501–501A	-45.021	-80.907	0.961	0.004	0.007
501–BM99	56643.050	-42878.588	9.836	0.085	0.142
501A–BM99	56688.065	-42797.703	8.944	0.118	0.196
502–502A	84.337	-18.384	0.957	0.002	0.004
502–503	4847.408	-10617.295	17.859	0.006	0.011
502–503A	4736.855	-10626.681	18.207	0.006	0.011
502–704	-9676.737	-8142.981	-7.723	0.017	0.034
502–704A	-9709.100	-8202.555	-3.077	0.015	0.027
502–BM99	50446.029	962.687	28.050	0.020	0.039
502A–704	-9761.104	-8124.598	-8.649	0.055	0.092
502A–704A	-9793.437	-8184.111	-4.039	0.162	0.309
502A–BM99	50361.676	981.017	27.109	0.033	0.063
503–503A	-110.550	-9.375	0.386	0.004	0.008
503–BM99	45598.576	11579.965	10.371	0.036	0.083
503A–504	10950.192	11028.899	-7.549	0.071	0.149

503A–BM99	45709.144	11589.373	9.897	0.019	0.041
504–504A	79.084	7.012	0.736	0.004	0.007
504–BM99	34758.963	560.473	17.416	0.022	0.043
601–601A	113.566	-6.420	1.016	0.004	0.007
601–BM99	5508.590	-16085.020	2.852	0.011	0.018
601A–BM99	5395.014	-16078.591	1.796	0.016	0.023
602–602A	-16.198	93.944	1.090	0.003	0.005
602–BM99	34969.727	-14060.016	18.936	0.024	0.045
602A–BM99	34985.911	-14153.967	17.795	0.022	0.039
603–603A	40.393	6.402	-0.275	0.024	0.039
603–BM99	56098.619	-21256.214	38.744	0.058	0.111
603A–BM99	56058.241	-21262.633	39.031	0.069	0.134
604–604A	18.815	-80.857	-0.265	0.015	0.024
604–BM99	16344.516	16626.141	7.614	0.015	0.025
604A–BM99	16325.713	16706.997	7.871	0.012	0.020
701–BM99	16117.337	-10935.296	23.922	0.022	0.057
701A–BM99	16137.039	-11212.004	16.956	0.377	1.136
702–702A	-12.828	88.053	2.045	0.371	0.697
702–BM99	45627.867	-25971.408	16.230	0.071	0.135
702A–BM99	45640.667	-26059.487	14.275	0.083	0.154
703–703A	7.207	60.667	0.004	0.039	0.069
704–704A	-32.333	-59.556	4.610	0.021	0.041
704–BM99	60122.795	9105.656	35.774	0.070	0.146
704A–BM99	60155.128	9165.216	31.144	0.077	0.134
BM99–EH2124	-5344.996	-30029.478	-5.081	0.023	0.034

GPS Observation Residuals

Name	dN (USft)	dE (USft)	dHt (USft)	Horz RMS (USft)	Vert RMS (USft)
301–BM99	4083.396	-1577.071	6.740	0.021	0.035
302–BM99	6328.404	17436.095	10.517	0.024	0.033
401–501	-10947.973	6821.794	5.971	0.018	0.031
401–501A	-10992.992	6740.887	6.917	0.014	0.024
401–702	67.209	-10085.392	-0.302	0.027	0.051
401–703	-10577.603	-2383.420	-20.367	0.036	0.066
401–703A	-10570.378	-2322.751	-20.277	0.036	0.063
401–BM99	45695.045	-36056.817	15.911	0.021	0.036
402–403	10485.644	285.301	7.514	0.009	0.014

402–603	-172.483	11504.908	-7.508	0.006	0.011
402–603A	-132.070	11511.299	-7.749	0.021	0.034
402–BM99	55926.160	-9751.291	31.284	0.021	0.036
403–BM99	45440.464	-10036.575	23.903	0.054	0.088
404–504	9.389	16553.217	-8.534	0.019	0.035
404–BM99	34768.297	17113.682	8.976	0.044	0.095
405–BM99	18551.415	247.469	14.062	0.021	0.035
501–501A	-45.021	-80.907	0.961	0.004	0.007
501–BM99	56643.050	-42878.588	9.836	0.085	0.142
501A–BM99	56688.065	-42797.703	8.944	0.118	0.196
502–502A	84.337	-18.384	0.957	0.002	0.004
502–503	4847.408	-10617.295	17.859	0.006	0.011
502–503A	4736.855	-10626.681	18.207	0.006	0.011
502–704	-9676.737	-8142.981	-7.723	0.017	0.034
502–704A	-9709.100	-8202.555	-3.077	0.015	0.027
502–BM99	50446.029	962.687	28.050	0.020	0.039
502A–704	-9761.104	-8124.598	-8.649	0.055	0.092
502A–704A	-9793.437	-8184.111	-4.039	0.162	0.309
502A–BM99	50361.676	981.017	27.109	0.033	0.063
503–503A	-110.550	-9.375	0.386	0.004	0.008
503–BM99	45598.576	11579.965	10.371	0.036	0.083
503A–504	10950.192	11028.899	-7.549	0.071	0.149
503A–BM99	45709.144	11589.373	9.897	0.019	0.041
504–504A	79.084	7.012	0.736	0.004	0.007
504–BM99	34758.963	560.473	17.416	0.022	0.043
601–601A	113.566	-6.420	1.016	0.004	0.007
601–BM99	5508.590	-16085.020	2.852	0.011	0.018
601A–BM99	5395.014	-16078.591	1.796	0.016	0.023
602–602A	-16.198	93.944	1.090	0.003	0.005
602–BM99	34969.727	-14060.016	18.936	0.024	0.045
602A–BM99	34985.911	-14153.967	17.795	0.022	0.039
603–603A	40.393	6.402	-0.275	0.024	0.039
603–BM99	56098.619	-21256.214	38.744	0.058	0.111
603A–BM99	56058.241	-21262.633	39.031	0.069	0.134
604–604A	18.815	-80.857	-0.265	0.015	0.024
604–BM99	16344.516	16626.141	7.614	0.015	0.025
604A–BM99	16325.713	16706.997	7.871	0.012	0.020
701–701A	-19.642	276.738	7.207	0.625	1.974

701–BM99	16117.337	-10935.296	23.922	0.022	0.057
701A–BM99	16137.039	-11212.004	16.956	0.377	1.136
702–702A	-12.828	88.053	2.045	0.371	0.697
702–BM99	45627.867	-25971.408	16.230	0.071	0.135
702A–BM99	45640.667	-26059.487	14.275	0.083	0.154
703–703A	7.207	60.667	0.004	0.039	0.069
704–704A	-32.333	-59.556	4.610	0.021	0.041
704–BM99	60122.795	9105.656	35.774	0.070	0.146
704A–BM99	60155.128	9165.216	31.144	0.077	0.134
BM99–EH2124	-5344.996	-30029.478	-5.081	0.023	0.034

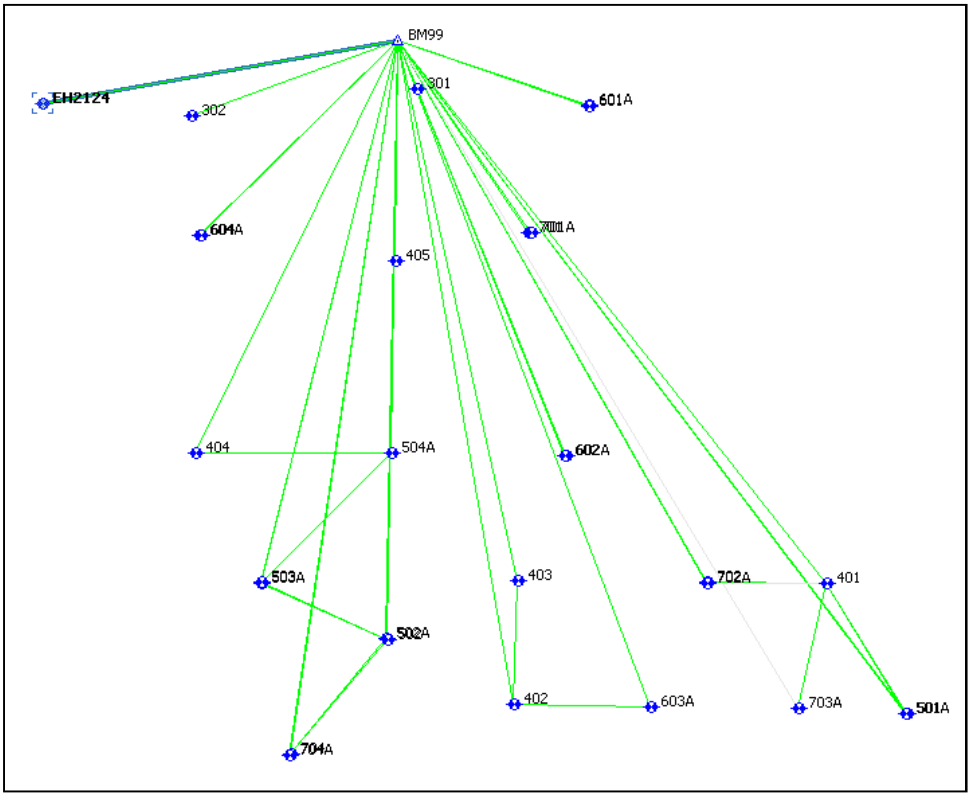
Control Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
BM99	2087655.036	1386879.484	238.636	

Adjusted Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
301	2083571.640	1388456.555	231.842	
302	2081326.632	1369443.389	227.922	
401	2041959.985	1422936.300	222.296	
402	2031728.886	1396630.778	206.577	
403	2042214.531	1396916.077	214.235	
404	2052886.700	1369765.797	229.068	
405	2069103.621	1386632.015	224.288	
501	2031012.013	1429758.093	228.172	
501A	2030966.991	1429677.187	229.130	
502	2037209.024	1385916.802	209.772	
502A	2037293.361	1385898.419	210.730	
503	2042056.432	1375299.503	227.598	
503A	2041945.882	1375290.124	227.972	
504	2052896.081	1386319.014	220.669	
504A	2052975.165	1386326.026	221.406	
601	2082146.450	1402964.501	235.807	
601A	2082260.017	1402958.079	236.828	
602	2052685.316	1400939.503	219.294	
602A	2052669.119	1401033.447	220.386	
603	2031556.404	1408135.686	199.166	

603A	2031596.806	1408142.083	198.910	
604	2071310.516	1370253.344	230.666	
604A	2071329.326	1370172.487	230.404	
701	2071537.699	1397814.780	214.538	
701A	2071517.997	1398091.488	221.505	
702	2042027.191	1412850.906	221.926	
702A	2042014.369	1412938.970	223.867	
703	2031382.388	1420552.881	201.813	
703A	2031389.601	1420613.548	201.849	
704	2027532.274	1377773.816	201.850	
704A	2027499.928	1377714.251	206.474	
EH2124	2082310.040	1356850.006	233.307	



Project Summary

Project name: Arkansas2_05232012.ttp
Surveyor:
Comment:
Linear unit: USFeet

Projection: SPC83-Arkansas (South)
Geoid: g2009u07
Adjustment Summary

Adjustment type: Plane + Height, Minimal constraint
Confidence level: 95 %
Number of adjusted points: 41
Number of plane control points: 1
Number of used GPS vectors: 101
Number of rejected GPS vectors by plane: 1
A posteriori plane UWE: 0.8507363 , Bounds: (0.8735324 , 1.126258)
Number of height control points: 1
Number of rejected GPS vectors by height: 1
A posteriori height UWE: 0.6062592 , Bounds: (0.8213158 , 1.178284)

Used GPS Observations					
Name	**dN (USft)**	**dE (USft)**	**dHt (USft)**	**Horz RMS (USft)**	**Vert RMS (USft)**
303–406	8657.216	-7845.848	3.296	0.010	0.015
303–BM98	24997.704	-7554.550	9.221	0.018	0.029
303–BM99	79856.789	1322.498	36.868	0.060	0.097
304–506	-18392.699	-243.050	-1.720	0.007	0.014
304–506A	-18445.729	-244.446	-1.656	0.018	0.033
304–507	-29190.605	15587.225	-2.487	0.019	0.036
304–507A	-29267.698	15502.386	-2.521	0.021	0.044
304–606	-665.359	15615.709	-0.323	0.006	0.011
304–606A	-782.140	15622.846	1.405	0.018	0.032
304–BM98	38129.808	-7411.500	10.666	0.014	0.024
304–BM99	92988.861	1465.524	38.374	0.032	0.056
305–607	8062.359	-4693.433	3.426	0.009	0.017
305–607A	8011.438	-4725.134	3.682	0.007	0.013
305–BM98	38718.813	969.867	5.006	0.014	0.030
305–BM99	93577.880	9846.939	32.561	0.036	0.059
306–510	-8503.977	-15296.221	-10.817	0.017	0.029
306–510A	-8509.434	-15372.866	-10.858	0.019	0.034
306–BM99	3965.587	44595.306	-0.507	0.021	0.042
406–BM98	16340.488	291.295	5.894	0.020	0.029
406–BM99	71199.524	9168.373	33.543	0.089	0.142
407–706	8497.653	-9012.776	2.315	0.015	0.026
407–706A	8496.007	-8942.387	2.229	0.025	0.042
407–BM98	16196.250	15571.509	-2.801	0.010	0.020

407–BM99	71055.351	24448.569	24.852	0.034	0.062
408–508	-9456.820	7972.685	-1.345	0.014	0.024
408–508A	-9529.746	7980.129	-1.592	0.090	0.147
408–BM98	-18460.885	48999.367	-18.577	0.115	0.142
408–BM99	36398.159	57876.371	9.093	0.115	0.167
409–707	-601.512	-16511.850	2.860	0.044	0.080
409–707A	-556.399	-16497.512	2.582	0.127	0.297
409–BM98	-26950.305	42052.620	-16.633	0.021	0.038
409–BM99	27908.774	50929.642	11.055	0.024	0.048
410–608	11475.016	-5359.103	0.473	0.005	0.012
410–608A	11432.467	-5354.117	0.939	0.006	0.016
410–BM99	19496.266	76563.096	1.546	0.063	0.137
505–505A	58.777	2.925	-0.092	0.003	0.005
505–605	11156.782	-8413.673	5.857	0.009	0.012
505–605A	11115.645	-8409.654	6.515	0.008	0.011
505–705	8237.759	5605.049	4.473	1.373	1.535
505–705A	8246.630	5476.576	0.489	0.013	0.018
505–BM98	25674.858	-27119.653	15.524	0.015	0.022
505–BM99	80533.933	-18242.628	43.254	0.033	0.047
505A–BM98	25616.105	-27122.557	15.609	0.034	0.055
505A–BM99	80475.153	-18245.548	43.302	0.065	0.118
506–506A	-53.025	-1.402	0.041	0.013	0.025
506–BM98	56522.544	-7168.449	12.402	0.052	0.097
506A–BM98	56575.562	-7167.083	12.192	0.061	0.112
507–507A	-77.072	-84.855	-0.054	0.003	0.005
507–BM98	67320.403	-22998.720	13.128	0.043	0.075
507A–BM98	67397.497	-22913.890	13.175	0.047	0.091
508–508A	-72.954	7.414	-0.246	0.007	0.014
508–BM98	-9004.070	41026.634	-17.199	0.023	0.043
508–BM99	45854.981	49903.637	10.539	0.027	0.052
508A–BM98	-8931.149	41019.200	-16.964	0.025	0.052
508A–BM99	45927.902	49896.189	10.752	0.039	0.082
509–509A	3.929	-57.846	0.037	0.004	0.007
509–BM99	17974.577	33601.837	3.887	0.023	0.045
509A–BM99	17970.650	33659.638	3.772	0.026	0.053
510–510A	-5.453	-76.651	-0.038	0.003	0.006
510–BM99	12469.496	59891.510	10.350	0.044	0.091
510A–BM99	12474.962	59968.145	10.371	0.055	0.108

605–605A	-41.136	4.024	0.677	0.006	0.007
605–BM98	14518.108	-18705.888	9.741	0.029	0.034
605–BM99	69377.156	-9828.929	37.415	0.083	0.107
605A–BM98	14559.242	-18709.922	9.059	0.035	0.042
605A–BM99	69418.314	-9832.956	36.760	0.095	0.131
606–606A	-116.796	7.132	1.752	0.004	0.006
606–BM98	38795.164	-23027.230	11.015	0.048	0.081
606–BM99	93654.196	-14150.190	38.662	0.093	0.155
606A–BM98	38911.974	-23034.353	9.239	0.059	0.109
606A–BM99	93770.981	-14157.325	36.909	0.121	0.201
607–607A	-50.919	-31.709	0.259	0.002	0.005
607–BM98	30656.425	5663.301	1.559	0.038	0.054
607A–BM98	30707.342	5695.007	1.313	0.038	0.070
608–608A	-42.563	4.992	0.510	0.002	0.004
608–BM99	8021.213	81922.185	1.086	0.025	0.054
608A–BM99	8063.787	81917.179	0.647	0.040	0.076
705–705A	6.947	-128.718	-1.544	0.055	0.071
705A–BM98	17428.230	-32596.222	15.030	0.050	0.066
705A–BM99	72287.292	-23719.228	42.782	0.097	0.130
706–706A	-1.615	70.413	-0.163	0.023	0.042
706–BM98	7698.593	24584.285	-5.093	0.025	0.044
706–BM99	62557.688	33461.316	22.585	0.252	0.525
706A–BM98	7700.224	24513.894	-4.993	0.039	0.076
706A–BM99	62559.308	33390.948	22.698	0.184	0.387
707–707A	45.123	14.351	-0.196	0.037	0.070
707A–BM99	28465.110	67427.159	8.530	0.487	1.228
708–708A	-140.455	-35.527	3.747	0.019	0.031
708–709	17913.544	-2763.467	21.786	0.060	0.095
708–709A	17737.400	-2724.799	20.186	0.043	0.069
708–BM98	-6455.216	19225.097	-1.705	0.014	0.023
708–BM99	48403.827	28102.131	26.033	0.038	0.060
708A–709	18054.039	-2727.955	18.004	0.062	0.085
708A–BM98	-6314.739	19260.612	-5.456	0.011	0.018
708A–BM99	48544.280	28137.582	22.241	0.026	0.045
709–709A	-176.187	38.701	-1.649	0.172	0.293
709–BM98	-24368.777	21988.552	-23.508	0.030	0.049
709–BM99	30490.275	30865.567	4.100	0.118	0.202
709A–BM98	-24192.622	21949.885	-21.930	0.047	0.086

709A–BM99	30666.420	30826.894	5.820	0.043	0.078
BM98–BM99	54859.054	8877.019	27.692	0.020	0.033

GPS Observation Residuals

Name	dN (USft)	dE (USft)	dHt (USft)	Horz RMS (USft)	Vert RMS (USft)
303–406	8657.216	-7845.848	3.296	0.010	0.015
303–BM98	24997.704	-7554.550	9.221	0.018	0.029
303–BM99	79856.789	1322.498	36.868	0.060	0.097
304–506	-18392.699	-243.050	-1.720	0.007	0.014
304–506A	-18445.729	-244.446	-1.656	0.018	0.033
304–507	-29190.605	15587.225	-2.487	0.019	0.036
304–507A	-29267.698	15502.386	-2.521	0.021	0.044
304–606	-665.359	15615.709	-0.323	0.006	0.011
304–606A	-782.140	15622.846	1.405	0.018	0.032
304–BM98	38129.808	-7411.500	10.666	0.014	0.024
304–BM99	92988.861	1465.524	38.374	0.032	0.056
305–607	8062.359	-4693.433	3.426	0.009	0.017
305–607A	8011.438	-4725.134	3.682	0.007	0.013
305–BM98	38718.813	969.867	5.006	0.014	0.030
305–BM99	93577.880	9846.939	32.561	0.036	0.059
306–510	-8503.977	-15296.221	-10.817	0.017	0.029
306–510A	-8509.434	-15372.866	-10.858	0.019	0.034
306–BM99	3965.587	44595.306	-0.507	0.021	0.042
406–BM98	16340.488	291.295	5.894	0.020	0.029
406–BM99	71199.524	9168.373	33.543	0.089	0.142
407–706	8497.653	-9012.776	2.315	0.015	0.026
407–706A	8496.007	-8942.387	2.229	0.025	0.042
407–BM98	16196.250	15571.509	-2.801	0.010	0.020
407–BM99	71055.351	24448.569	24.852	0.034	0.062
408–508	-9456.820	7972.685	-1.345	0.014	0.024
408–508A	-9529.746	7980.129	-1.592	0.090	0.147
408–BM98	-18460.885	48999.367	-18.577	0.115	0.142
408–BM99	36398.159	57876.371	9.093	0.115	0.167
409–707	-601.512	-16511.850	2.860	0.044	0.080

409–707A	-556.399	-16497.512	2.582	0.127	0.297
409–BM98	-26950.305	42052.620	-16.633	0.021	0.038
409–BM99	27908.774	50929.642	11.055	0.024	0.048
410–608	11475.016	-5359.103	0.473	0.005	0.012
410–608A	11432.467	-5354.117	0.939	0.006	0.016
410–BM99	19496.266	76563.096	1.546	0.063	0.137
505–505A	58.777	2.925	-0.092	0.003	0.005
505–605	11156.782	-8413.673	5.857	0.009	0.012
505–605A	11115.645	-8409.654	6.515	0.008	0.011
505–705	8237.759	5605.049	4.473	1.373	1.535
505–705A	8246.630	5476.576	0.489	0.013	0.018
505–BM98	25674.858	-27119.653	15.524	0.015	0.022
505–BM99	80533.933	-18242.628	43.254	0.033	0.047
505A–BM98	25616.105	-27122.557	15.609	0.034	0.055
505A–BM99	80475.153	-18245.548	43.302	0.065	0.118
506–506A	-53.025	-1.402	0.041	0.013	0.025
506–BM98	56522.544	-7168.449	12.402	0.052	0.097
506–BM99	111381.979	1707.002	39.591	0.568	0.202
506A–BM98	56575.562	-7167.083	12.192	0.061	0.112
506A–BM99	111435.054	1708.412	39.619	0.611	0.228
507–507A	-77.072	-84.855	-0.054	0.003	0.005
507–BM98	67320.403	-22998.720	13.128	0.043	0.075
507–BM99	122179.462	-14121.049	41.043	0.617	0.284
507A–BM98	67397.497	-22913.890	13.175	0.047	0.091
507A–BM99	122256.609	-14036.428	41.208	0.424	0.197
508–508A	-72.954	7.414	-0.246	0.007	0.014
508–BM98	-9004.070	41026.634	-17.199	0.023	0.043
508–BM99	45854.981	49903.637	10.539	0.027	0.052
508A–BM98	-8931.149	41019.200	-16.964	0.025	0.052
508A–BM99	45927.902	49896.189	10.752	0.039	0.082
509–509A	3.929	-57.846	0.037	0.004	0.007
509–BM99	17974.577	33601.837	3.887	0.023	0.045
509A–BM99	17970.650	33659.638	3.772	0.026	0.053
510–510A	-5.453	-76.651	-0.038	0.003	0.006
510–BM99	12469.496	59891.510	10.350	0.044	0.091
510A–BM99	12474.962	59968.145	10.371	0.055	0.108

605–605A	-41.136	4.024	0.677	0.006	0.007
605–BM98	14518.108	-18705.888	9.741	0.029	0.034
605–BM99	69377.156	-9828.929	37.415	0.083	0.107
605A–BM98	14559.242	-18709.922	9.059	0.035	0.042
605A–BM99	69418.314	-9832.956	36.760	0.095	0.131
606–606A	-116.796	7.132	1.752	0.004	0.006
606–BM98	38795.164	-23027.230	11.015	0.048	0.081
606–BM99	93654.196	-14150.190	38.662	0.093	0.155
606A–BM98	38911.974	-23034.353	9.239	0.059	0.109
606A–BM99	93770.981	-14157.325	36.909	0.121	0.201
607–607A	-50.919	-31.709	0.259	0.002	0.005
607–BM98	30656.425	5663.301	1.559	0.038	0.054
607–BM99	85515.535	14540.405	29.147	0.076	0.153
607A–BM98	30707.342	5695.007	1.313	0.038	0.070
607A–BM99	85566.466	14572.118	28.885	0.114	0.170
608–608A	-42.563	4.992	0.510	0.002	0.004
608–BM99	8021.213	81922.185	1.086	0.025	0.054
608A–BM99	8063.787	81917.179	0.647	0.040	0.076
705–705A	6.947	-128.718	-1.544	0.055	0.071
705–BM98	17440.091	-32734.365	-1.248	4.469	4.882
705–BM99	72299.037	-23857.103	26.929	4.018	4.389
705A–BM98	17428.230	-32596.222	15.030	0.050	0.066
705A–BM99	72287.292	-23719.228	42.782	0.097	0.130
706–706A	-1.615	70.413	-0.163	0.023	0.042
706–BM98	7698.593	24584.285	-5.093	0.025	0.044
706–BM99	62557.688	33461.316	22.585	0.252	0.525
706A–BM98	7700.224	24513.894	-4.993	0.039	0.076
706A–BM99	62559.308	33390.948	22.698	0.184	0.387
707–707A	45.123	14.351	-0.196	0.037	0.070
707–BM98	-26348.807	58564.420	-19.199	0.057	0.123
707–BM99	28510.320	67441.588	8.224	0.087	0.154
707A–BM98	-26393.892	58550.213	-18.980	0.106	0.312
707A–BM99	28465.110	67427.159	8.530	0.487	1.228
708–708A	-140.455	-35.527	3.747	0.019	0.031
708–709	17913.544	-2763.467	21.786	0.060	0.095
708–709A	17737.400	-2724.799	20.186	0.043	0.069

708–BM98	-6455.216	19225.097	-1.705	0.014	0.023
708–BM99	48403.827	28102.131	26.033	0.038	0.060
708A–709	18054.039	-2727.955	18.004	0.062	0.085
708A–709A	17874.471	-2689.271	24.601	7.948	3.917
708A–BM98	-6314.739	19260.612	-5.456	0.011	0.018
708A–BM99	48544.280	28137.582	22.241	0.026	0.045
709–709A	-176.187	38.701	-1.649	0.172	0.293
709–BM98	-24368.777	21988.552	-23.508	0.030	0.049
709–BM99	30490.275	30865.567	4.100	0.118	0.202
709A–BM98	-24192.622	21949.885	-21.930	0.047	0.086
709A–BM99	30666.420	30826.894	5.820	0.043	0.078
BM98–BM99	54859.054	8877.019	27.692	0.020	0.033

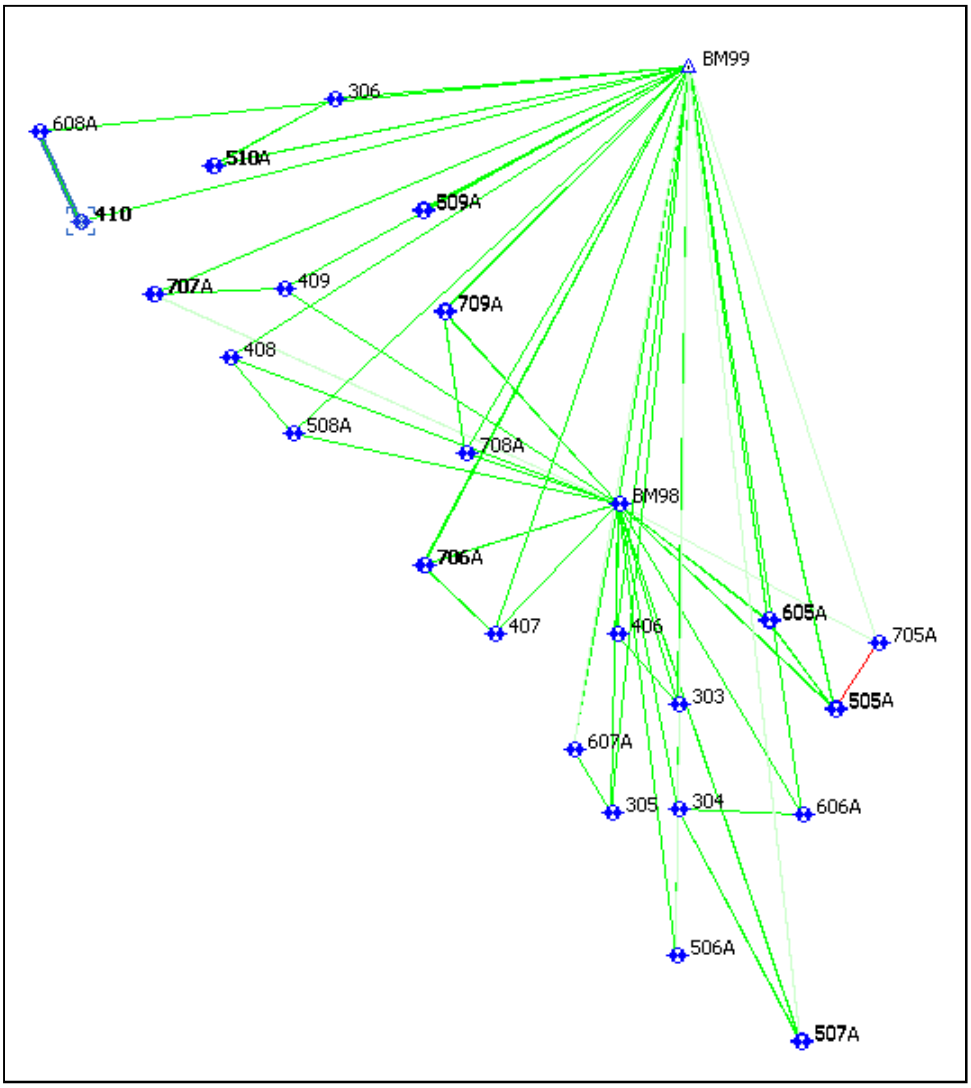
Control Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
BM99	2087655.036	1386879.484	238.636	

Adjusted Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
303	2007798.277	1385557.016	200.569	
304	1994666.173	1385413.969	198.941	
305	1994077.175	1377032.593	204.524	
306	2083689.465	1342284.187	238.835	
406	2016455.493	1377711.168	203.895	
407	2016599.729	1362430.954	212.448	
408	2051256.885	1329003.158	228.502	
409	2059746.277	1335949.847	226.807	
410	2068158.794	1310316.407	236.279	
505	2007121.116	1405122.092	194.416	
505A	2007179.892	1405125.018	194.325	
506	1976273.473	1385170.920	197.000	
506A	1976220.445	1385169.521	197.052	
507	1965475.561	1401001.200	196.262	
507A	1965398.488	1400916.346	196.207	
508	2041800.066	1336975.846	227.041	
508A	2041727.114	1336983.263	226.795	
509	2069680.458	1353277.667	234.296	

509A	2069684.386	1353219.823	234.334	
510	2075185.492	1326987.969	227.768	
510A	2075180.039	1326911.319	227.729	
605	2018277.896	1396708.411	200.311	
605A	2018236.760	1396712.435	200.984	
606	1994000.816	1401029.679	198.772	
606A	1993884.021	1401036.811	200.521	
607	2002139.534	1372339.164	208.000	
607A	2002088.614	1372307.456	208.257	
608	2079633.815	1304957.302	236.951	
608A	2079591.254	1304962.293	237.455	
705	2015360.799	1410727.389	196.595	
705A	2015367.746	1410598.671	195.050	
706	2025097.379	1353418.176	214.817	
706A	2025095.752	1353488.577	214.691	
707	2059144.763	1319437.994	229.523	
707A	2059189.885	1319452.344	229.324	
708	2039251.195	1358777.375	211.677	
708A	2039110.730	1358741.860	215.427	
709	2057164.758	1356013.912	233.761	
709A	2056988.604	1356052.582	232.152	
BM98	2032795.982	1378002.465	210.032	



Project Summary

Project name: Arkansas2_05242012.ttp
Surveyor:
Comment:
Linear unit: USFeet
Projection: SPC83-Arkansas (South)
Geoid: g2009u07
Adjustment Summary

Adjustment type: Plane + Height, Constraint
Confidence level: 95 %
Number of adjusted points: 46
Number of plane control points: 2
Number of used GPS vectors: 81
A posteriori plane UWE: 0.8069062 , Bounds: (0.8390437 , 1.160626)

Number of height control points: 2
A posteriori height UWE: 0.635865 , Bounds: (0.7727575 , 1.226634)

Used GPS Observations					
Name	**dN (USft)**	**dE (USft)**	**dHt (USft)**	**Horz RMS (USft)**	**Vert RMS (USft)**
307–308	13774.634	4872.983	0.425	0.026	0.042
307–309	-633.551	15231.602	7.402	0.031	0.049
307–515	10165.421	-9518.993	-6.404	0.013	0.022
307–515A	10172.537	-9430.587	-7.275	0.012	0.018
307–613	-6142.445	-8575.301	-6.607	0.009	0.016
307–613A	-6183.905	-8624.936	-6.785	0.011	0.019
307–712	5944.781	9856.063	4.360	0.012	0.020
307–712A	5962.611	9773.829	4.362	0.099	0.178
307–BM97	41947.530	-683.049	14.147	0.016	0.031
307–BM97	41947.470	-683.026	14.108	0.015	0.027
310–BM97	51655.335	-26342.780	8.777	0.040	0.084
310–EH3099	-13970.112	6729.160	-4.149	0.012	0.025
311–514	2568.616	13831.458	4.418	0.033	0.060
311–BM97	63514.680	39796.364	30.391	0.084	0.176
411–BM97	10809.924	-11043.799	2.622	0.015	0.031
412–BM97	21491.955	-10910.133	9.407	0.014	0.023
413–BM97	54384.564	-40030.823	11.876	0.054	0.099
413–EH3099	-11240.820	-6958.828	-1.214	0.041	0.077
414–715	-5393.298	16340.777	4.475	0.063	0.111
414–BM97	61177.519	5933.458	21.448	0.066	0.130
511–511A	48.497	-1.082	-0.312	0.003	0.004
511–BM97	10434.801	13.882	0.050	0.008	0.011
511A–BM97	10386.309	14.965	0.355	0.010	0.014
512–512A	-84.295	1.375	0.028	0.002	0.004
512–BM97	62636.306	-42626.584	15.076	0.060	0.098
512–EH3099	-2989.157	-9554.653	2.073	0.031	0.054
512A–BM97	62720.601	-42627.960	15.081	0.063	0.104
512A–EH3099	-2904.863	-9556.022	2.037	0.033	0.056
513–513A	2.147	-97.321	0.268	0.004	0.006
513–715	-13301.120	2236.091	3.803	0.019	0.032
513–BM97	53269.720	-8171.267	20.715	0.054	0.098
513A–715	-13303.266	2333.401	3.541	0.017	0.030
513A–BM97	53267.570	-8073.920	20.460	0.050	0.096
514–514A	36.959	67.003	-0.358	0.004	0.008

514–BM97	60946.102	25964.952	25.889	0.021	0.044
514A–BM97	60909.091	25897.948	26.353	0.089	0.179
515–515A	7.123	88.402	-0.862	0.003	0.004
609–609A	110.069	34.679	-0.336	0.005	0.006
609–BM97	11781.257	21656.317	22.341	0.020	0.027
609A–BM97	11671.184	21621.629	22.661	0.024	0.031
610–610A	-47.109	-44.617	0.237	0.008	0.014
610–611	-1973.414	16174.786	-4.475	0.055	0.082
610–611A	-1972.023	16121.119	-4.433	0.120	0.186
610–BM97	19390.543	21615.137	24.080	0.017	0.028
610A–611	-1926.350	16219.363	-4.629	0.033	0.053
610A–611A	-1924.912	16165.727	-4.584	0.142	0.269
610A–BM97	19437.656	21659.745	23.835	0.017	0.030
611–611A	1.371	-53.691	0.093	0.025	0.041
611–BM97	21363.993	5440.362	28.506	0.018	0.029
611A–BM97	21362.625	5494.031	28.380	0.019	0.031
612–612A	-57.396	-16.776	-0.028	0.004	0.006
612–715	-14784.810	10642.792	-5.580	0.020	0.032
612–BM97	51786.035	235.471	11.334	0.057	0.103
612A–715	-14727.414	10659.556	-5.588	0.022	0.036
612A–BM97	51843.404	252.195	11.330	0.058	0.118
613–613A	-41.455	-49.626	-0.163	0.003	0.006
613–BM97	48089.888	7892.278	20.752	0.044	0.106
710–710A	1.384	49.639	-0.227	0.010	0.013
710–BM97	10113.617	13762.654	19.985	0.012	0.017
710A–BM97	10112.248	13713.012	20.159	0.016	0.023
711–711A	82.313	30.319	1.680	0.016	0.019
711–BM97	-2491.070	11068.823	3.543	0.010	0.014
711A–BM97	-2573.401	11038.473	1.914	0.023	0.029
712–712A	17.851	-82.241	0.047	0.034	0.053
713–713A	5.223	-35.343	-0.204	0.012	0.026
713–BM97	40533.514	-26660.215	8.856	0.036	0.081
713–EH3099	-25091.898	6411.734	-4.094	0.019	0.041
713A–BM97	40528.330	-26624.893	9.135	0.040	0.074
713A–EH3099	-25097.111	6447.123	-3.966	0.022	0.038
714–714A	-88.827	-20.386	0.025	0.022	0.037
714–EH3099	-2659.486	6636.253	-0.286	0.013	0.021
714A–EH3099	-2570.682	6656.654	-0.355	0.018	0.034

715–715A	44.705	139.863	0.034	0.007	0.011
715–BM97	66570.840	-10407.350	16.881	0.023	0.043
715A–BM97	66526.161	-10547.242	16.823	0.066	0.109
BM97–BM99	72853.551	-53237.191	16.769	0.033	0.054
BM97–EH3099	-65625.457	33071.932	-12.956	0.026	0.047
BM97–EH3128	0.776	-586.842	1.332	0.006	0.008
BM97–EH3129	1763.484	-94.311	-4.962	0.002	0.004
BM99–EH3128	-72852.816	52650.348	-15.501	0.143	0.244
BM99–EH3129	-71090.068	53142.854	-21.799	0.036	0.058

GPS Observation Residuals

Name	dN (USft)	dE (USft)	dHt (USft)	Horz RMS (USft)	Vert RMS (USft)
307–308	13774.634	4872.983	0.425	0.026	0.042
307–309	-633.551	15231.602	7.402	0.031	0.049
307–515	10165.421	-9518.993	-6.404	0.013	0.022
307–515A	10172.537	-9430.587	-7.275	0.012	0.018
307–613	-6142.445	-8575.301	-6.607	0.009	0.016
307–613A	-6183.905	-8624.936	-6.785	0.011	0.019
307–712	5944.781	9856.063	4.360	0.012	0.020
307–712A	5962.611	9773.829	4.362	0.099	0.178
307–BM97	41947.530	-683.049	14.147	0.016	0.031
307–BM97	41947.470	-683.026	14.108	0.015	0.027
308–BM97	28172.816	-5556.051	13.664	0.038	0.062
309–BM97	42581.072	-15914.662	6.786	0.041	0.083
310–714	-11310.941	93.081	-2.041	0.059	0.278
310–BM97	51655.335	-26342.780	8.777	0.040	0.084
310–EH3099	-13970.112	6729.160	-4.149	0.012	0.025
311–514	2568.616	13831.458	4.418	0.033	0.060
311–BM97	63514.680	39796.364	30.391	0.084	0.176
411–BM97	10809.924	-11043.799	2.622	0.015	0.031
412–BM97	21491.955	-10910.133	9.407	0.014	0.023
413–BM97	54384.564	-40030.823	11.876	0.054	0.099
413–EH3099	-11240.820	-6958.828	-1.214	0.041	0.077
414–715	-5393.298	16340.777	4.475	0.063	0.111
414–BM97	61177.519	5933.458	21.448	0.066	0.130
511–511A	48.497	-1.082	-0.312	0.003	0.004
511–BM97	10434.801	13.882	0.050	0.008	0.011
511A–BM97	10386.309	14.965	0.355	0.010	0.014

512–512A	-84.295	1.375	0.028	0.002	0.004
512–BM97	62636.306	-42626.584	15.076	0.060	0.098
512–EH3099	-2989.157	-9554.653	2.073	0.031	0.054
512A–BM97	62720.601	-42627.960	15.081	0.063	0.104
512A–EH3099	-2904.863	-9556.022	2.037	0.033	0.056
513–513A	2.147	-97.321	0.268	0.004	0.006
513–715	-13301.120	2236.091	3.803	0.019	0.032
513–BM97	53269.720	-8171.267	20.715	0.054	0.098
513A–715	-13303.266	2333.401	3.541	0.017	0.030
513A–BM97	53267.570	-8073.920	20.460	0.050	0.096
514–514A	36.959	67.003	-0.358	0.004	0.008
514–BM97	60946.102	25964.952	25.889	0.021	0.044
514A–BM97	60909.091	25897.948	26.353	0.089	0.179
515–515A	7.123	88.402	-0.862	0.003	0.004
515–BM97	31782.023	8835.991	20.516	0.035	0.057
515A–BM97	31774.905	8747.601	21.350	0.040	0.052
609–609A	110.069	34.679	-0.336	0.005	0.006
609–BM97	11781.257	21656.317	22.341	0.020	0.027
609A–BM97	11671.184	21621.629	22.661	0.024	0.031
610–610A	-47.109	-44.617	0.237	0.008	0.014
610–611	-1973.414	16174.786	-4.475	0.055	0.082
610–611A	-1972.023	16121.119	-4.433	0.120	0.186
610–BM97	19390.543	21615.137	24.080	0.017	0.028
610A–611	-1926.350	16219.363	-4.629	0.033	0.053
610A–611A	-1924.912	16165.727	-4.584	0.142	0.269
610A–BM97	19437.656	21659.745	23.835	0.017	0.030
611–611A	1.371	-53.691	0.093	0.025	0.041
611–BM97	21363.993	5440.362	28.506	0.018	0.029
611A–BM97	21362.625	5494.031	28.380	0.019	0.031
612–612A	-57.396	-16.776	-0.028	0.004	0.006
612–715	-14784.810	10642.792	-5.580	0.020	0.032
612–BM97	51786.035	235.471	11.334	0.057	0.103
612A–715	-14727.414	10659.556	-5.588	0.022	0.036
612A–BM97	51843.404	252.195	11.330	0.058	0.118
613–613A	-41.455	-49.626	-0.163	0.003	0.006
613–BM97	48089.888	7892.278	20.752	0.044	0.106
613A–BM97	48131.331	7941.876	20.889	0.047	0.109
710–710A	1.384	49.639	-0.227	0.010	0.013

710–BM97	10113.617	13762.654	19.985	0.012	0.017
710A–BM97	10112.248	13713.012	20.159	0.016	0.023
711–711A	82.313	30.319	1.680	0.016	0.019
711–BM97	-2491.070	11068.823	3.543	0.010	0.014
711A–BM97	-2573.401	11038.473	1.914	0.023	0.029
712–712A	17.851	-82.241	0.047	0.034	0.053
712–BM97	36002.766	-10539.184	9.717	0.029	0.058
712A–BM97	35984.904	-10456.998	9.590	0.035	0.063
713–713A	5.223	-35.343	-0.204	0.012	0.026
713–BM97	40533.514	-26660.215	8.856	0.036	0.081
713–EH3099	-25091.898	6411.734	-4.094	0.019	0.041
713A–BM97	40528.330	-26624.893	9.135	0.040	0.074
713A–EH3099	-25097.111	6447.123	-3.966	0.022	0.038
714–714A	-88.827	-20.386	0.025	0.022	0.037
714–BM97	62965.955	-26435.753	12.382	0.037	0.063
714–EH3099	-2659.486	6636.253	-0.286	0.013	0.021
714A–BM97	63054.788	-26415.352	12.390	0.062	0.104
714A–EH3099	-2570.682	6656.654	-0.355	0.018	0.034
715–715A	44.705	139.863	0.034	0.007	0.011
715–BM97	66570.840	-10407.350	16.881	0.023	0.043
715A–BM97	66526.161	-10547.242	16.823	0.066	0.109
BM97–BM99	72853.551	-53237.191	16.769	0.033	0.054
BM97–EH3099	-65625.457	33071.932	-12.956	0.026	0.047
BM97–EH3128	0.776	-586.842	1.332	0.006	0.008
BM97–EH3129	1763.484	-94.311	-4.962	0.002	0.004
BM99–EH3128	-72852.816	52650.348	-15.501	0.143	0.244
BM99–EH3129	-71090.068	53142.854	-21.799	0.036	0.058

Control Points

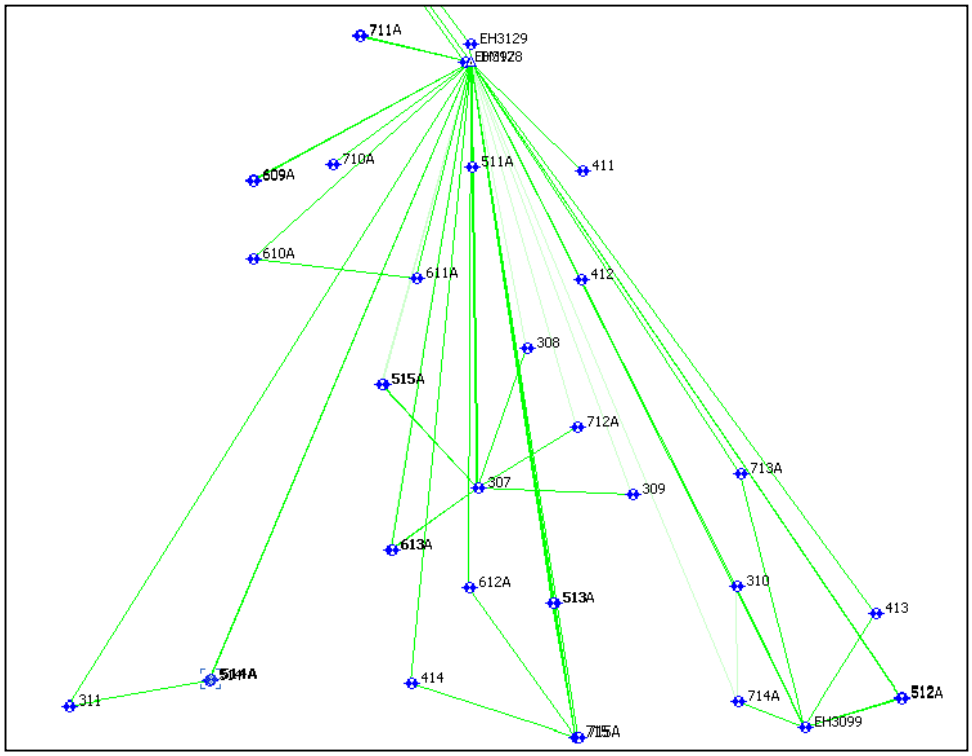
Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
BM97	2014801.474	1440116.665	221.176	
BM99	2087655.036	1386879.484	238.636	

Adjusted Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
307	1972853.976	1440799.706	206.577	
308	1986628.610	1445672.689	207.207	

309	1972220.425	1456031.308	214.073	
310	1963146.142	1466459.455	211.923	
311	1951286.763	1400320.262	189.773	
411	2003991.550	1451160.464	218.504	
412	1993309.519	1451026.798	211.608	
413	1960416.872	1480147.460	209.003	
414	1953623.940	1434183.222	199.010	
511	2004366.673	1440102.783	221.020	
511A	2004415.170	1440101.701	220.708	
512	1952165.184	1482743.263	205.670	
512A	1952080.888	1482744.637	205.697	
513	1961531.754	1448287.926	199.912	
513A	1961533.901	1448190.605	200.178	
514	1953855.376	1414151.715	194.349	
514A	1953892.336	1414218.719	193.992	
515	1983019.393	1431280.715	200.232	
515A	1983026.516	1431369.118	199.370	
609	2003020.219	1418460.351	198.567	
609A	2003130.288	1418495.031	198.233	
610	1995410.927	1418501.533	196.741	
610A	1995363.820	1418456.919	196.976	
611	1993437.480	1434676.304	192.422	
611A	1993438.851	1434622.627	192.528	
612	1963015.444	1439881.223	209.270	
612A	1962958.049	1439864.449	209.242	
613	1966711.531	1432224.402	199.818	
613A	1966670.075	1432174.775	199.652	
710	2004687.853	1426354.011	201.010	
710A	2004689.234	1426403.651	200.793	
711	2017292.545	1429047.846	217.583	
711A	2017374.863	1429078.174	219.251	
712	1978798.756	1450655.769	211.078	
712A	1978816.605	1450573.528	211.121	
713	1974267.931	1466776.871	212.017	
713A	1974273.151	1466741.521	211.823	
714	1951835.521	1466552.360	207.923	
714A	1951746.703	1466531.967	207.967	
715	1948230.634	1450524.012	203.573	

715A	1948275.339	1450663.875	203.609	
EH3099	1949176.031	1473188.616	207.644	
EH3128	2014802.250	1439529.823	222.504	
EH3129	2016564.958	1440022.353	216.232	



Project Summary

Project name: Arkansas2_05252012.ttp
Surveyor:
Comment:
Linear unit: USFeet
Projection: SPC83-Arkansas (South)
Geoid: g2009u07
Adjustment Summary

Adjustment type: Plane + Height, Constraint
Confidence level: 95 %
Number of adjusted points: 40
Number of plane control points: 2
Number of used GPS vectors: 65
A posteriori plane UWE: 0.8118403 , Bounds: (0.8116928 , 1.187867)
Number of height control points: 2
A posteriori height UWE: 0.8003948 , Bounds: (0.7345949 , 1.264765)

Used GPS Observations					
Name	**dN (USft)**	**dE (USft)**	**dHt (USft)**	**Horz RMS (USft)**	**Vert RMS (USft)**
313–314	-8963.681	-6986.567	0.827	0.011	0.017
313–616A	12291.062	14652.030	-18.686	0.123	0.164
313–617	970.821	14697.170	-16.513	0.009	0.017
313–617A	1050.961	14702.909	-16.515	0.012	0.023
313–BM99	-12333.474	68812.905	-21.049	0.025	0.042
315–517	13029.450	3154.815	12.476	0.017	0.043
315–517A	13037.464	3110.894	12.641	0.022	0.053
315–618	1337.832	-7000.419	0.617	0.017	0.025
315–618A	1344.237	-6939.917	0.595	0.010	0.017
315–BM99	-17180.962	83267.959	-23.630	0.026	0.055
316–416	-6938.515	1422.266	4.574	0.010	0.020
316–518	6523.930	2085.863	-9.233	0.012	0.021
316–518A	6496.762	2214.766	-11.393	0.010	0.017
316–619	6690.721	-9884.601	-50.314	0.016	0.029
316–619A	6536.825	-9857.677	-50.662	0.027	0.054
316–717	-4305.660	-7507.352	-42.107	0.029	0.064
316–717A	-4285.049	-7608.491	-41.853	0.019	0.042
316–BM99	-45221.619	75007.200	-72.016	0.032	0.058
317–519	1661.578	-8888.077	-34.953	0.021	0.041
317–519A	1655.795	-8829.414	-35.576	0.017	0.029
317–718	1178.465	11071.692	-18.537	0.028	0.081
317–718A	1161.291	11191.308	-17.969	0.018	0.055
317–BM99	-60693.007	76944.285	-76.911	0.031	0.061
318–417	-9799.493	-1575.844	27.259	0.008	0.015
415–614	-3310.909	11333.668	5.634	0.011	0.017
415–614A	-3431.174	11329.536	6.731	0.024	0.037
415–BM99	-13581.987	21367.995	2.786	0.011	0.019
417–418	2190.903	12611.809	40.010	0.054	0.110
417–719	7267.045	-8313.117	229.198	0.012	0.021
417–719A	7251.603	-8176.518	232.917	0.013	0.024
417–BM99	-67540.535	95541.568	-81.114	0.037	0.071
417–DF7953	8273.222	23883.768	-76.030	0.016	0.036
516–516A	-0.099	-126.527	-1.451	0.010	0.013
516–616	-251.376	15523.352	-19.076	0.014	0.017

516–616A	-249.916	15577.158	-19.109	0.016	0.020
516A–616	-251.281	15649.864	-17.587	0.012	0.016
516A–616A	-249.821	15703.676	-17.649	0.011	0.016
517–517A	8.021	-43.925	0.196	0.006	0.014
517–BM99	-30210.429	80113.107	-36.051	0.058	0.153
517A–BM99	-30218.461	80157.030	-36.246	0.064	0.152
518–518A	-27.167	128.900	-2.153	0.004	0.006
519–519A	-5.784	58.653	-0.608	0.003	0.005
614–614A	-120.270	-4.124	1.094	0.005	0.009
614–BM99	-10271.084	10034.313	-2.852	0.013	0.020
614A–BM99	-10150.829	10038.429	-3.945	0.014	0.022
615–615A	-7.568	-164.078	0.322	0.004	0.005
615–716	-11109.340	4798.668	-5.198	0.015	0.020
615–BM99	-24442.545	42394.541	-10.543	0.039	0.062
615A–716	-11101.764	4962.745	-5.520	0.018	0.023
615A–BM99	-24434.980	42558.625	-10.899	0.048	0.074
616–616A	1.454	53.814	-0.027	0.002	0.003
616–BM99	-24623.117	54214.683	-2.332	0.029	0.039
616A–BM99	-24624.568	54160.862	-2.332	0.025	0.034
617–617A	80.146	5.724	-0.063	0.003	0.006
617–BM99	-13304.283	54115.684	-4.452	0.053	0.108
617A–BM99	-13384.432	54109.923	-4.505	0.059	0.110
618–618A	6.398	60.507	-0.002	0.016	0.027
618A–BM99	-18525.161	90207.897	-24.286	0.107	0.178
619–619A	-153.819	26.953	-0.566	0.044	0.076
716–716A	-93.212	11.496	0.518	0.021	0.034
716–BM99	-13333.207	37595.914	-5.307	0.046	0.070
717–717A	20.629	-101.114	0.379	0.142	0.296
718–718A	-17.147	119.603	0.750	0.040	0.117
718A–BM99	-61854.209	65752.958	-59.146	0.059	0.196
719–719A	-15.428	136.627	3.704	0.017	0.030

GPS Observation Residuals

Name	dN (USft)	dE (USft)	dHt (USft)	Horz RMS (USft)	Vert RMS (USft)
313–314	-8963.681	-6986.567	0.827	0.011	0.017
313–616A	12291.062	14652.030	-18.686	0.123	0.164
313–617	970.821	14697.170	-16.513	0.009	0.017

313–617A	1050.961	14702.909	-16.515	0.012	0.023
313–BM99	-12333.474	68812.905	-21.049	0.025	0.042
314–BM99	-3370.072	75799.914	-22.086	0.082	0.128
315–517	13029.450	3154.815	12.476	0.017	0.043
315–517A	13037.464	3110.894	12.641	0.022	0.053
315–618	1337.832	-7000.419	0.617	0.017	0.025
315–618A	1344.237	-6939.917	0.595	0.010	0.017
315–BM99	-17180.962	83267.959	-23.630	0.026	0.055
316–416	-6938.515	1422.266	4.574	0.010	0.020
316–518	6523.930	2085.863	-9.233	0.012	0.021
316–518A	6496.762	2214.766	-11.393	0.010	0.017
316–619	6690.721	-9884.601	-50.314	0.016	0.029
316–619A	6536.825	-9857.677	-50.662	0.027	0.054
316–717	-4305.660	-7507.352	-42.107	0.029	0.064
316–717A	-4285.049	-7608.491	-41.853	0.019	0.042
316–BM99	-45221.619	75007.200	-72.016	0.032	0.058
317–519	1661.578	-8888.077	-34.953	0.021	0.041
317–519A	1655.795	-8829.414	-35.576	0.017	0.029
317–718	1178.465	11071.692	-18.537	0.028	0.081
317–718A	1161.291	11191.308	-17.969	0.018	0.055
317–BM99	-60693.007	76944.285	-76.911	0.031	0.061
318–417	-9799.493	-1575.844	27.259	0.008	0.015
318–BM99	-77339.693	93966.006	-54.750	0.608	0.333
415–614	-3310.909	11333.668	5.634	0.011	0.017
415–614A	-3431.174	11329.536	6.731	0.024	0.037
415–BM99	-13581.987	21367.995	2.786	0.011	0.019
416–BM99	-38283.105	73585.153	-76.971	0.089	0.156
417–418	2190.903	12611.809	40.010	0.054	0.110
417–719	7267.045	-8313.117	229.198	0.012	0.021
417–719A	7251.603	-8176.518	232.917	0.013	0.024
417–BM99	-67540.535	95541.568	-81.114	0.037	0.071
417–DF7953	8273.222	23883.768	-76.030	0.016	0.036
418–BM99	-69731.496	82929.939	-120.818	0.364	0.313
516–516A	-0.099	-126.527	-1.451	0.010	0.013
516–616	-251.376	15523.352	-19.076	0.014	0.017
516–616A	-249.916	15577.158	-19.109	0.016	0.020
516–BM99	-24874.439	69738.001	-21.669	0.070	0.098

516A–616	-251.281	15649.864	-17.587	0.012	0.016
516A–616A	-249.821	15703.676	-17.649	0.011	0.016
516A–BM99	-24874.549	69864.404	-19.371	0.074	0.099
517–517A	8.021	-43.925	0.196	0.006	0.014
517–BM99	-30210.429	80113.107	-36.051	0.058	0.153
517A–BM99	-30218.461	80157.030	-36.246	0.064	0.152
518–518A	-27.167	128.900	-2.153	0.004	0.006
518–BM99	-51745.416	72921.452	-62.553	0.081	0.153
518A–BM99	-51718.247	72792.557	-60.424	0.086	0.157
519–519A	-5.784	58.653	-0.608	0.003	0.005
519–BM99	-62353.863	85832.439	-42.736	1.337	0.665
519A–BM99	-62348.255	85774.564	-42.342	0.672	0.338
614–614A	-120.270	-4.124	1.094	0.005	0.009
614–BM99	-10271.084	10034.313	-2.852	0.013	0.020
614A–BM99	-10150.829	10038.429	-3.945	0.014	0.022
615–615A	-7.568	-164.078	0.322	0.004	0.005
615–716	-11109.340	4798.668	-5.198	0.015	0.020
615–BM99	-24442.545	42394.541	-10.543	0.039	0.062
615A–716	-11101.764	4962.745	-5.520	0.018	0.023
615A–BM99	-24434.980	42558.625	-10.899	0.048	0.074
616–616A	1.454	53.814	-0.027	0.002	0.003
616–BM99	-24623.117	54214.683	-2.332	0.029	0.039
616A–BM99	-24624.568	54160.862	-2.332	0.025	0.034
617–617A	80.146	5.724	-0.063	0.003	0.006
617–BM99	-13304.283	54115.684	-4.452	0.053	0.108
617A–BM99	-13384.432	54109.923	-4.505	0.059	0.110
618–618A	6.398	60.507	-0.002	0.016	0.027
618–BM99	-18518.604	90268.624	-24.410	0.120	0.161
618A–BM99	-18525.161	90207.897	-24.286	0.107	0.178
619–619A	-153.819	26.953	-0.566	0.044	0.076
619–BM99	-51912.839	84884.297	-20.737	2.428	0.401
619A–BM99	-51758.647	84863.792	-21.998	1.350	0.350
716–716A	-93.212	11.496	0.518	0.021	0.034
716–BM99	-13333.207	37595.914	-5.307	0.046	0.070
716A–BM99	-13240.046	37584.500	-5.598	0.052	0.080
717–717A	20.629	-101.114	0.379	0.142	0.296

717–BM99	-40915.843	82514.895	-29.522	0.080	0.186
717A–BM99	-40936.479	82615.558	-30.037	0.075	0.162
718–718A	-17.147	119.603	0.750	0.040	0.117
718–BM99	-61871.447	65872.485	-58.251	0.088	0.248
718A–BM99	-61854.209	65752.958	-59.146	0.059	0.196
719–719A	-15.428	136.627	3.704	0.017	0.030
719–BM99	-74809.047	103850.246	-309.788	1.349	0.388
719A–BM99	-74794.455	103711.270	-311.840	1.776	0.503
BM99–DF7953	75814.052	-71657.765	5.171	0.181	0.151

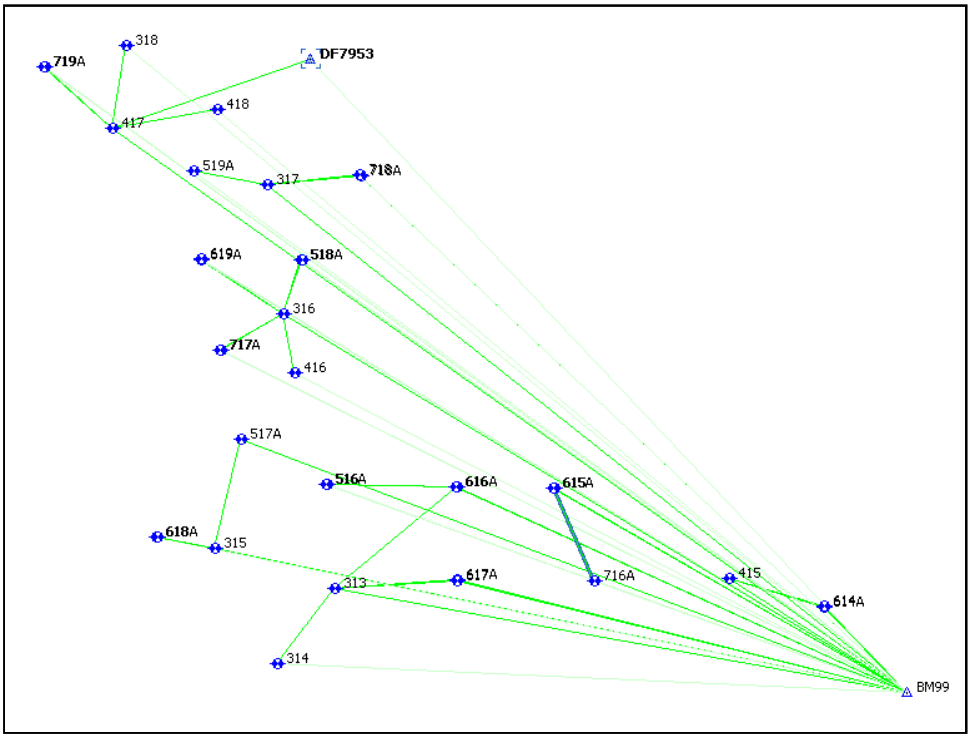
Control Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
BM99	2087655.036	1386879.484	238.636	
DF7953	2163468.810	1315221.680	245.030	

Adjusted Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
313	2099988.508	1318066.595	259.570	
314	2091024.827	1311080.028	260.183	
315	2104836.008	1303611.538	262.240	
316	2132876.655	1311872.284	311.259	
317	2148348.018	1309935.209	316.510	
318	2164995.077	1292913.757	293.938	
415	2101237.028	1365511.496	235.974	
416	2125938.139	1313294.550	315.678	
417	2155195.584	1291337.913	321.001	
418	2157386.487	1303949.722	360.985	
516	2112529.525	1317141.462	260.222	
516A	2112529.428	1317014.939	258.763	
517	2117865.457	1306766.357	274.999	
517A	2117873.478	1306722.433	275.194	
518	2139400.584	1313958.149	302.156	
518A	2139373.417	1314087.049	300.001	
519	2150009.596	1301047.138	281.627	
519A	2150003.812	1301105.791	281.018	
614	2097926.123	1376845.169	241.600	
614A	2097805.855	1376841.046	242.693	

615	2112097.581	1344484.931	249.408	
615A	2112090.012	1344320.852	249.730	
616	2112278.150	1332664.806	241.184	
616A	2112279.605	1332718.619	241.154	
617	2100959.327	1332763.772	243.157	
617A	2101039.472	1332769.498	243.101	
618	2106173.843	1296611.118	262.882	
618A	2106180.243	1296671.622	262.872	
619	2139567.368	1301987.682	261.147	
619A	2139413.502	1302014.609	260.709	
716	2100988.244	1349283.596	244.025	
716A	2100895.032	1349295.092	244.541	
717	2128570.994	1304364.932	269.068	
717A	2128591.606	1304263.793	269.331	
718	2149526.473	1321006.906	297.910	
718A	2149509.306	1321126.517	298.560	
719	2162462.625	1283024.789	550.413	
719A	2162447.191	1283161.403	554.123	



Project Summary

Project name: Arkansas2_05262012.ttp
Surveyor:
Comment:
Linear unit: USFeet
Projection: SPC83-Arkansas (South)
Geoid: g2009u07
Adjustment Summary

Adjustment type: Plane + Height, Minimal constraint
Confidence level: 95 %
Number of adjusted points: 16
Number of plane control points: 1
Number of used GPS vectors: 22
A posteriori plane UWE: 0.6056708 , Bounds: (0.6341473 , 1.365911)
Number of height control points: 1
A posteriori height UWE: 0.7703913 , Bounds: (0.4913538 , 1.51233)

Used GPS Observations					
Name	**dN (USft)**	**dE (USft)**	**dHt (USft)**	**Horz RMS (USft)**	**Vert RMS (USft)**
319–319A	-62.937	-17.560	-0.417	0.060	0.083
319–BM96	-9750.710	-9565.861	-247.507	0.039	0.053
319A–BM96	-9687.766	-9548.297	-247.051	0.030	0.048
320–320A	-1.006	40.456	0.599	0.003	0.004
320–BM96	-1002.602	11147.979	-11.967	0.014	0.022
320A–BM96	-1001.578	11107.525	-12.588	0.013	0.021
417–720	-2363.330	-28974.712	24.370	0.099	0.171
417–BM96	-2406.537	-28931.861	24.996	0.023	0.036
419–419A	-73.668	-1.033	2.955	0.007	0.010
419–BM96	-9014.240	26315.273	-234.011	0.024	0.031
419A–BM96	-8940.595	26316.315	-236.985	0.023	0.031
420–420A	-47.250	-81.792	-1.748	0.004	0.008
420–BM96	-960.346	22009.983	-70.501	0.017	0.034
420A–BM96	-913.094	22091.778	-68.770	0.018	0.038
520–520A	-32.378	-156.354	-2.920	0.013	0.016
520–BM96	-8874.743	13459.334	-248.417	0.012	0.018
520A–BM96	-8842.384	13615.710	-245.432	0.018	0.028
620–620A	87.153	111.284	0.349	0.028	0.042
620–BM96	-633.000	-11552.538	16.996	0.011	0.016
620A–BM96	-720.134	-11663.845	16.604	0.029	0.046
720–BM96	-43.202	42.846	0.550	0.060	0.114
720A–BM96	-96.110	4.925	8.299	0.045	0.073

GPS Observation Residuals

Name	dN (USft)	dE (USft)	dHt (USft)	Horz RMS (USft)	Vert RMS (USft)
319–319A	-62.937	-17.560	-0.417	0.060	0.083
319–BM96	-9750.710	-9565.861	-247.507	0.039	0.053
319A–BM96	-9687.766	-9548.297	-247.051	0.030	0.048
320–320A	-1.006	40.456	0.599	0.003	0.004
320–BM96	-1002.602	11147.979	-11.967	0.014	0.022
320A–BM96	-1001.578	11107.525	-12.588	0.013	0.021
417–720	-2363.330	-28974.712	24.370	0.099	0.171
417–BM96	-2406.537	-28931.861	24.996	0.023	0.036
419–419A	-73.668	-1.033	2.955	0.007	0.010
419–BM96	-9014.240	26315.273	-234.011	0.024	0.031
419A–BM96	-8940.595	26316.315	-236.985	0.023	0.031
420–420A	-47.250	-81.792	-1.748	0.004	0.008
420–BM96	-960.346	22009.983	-70.501	0.017	0.034
420A–BM96	-913.094	22091.778	-68.770	0.018	0.038
520–520A	-32.378	-156.354	-2.920	0.013	0.016
520–BM96	-8874.743	13459.334	-248.417	0.012	0.018
520A–BM96	-8842.384	13615.710	-245.432	0.018	0.028
620–620A	87.153	111.284	0.349	0.028	0.042
620–BM96	-633.000	-11552.538	16.996	0.011	0.016
620A–BM96	-720.134	-11663.845	16.604	0.029	0.046
720–BM96	-43.202	42.846	0.550	0.060	0.114
720A–BM96	-96.110	4.925	8.299	0.045	0.073

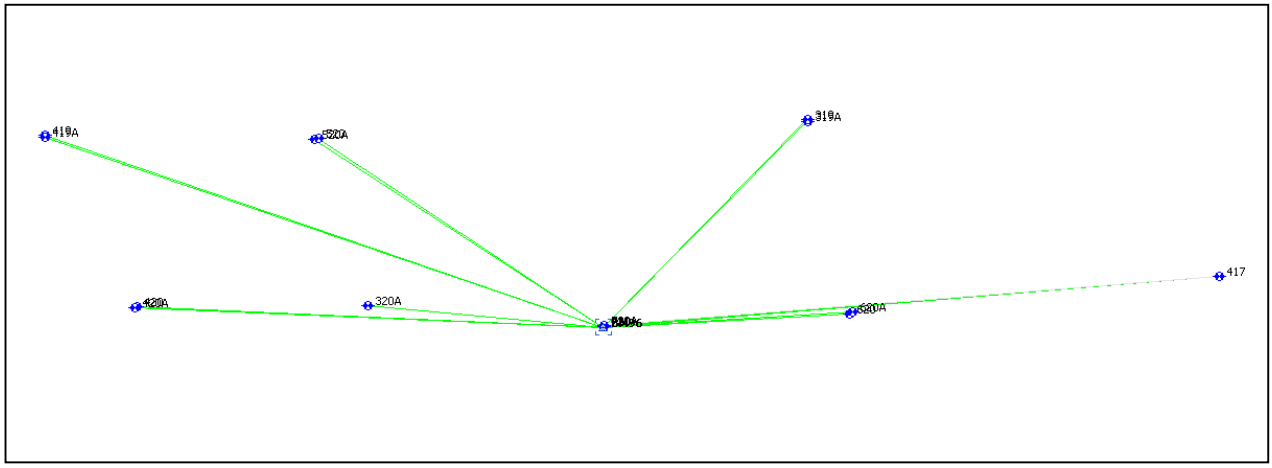
Control Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
BM96	2152789.050	1262406.059	346.187	

Adjusted Points

Name	Grid Northing (USft)	Grid Easting (USft)	Elevation (USft)	Code
319	2162539.758	1271971.919	593.807	
319A	2162476.817	1271954.356	593.367	
320	2153791.643	1251258.079	358.312	
320A	2153790.636	1251298.535	358.912	
417	2155195.587	1291337.920	321.003	
419	2161803.302	1236090.782	580.707	

419A	2161729.635	1236089.748	583.662	
420	2153749.395	1240396.075	416.969	
420A	2153702.145	1240314.283	415.222	
520	2161663.798	1248946.719	594.930	
520A	2161631.424	1248790.362	591.998	
620	2153422.050	1273958.597	329.096	
620A	2153509.193	1274069.894	329.467	
720	2152832.254	1262363.212	345.616	
720A	2152885.160	1262401.134	337.890	



Final Control Summary

Name	Network Control Grid Northing (m)	Grid Easting (m)	Elevation (m)	Control	Note
417	3871531.321	584875.522	97.841	None	
BM96	3870710.162	576068.132	105.518	None	
BM97	3829205.311	630636.578	67.415	None	
BM98	3834500.114	611654.017	64.018	None	
BM99	3851243.456	614192.088	72.736	None	
DF7953	3874124.756	592127.094	74.685	Both	
EH2124	3849523.319	605058.177	71.112	None	
EH3099	3809306.370	640914.077	63.292	Both	
EH3128	3829203.764	630457.743	67.820	None	
EH3129	3829742.425	630602.478	65.908	None	

Name	LIDAR QC Grid Northing (m)	Grid Easting (m)	Elevation (m)	Control	Note
301	3850004.010	614685.092	70.666	None	U
302	3849262.001	608898.444	69.471	None	U
303	3826905.695	614031.830	61.134	None	U
304	3822903.587	614027.994	60.637	None	U
305	3822698.752	611475.766	62.339	None	U
306	3849899.332	600615.747	72.797	None	U
307	3816424.264	630971.942	62.965	None	U
308	3820636.756	632415.231	63.157	None	U
309	3816277.303	635615.631	65.250	None	U
310	3813543.479	638821.085	64.594	None	U
311	3809729.602	618701.428	57.843	None	U
313	3854791.973	593187.206	79.117	None	U
314	3852039.593	591085.681	79.304	None	U
315	3856225.043	588768.175	79.931	None	U
316	3864793.736	591199.844	94.872	None	U
317	3869501.667	590562.532	96.472	None	U
318	3874521.756	585325.798	89.593	None	U
319	3873709.962	578952.923	180.993	None	U
319A	3873690.732	578947.764	180.859	None	U
320	3870981.785	572668.657	109.214	None	U
320A	3870981.600	572680.986	109.397	None	U
401	3837429.157	625318.545	67.756	None	OT
402	3834231.496	617333.684	62.965	None	OT
403	3837427.571	617388.762	65.299	None	OT
404	3840597.054	609083.182	69.820	None	OT
405	3845589.861	614173.217	68.363	None	OT
406	3829519.971	611614.800	62.147	None	OT
407	3829517.639	606958.200	64.754	None	OT
408	3839976.757	596667.435	69.648	None	OT
409	3842584.564	598758.374	69.131	None	OT
410	3845070.132	590922.365	72.018	None	OT
411	3825944.643	634034.910	66.600	None	OT
412	3822688.958	634026.603	64.498	None	OT
413	3812753.150	643000.836	63.704	None	OT
414	3810544.026	629013.746	60.658	None	OT
415	3855316.811	607639.711	71.925	None	OT
416	3862684.010	591654.305	96.219	None	OT
417	3871531.321	584875.522	97.841	None	OT
417	3871531.321	584875.524	97.842	None	OT
418	3872237.245	588711.347	110.028	None	OT
419	3873376.658	568023.421	177.000	None	OT
419A	3873354.211	568023.329	177.901	None	OT
420	3870935.974	569359.501	127.092	None	OT
420A	3870921.331	569334.725	126.560	None	OT
501	3834113.736	627430.669	69.547	None	TW
502	3835868.873	614052.267	63.939	None	TW

503	3837313.725	610802.272	69.372	None	TW
504	3840650.224	614127.160	67.260	None	TW
505	3826758.634	619995.876	59.258	None	TW
506	3817298.107	614009.534	60.046	None	TW
507	3814055.465	618866.115	59.821	None	TW
508	3837119.375	599125.407	69.202	None	TW
509	3845664.164	604008.073	71.414	None	TW
510	3847261.712	595980.833	69.424	None	TW
511	3826025.382	630664.042	67.367	None	TW
512	3810246.234	643816.897	62.688	None	TW
513	3812996.522	633288.196	60.933	None	TW
514	3810554.080	622908.626	59.238	None	TW
515	3819493.273	628040.334	61.031	None	TW
516	3858610.285	592867.201	79.316	None	TW
517	3860204.526	589689.816	83.820	None	TW
518	3866787.815	591815.503	92.097	None	TW
519	3869980.839	587849.472	85.840	None	TW
520	3873373.148	571940.579	181.335	None	TW
501A	3834099.771	627406.151	69.839	None	TW
502A	3835894.517	614046.410	64.231	None	TW
503A	3837280.010	610799.750	69.486	None	TW
504A	3840674.343	614129.056	67.485	None	TW
505A	3826776.554	619996.589	59.230	None	TW
506A	3817281.944	614009.268	60.062	None	TW
507A	3814031.722	618840.490	59.804	None	TW
508A	3837097.169	599127.888	69.127	None	TW
509A	3845665.185	603990.436	71.425	None	TW
510A	3847259.818	595957.495	69.412	None	TW
511A	3826040.158	630663.565	67.272	None	TW
512A	3810220.548	643817.571	62.696	None	TW
513A	3812996.882	633258.531	61.014	None	TW
514A	3810565.545	622928.933	59.129	None	TW
515A	3819495.712	628067.252	60.768	None	TW
516A	3858609.870	592828.651	78.871	None	TW
517A	3860206.837	589676.408	83.879	None	TW
518A	3866779.930	591854.859	91.440	None	TW
519A	3869979.255	587867.359	85.655	None	TW
520A	3873362.810	571893.041	180.442	None	TW
601	3849613.990	619110.207	71.874	None	B
602	3840630.476	618582.936	66.841	None	B
603	3834213.887	620840.035	60.706	None	B
604	3846212.474	609175.730	70.307	None	B
605	3830132.892	617398.166	61.055	None	B
606	3822748.096	618788.545	60.586	None	B
607	3825141.335	610021.185	63.398	None	B
608	3848550.263	589254.690	72.223	None	B
609	3825549.404	624072.892	60.523	None	B
610	3823230.721	624108.507	59.967	None	B
611	3822678.364	629043.537	58.650	None	B

612	3813423.251	630721.801	63.786	None	B
613	3814526.458	628377.261	60.905	None	B
614	3854342.531	611103.223	73.640	None	B
615	3858561.914	601199.845	76.020	None	B
616	3858580.930	597597.780	73.513	None	B
617	3855132.461	597662.382	74.114	None	B
618	3856611.409	586631.177	80.127	None	B
619	3866802.183	588167.825	79.598	None	B
620	3870938.113	579585.920	100.309	None	B
601A	3849648.577	619107.904	72.185	None	B
602A	3840625.827	618611.612	67.174	None	B
603A	3834226.218	620841.862	60.628	None	B
604A	3846217.959	609151.035	70.227	None	B
605A	3830120.369	617399.517	61.260	None	B
606A	3822712.526	618791.072	61.119	None	B
607A	3825125.723	610011.677	63.477	None	B
608A	3848537.310	589256.340	72.376	None	B
609A	3825583.051	624083.126	60.422	None	B
610A	3823216.230	624095.055	60.038	None	B
611A	3822678.619	629027.175	58.683	None	B
612A	3813405.710	630716.863	63.777	None	B
613A	3814513.674	628362.263	60.854	None	B
614A	3854305.872	611102.334	73.973	None	B
615A	3858559.108	601149.874	76.118	None	B
616A	3858581.537	597614.172	73.504	None	B
617A	3855156.898	597663.883	74.097	None	B
618A	3856613.543	586649.593	80.123	None	B
619A	3866755.385	588176.497	79.464	None	B
620A	3870965.001	579619.565	100.422	None	B
701	3846365.629	617573.359	65.391	None	F
702	3837418.944	622245.048	67.643	None	F
703	3834198.604	624624.429	61.513	None	F
704	3832895.472	611600.312	61.524	None	F
705	3829286.507	621678.981	59.922	None	F
706	3832079.708	604186.141	65.476	None	F
707	3842351.218	593729.012	69.959	None	F
708	3836408.795	605776.262	64.519	None	F
709	3841858.856	604879.846	71.250	None	F
710	3826081.532	626473.303	61.268	None	F
711	3829930.799	627255.941	66.319	None	F
712	3818265.749	633957.526	64.337	None	F
713	3816933.829	638884.139	64.623	None	F
714	3810096.809	638883.609	63.375	None	F
715	3808949.785	634009.835	62.049	None	F
716	3855191.555	602695.825	74.379	None	F
717	3863459.029	588925.585	82.012	None	F
718	3869894.472	593932.265	90.803	None	F
719	3873720.083	582320.628	167.766	None	F
720	3870723.195	576054.947	105.344	None	F

701A	3846360.469	617657.736	67.515	None	F
702A	3837415.305	622271.922	68.235	None	F
703A	3834200.987	624642.895	61.524	None	F
704A	3832885.435	611582.259	62.933	None	F
705A	3829288.234	621639.736	59.451	None	F
706A	3832079.425	604207.598	65.438	None	F
707A	3842365.010	593733.247	69.898	None	F
708A	3836365.886	605765.867	65.662	None	F
709A	3841805.297	604892.164	70.760	None	F
710A	3826082.104	626488.426	61.202	None	F
711A	3829955.976	627264.933	66.828	None	F
712A	3818270.940	633932.409	64.350	None	F
713A	3816935.313	638873.350	64.564	None	F
714A	3810069.680	638877.663	63.388	None	F
715A	3808963.831	634052.323	62.060	None	F
716A	3855163.189	602699.612	74.536	None	F
717A	3863465.002	588894.707	82.092	None	F
718A	3869889.606	593968.760	91.001	None	F
719A	3873715.796	582362.297	168.897	None	F
720A	3870739.429	576066.340	102.989	None	F
BM96	3870710.162	576068.132	105.518	Both	OT
BM97	3829205.311	630636.578	67.415	Both	OT_U
BM98	3834500.114	611654.017	64.018	None	OT
BM99	3851243.456	614192.088	72.736	Both	OT
DF7953	3874124.756	592127.094	74.685	Both	NGS PID
EH3099	3809306.376	640914.082	63.290	None	NGS PID
EH3128	3829203.765	630457.743	67.819	None	NGS PID
EH3129	3829742.425	630602.478	65.908	None	NGS PID
EH2124	3849523.319	605058.177	71.112	None	NGS PID

Name	Std Dev n (m)	Std Dev e (m)	Std Dev u (m)	Std Dev Hz (m)	Geoid Separation (m)
417	0.004	0.003	0.010	0.005	-27.236
BM96	0.007	0.005	0.015	0.009	-27.293
BM97	0.005	0.005	0.013	0.007	-26.678
BM98	0.008	0.007	0.018	0.010	-26.595
BM99	0.006	0.005	0.015	0.008	-26.873
DF7953	0.000	0.000	0.000	0.000	-27.249
EH2124	0.008	0.008	0.018	0.011	-26.797
EH3099	0.000	0.000	0.000	0.000	-26.512
EH3128	0.005	0.005	0.013	0.007	-26.676
EH3129	0.005	0.005	0.013	0.007	-26.683

Name	Std Dev n (m)	Std Dev e (m)	Std Dev u (m)	Std Dev Hz (m)	Geoid Separation (m)
301	0.005	0.005	0.011	0.007	-26.856
302	0.006	0.005	0.010	0.007	-26.813
303	0.004	0.003	0.008	0.005	-26.515
304	0.003	0.003	0.007	0.004	-26.464
305	0.003	0.003	0.008	0.004	-26.433
306	0.004	0.004	0.011	0.006	-26.781
307	0.002	0.002	0.006	0.003	-26.533
308	0.007	0.005	0.014	0.009	-26.596
309	0.007	0.007	0.016	0.010	-26.562
310	0.004	0.004	0.011	0.006	-26.550
311	0.009	0.006	0.021	0.011	-26.349
313	0.005	0.004	0.011	0.007	-26.842
314	0.006	0.004	0.012	0.008	-26.777
315	0.005	0.004	0.015	0.007	-26.866
316	0.007	0.007	0.018	0.010	-27.057
317	0.006	0.005	0.018	0.008	-27.162
318	0.004	0.003	0.011	0.005	-27.295
319	0.007	0.008	0.014	0.010	-27.330
319A	0.006	0.006	0.013	0.009	-27.330
320	0.003	0.002	0.005	0.003	-27.338
320A	0.003	0.002	0.005	0.003	-27.338
401	0.004	0.004	0.010	0.006	-26.740
402	0.004	0.004	0.010	0.006	-26.640
403	0.004	0.004	0.011	0.006	-26.685
404	0.006	0.005	0.014	0.007	-26.671
405	0.005	0.004	0.011	0.006	-26.785
406	0.004	0.003	0.008	0.005	-26.523
407	0.003	0.003	0.007	0.004	-26.477
408	0.005	0.004	0.011	0.006	-26.573
409	0.004	0.003	0.010	0.005	-26.637
410	0.005	0.004	0.013	0.006	-26.631
411	0.003	0.004	0.010	0.005	-26.663
412	0.003	0.003	0.007	0.004	-26.628
413	0.008	0.007	0.019	0.010	-26.568
414	0.010	0.010	0.026	0.014	-26.445
415	0.002	0.002	0.005	0.003	-26.910
416	0.007	0.007	0.019	0.010	-27.010
417	0.004	0.003	0.010	0.005	-27.236
417	0.006	0.004	0.011	0.007	-27.236
418	0.013	0.011	0.035	0.017	-27.228
419	0.004	0.003	0.007	0.005	-27.446
419A	0.004	0.003	0.007	0.005	-27.445
420	0.003	0.003	0.008	0.004	-27.377
420A	0.003	0.003	0.008	0.004	-27.377
501	0.005	0.005	0.012	0.007	-26.713

502	0.003	0.002	0.007	0.004	-26.636
503	0.003	0.003	0.008	0.004	-26.631
504	0.004	0.004	0.012	0.006	-26.709
505	0.003	0.003	0.006	0.004	-26.573
506	0.004	0.003	0.008	0.005	-26.395
507	0.004	0.004	0.010	0.006	-26.401
508	0.003	0.003	0.009	0.005	-26.539
509	0.004	0.004	0.011	0.005	-26.725
510	0.005	0.004	0.012	0.006	-26.706
511	0.001	0.002	0.003	0.002	-26.645
512	0.005	0.005	0.013	0.007	-26.543
513	0.004	0.004	0.011	0.006	-26.506
514	0.005	0.004	0.013	0.006	-26.395
515	0.003	0.003	0.008	0.004	-26.553
516	0.005	0.004	0.009	0.006	-26.924
517	0.006	0.004	0.017	0.007	-26.957
518	0.007	0.007	0.018	0.010	-27.098
519	0.007	0.006	0.019	0.009	-27.186
520	0.002	0.003	0.005	0.004	-27.397
501A	0.005	0.005	0.012	0.007	-26.712
502A	0.003	0.003	0.008	0.004	-26.637
503A	0.003	0.002	0.007	0.004	-26.631
504A	0.005	0.004	0.012	0.006	-26.709
505A	0.003	0.003	0.007	0.004	-26.573
506A	0.004	0.004	0.010	0.005	-26.395
507A	0.004	0.004	0.010	0.006	-26.401
508A	0.004	0.003	0.009	0.005	-26.538
509A	0.004	0.004	0.011	0.005	-26.724
510A	0.005	0.004	0.012	0.006	-26.706
511A	0.001	0.002	0.003	0.002	-26.645
512A	0.005	0.005	0.013	0.007	-26.543
513A	0.004	0.004	0.011	0.006	-26.506
514A	0.005	0.004	0.013	0.006	-26.395
515A	0.003	0.003	0.008	0.004	-26.553
516A	0.005	0.004	0.008	0.006	-26.923
517A	0.006	0.004	0.017	0.007	-26.957
518A	0.007	0.007	0.018	0.010	-27.098
519A	0.007	0.006	0.019	0.009	-27.186
520A	0.003	0.003	0.006	0.004	-27.398
601	0.002	0.002	0.005	0.003	-26.875
602	0.003	0.004	0.009	0.005	-26.740
603	0.004	0.004	0.010	0.006	-26.669
604	0.003	0.002	0.006	0.004	-26.763
605	0.003	0.003	0.007	0.004	-26.588
606	0.004	0.003	0.008	0.005	-26.511
607	0.003	0.003	0.009	0.005	-26.449
608	0.005	0.004	0.013	0.006	-26.696
609	0.004	0.003	0.006	0.005	-26.594
610	0.003	0.002	0.006	0.004	-26.568

611	0.004	0.002	0.007	0.004	-26.599
612	0.005	0.004	0.011	0.006	-26.493
613	0.003	0.003	0.007	0.004	-26.489
614	0.002	0.002	0.004	0.003	-26.907
615	0.005	0.006	0.012	0.008	-26.943
616	0.005	0.004	0.008	0.006	-26.933
617	0.005	0.004	0.012	0.007	-26.866
618	0.006	0.005	0.016	0.008	-26.876
619	0.008	0.008	0.020	0.011	-27.113
620	0.002	0.003	0.005	0.004	-27.264
601A	0.003	0.002	0.005	0.003	-26.876
602A	0.003	0.004	0.009	0.005	-26.740
603A	0.005	0.005	0.012	0.007	-26.669
604A	0.003	0.002	0.005	0.003	-26.763
605A	0.003	0.003	0.007	0.004	-26.588
606A	0.004	0.003	0.008	0.005	-26.511
607A	0.003	0.003	0.009	0.005	-26.449
608A	0.005	0.004	0.013	0.006	-26.696
609A	0.004	0.003	0.007	0.005	-26.594
610A	0.003	0.002	0.006	0.004	-26.568
611A	0.004	0.003	0.008	0.005	-26.599
612A	0.005	0.004	0.011	0.006	-26.493
613A	0.003	0.003	0.007	0.004	-26.488
614A	0.002	0.002	0.005	0.003	-26.907
615A	0.005	0.006	0.012	0.008	-26.943
616A	0.005	0.003	0.008	0.006	-26.933
617A	0.005	0.004	0.012	0.007	-26.867
618A	0.006	0.004	0.015	0.007	-26.876
619A	0.009	0.008	0.022	0.012	-27.112
620A	0.004	0.005	0.010	0.006	-27.264
701	0.006	0.003	0.017	0.007	-26.819
702	0.006	0.007	0.017	0.009	-26.720
703	0.008	0.008	0.019	0.011	-26.696
704	0.004	0.004	0.011	0.005	-26.571
705	0.014	0.011	0.023	0.018	-26.617
706	0.004	0.004	0.009	0.005	-26.492
707	0.010	0.009	0.025	0.014	-26.595
708	0.003	0.003	0.007	0.004	-26.576
709	0.005	0.006	0.012	0.008	-26.664
710	0.003	0.002	0.005	0.003	-26.618
711	0.003	0.002	0.004	0.003	-26.665
712	0.004	0.003	0.009	0.005	-26.577
713	0.004	0.004	0.011	0.006	-26.589
714	0.005	0.004	0.011	0.006	-26.508
715	0.004	0.004	0.010	0.005	-26.461
716	0.005	0.006	0.012	0.008	-26.887
717	0.009	0.009	0.026	0.013	-27.034
718	0.008	0.007	0.027	0.011	-27.157
719	0.005	0.004	0.012	0.006	-27.300

720	0.012	0.011	0.029	0.016	-27.293
701A	0.113	0.023	0.346	0.115	-26.819
702A	0.015	0.020	0.046	0.025	-26.720
703A	0.008	0.008	0.019	0.011	-26.696
704A	0.004	0.004	0.010	0.005	-26.571
705A	0.004	0.003	0.008	0.005	-26.617
706A	0.004	0.004	0.011	0.006	-26.492
707A	0.012	0.012	0.032	0.017	-26.595
708A	0.003	0.003	0.006	0.004	-26.575
709A	0.005	0.006	0.014	0.008	-26.663
710A	0.003	0.002	0.005	0.004	-26.618
711A	0.004	0.003	0.006	0.005	-26.665
712A	0.008	0.007	0.018	0.011	-26.576
713A	0.004	0.004	0.011	0.006	-26.589
714A	0.005	0.004	0.013	0.007	-26.507
715A	0.004	0.004	0.010	0.006	-26.462
716A	0.006	0.008	0.016	0.010	-26.887
717A	0.008	0.008	0.022	0.011	-27.034
718A	0.007	0.006	0.023	0.009	-27.157
719A	0.004	0.004	0.012	0.006	-27.300
720A	0.010	0.009	0.022	0.014	-27.294
BM96	0.000	0.000	0.000	0.000	-27.293
BM97	0.000	0.000	0.000	0.000	-26.678
BM98	0.002	0.002	0.005	0.003	-26.595
BM99	0.000	0.000	0.000	0.000	-26.873
DF7953	0.000	0.000	0.000	0.000	-27.249
EH3099	0.004	0.003	0.009	0.005	-26.512
EH3128	0.002	0.001	0.003	0.002	-26.676
EH3129	0.001	0.001	0.002	0.002	-26.683
EH2124	0.005	0.006	0.011	0.007	-26.797

Gps Observations Summary Part One

Point Name	Original Name	Antenna Type	Network Antenna Height (m)	Ant Height Method	Start Time
EH2124	R0600523ba_1LHC	HiPer+	1.344	Vertical	5/23/2012 1:39
BM99	B0560522a_81KW	HiPer+	1.314	Vertical	5/22/2012 16:50
BM98	R0590523m_UN0G	HiPer+	1.320	Vertical	5/23/2012 12:55
BM99	B0560523a_81KW	HiPer+	1.268	Vertical	5/23/2012 11:57
BM99	B0560524a_81KW	HiPer+	1.295	Vertical	5/24/2012 10:55
BM97	R0590524l_UN0G	HiPer+	1.344	Vertical	5/24/2012 11:46

EH3099	B0560524b_81KW	HiPer+	1.113	Vertical	5/24/2012 19:17
EH3129	B38730524l_DO1S	HiPer+	1.344	Vertical	5/24/2012 11:57
EH3128	B38730524m_DO1S	HiPer+	1.344	Vertical	5/24/2012 12:46
417	B38730525w_DO1S	HiPer+	1.149	Vertical	5/25/2012 22:19
DF7953	R0600526a_1LHC	HiPer+	1.344	Vertical	5/26/2012 0:01
BM99	B0560525b_81KW	HiPer+	1.289	Vertical	5/25/2012 11:41
BM96	R0600526m_1LHC	HiPer+	1.350	Vertical	5/26/2012 12:25
417	B3610526a_ESQO	HiPer+	1.228	Vertical	5/26/2012 12:05

LIDAR QC

Point Name	Original Name	Antenna Type	Antenna Height (m)	Ant Height Method	Start Time
EH2124	R0600523ba_1LHC	HiPer+	1.344	Vertical	5/23/2012 1:39
BM99	B0560522a_81KW	HiPer+	1.314	Vertical	5/22/2012 16:50
601A	B2850522b_1728	HiPer GD/GGD	1.344	Vertical	5/22/2012 17:37
602A	B2850522c_1728	HiPer GD/GGD	1.344	Vertical	5/22/2012 18:35
702	B2850522d_1728	HiPer GD/GGD	1.344	Vertical	5/22/2012 19:27
501	B2850522e_1728	HiPer GD/GGD	1.344	Vertical	5/22/2012 19:55
703	B2850522f_1728	HiPer GD/GGD	1.344	Vertical	5/22/2012 20:20
603	B2850522g_1728	HiPer GD/GGD	1.344	Vertical	5/22/2012 21:32
502A	B2850522h_1728	HiPer GD/GGD	1.311	Vertical	5/22/2012 22:22
504A	B2850522i_1728	HiPer GD/GGD	1.344	Vertical	5/22/2012 23:45
405	B2850523a_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 0:26
301	B3610522a_ESQO	HiPer GD/GGD	1.314	Vertical	5/22/2012 17:11
701	B3610522b_ESQO	HiPer GD/GGD	1.344	Vertical	5/22/2012 17:57
503A	B3610522c_ESQO	HiPer GD/GGD	1.344	Vertical	5/22/2012 23:06
604A	B3610523a_ESQO	HiPer	1.344	Vertical	5/23/2012

		GD/GGD			0:53
601	B38730522r_DO1S	HiPer+	1.344	Vertical	5/22/2012 17:31
602	B38730522s_DO1S	HiPer+	1.344	Vertical	5/22/2012 18:37
702A	B38730522t_DO1S	HiPer+	1.344	Vertical	5/22/2012 19:30
501A	B38730522ta_DO1S	HiPer+	1.344	Vertical	5/22/2012 19:57
703A	B38730522u_DO1S	HiPer+	1.344	Vertical	5/22/2012 20:21
603A	B38730522v_DO1S	HiPer+	1.344	Vertical	5/22/2012 21:34
403	B38730522va_DO1S	HiPer+	1.344	Vertical	5/22/2012 21:57
704	B38730522w_DO1S	HiPer+	1.344	Vertical	5/22/2012 22:40
604	B38730523a_DO1S	HiPer+	1.344	Vertical	5/23/2012 0:49
401	R0590522t_UN0G	HiPer+	1.265	Vertical	5/22/2012 19:03
402	R0590522v_UN0G	HiPer+	1.241	Vertical	5/22/2012 21:09
502	R0590522w_UN0G	HiPer+	1.497	Vertical	5/22/2012 22:22
504	R0590522x_UN0G	HiPer+	1.353	Vertical	5/22/2012 23:33
701A	R0600522s_1LHC	HiPer+	1.295	Vertical	5/22/2012 18:11
704A	R0600522w_1LHC	HiPer+	1.344	Vertical	5/22/2012 22:41
503	R0600522x_1LHC	HiPer+	1.344	Vertical	5/22/2012 23:03
404	R0600523a_1LHC	HiPer+	1.344	Vertical	5/23/2012 0:02
302	R0600523b_1LHC	HiPer+	1.332	Vertical	5/23/2012 1:21

Point Name	Original Name	Antenna Type	Antenna Height (m)	Ant Height Method	Start Time
410	R0600524a_1LHC	HiPer+	1.344	Vertical	5/24/2012 0:39
BM99	B0560523a_81KW	HiPer+	1.268	Vertical	5/23/2012 11:57
705A	B2850523b_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 14:31
605A	B2850523c_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 14:56
606A	B2850523d_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 16:19

506A	B2850523e_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 16:52
507	B2850523f_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 17:16
607	B2850523g_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 18:43
706	B2850523h_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 19:35
508A	B2850523i_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 20:06
708A	B2850523j_1728	HiPer GD/GGD	1.344	Vertical	5/23/2012 21:47
608A	B2850524a_1728	HiPer GD/GGD	1.344	Vertical	5/24/2012 0:23
505A	B3610523b_ESQO	HiPer GD/GGD	1.344	Vertical	5/23/2012 13:35
707	B3610523c_ESQO	HiPer GD/GGD	1.344	Vertical	5/23/2012 21:10
709	B3610523d_ESQO	HiPer GD/GGD	1.344	Vertical	5/23/2012 22:14
509A	B3610523e_ESQO	HiPer GD/GGD	1.344	Vertical	5/23/2012 22:50
510A	B3610523f_ESQO	HiPer GD/GGD	1.344	Vertical	5/23/2012 23:54
705	B38730523o_DO1S	HiPer+	1.344	Vertical	5/23/2012 14:28
605	B38730523oa_DO1S	HiPer+	1.344	Vertical	5/23/2012 14:53
303	B38730523p_DO1S	HiPer+	1.344	Vertical	5/23/2012 15:25
304	B38730523q_DO1S	HiPer+	1.344	Vertical	5/23/2012 16:00
305	B38730523s_DO1S	HiPer+	1.344	Vertical	5/23/2012 18:20
407	B38730523t_DO1S	HiPer+	1.344	Vertical	5/23/2012 19:20
508	B38730523u_DO1S	HiPer+	1.344	Vertical	5/23/2012 20:03
409	B38730523ua_DO1S	HiPer+	1.344	Vertical	5/23/2012 20:45
708	B38730523v_DO1S	HiPer+	1.344	Vertical	5/23/2012 21:43
306	B38730523x_DO1S	HiPer+	1.344	Vertical	5/23/2012 23:27
608	B38730524a_DO1S	HiPer+	1.344	Vertical	5/24/2012 0:22
BM98	R0590523m_UN0G	HiPer+	1.320	Vertical	5/23/2012 12:55
505	R0600523n_1LHC	HiPer+	1.344	Vertical	5/23/2012 13:33

406	R0600523p_1LHC	HiPer+	1.344	Vertical	5/23/2012 15:34
606	R0600523q_1LHC	HiPer+	1.344	Vertical	5/23/2012 16:15
506	R0600523qa_1LHC	HiPer+	1.344	Vertical	5/23/2012 16:50
507A	R0600523r_1LHC	HiPer+	1.344	Vertical	5/23/2012 17:21
607A	R0600523s_1LHC	HiPer+	1.344	Vertical	5/23/2012 18:46
706A	R0600523t_1LHC	HiPer+	1.344	Vertical	5/23/2012 19:38
408	R0600523u_1LHC	HiPer+	1.344	Vertical	5/23/2012 20:25
707A	R0600523v_1LHC	HiPer+	1.344	Vertical	5/23/2012 21:12
709A	R0600523w_1LHC	HiPer+	1.344	Vertical	5/23/2012 22:18
509	R0600523wa_1LHC	HiPer+	1.344	Vertical	5/23/2012 22:48
510	R0600523x_1LHC	HiPer+	1.344	Vertical	5/23/2012 23:52

Point Name	Original Name	Antenna Type	Antenna Height (m)	Ant Height Method	Start Time
514A	R0600524x_1LHC	HiPer+	1.344	Vertical	5/24/2012 23:41
BM99	B0560524a_81KW	HiPer+	1.295	Vertical	5/24/2012 10:55
EH3099	B0560524b_81KW	HiPer+	1.113	Vertical	5/24/2012 19:17
514	B0560524c_81KW	HiPer+	1.399	Vertical	5/24/2012 23:32
307	B0560525a_81KW	HiPer+	1.503	Vertical	5/25/2012 0:38
511A	B2850524b_1728	HiPer GD/GGD	1.314	Vertical	5/24/2012 13:42
710	B2850524c_1728	HiPer GD/GGD	1.344	Vertical	5/24/2012 14:06
609A	B2850524d_1728	HiPer GD/GGD	1.314	Vertical	5/24/2012 15:07
610A	B2850524e_1728	HiPer GD/GGD	1.344	Vertical	5/24/2012 15:40
712	B2850524f_1728	HiPer GD/GGD	1.344	Vertical	5/24/2012 18:09
512	B2850524g_1728	HiPer GD/GGD	1.344	Vertical	5/24/2012 19:30
310	B2850524i_1728	HiPer GD/GGD	1.344	Vertical	5/24/2012 20:59
715	B2850524j_1728	HiPer	1.399	Vertical	5/24/2012

		GD/GGD			21:50
711A	B3610524a_ESQO	HiPer GD/GGD	1.344	Vertical	5/24/2012 14:32
611A	B3610524b_ESQO	HiPer GD/GGD	1.314	Vertical	5/24/2012 16:01
308	B3610524c_ESQO	HiPer GD/GGD	1.344	Vertical	5/24/2012 17:44
712A	B3610524d_ESQO	HiPer GD/GGD	1.344	Vertical	5/24/2012 18:11
714	B3610524e_ESQO	HiPer GD/GGD	1.344	Vertical	5/24/2012 21:12
513	B3610524f_ESQO	HiPer GD/GGD	1.344	Vertical	5/24/2012 22:14
612A	B3610524g_ESQO	HiPer GD/GGD	1.311	Vertical	5/24/2012 22:41
613A	B3610525a_ESQO	HiPer GD/GGD	1.311	Vertical	5/25/2012 0:41
515A	B3610525b_ESQO	HiPer GD/GGD	1.250	Vertical	5/25/2012 1:09
EH3129	B38730524l_DO1S	HiPer+	1.344	Vertical	5/24/2012 11:57
EH3128	B38730524m_DO1S	HiPer+	1.344	Vertical	5/24/2012 12:46
411	B38730524n_DO1S	HiPer+	1.344	Vertical	5/24/2012 13:13
511	B38730524na_DO1S	HiPer+	1.314	Vertical	5/24/2012 13:39
710A	B38730524o_DO1S	HiPer+	1.344	Vertical	5/24/2012 14:08
609	B38730524p_DO1S	HiPer+	1.344	Vertical	5/24/2012 15:03
610	B38730524pa_DO1S	HiPer+	1.344	Vertical	5/24/2012 15:35
412	B38730524q_DO1S	HiPer+	1.344	Vertical	5/24/2012 16:18
307	B38730524r_DO1S	HiPer+	1.344	Vertical	5/24/2012 17:29
512A	B38730524t_DO1S	HiPer+	1.344	Vertical	5/24/2012 19:32
713	B38730524ua_DO1S	HiPer+	1.344	Vertical	5/24/2012 20:34
714A	B38730524v_DO1S	HiPer+	1.344	Vertical	5/24/2012 21:22
513A	B38730524w_DO1S	HiPer+	1.344	Vertical	5/24/2012 22:16
612	B38730524wa_DO1S	HiPer+	1.311	Vertical	5/24/2012 22:39
414	B38730524x_DO1S	HiPer+	1.344	Vertical	5/24/2012 23:06
311	B38730525a_DO1S	HiPer+	1.344	Vertical	5/25/2012

613	B38730525aa_DO1S	HiPer+	1.311	Vertical	5/25/2012 0:00
515	B38730525b_DO1S	HiPer+	1.250	Vertical	5/25/2012 0:40
BM97	R0590524l_UN0G	HiPer+	1.344	Vertical	5/24/2012 1:08
711	R0600524o_1LHC	HiPer+	1.344	Vertical	5/24/2012 11:46
611	R0600524p_1LHC	HiPer+	1.314	Vertical	5/24/2012 14:28
309	R0600524s_1LHC	HiPer+	1.344	Vertical	5/24/2012 15:57
413	R0600524t_1LHC	HiPer+	1.344	Vertical	5/24/2012 18:36
713A	R0600524u_1LHC	HiPer+	1.344	Vertical	5/24/2012 19:54
715A	R0600524v_1LHC	HiPer+	1.344	Vertical	5/24/2012 20:34
					5/24/2012 21:56

Point Name	Original Name	Antenna Type	Antenna Height (m)	Ant Height Method	Start Time
DF7953	R0600526a_1LHC	HiPer+	1.344	Vertical	5/26/2012 0:01
BM99	B0560525b_81KW	HiPer+	1.289	Vertical	5/25/2012 11:41
614A	B2850525b_1728	HiPer GD/GGD	1.311	Vertical	5/25/2012 12:48
615	B2850525c_1728	HiPer GD/GGD	1.311	Vertical	5/25/2012 13:32
516	B2850525d_1728	HiPer GD/GGD	1.311	Vertical	5/25/2012 14:14
314	B2850525e_1728	HiPer GD/GGD	1.344	Vertical	5/25/2012 15:18
617A	B2850525f_1728	HiPer GD/GGD	1.344	Vertical	5/25/2012 15:46
618	B2850525h_1728	HiPer GD/GGD	1.311	Vertical	5/25/2012 17:28
517A	B2850525i_1728	HiPer GD/GGD	1.311	Vertical	5/25/2012 18:00
717	B2850525j_1728	HiPer GD/GGD	1.344	Vertical	5/25/2012 19:15
619A	B2850525k_1728	HiPer GD/GGD	1.311	Vertical	5/25/2012 19:43
518	B2850525l_1728	HiPer GD/GGD	1.344	Vertical	5/25/2012 20:07
718A	B2850525m_1728	HiPer GD/GGD	1.344	Vertical	5/25/2012 21:01
519	B2850525n_1728	HiPer	1.344	Vertical	5/25/2012

		GD/GGD			21:26
719A	B28505250_1728	HiPer GD/GGD	1.344	Vertical	5/25/2012 22:42
716	B3610525c_ESQO	HiPer GD/GGD	1.344	Vertical	5/25/2012 13:15
616A	B3610525d_ESQO	HiPer GD/GGD	1.280	Vertical	5/25/2012 14:03
614	B38730525m_DO1S	HiPer+	1.311	Vertical	5/25/2012 12:44
615A	B38730525n_DO1S	HiPer+	1.311	Vertical	5/25/2012 13:36
516A	B387305250_DO1S	HiPer+	1.311	Vertical	5/25/2012 14:15
617	B38730525p_DO1S	HiPer+	1.344	Vertical	5/25/2012 15:45
618A	B38730525r_DO1S	HiPer+	1.311	Vertical	5/25/2012 17:30
517	B38730525ra_DO1S	HiPer+	1.311	Vertical	5/25/2012 17:59
416	B38730525s_DO1S	HiPer+	1.344	Vertical	5/25/2012 18:53
717A	B38730525t_DO1S	HiPer+	1.344	Vertical	5/25/2012 19:16
619	B38730525ta_DO1S	HiPer+	1.311	Vertical	5/25/2012 19:40
518A	B38730525u_DO1S	HiPer+	1.344	Vertical	5/25/2012 20:08
718	B38730525ua_DO1S	HiPer+	1.344	Vertical	5/25/2012 20:59
519A	B38730525v_DO1S	HiPer+	1.344	Vertical	5/25/2012 21:27
417	B38730525w_DO1S	HiPer+	1.149	Vertical	5/25/2012 22:19
316	R0590525s_UN0G	HiPer+	1.384	Vertical	5/25/2012 18:34
317	R0590525u_UN0G	HiPer+	1.487	Vertical	5/25/2012 20:39
415	R0600525m_1LHC	HiPer+	1.344	Vertical	5/25/2012 12:19
716A	R0600525n_1LHC	HiPer+	1.344	Vertical	5/25/2012 13:17
616	R06005250_1LHC	HiPer+	1.280	Vertical	5/25/2012 14:00
313	R06005250a_1LHC	HiPer+	1.344	Vertical	5/25/2012 14:52
315	R0600525r_1LHC	HiPer+	1.344	Vertical	5/25/2012 17:24
719	R0600525w_1LHC	HiPer+	1.344	Vertical	5/25/2012 22:41
318	R0600525x_1LHC	HiPer+	1.344	Vertical	5/25/2012

418	R0600525xa_1LHC	HiPer+	1.344	Vertical	23:08 5/25/2012 23:38

Point Name	Original Name	Antenna Type	Antenna Height (m)	Ant Height Method	Start Time
BM96	R0600526m_1LHC	HiPer+	1.350	Vertical	5/26/2012 12:25
720	B2850526a_1728	HiPer GD/GGD	1.344	Vertical	5/26/2012 12:41
620	B2850526b_1728	HiPer GD/GGD	1.344	Vertical	5/26/2012 13:14
319A	B2850526c_1728	HiPer GD/GGD	1.344	Vertical	5/26/2012 13:51
520A	B2850526d_1728	HiPer GD/GGD	1.344	Vertical	5/26/2012 14:17
419	B2850526e_1728	HiPer GD/GGD	1.344	Vertical	5/26/2012 14:40
320A	B2850526f_1728	HiPer GD/GGD	1.344	Vertical	5/26/2012 15:14
420	B2850526g_1728	HiPer GD/GGD	1.344	Vertical	5/26/2012 15:43
417	B3610526a_ESQO	HiPer GD/GGD	1.228	Vertical	5/26/2012 12:05
720A	B38730526m_DO1S	HiPer+	1.344	Vertical	5/26/2012 12:42
620A	B38730526n_DO1S	HiPer+	1.344	Vertical	5/26/2012 13:19
319	B38730526na_DO1S	HiPer+	1.344	Vertical	5/26/2012 13:50
520	B38730526o_DO1S	HiPer+	1.344	Vertical	5/26/2012 14:16
419A	B38730526oa_DO1S	HiPer+	1.344	Vertical	5/26/2012 14:42
320	B38730526p_DO1S	HiPer+	1.344	Vertical	5/26/2012 15:13
420A	B38730526pa_DO1S	HiPer+	1.344	Vertical	5/26/2012 15:44

Gps Observations Summary Part Two

Point Name	Stop Time	Duration	Method	Receiver
EH2124	5/23/2012 2:00	0:20:55	Static	8RJYCOT1LHC
BM99	5/23/2012 2:10	9:20:50	Static	8PZFI4M81KW
BM98	5/23/2012 22:42	9:46:15	Static	8QCP5IOUN0G
BM99	5/24/2012 1:39	13:42:15	Static	8PZFI4M81KW

BM99	5/24/2012 13:13	2:17:55	Static	8PZFI4M81KW
BM97	5/25/2012 1:40	13:54:15	Static	8QCP5IOUN0G
EH3099	5/24/2012 21:43	2:26:25	Static	8PZFI4M81KW
EH3129	5/24/2012 12:41	0:43:55	Static	8RHDWKLDO1S
EH3128	5/24/2012 12:54	0:08:20	Static	8RHDWKLDO1S
417	5/26/2012 0:19	2:00:00	Static	8RHDWKLDO1S
DF7953	5/26/2012 0:18	0:17:45	Static	8RJYCOT1LHC
BM99	5/26/2012 0:58	13:16:45	Static	8PZFI4M81KW
BM96	5/26/2012 16:11	3:45:45	Static	8RJYCOT1LHC
417	5/26/2012 12:51	0:45:55	Static	8PJPJX3ESQO

Point Name	Stop Time	Duration	Method	Receiver
EH2124	5/23/2012 2:00	0:20:55	Static	8RJYCOT1LHC
BM99	5/23/2012 2:10	9:20:50	Static	8PZFI4M81KW
601A	5/22/2012 17:55	0:17:55	Static	8R0PSO61728
602A	5/22/2012 19:04	0:28:30	Static	8R0PSO61728
702	5/22/2012 19:40	0:13:05	Static	8R0PSO61728
501	5/22/2012 20:07	0:11:55	Static	8R0PSO61728
703	5/22/2012 20:32	0:12:00	Static	8R0PSO61728
603	5/22/2012 21:45	0:13:35	Static	8R0PSO61728
502A	5/22/2012 22:43	0:20:25	Static	8R0PSO61728
504A	5/22/2012 23:50	0:04:55	Static	8R0PSO61728
405	5/23/2012 0:41	0:15:05	Static	8R0PSO61728
301	5/22/2012 17:26	0:14:20	Static	8PJPJX3ESQO
701	5/22/2012 18:28	0:31:05	Static	8PJPJX3ESQO
503A	5/22/2012 23:36	0:30:35	Static	8PJPJX3ESQO
604A	5/23/2012 1:13	0:19:50	Static	8PJPJX3ESQO
601	5/22/2012	0:20:15	Static	8RHDWKLDO1S

602	5/22/2012 17:52	0:26:10	Static	8RHDWKLDO1S
702A	5/22/2012 19:03	0:10:25	Static	8RHDWKLDO1S
501A	5/22/2012 19:40	0:11:30	Static	8RHDWKLDO1S
703A	5/22/2012 20:08	0:11:45	Static	8RHDWKLDO1S
603A	5/22/2012 20:33	0:11:20	Static	8RHDWKLDO1S
403	5/22/2012 21:46	0:13:05	Static	8RHDWKLDO1S
704	5/22/2012 22:10	0:12:10	Static	8RHDWKLDO1S
604	5/22/2012 22:52	0:24:30	Static	8RHDWKLDO1S
401	5/23/2012 1:13	1:39:20	Static	8QCP5IOUN0G
402	5/22/2012 20:42	0:59:05	Static	8QCP5IOUN0G
502	5/22/2012 22:08	0:58:15	Static	8QCP5IOUN0G
504	5/22/2012 23:21	0:40:20	Static	8QCP5IOUN0G
701A	5/23/2012 0:13	0:14:50	Static	8RJYCOT1LHC
704A	5/22/2012 18:26	0:11:10	Static	8RJYCOT1LHC
503	5/22/2012 22:53	0:15:00	Static	8RJYCOT1LHC
404	5/22/2012 23:18	0:10:50	Static	8RJYCOT1LHC
302	5/23/2012 0:13	0:12:35	Static	8RJYCOT1LHC

Point Name	Stop Time	Duration	Method	Receiver
410	5/23/2012 1:33	0:14:20	Static	8RJYCOT1LHC
BM99	5/24/2012 0:53	13:42:15	Static	8PZFI4M81KW
705A	5/24/2012 1:39	0:12:55	Static	8R0PSO61728
605A	5/23/2012 14:43	0:12:05	Static	8R0PSO61728
606A	5/23/2012 15:08	0:10:35	Static	8R0PSO61728
506A	5/23/2012 16:29	0:12:50	Static	8R0PSO61728
507	5/23/2012 17:05	0:23:15	Static	8R0PSO61728
607	5/23/2012 17:39	0:13:40	Static	8R0PSO61728
706	5/23/2012 18:57	0:14:15	Static	8R0PSO61728
606	5/23/2012 19:50	0:12:15	Static	8R0PSO61728

508A	5/23/2012 20:27	0:21:10	Static	8R0PSO61728
708A	5/23/2012 22:20	0:33:05	Static	8R0PSO61728
608A	5/24/2012 0:50	0:26:20	Static	8R0PSO61728
505A	5/23/2012 13:52	0:16:40	Static	8PJPJX3ESQO
707	5/23/2012 21:23	0:13:25	Static	8PJPJX3ESQO
709	5/23/2012 22:31	0:16:40	Static	8PJPJX3ESQO
509A	5/23/2012 23:11	0:21:15	Static	8PJPJX3ESQO
510A	5/24/2012 0:09	0:14:20	Static	8PJPJX3ESQO
705	5/23/2012 14:41	0:13:00	Static	8RHDWKLDO1S
605	5/23/2012 15:08	0:14:30	Static	8RHDWKLDO1S
303	5/23/2012 15:47	0:21:25	Static	8RHDWKLDO1S
304	5/23/2012 17:52	1:52:00	Static	8RHDWKLDO1S
305	5/23/2012 18:57	0:37:40	Static	8RHDWKLDO1S
407	5/23/2012 19:49	0:29:35	Static	8RHDWKLDO1S
508	5/23/2012 20:36	0:33:05	Static	8RHDWKLDO1S
409	5/23/2012 21:25	0:40:00	Static	8RHDWKLDO1S
708	5/23/2012 22:30	0:47:00	Static	8RHDWKLDO1S
306	5/24/2012 0:06	0:38:40	Static	8RHDWKLDO1S
608	5/24/2012 1:11	0:49:45	Static	8RHDWKLDO1S
BM98	5/23/2012 22:42	9:46:15	Static	8QCP5IOUN0G
505	5/23/2012 15:09	1:36:35	Static	8RJYCOT1LHC
406	5/23/2012 15:46	0:11:55	Static	8RJYCOT1LHC
606	5/23/2012 16:29	0:13:50	Static	8RJYCOT1LHC
506	5/23/2012 17:05	0:14:45	Static	8RJYCOT1LHC
507A	5/23/2012 17:40	0:19:30	Static	8RJYCOT1LHC
607A	5/23/2012	0:11:20	Static	8RJYCOT1LHC

	18:57			
706A	5/23/2012 19:50	0:12:05	Static	8RJYCOT1LHC
408	5/23/2012 20:38	0:12:40	Static	8RJYCOT1LHC
707A	5/23/2012 21:24	0:11:10	Static	8RJYCOT1LHC
709A	5/23/2012 22:32	0:14:10	Static	8RJYCOT1LHC
509	5/23/2012 23:10	0:22:50	Static	8RJYCOT1LHC
510	5/24/2012 0:10	0:17:15	Static	8RJYCOT1LHC

Point Name	Stop Time	Duration	Method	Receiver
514A	5/24/2012 23:50	0:09:15	Static	8RJYCOT1LHC
BM99	5/24/2012 13:13	2:17:55	Static	8PZFI4M81KW
EH3099	5/24/2012 21:43	2:26:25	Static	8PZFI4M81KW
514	5/25/2012 0:25	0:52:30	Static	8PZFI4M81KW
307	5/25/2012 1:23	0:45:15	Static	8PZFI4M81KW
511A	5/24/2012 13:53	0:11:15	Static	8R0PSO61728
710	5/24/2012 14:27	0:21:20	Static	8R0PSO61728
609A	5/24/2012 15:24	0:17:20	Static	8R0PSO61728
610A	5/24/2012 16:03	0:23:50	Static	8R0PSO61728
712	5/24/2012 18:26	0:16:45	Static	8R0PSO61728
512	5/24/2012 19:48	0:18:20	Static	8R0PSO61728
310	5/24/2012 21:17	0:17:50	Static	8R0PSO61728
715	5/24/2012 23:17	1:27:15	Static	8R0PSO61728
711A	5/24/2012 14:45	0:12:45	Static	8PJPJX3ESQO
611A	5/24/2012 16:17	0:16:30	Static	8PJPJX3ESQO
308	5/24/2012 17:55	0:11:15	Static	8PJPJX3ESQO
712A	5/24/2012 18:26	0:15:05	Static	8PJPJX3ESQO
714	5/24/2012 21:38	0:26:30	Static	8PJPJX3ESQO
513	5/24/2012	0:14:20	Static	8PJPJX3ESQO

	22:29			
612A	5/24/2012 22:53	0:11:20	Static	8PJPJX3ESQO
613A	5/25/2012 0:53	0:11:55	Static	8PJPJX3ESQO
515A	5/25/2012 1:23	0:14:30	Static	8PJPJX3ESQO
EH3129	5/24/2012 12:41	0:43:55	Static	8RHDWKLDO1S
EH3128	5/24/2012 12:54	0:08:20	Static	8RHDWKLDO1S
411	5/24/2012 13:24	0:11:05	Static	8RHDWKLDO1S
511	5/24/2012 13:54	0:14:55	Static	8RHDWKLDO1S
710A	5/24/2012 14:26	0:18:20	Static	8RHDWKLDO1S
609	5/24/2012 15:23	0:20:25	Static	8RHDWKLDO1S
610	5/24/2012 16:05	0:30:30	Static	8RHDWKLDO1S
412	5/24/2012 16:39	0:21:05	Static	8RHDWKLDO1S
307	5/24/2012 18:53	1:24:25	Static	8RHDWKLDO1S
512A	5/24/2012 19:49	0:17:20	Static	8RHDWKLDO1S
713	5/24/2012 20:50	0:15:55	Static	8RHDWKLDO1S
714A	5/24/2012 21:38	0:15:50	Static	8RHDWKLDO1S
513A	5/24/2012 22:30	0:14:15	Static	8RHDWKLDO1S
612	5/24/2012 22:52	0:12:40	Static	8RHDWKLDO1S
414	5/24/2012 23:18	0:12:00	Static	8RHDWKLDO1S
311	5/25/2012 0:11	0:10:35	Static	8RHDWKLDO1S
613	5/25/2012 0:52	0:12:15	Static	8RHDWKLDO1S
515	5/25/2012 1:22	0:14:15	Static	8RHDWKLDO1S
BM97	5/25/2012 1:40	13:54:15	Static	8QCP5IOUN0G
711	5/24/2012 14:45	0:17:40	Static	8RJYCOT1LHC
611	5/24/2012 16:18	0:21:10	Static	8RJYCOT1LHC
309	5/24/2012 18:50	0:14:15	Static	8RJYCOT1LHC
413	5/24/2012 20:11	0:16:50	Static	8RJYCOT1LHC
713A	5/24/2012 20:51	0:16:35	Static	8RJYCOT1LHC
715A	5/24/2012	0:14:55	Static	8RJYCOT1LHC

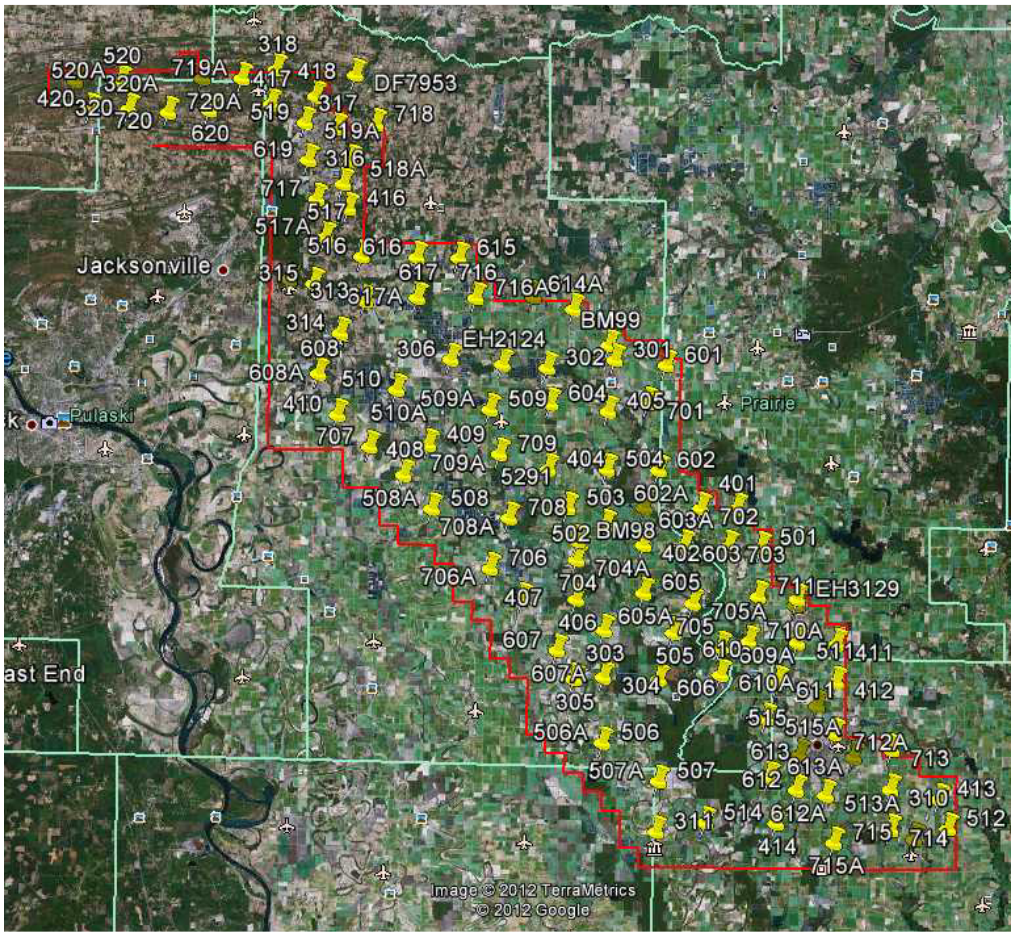
22:11

Point Name	Stop Time	Duration	Method	Receiver
DF7953	5/26/2012 0:18	0:17:45	Static	8RJYCOT1LHC
BM99	5/26/2012 0:58	13:16:45	Static	8PZFI4M81KW
614A	5/25/2012 12:59	0:11:30	Static	8R0PSO61728
615	5/25/2012 13:51	0:19:20	Static	8R0PSO61728
516	5/25/2012 14:31	0:17:05	Static	8R0PSO61728
314	5/25/2012 15:32	0:14:10	Static	8R0PSO61728
617A	5/25/2012 15:59	0:12:45	Static	8R0PSO61728
618	5/25/2012 17:41	0:12:10	Static	8R0PSO61728
517A	5/25/2012 18:14	0:14:00	Static	8R0PSO61728
717	5/25/2012 19:29	0:14:25	Static	8R0PSO61728
619A	5/25/2012 19:56	0:13:55	Static	8R0PSO61728
518	5/25/2012 20:21	0:13:50	Static	8R0PSO61728
718A	5/25/2012 21:12	0:11:45	Static	8R0PSO61728
519	5/25/2012 21:39	0:13:00	Static	8R0PSO61728
719A	5/25/2012 22:56	0:13:50	Static	8R0PSO61728
716	5/25/2012 13:50	0:34:50	Static	8PJPJX3ESQO
616A	5/25/2012 14:55	0:51:25	Static	8PJPJX3ESQO
614	5/25/2012 12:58	0:14:05	Static	8RHDWKLDO1S
615A	5/25/2012 13:52	0:16:10	Static	8RHDWKLDO1S
516A	5/25/2012 14:32	0:16:40	Static	8RHDWKLDO1S
617	5/25/2012 15:58	0:13:15	Static	8RHDWKLDO1S
618A	5/25/2012 17:41	0:11:45	Static	8RHDWKLDO1S
517	5/25/2012 18:13	0:14:10	Static	8RHDWKLDO1S

416	5/25/2012 19:05	0:12:30	Static	8RHDWKLDO1S
717A	5/25/2012 19:30	0:13:45	Static	8RHDWKLDO1S
619	5/25/2012 19:55	0:15:10	Static	8RHDWKLDO1S
518A	5/25/2012 20:22	0:13:20	Static	8RHDWKLDO1S
718	5/25/2012 21:12	0:12:20	Static	8RHDWKLDO1S
519A	5/25/2012 21:40	0:12:55	Static	8RHDWKLDO1S
417	5/26/2012 0:19	2:00:00	Static	8RHDWKLDO1S
316	5/25/2012 20:23	1:49:50	Static	8QCP5IOUN0G
317	5/25/2012 21:57	1:18:30	Static	8QCP5IOUN0G
415	5/25/2012 13:06	0:46:25	Static	8RJYCOT1LHC
716A	5/25/2012 13:29	0:12:10	Static	8RJYCOT1LHC
616	5/25/2012 14:35	0:35:00	Static	8RJYCOT1LHC
313	5/25/2012 16:06	1:14:30	Static	8RJYCOT1LHC
315	5/25/2012 18:20	0:55:25	Static	8RJYCOT1LHC
719	5/25/2012 22:54	0:13:20	Static	8RJYCOT1LHC
318	5/25/2012 23:20	0:12:40	Static	8RJYCOT1LHC
418	5/25/2012 23:49	0:11:00	Static	8RJYCOT1LHC

Point Name	Stop Time	Duration	Method	Receiver
BM96	5/26/2012 16:11	3:45:45	Static	8RJYCOT1LHC
720	5/26/2012 12:55	0:14:30	Static	8R0PSO61728
620	5/26/2012 13:31	0:16:50	Static	8R0PSO61728
319A	5/26/2012 14:02	0:10:55	Static	8R0PSO61728
520A	5/26/2012 14:29	0:12:05	Static	8R0PSO61728
419	5/26/2012 15:00	0:20:00	Static	8R0PSO61728
320A	5/26/2012 15:27	0:12:25	Static	8R0PSO61728

420	5/26/2012 15:58	0:15:40	Static	8RoPSO61728
417	5/26/2012 12:51	0:45:55	Static	8PJPJX3ESQO
720A	5/26/2012 12:56	0:13:25	Static	8RHDWKLDO1S
620A	5/26/2012 13:30	0:11:25	Static	8RHDWKLDO1S
319	5/26/2012 14:01	0:11:15	Static	8RHDWKLDO1S
520	5/26/2012 14:28	0:12:35	Static	8RHDWKLDO1S
419A	5/26/2012 15:02	0:20:30	Static	8RHDWKLDO1S
320	5/26/2012 15:26	0:12:45	Static	8RHDWKLDO1S
420A	5/26/2012 15:59	0:14:25	Static	8RHDWKLDO1S



Appendix B: Complete List of Delivered Tiles

15SWU655685	15SWU895685	15SXU015310	15SXU105325	15SXU180280	15SXU270250
15SWU655700	15SWU895700	15SXU015325	15SXU105340	15SXU180295	15SXU270265
15SWU655715	15SWU895715	15SXU015340	15SXU105355	15SXU180310	15SXU270280
15SWU655730	15SWU895730	15SXU015355	15SXU105370	15SXU180325	15SXU270295
15SWU655745	15SWU895745	15SXU015370	15SXU105385	15SXU180340	15SXU270310
15SWU670685	15SWU910400	15SXU015385	15SXU105400	15SXU180355	15SXU270325
15SWU670700	15SWU910415	15SXU015400	15SXU105415	15SXU180370	15SXU270340
15SWU670715	15SWU910430	15SXU015415	15SXU105430	15SXU180385	15SXU270355
15SWU670730	15SWU910445	15SXU015430	15SXU105445	15SXU180400	15SXU270370
15SWU670745	15SWU910460	15SXU015445	15SXU105460	15SXU180415	15SXU270385
15SWU685685	15SWU910475	15SXU015460	15SXU105475	15SXU180430	15SXU285070
15SWU685700	15SWU910490	15SXU015475	15SXU105490	15SXU180445	15SXU285085
15SWU685715	15SWU910505	15SXU015490	15SXU105505	15SXU180460	15SXU285100
15SWU685730	15SWU910520	15SXU015505	15SXU105520	15SXU180475	15SXU285115
15SWU685745	15SWU910535	15SXU015520	15SXU105535	15SXU180490	15SXU285130
15SWU700685	15SWU910550	15SXU015535	15SXU105550	15SXU180505	15SXU285145
15SWU700700	15SWU910565	15SXU015550	15SXU120130	15SXU180520	15SXU285160
15SWU700715	15SWU910580	15SXU015565	15SXU120145	15SXU195070	15SXU285175
15SWU700730	15SWU910595	15SXU015580	15SXU120160	15SXU195085	15SXU285190
15SWU700745	15SWU910610	15SXU015595	15SXU120175	15SXU195100	15SXU285205
15SWU715685	15SWU910625	15SXU015610	15SXU120190	15SXU195115	15SXU285220
15SWU715700	15SWU910640	15SXU030280	15SXU120205	15SXU195130	15SXU285235
15SWU715715	15SWU910655	15SXU030295	15SXU120220	15SXU195145	15SXU285250
15SWU715730	15SWU910670	15SXU030310	15SXU120235	15SXU195160	15SXU285265
15SWU715745	15SWU910685	15SXU030325	15SXU120250	15SXU195175	15SXU285280
15SWU730685	15SWU910700	15SXU030340	15SXU120265	15SXU195190	15SXU285295
15SWU730700	15SWU910715	15SXU030355	15SXU120280	15SXU195205	15SXU285310
15SWU730715	15SWU925400	15SXU030370	15SXU120295	15SXU195220	15SXU285325
15SWU730730	15SWU925415	15SXU030385	15SXU120310	15SXU195235	15SXU285340
15SWU730745	15SWU925430	15SXU030400	15SXU120325	15SXU195250	15SXU285355
15SWU745685	15SWU925445	15SXU030415	15SXU120340	15SXU195265	15SXU300070
15SWU745700	15SWU925460	15SXU030430	15SXU120355	15SXU195280	15SXU300085
15SWU745715	15SWU925475	15SXU030445	15SXU120370	15SXU195295	15SXU300100
15SWU745730	15SWU925490	15SXU030460	15SXU120385	15SXU195310	15SXU300115
15SWU745745	15SWU925505	15SXU030475	15SXU120400	15SXU195325	15SXU300130
15SWU760685	15SWU925520	15SXU030490	15SXU120415	15SXU195340	15SXU300145
15SWU760700	15SWU925535	15SXU030505	15SXU120430	15SXU195355	15SXU300160
15SWU760715	15SWU925550	15SXU030520	15SXU120445	15SXU195370	15SXU300175

15SWU760730	15SWU925565	15SXU030535	15SXU120460	15SXU195385	15SXU300190
15SWU760745	15SWU925580	15SXU030550	15SXU120475	15SXU195400	15SXU300205
15SWU760760	15SWU925595	15SXU030565	15SXU120490	15SXU195415	15SXU300220
15SWU775685	15SWU925610	15SXU030580	15SXU120505	15SXU195430	15SXU300235
15SWU775700	15SWU925625	15SXU030595	15SXU120520	15SXU195445	15SXU300250
15SWU775715	15SWU925640	15SXU030610	15SXU120535	15SXU195460	15SXU300265
15SWU775730	15SWU925655	15SXU045250	15SXU120550	15SXU195475	15SXU300280
15SWU775745	15SWU925670	15SXU045265	15SXU135115	15SXU195490	15SXU300295
15SWU775760	15SWU925685	15SXU045280	15SXU135130	15SXU195505	15SXU300310
15SWU790685	15SWU925700	15SXU045295	15SXU135145	15SXU210070	15SXU315070
15SWU790700	15SWU940355	15SXU045310	15SXU135160	15SXU210085	15SXU315085
15SWU790715	15SWU940370	15SXU045325	15SXU135175	15SXU210100	15SXU315100
15SWU790730	15SWU940385	15SXU045340	15SXU135190	15SXU210115	15SXU315115
15SWU790745	15SWU940400	15SXU045355	15SXU135205	15SXU210130	15SXU315130
15SWU805685	15SWU940415	15SXU045370	15SXU135220	15SXU210145	15SXU315145
15SWU805700	15SWU940430	15SXU045385	15SXU135235	15SXU210160	15SXU315160
15SWU805715	15SWU940445	15SXU045400	15SXU135250	15SXU210175	15SXU315175
15SWU805730	15SWU940460	15SXU045415	15SXU135265	15SXU210190	15SXU315190
15SWU805745	15SWU940475	15SXU045430	15SXU135280	15SXU210205	15SXU315205
15SWU820685	15SWU940490	15SXU045445	15SXU135295	15SXU210220	15SXU315220
15SWU820700	15SWU940505	15SXU045460	15SXU135310	15SXU210235	15SXU315235
15SWU820715	15SWU940520	15SXU045475	15SXU135325	15SXU210250	15SXU315250
15SWU820730	15SWU940535	15SXU045490	15SXU135340	15SXU210265	15SXU315265
15SWU820745	15SWU940550	15SXU045505	15SXU135355	15SXU210280	15SXU315280
15SWU835685	15SWU940565	15SXU045520	15SXU135370	15SXU210295	15SXU315295
15SWU835700	15SWU940580	15SXU045535	15SXU135385	15SXU210310	15SXU315310
15SWU835715	15SWU940595	15SXU045550	15SXU135400	15SXU210325	15SXU330070
15SWU835730	15SWU940610	15SXU045565	15SXU135415	15SXU210340	15SXU330085
15SWU835745	15SWU940670	15SXU060235	15SXU135430	15SXU210355	15SXU330100
15SWU850430	15SWU940685	15SXU060250	15SXU135445	15SXU210370	15SXU330115
15SWU850445	15SWU940700	15SXU060265	15SXU135460	15SXU210385	15SXU330130
15SWU850460	15SWU955340	15SXU060280	15SXU135475	15SXU210400	15SXU330145
15SWU850475	15SWU955355	15SXU060295	15SXU135490	15SXU210415	15SXU330160
15SWU850490	15SWU955370	15SXU060310	15SXU135505	15SXU225070	15SXU330175
15SWU850505	15SWU955385	15SXU060325	15SXU135520	15SXU225085	15SXU330190
15SWU850520	15SWU955400	15SXU060340	15SXU135535	15SXU225100	15SXU330205
15SWU850535	15SWU955415	15SXU060355	15SXU150085	15SXU225115	15SXU330220
15SWU850550	15SWU955430	15SXU060370	15SXU150100	15SXU225130	15SXU330235
15SWU850565	15SWU955445	15SXU060385	15SXU150115	15SXU225145	15SXU330250
15SWU850580	15SWU955460	15SXU060400	15SXU150130	15SXU225160	15SXU330265
15SWU850595	15SWU955475	15SXU060415	15SXU150145	15SXU225175	15SXU330280
15SWU850610	15SWU955490	15SXU060430	15SXU150160	15SXU225190	15SXU330295

15SWU850625	15SWU955505	15SXU060445	15SXU150175	15SXU225205	15SXU345070
15SWU850640	15SWU955520	15SXU060460	15SXU150190	15SXU225220	15SXU345085
15SWU850655	15SWU955535	15SXU060475	15SXU150205	15SXU225235	15SXU345100
15SWU850670	15SWU955550	15SXU060490	15SXU150220	15SXU225250	15SXU345115
15SWU850685	15SWU955565	15SXU060505	15SXU150235	15SXU225265	15SXU345130
15SWU850700	15SWU955580	15SXU060520	15SXU150250	15SXU225280	15SXU345145
15SWU850715	15SWU955595	15SXU060535	15SXU150265	15SXU225295	15SXU345160
15SWU850730	15SWU955610	15SXU060550	15SXU150280	15SXU225310	15SXU345175
15SWU850745	15SWU970340	15SXU075190	15SXU150295	15SXU225325	15SXU345190
15SWU865430	15SWU970355	15SXU075205	15SXU150310	15SXU225340	15SXU345205
15SWU865445	15SWU970370	15SXU075220	15SXU150325	15SXU225355	15SXU345220
15SWU865460	15SWU970385	15SXU075235	15SXU150340	15SXU225370	15SXU345235
15SWU865475	15SWU970400	15SXU075250	15SXU150355	15SXU225385	15SXU345250
15SWU865490	15SWU970415	15SXU075265	15SXU150370	15SXU225400	15SXU345265
15SWU865505	15SWU970430	15SXU075280	15SXU150385	15SXU240070	15SXU345280
15SWU865520	15SWU970445	15SXU075295	15SXU150400	15SXU240085	15SXU360070
15SWU865535	15SWU970460	15SXU075310	15SXU150415	15SXU240100	15SXU360085
15SWU865550	15SWU970475	15SXU075325	15SXU150430	15SXU240115	15SXU360100
15SWU865565	15SWU970490	15SXU075340	15SXU150445	15SXU240130	15SXU360115
15SWU865580	15SWU970505	15SXU075355	15SXU150460	15SXU240145	15SXU360130
15SWU865595	15SWU970520	15SXU075370	15SXU150475	15SXU240160	15SXU360145
15SWU865610	15SWU970535	15SXU075385	15SXU150490	15SXU240175	15SXU360160
15SWU865625	15SWU970550	15SXU075400	15SXU150505	15SXU240190	15SXU360175
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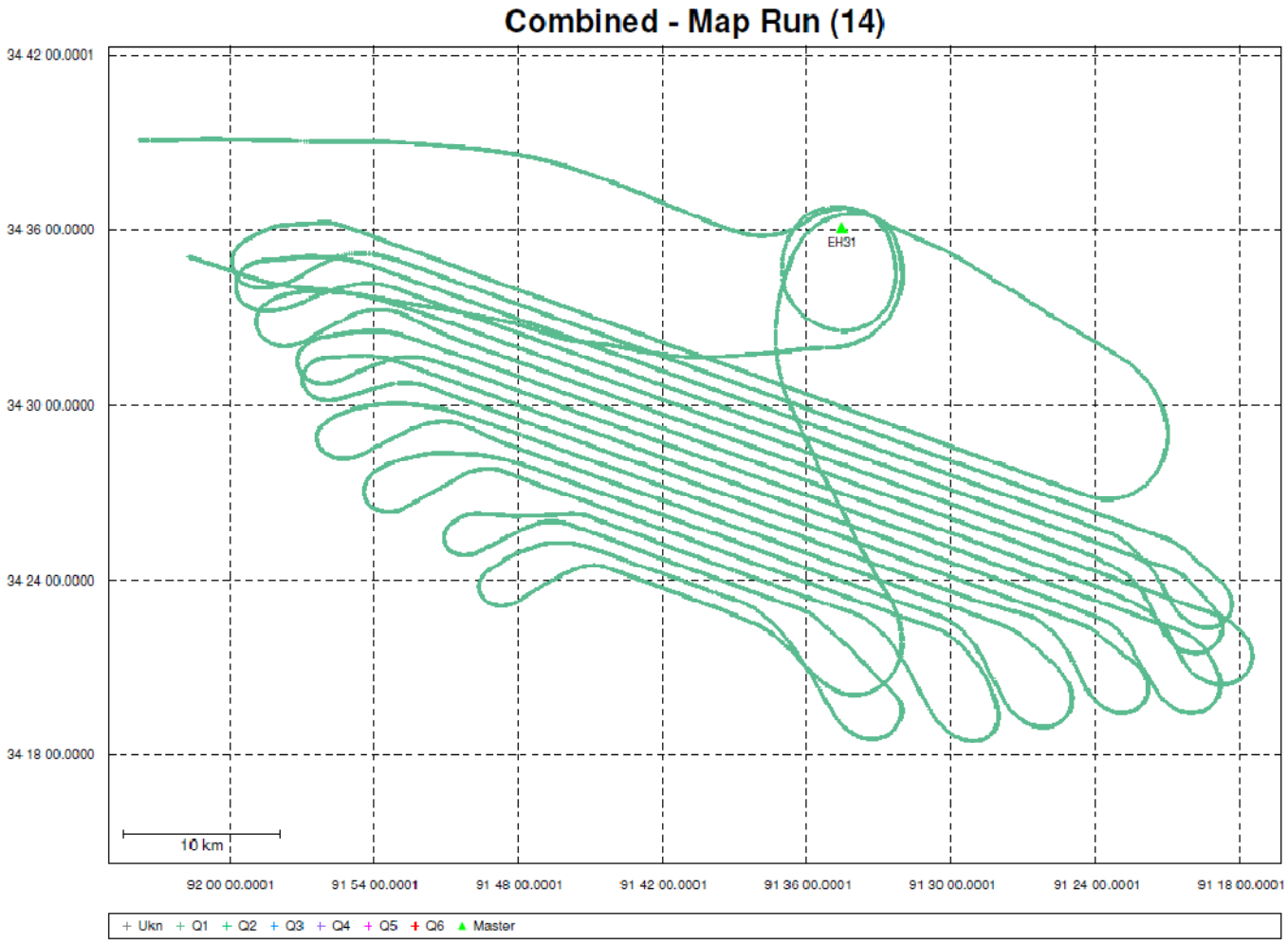
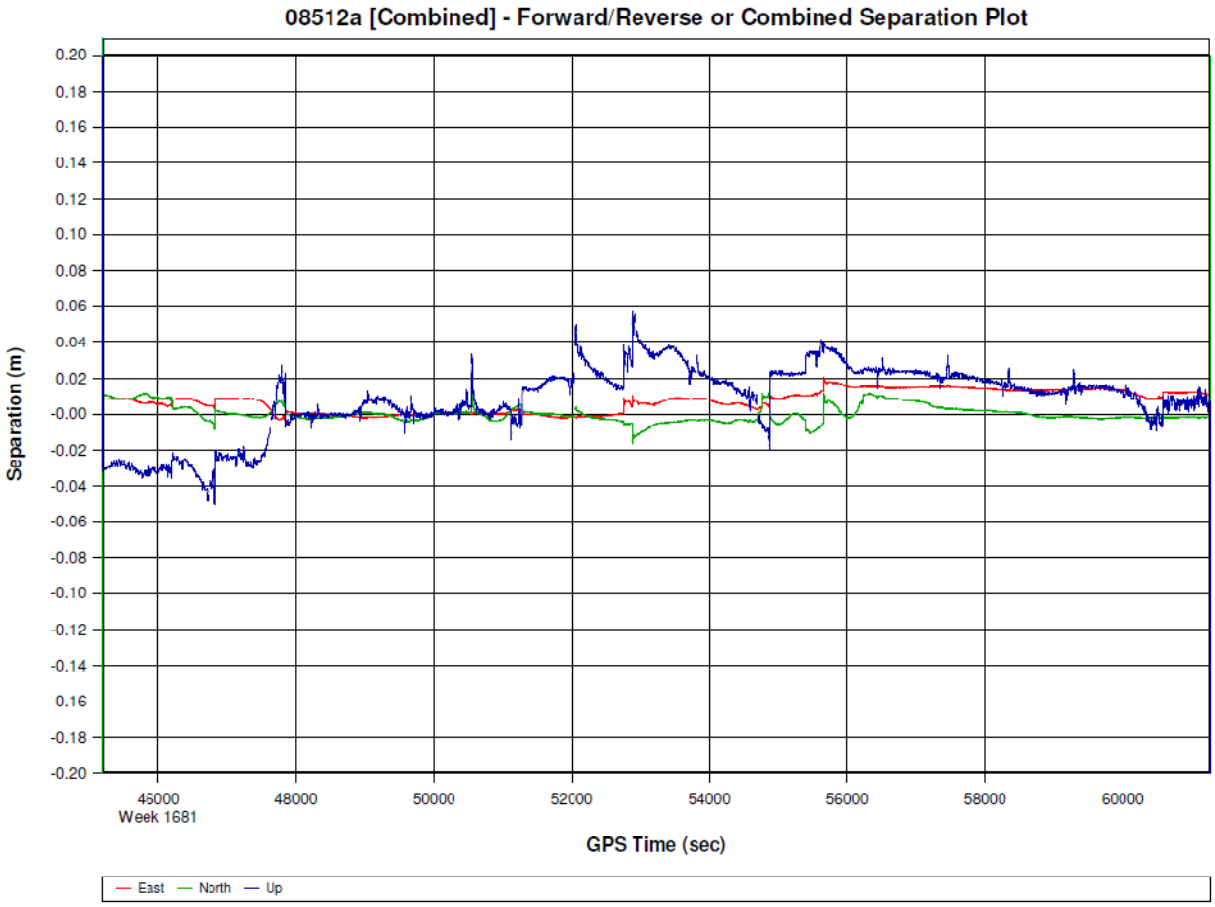
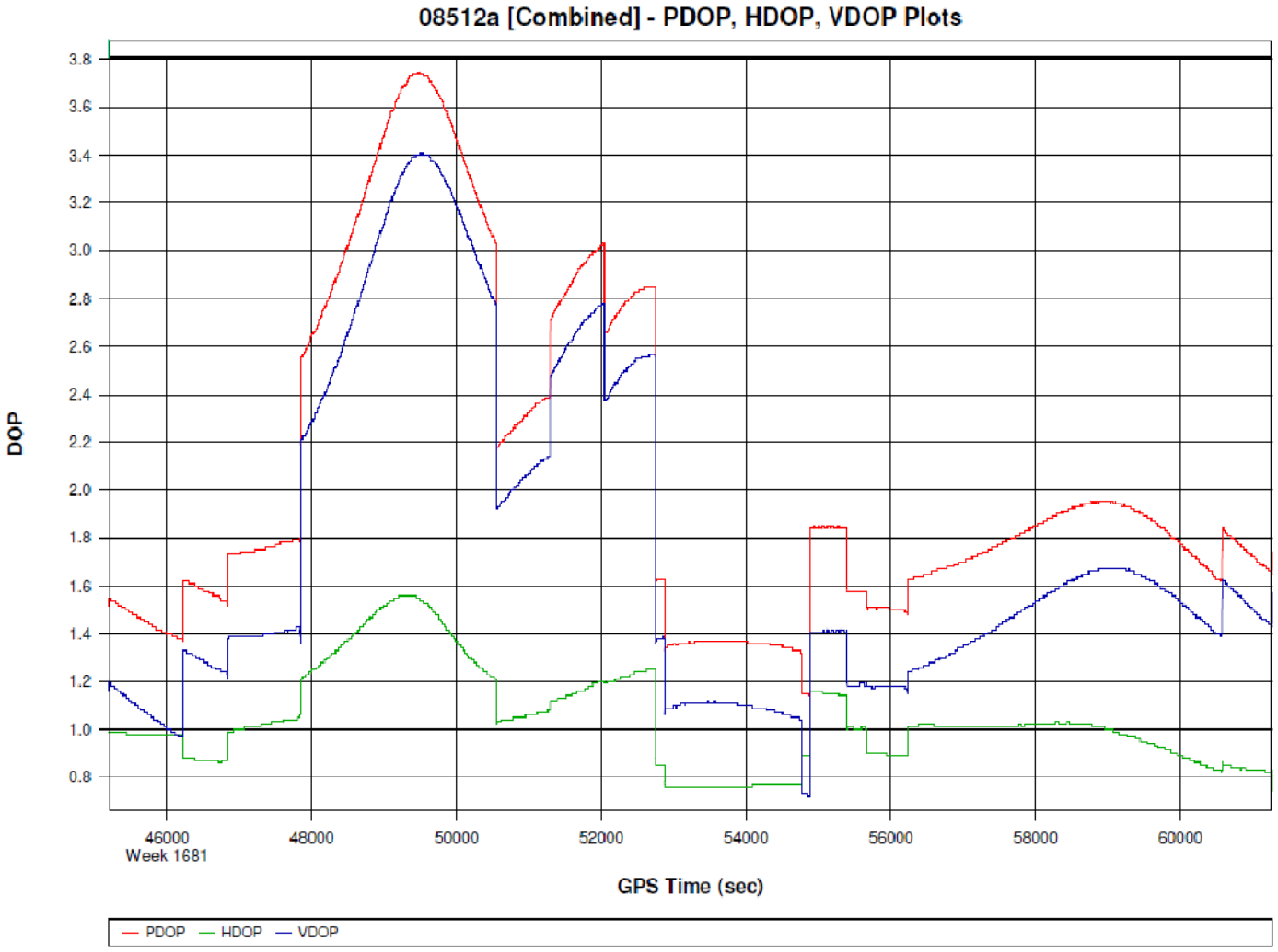
15SWU865655	15SWU970580	15SXU075430	15SXU150535	15SXU240220	15SXU375070
15SWU865670	15SWU970595	15SXU075445	15SXU165070	15SXU240235	15SXU375085
15SWU865685	15SWU970610	15SXU075460	15SXU165085	15SXU240250	15SXU375100
15SWU865700	15SWU985325	15SXU075475	15SXU165100	15SXU240265	15SXU375115
15SWU865715	15SWU985340	15SXU075490	15SXU165115	15SXU240280	15SXU375130
15SWU865730	15SWU985355	15SXU075505	15SXU165130	15SXU240295	15SXU375145
15SWU865745	15SWU985370	15SXU075520	15SXU165145	15SXU240310	15SXU375160
15SWU880430	15SWU985385	15SXU075535	15SXU165160	15SXU240325	15SXU375175
15SWU880445	15SWU985400	15SXU075550	15SXU165175	15SXU240340	15SXU375190
15SWU880460	15SWU985415	15SXU090175	15SXU165190	15SXU240355	15SXU390070
15SWU880475	15SWU985430	15SXU090190	15SXU165205	15SXU240370	15SXU390085
15SWU880490	15SWU985445	15SXU090205	15SXU165220	15SXU240385	15SXU390100
15SWU880505	15SWU985460	15SXU090220	15SXU165235	15SXU255070	15SXU390115
15SWU880520	15SWU985475	15SXU090235	15SXU165250	15SXU255085	15SXU390130
15SWU880535	15SWU985490	15SXU090250	15SXU165265	15SXU255100	15SXU390145
15SWU880550	15SWU985505	15SXU090265	15SXU165280	15SXU255115	15SXU390160
15SWU880565	15SWU985520	15SXU090280	15SXU165295	15SXU255130	15SXU390175
15SWU880580	15SWU985535	15SXU090295	15SXU165310	15SXU255145	15SXU405070

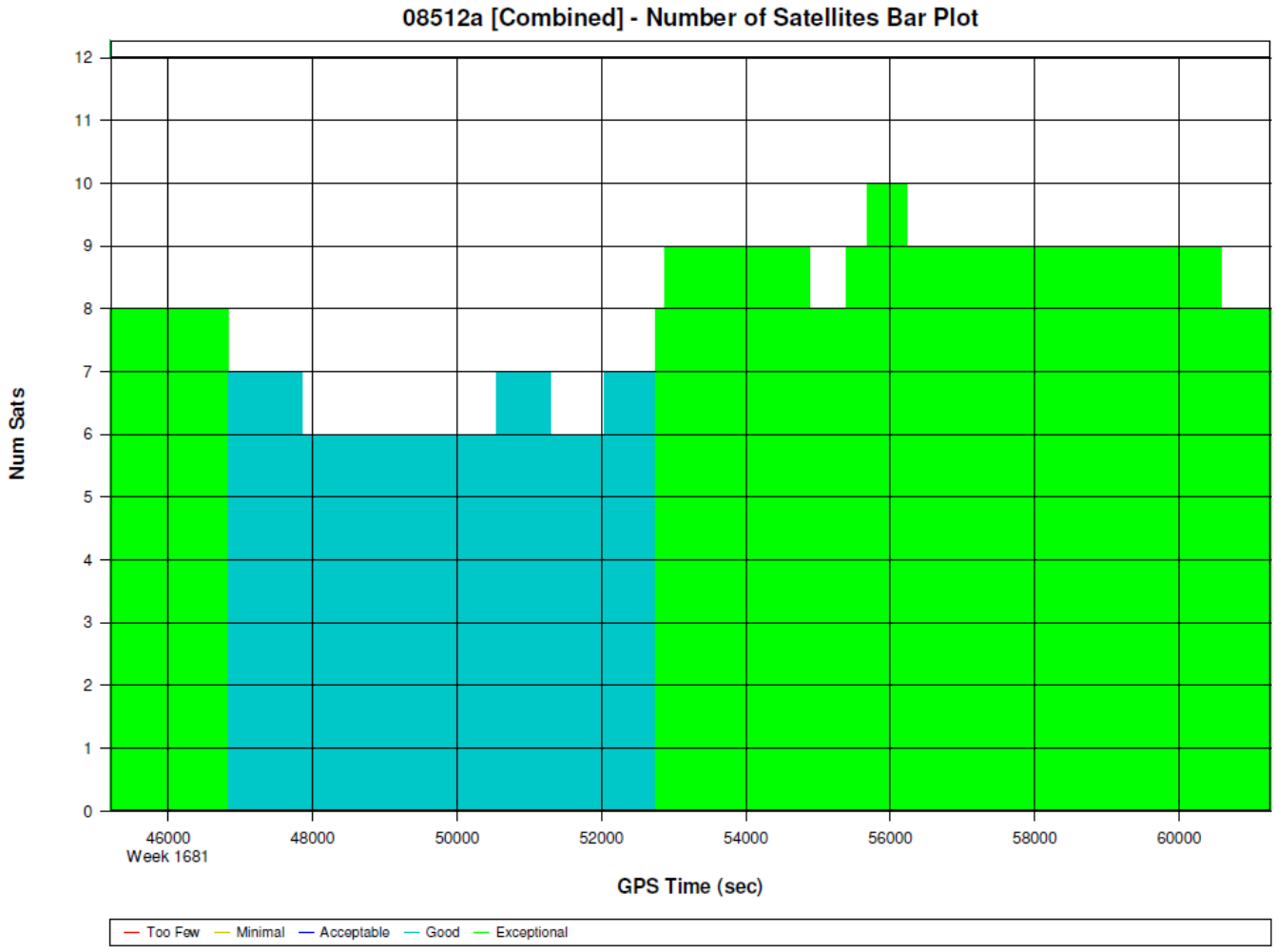
15SWU880595	15SWU985550	15SXU090310	15SXU165325	15SXU255160	15SXU405085
15SWU880610	15SWU985565	15SXU090325	15SXU165340	15SXU255175	15SXU405100
15SWU880625	15SWU985580	15SXU090340	15SXU165355	15SXU255190	15SXU405115
15SWU880640	15SWU985595	15SXU090355	15SXU165370	15SXU255205	15SXU405130
15SWU880655	15SWU985610	15SXU090370	15SXU165385	15SXU255220	15SXU405145
15SWU880670	15SXU000295	15SXU090385	15SXU165400	15SXU255235	15SXU405160
15SWU880685	15SXU000310	15SXU090400	15SXU165415	15SXU255250	15SXU405175
15SWU880700	15SXU000325	15SXU090415	15SXU165430	15SXU255265	15SXU420070
15SWU880715	15SXU000340	15SXU090430	15SXU165445	15SXU255280	15SXU420085
15SWU880730	15SXU000355	15SXU090445	15SXU165460	15SXU255295	15SXU420100
15SWU880745	15SXU000370	15SXU090460	15SXU165475	15SXU255310	15SXU420115
15SWU895430	15SXU000385	15SXU090475	15SXU165490	15SXU255325	15SXU420130
15SWU895445	15SXU000400	15SXU090490	15SXU165505	15SXU255340	15SXU420145
15SWU895460	15SXU000415	15SXU090505	15SXU165520	15SXU255355	15SXU420160
15SWU895475	15SXU000430	15SXU090520	15SXU180070	15SXU255370	15SXU435070
15SWU895490	15SXU000445	15SXU090535	15SXU180085	15SXU255385	15SXU435085
15SWU895505	15SXU000460	15SXU090550	15SXU180100	15SXU270070	15SXU435100
15SWU895520	15SXU000475	15SXU105160	15SXU180115	15SXU270085	15SXU435115
15SWU895535	15SXU000490	15SXU105175	15SXU180130	15SXU270100	15SXU435130
15SWU895550	15SXU000505	15SXU105190	15SXU180145	15SXU270115	15SXU435145
15SWU895565	15SXU000520	15SXU105205	15SXU180160	15SXU270130	15SXU435160
15SWU895580	15SXU000535	15SXU105220	15SXU180175	15SXU270145	
15SWU895595	15SXU000550	15SXU105235	15SXU180190	15SXU270160	
15SWU895610	15SXU000565	15SXU105250	15SXU180205	15SXU270175	
15SWU895625	15SXU000580	15SXU105265	15SXU180220	15SXU270190	
15SWU895640	15SXU000595	15SXU105280	15SXU180235	15SXU270205	
15SWU895655	15SXU000610	15SXU105295	15SXU180250	15SXU270220	
15SWU895670	15SXU015295	15SXU105310	15SXU180265	15SXU270235	

Appendix C: GPS Processing Reports for Each Mission




08512a [Combined] - Forward/Reverse or Combined Separation Plot
Separation (m)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
-0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
0.16
-0.18
-0.20
45000
Week 1681
48000
50000
52000
54000
56000
58000
60000
GPS Time (sec)
East
North
Up


08512a [Combined] - PDOP, HDOP, VDOP Plots
DOP
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
46000
Week 1681
48000
50000
52000
54000
56000
58000
60000
GPS Time (sec)
PDOP
HDOP
VDOP



Processing Summary Information

Program: POSGPS
Version: 4.30.3108
Project: G:\Projects\Dewberry\AR\12085a\pos\GPS\08512a.gnv

Solution Type: Combined Fwd/Rev

Number of Epochs:

Total in GPB file: 176637
No processed position: 160557
Missing Fwd or Rev: 4
With bad C/A code: 0
With bad L1 Phase: 0

Measurement RMS Values:

L1 Phase: 0.0163 (m)
C/A Code: 0.93 (m)

L1 Doppler: 0.016 (m/s)

Fwd/Rev Separation RMS Values:

East: 0.010 (m)
North: 0.008 (m)
Height: 0.022 (m)

Fwd/Rev Sep. RMS for 25%-75% weighting (16074 occurrences):

East: 0.009 (m)
North: 0.004 (m)
Height: 0.021 (m)

Quality Number Percentages:

Q 1: 100.0 %
Q 2: 0.0 %
Q 3: 0.0 %
Q 4: 0.0 %
Q 5: 0.0 %
Q 6: 0.0 %

Position Standard Deviation Percentages:

0.00 - 0.10 m: 100.0 %
0.10 - 0.30 m: 0.0 %
0.30 - 1.00 m: 0.0 %
1.00 - 5.00 m: 0.0 %
5.00 m + over: 0.0 %

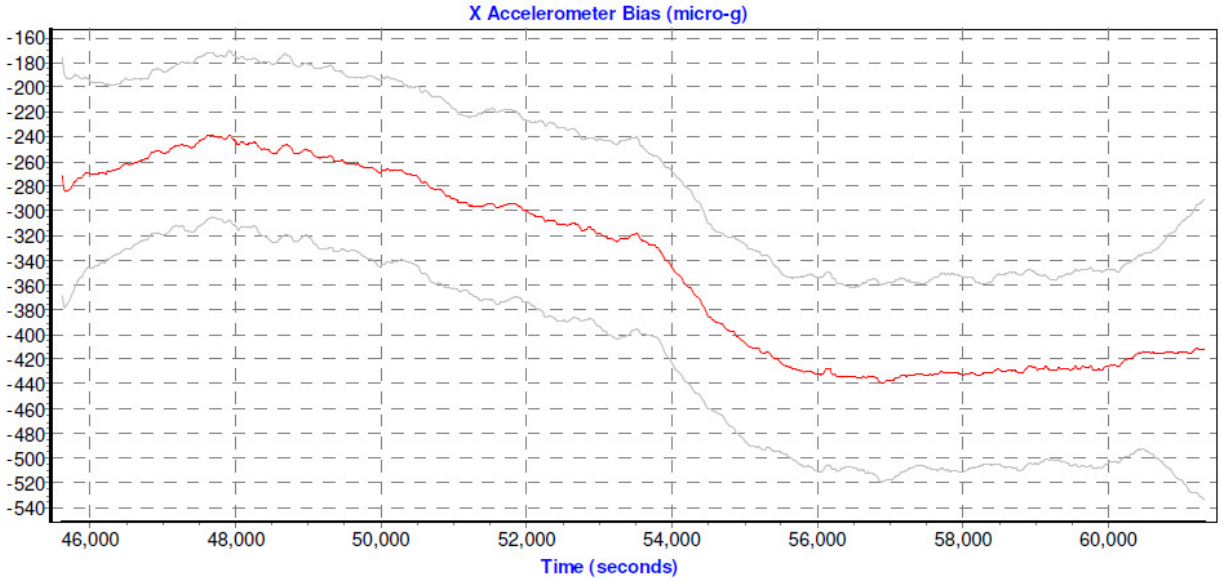
Percentages of epochs with DD_DOP over 10.00:

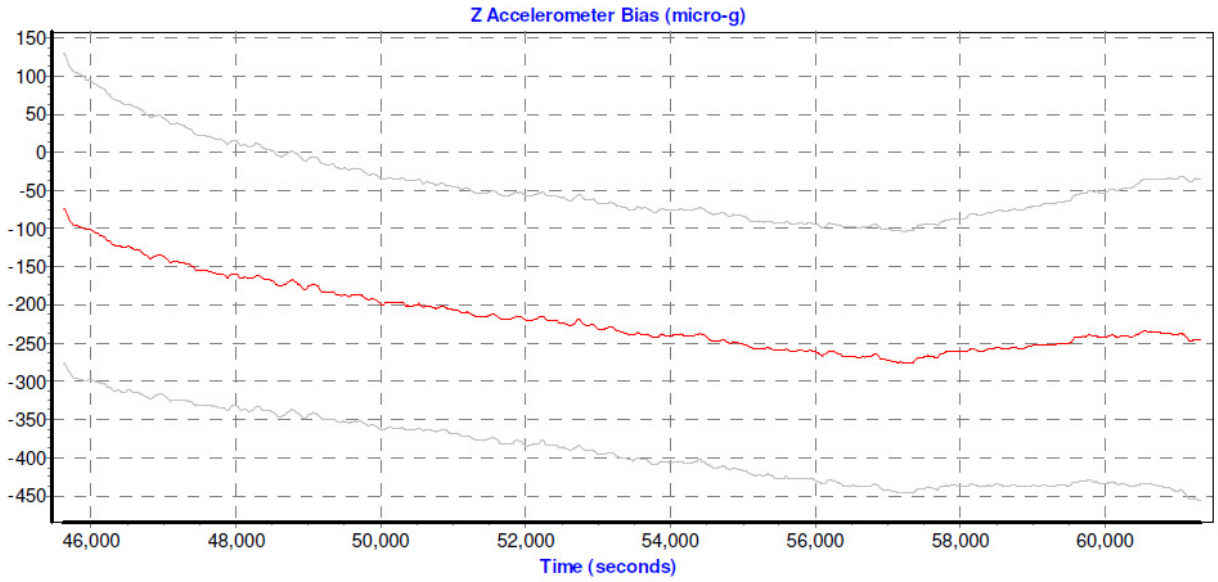
DOP over Tol: 0.0 %

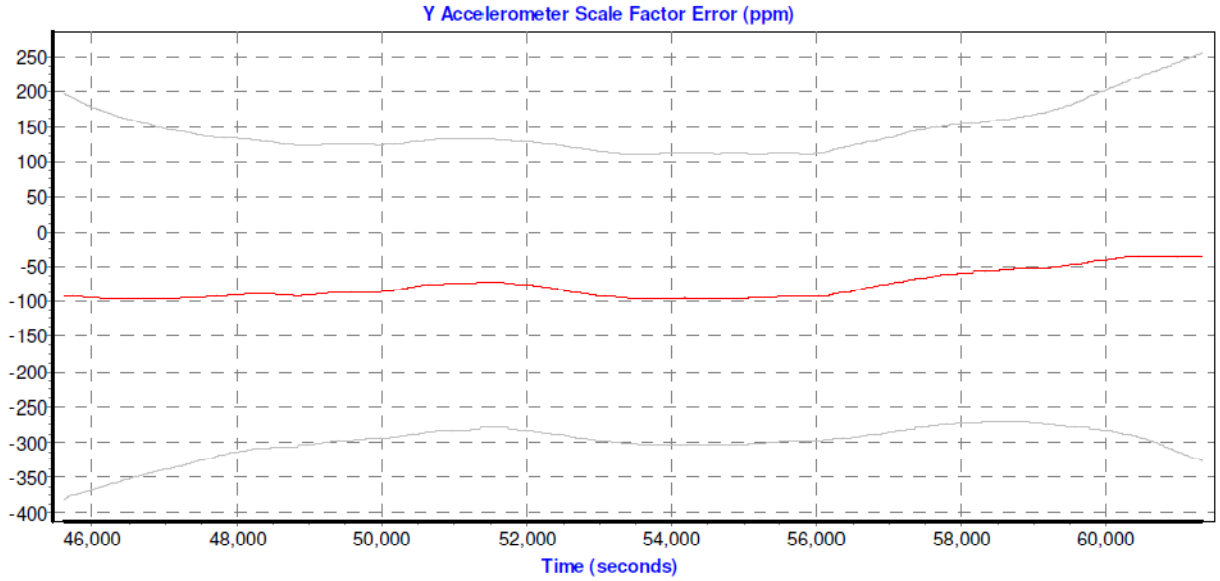
Baseline Distances:

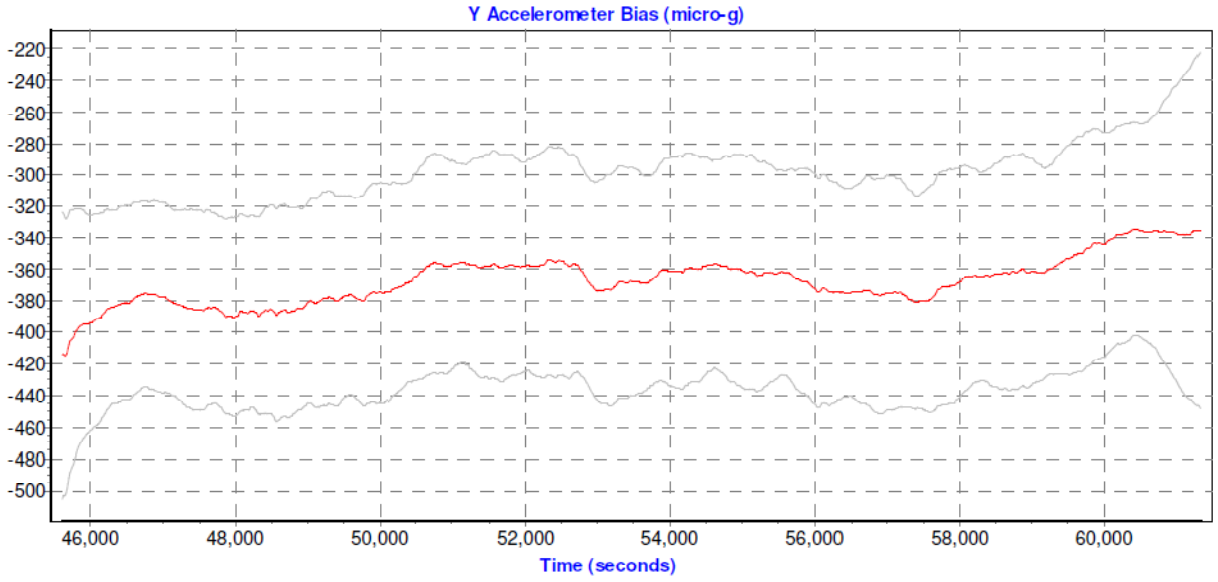
Maximum: 45.062 (km)
Minimum: 1.438 (km)
Average: 23.646 (km)
First Epoch: 41.528 (km)
Last Epoch: 45.062 (km)

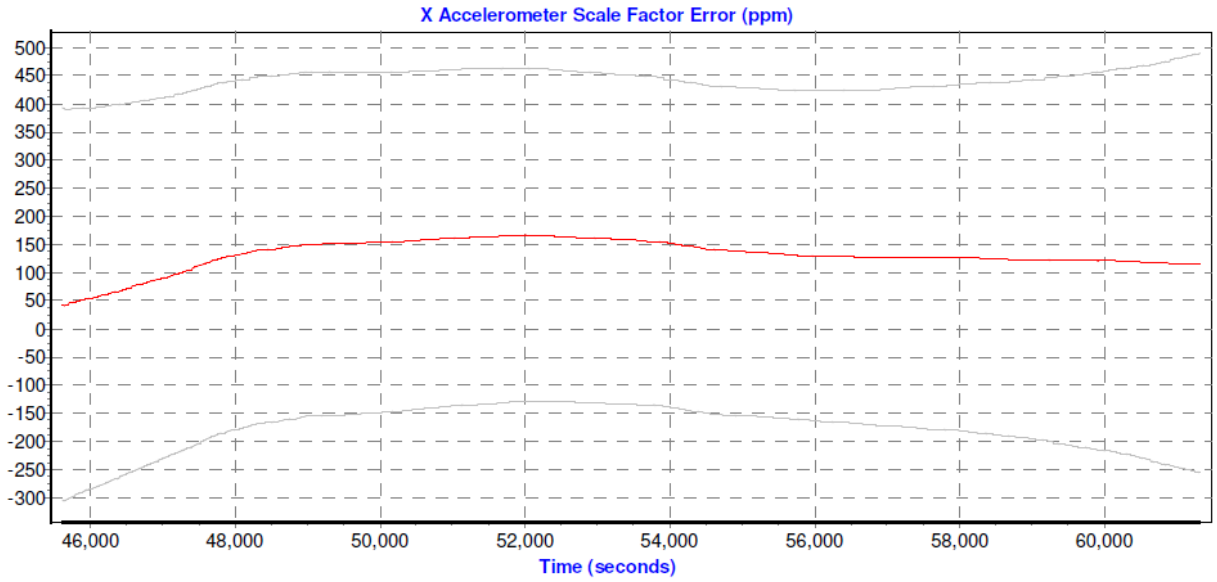
Sensor Errors

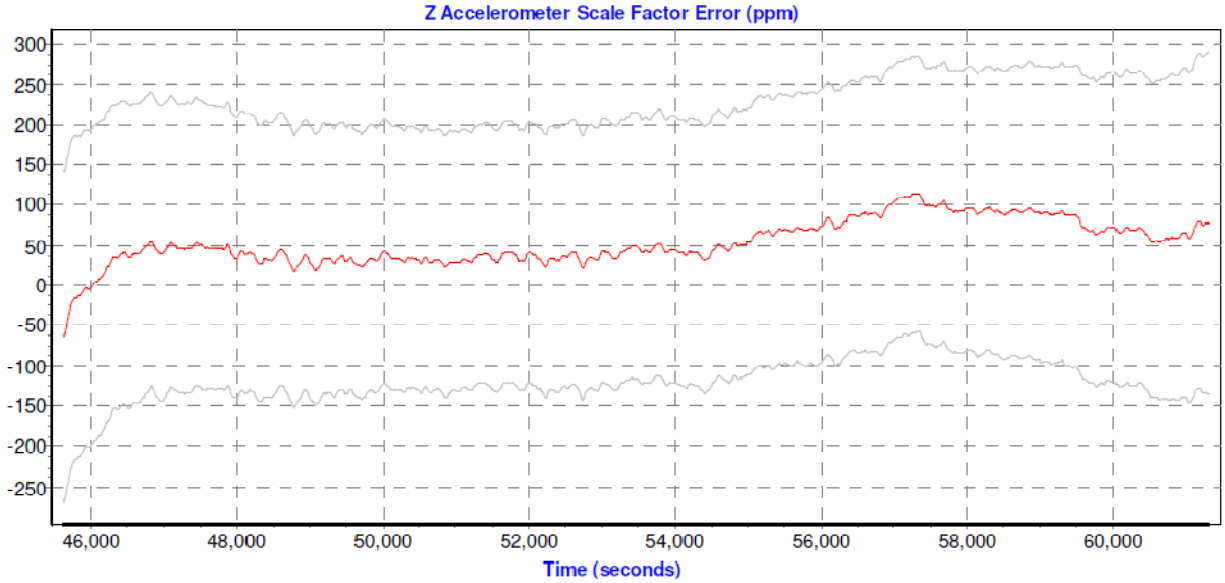


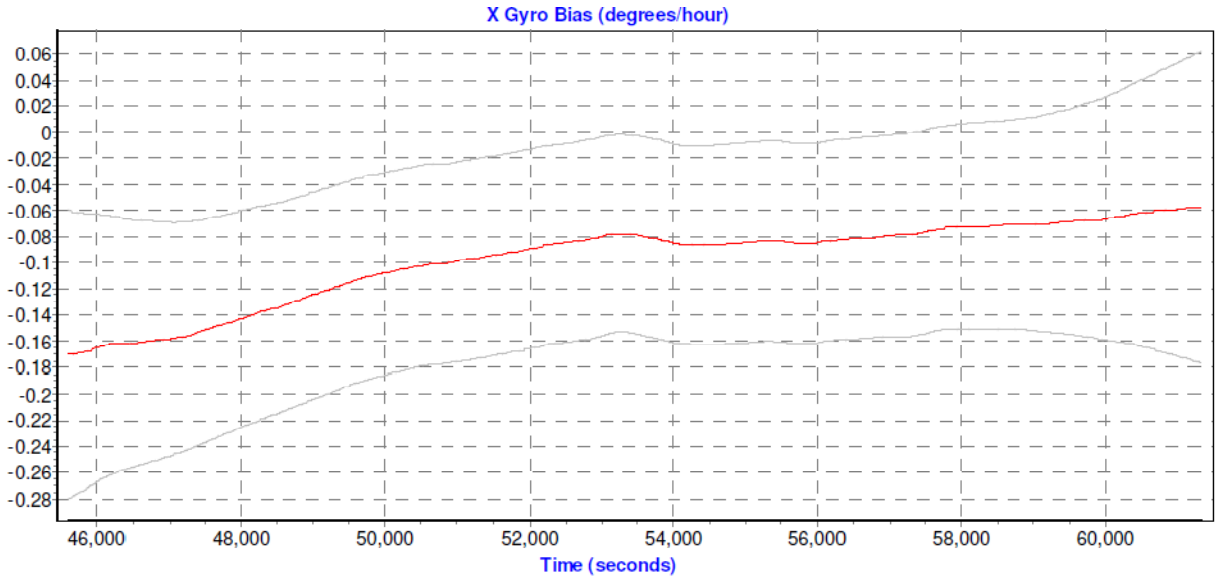


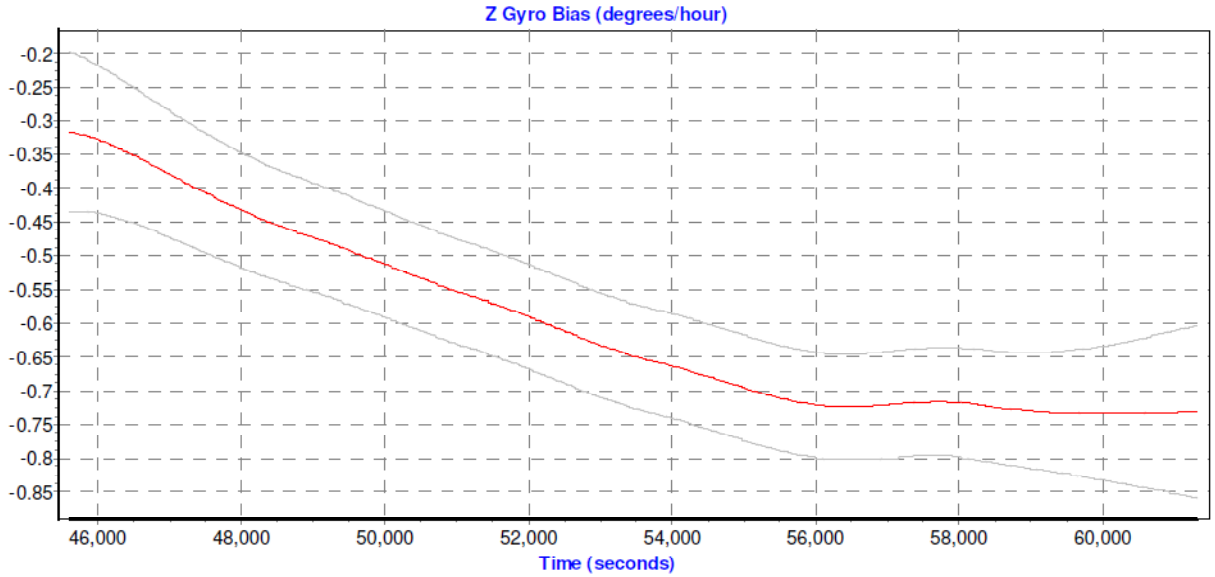

Y Accelerometer Scale Factor Error (ppm)
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
-400
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)

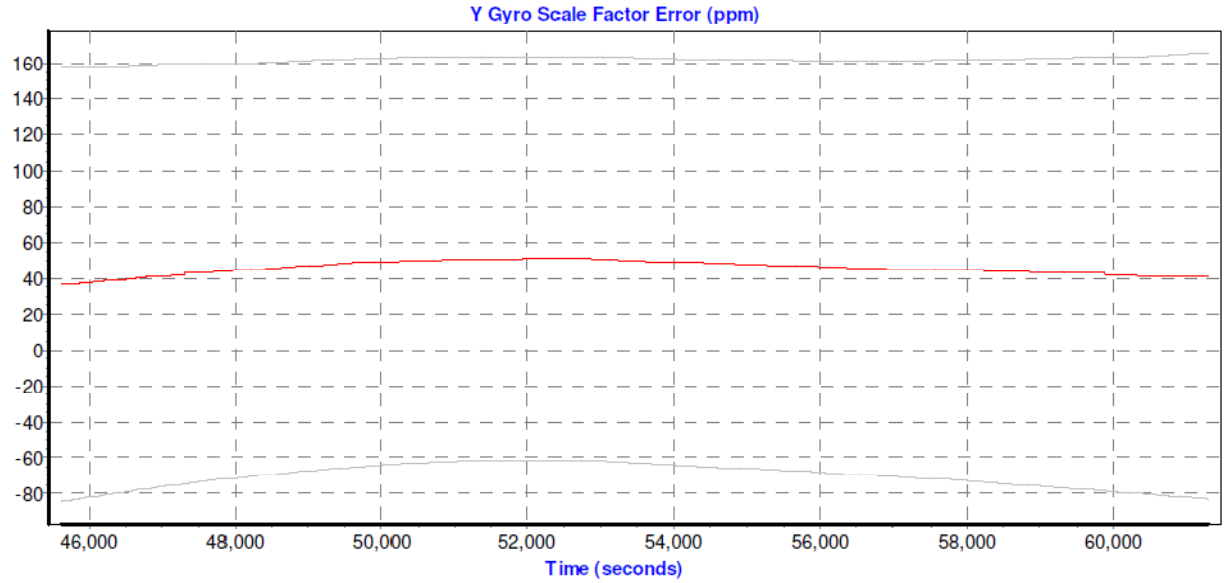

Y Accelerometer Bias (micro-g)
-220
-240
-260
-280
-300
-320
-340
-360
-380
-400
-420
-440
-460
-480
-500
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)

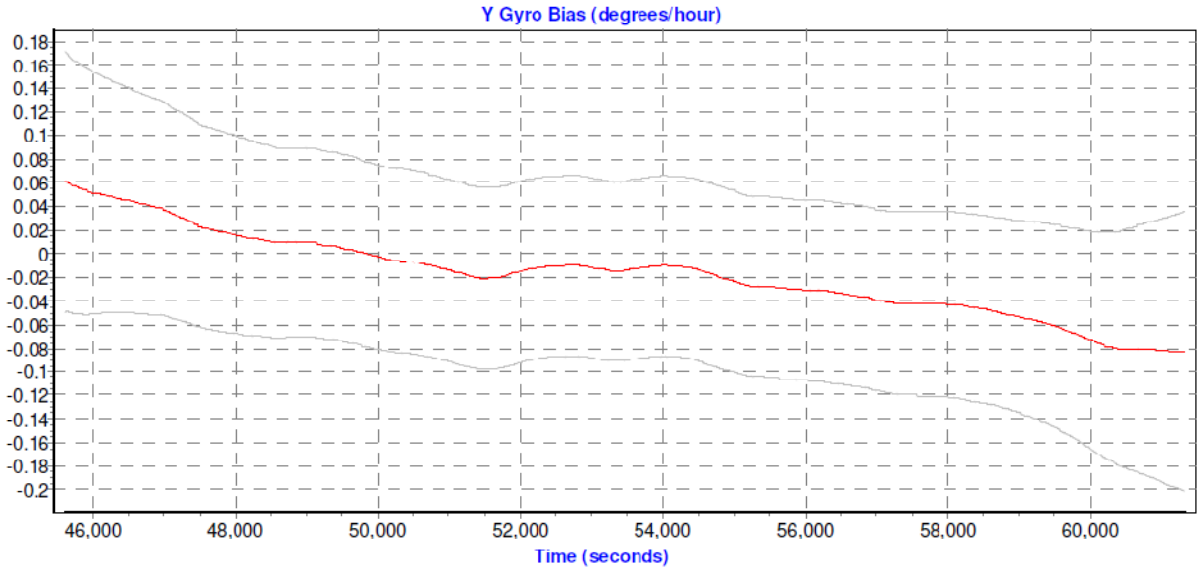

X Accelerometer Scale Factor Error (ppm)
500
450
400
350
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)

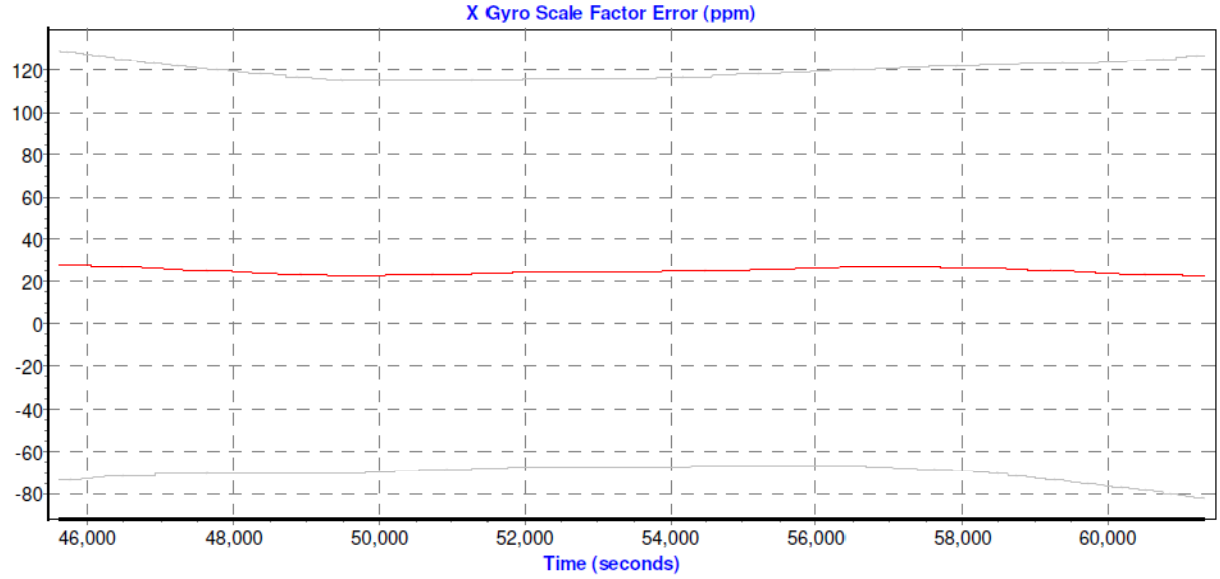

Z Accelerometer Scale Factor Error (ppm)
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)


X Gyro Bias (degrees/hour)
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
-0.2
-0.22
-0.24
-0.26
-0.28
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)

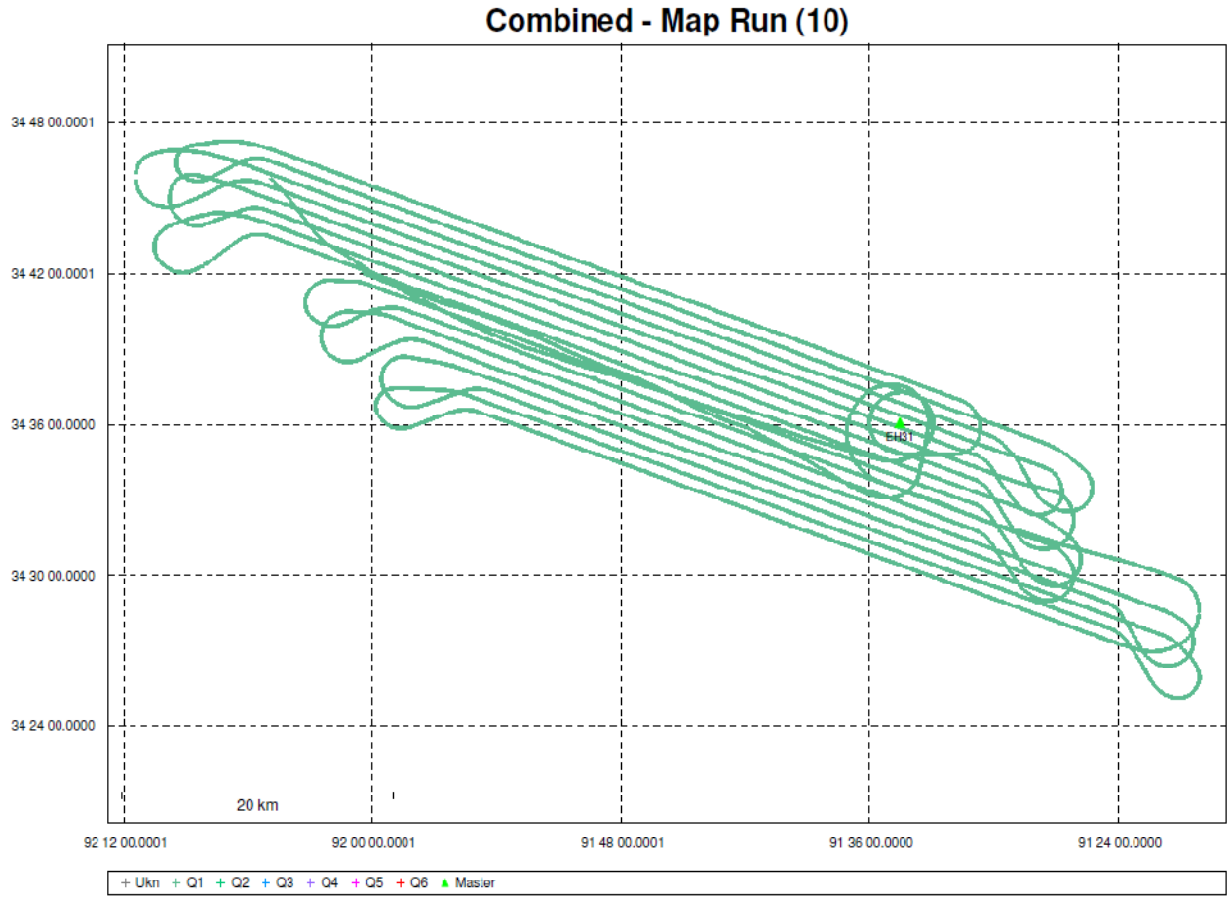

Z Gyro Bias (degrees/hour)
-0.2
-0.25
-0.3
-0.35
-0.4
-0.45
-0.5
-0.55
-0.6
-0.65
-0.7
-0.75
-0.8
-0.85
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)

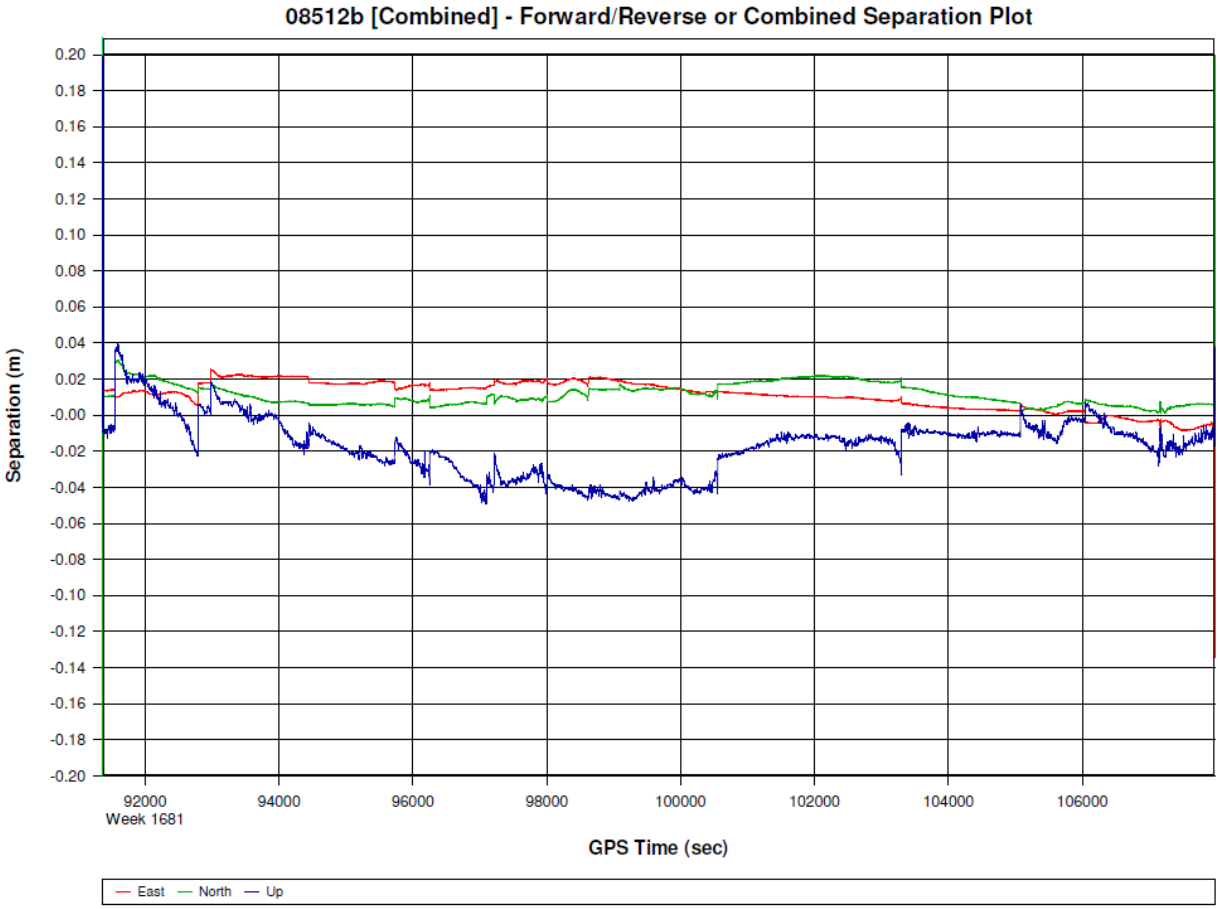

Y Gyro Scale Factor Error (ppm)
160
140
120
100
80
60
40
20
0
-20
-40
-60
-80
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)

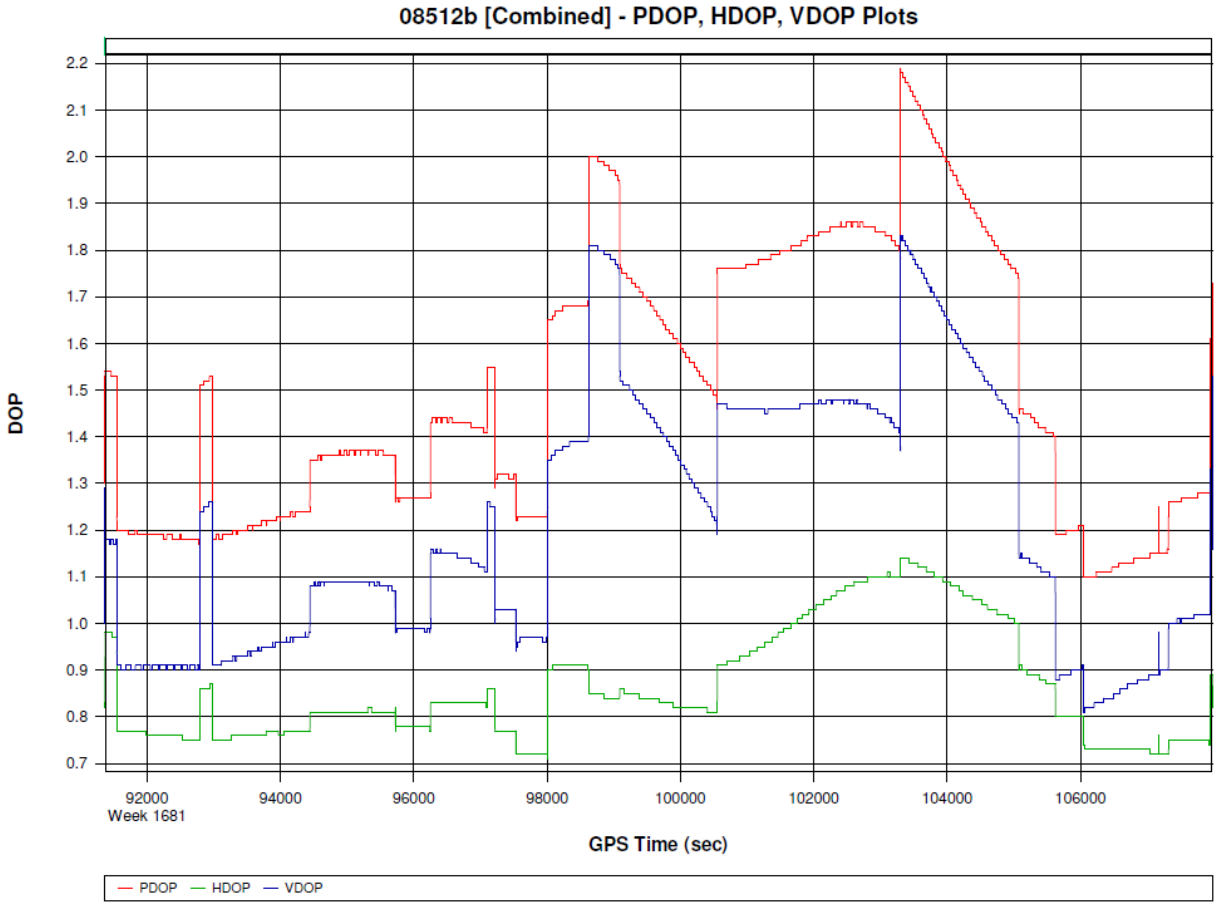

Y Gyro Bias (degrees/hour)
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
-0.2
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)

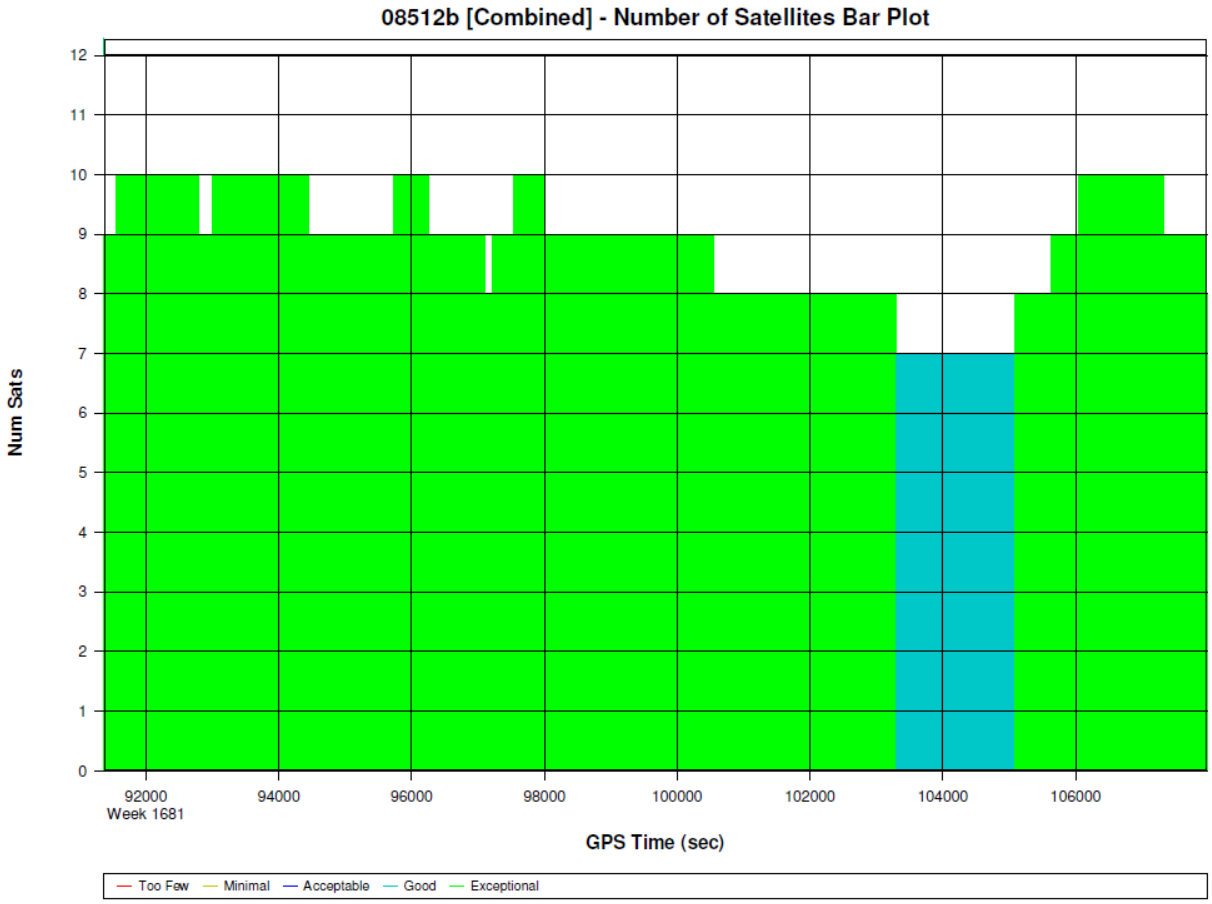

X Gyro Scale Factor Error (ppm)
120
100
80
60
40
20
0
-20
-40
-60
-80
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)


Z Gyro Scale Factor Error (ppm)
160
140
120
100
80
60
40
20
0
-20
-40
46,000
48,000
50,000
52,000
54,000
56,000
58,000
60,000
Time (seconds)


Combined - Map Run (10)
34 48 00.0001
34 42 00.0001
34 36 00.0000
34 30 00.0000
34 24 00.0000
20 km
92 12 00.0001
92 00 00.0001
91 48 00.0001
91 36 00.0000
91 24 00.0000
Ukn
Q1
Q2
Q3
Q4
Q5
Q6
Master


08512b [Combined] - Forward/Reverse or Combined Separation Plot
Separation (m)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
-0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
-0.18
-0.20
92000
Week 1681
94000
96000
98000
100000
102000
104000
106000
GPS Time (sec)
East
North
Up


08512b [Combined] - PDOP, HDOP, VDOP Plots
DOP
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
92000
Week 1681
94000
96000
98000
100000
102000
104000
106000
GPS Time (sec)
PDOP
HDOP
VDOP



Processing Summary Information
Program: POSGPS
Version: 4.30.3108
Project: G:\Projects\Dewberry\AR\12085b\pos\GPS\08512b.gnv

Solution Type: Combined Fwd/Rev

Number of Epochs:

Total in GPB file: 182674
No processed position: 166055
Missing Fwd or Rev: 4
With bad C/A code: 0
With bad L1 Phase: 0

Measurement RMS Values:

L1 Phase: 0.0175 (m)
C/A Code: 0.87 (m)
L1 Doppler: 0.016 (m/s)

Fwd/Rev Separation RMS Values:

East: 0.014 (m)
North: 0.014 (m)
Height: 0.023 (m)
Fwd/Rev Sep. RMS for 25%-75% weighting (16613 occurrences):
East: 0.014 (m)
North: 0.013 (m)
Height: 0.023 (m)

Quality Number Percentages:

Q 1: 100.0 %
Q 2: 0.0 %
Q 3: 0.0 %
Q 4: 0.0 %
Q 5: 0.0 %
Q 6: 0.0 %

Position Standard Deviation Percentages:

0.00 - 0.10 m: 100.0 %
0.10 - 0.30 m: 0.0 %
0.30 - 1.00 m: 0.0 %
1.00 - 5.00 m: 0.0 %
5.00 m + over: 0.0 %

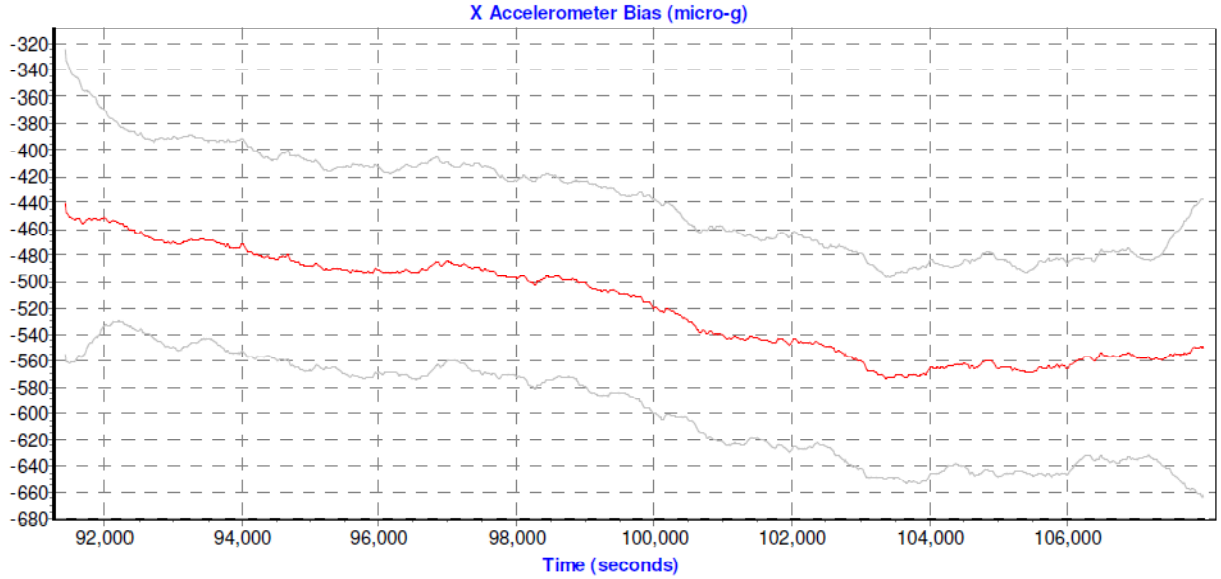
Percentages of epochs with DD_DOP over 10.00:

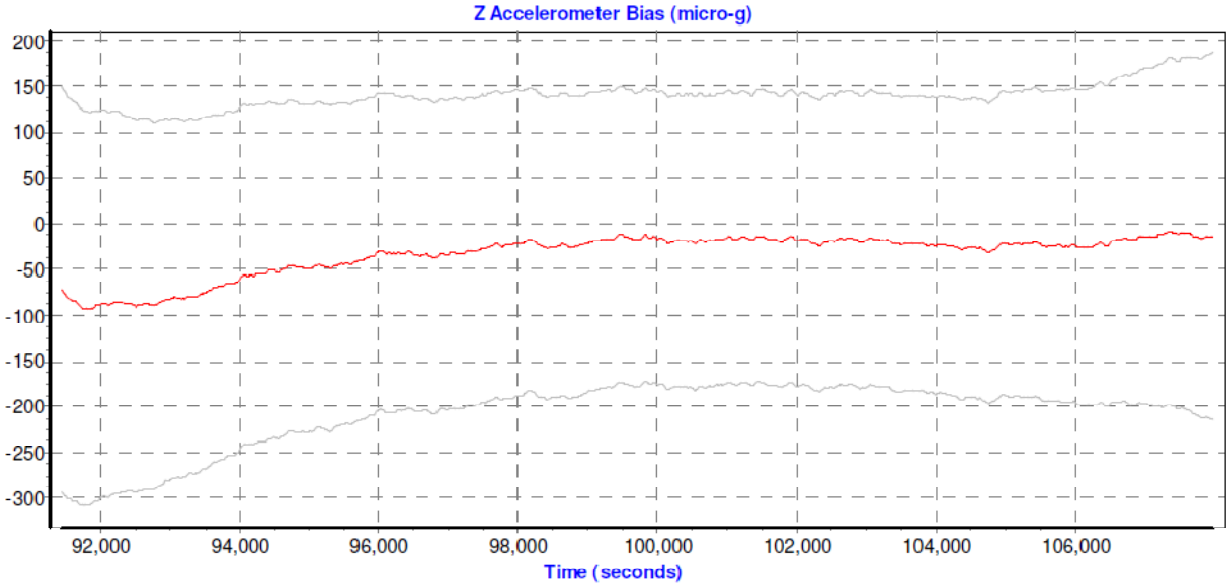
DOP over Tol: 0.0 %

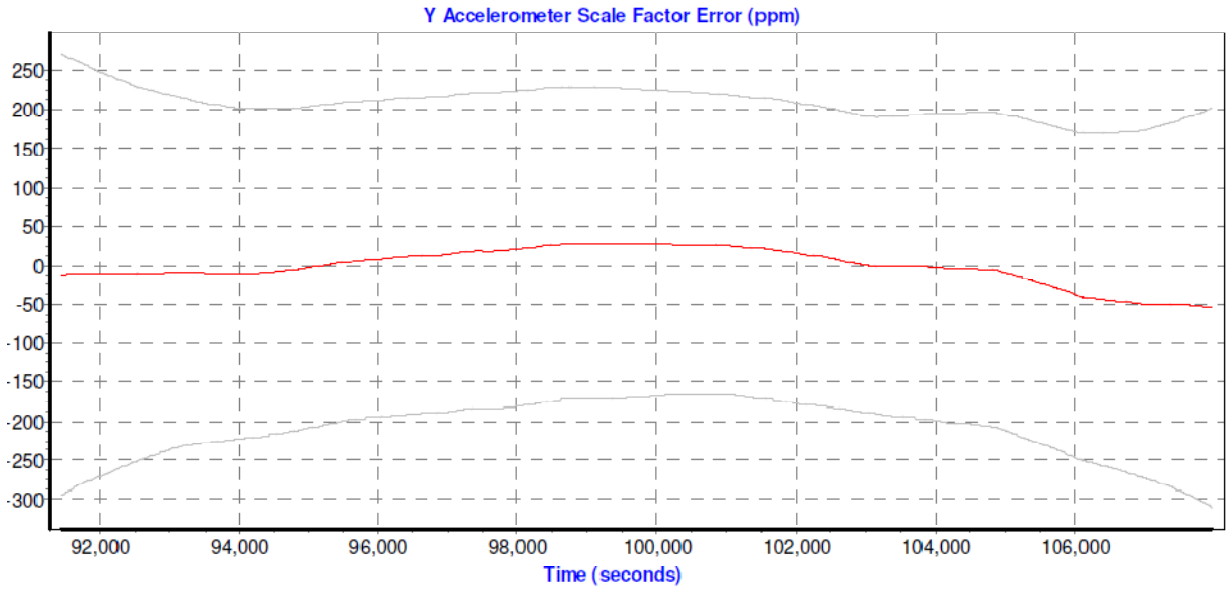
Baseline Distances:

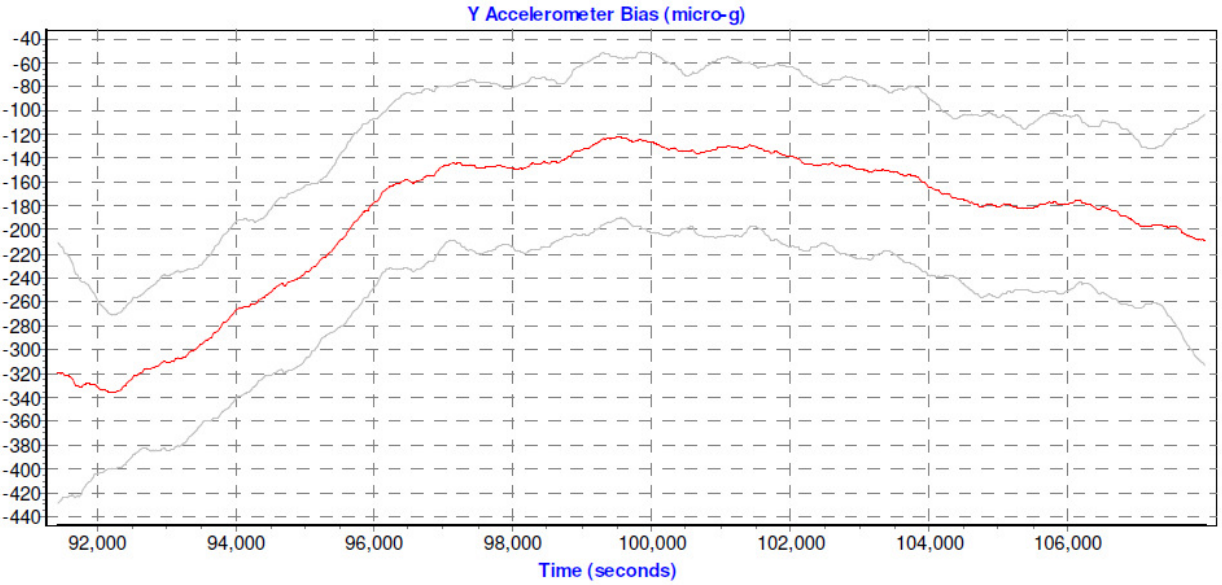
Maximum: 59.332 (km)
Minimum: 2.343 (km)
Average: 22.181 (km)
First Epoch: 41.122 (km)
Last Epoch: 49.715 (km)

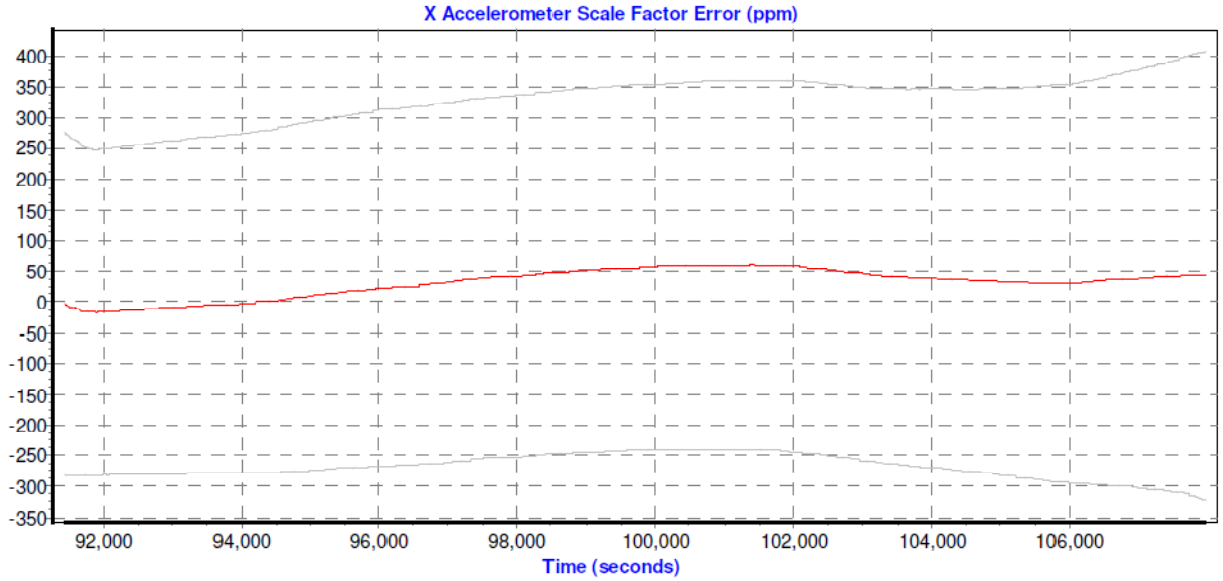
Sensor Errors

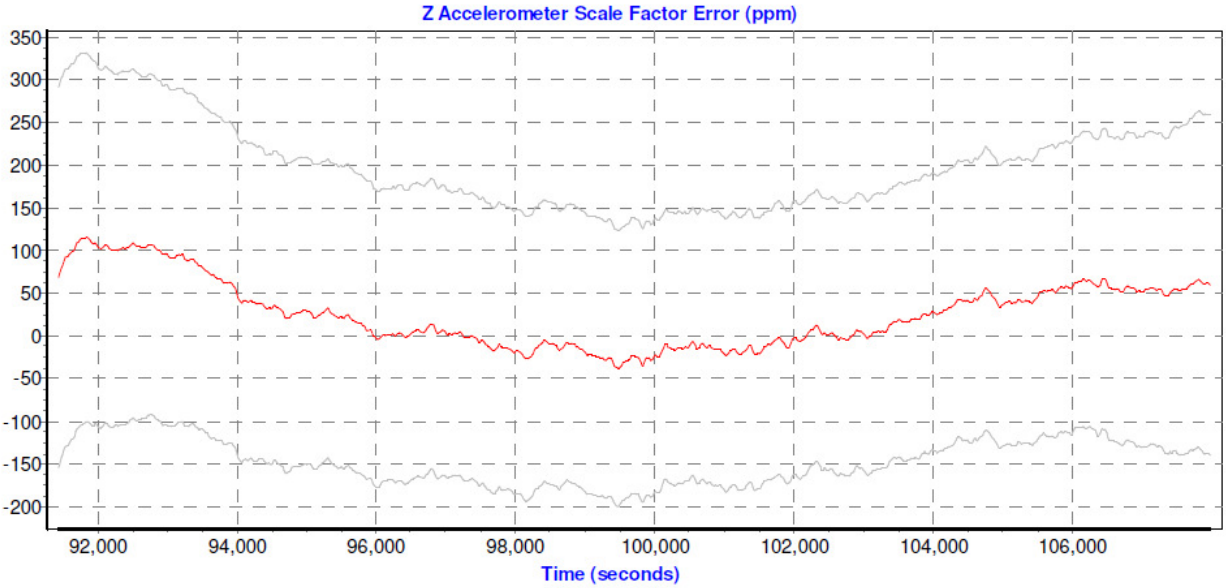


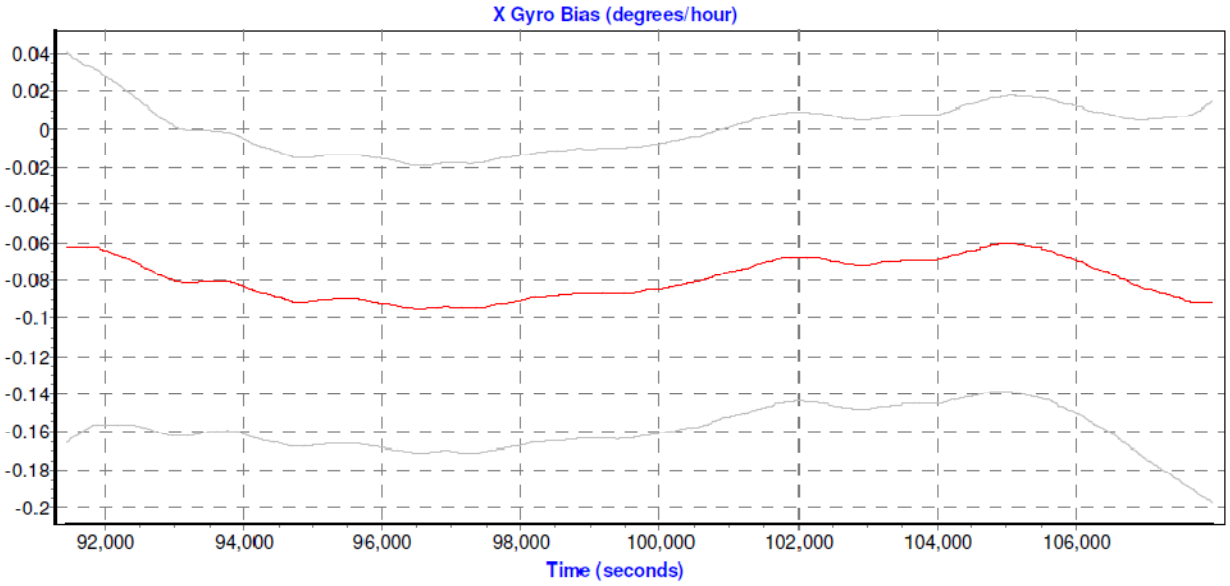


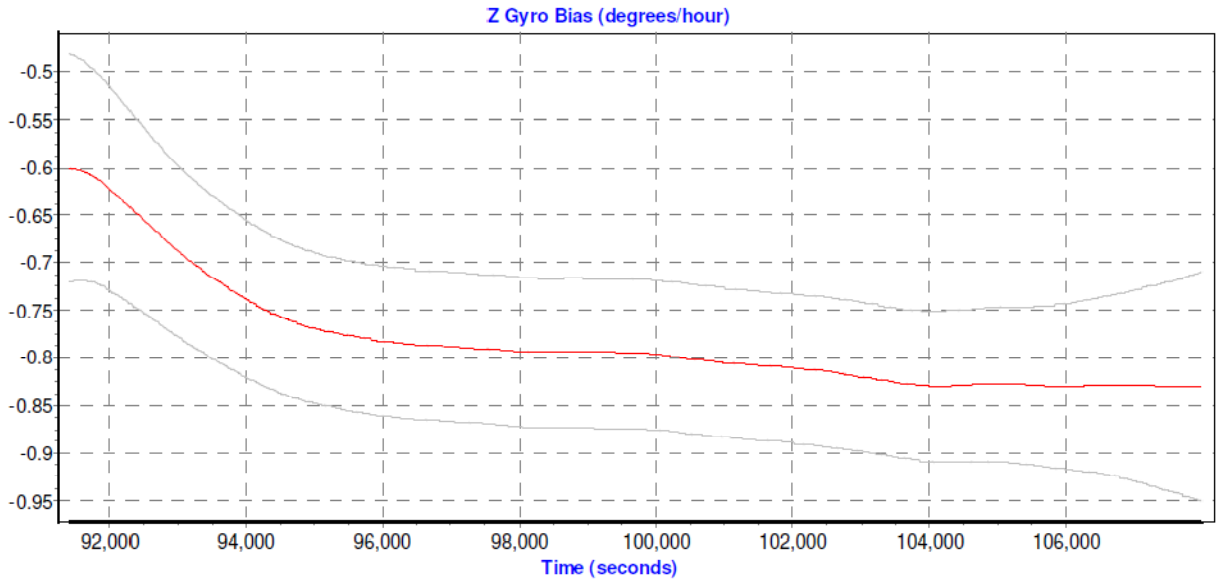

Y Accelerometer Scale Factor Error (ppm)
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)

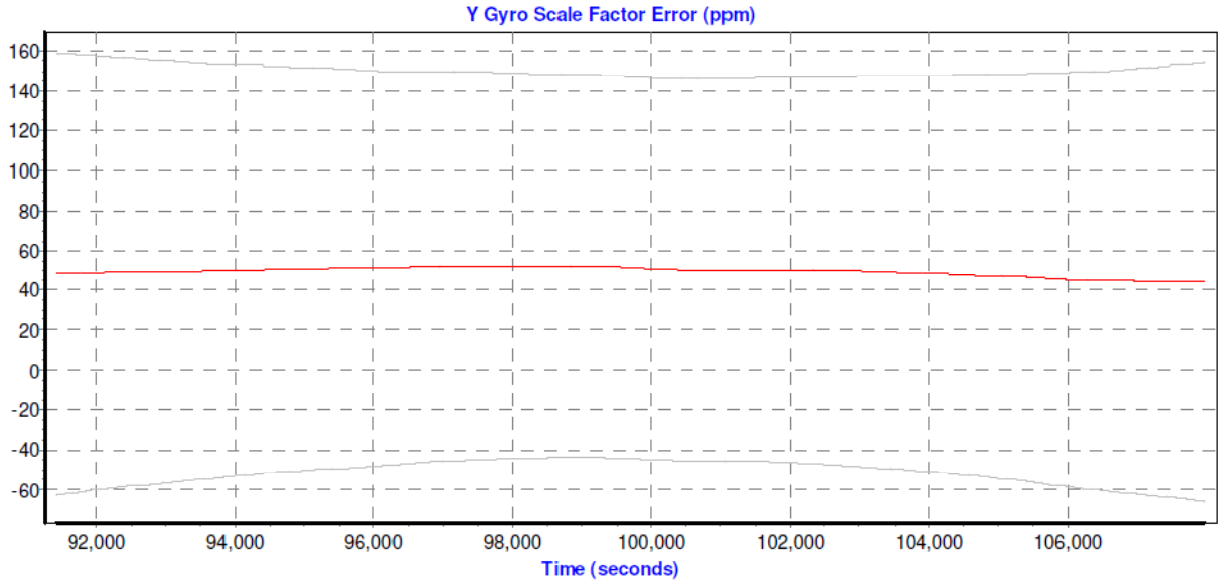

Y Accelerometer Bias (micro-g)
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240
-260
-280
-300
-320
-340
-360
-380
-400
-420
-440
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)

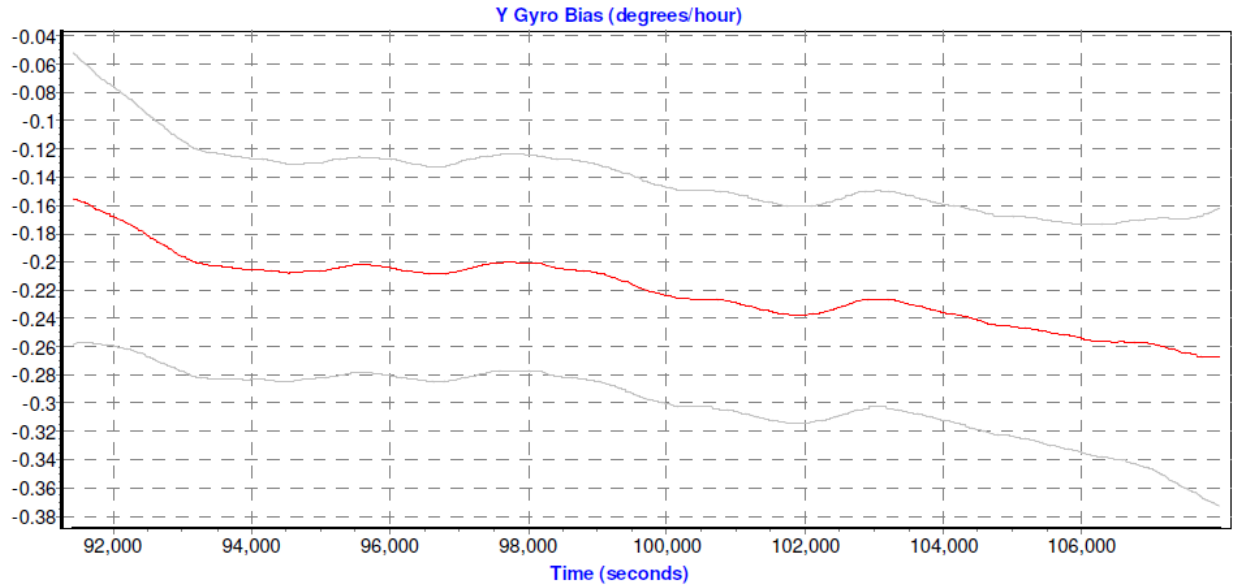

X Accelerometer Scale Factor Error (ppm)
400
350
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)


Z Accelerometer Scale Factor Error (ppm)
350
300
250
200
150
100
50
0
-50
-100
-150
-200
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)

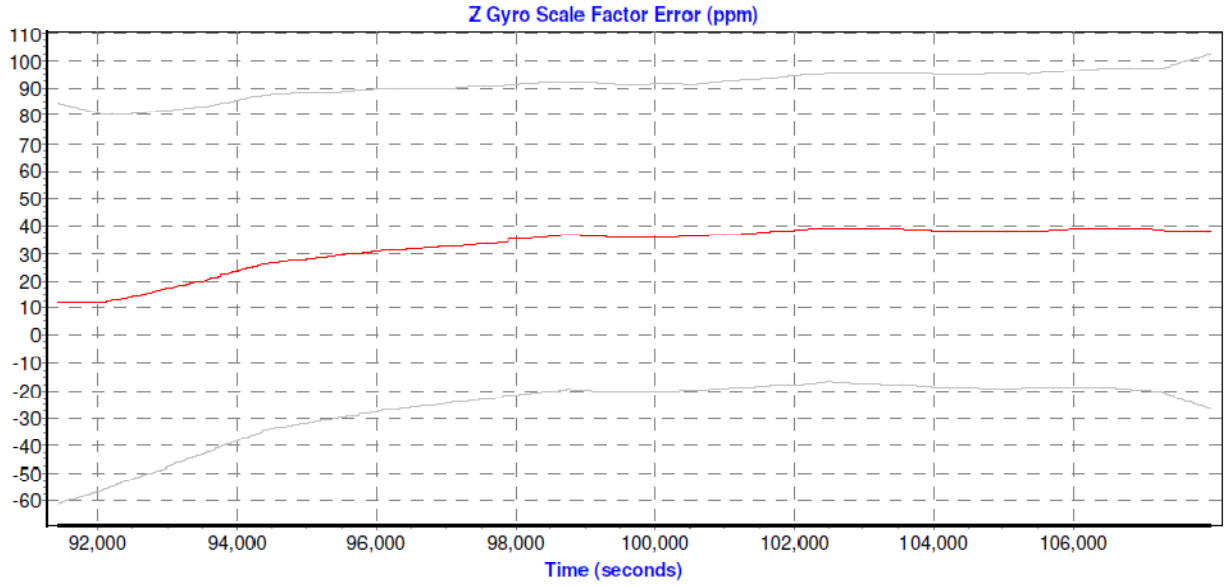

X Gyro Bias (degrees/hour)
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
-0.2
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)

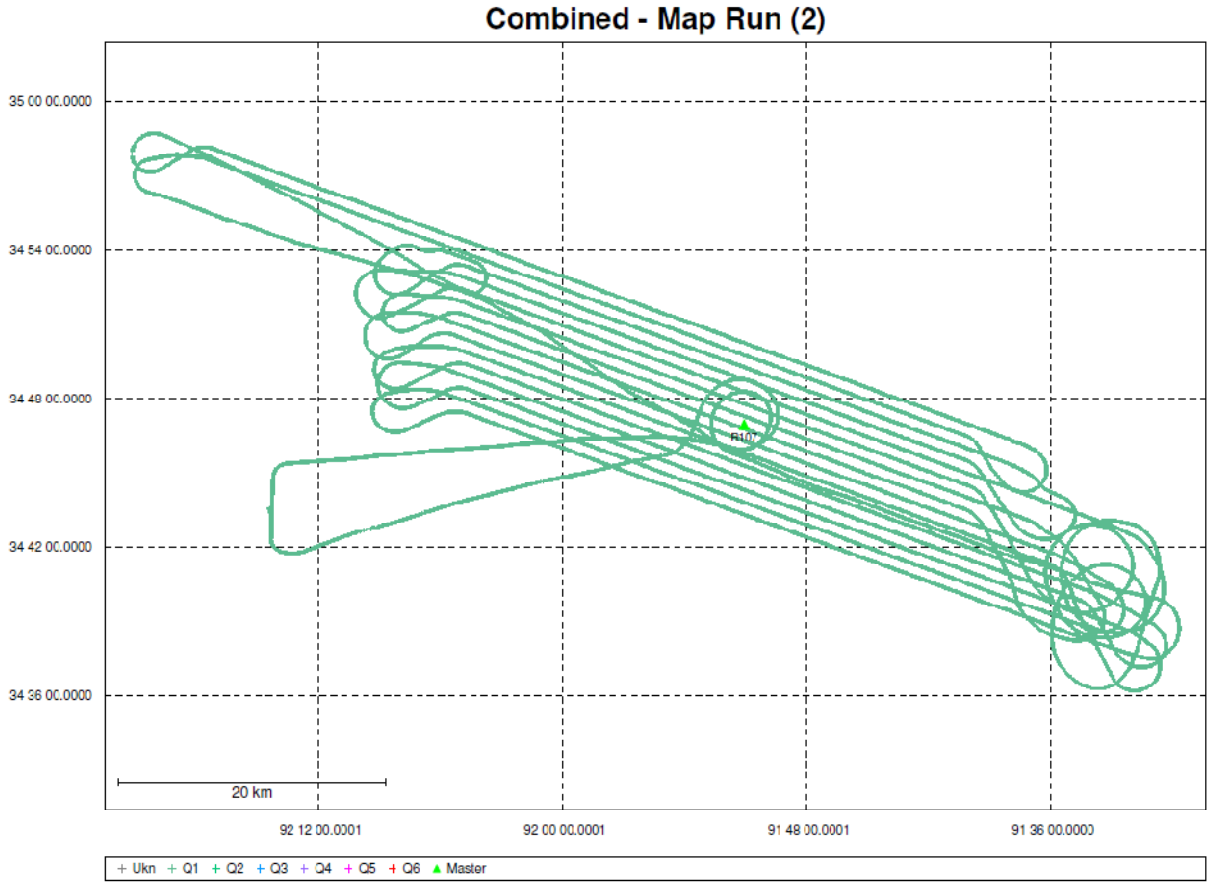

Z Gyro Bias (degrees/hour)
-0.5
-0.55
-0.6
-0.65
-0.7
-0.75
-0.8
-0.85
-0.9
-0.95
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)

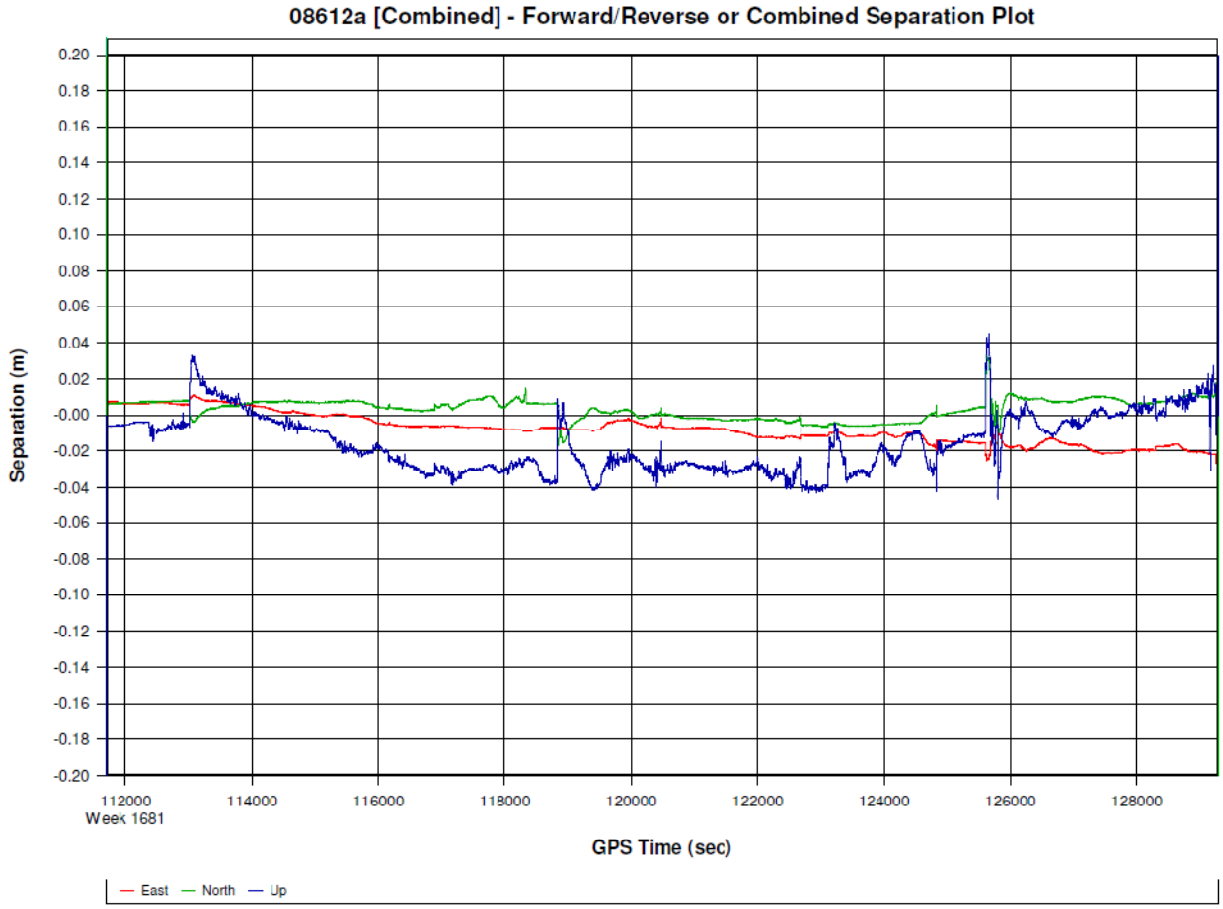

Y Gyro Scale Factor Error (ppm)
160
140
120
100
80
60
40
20
0
-20
-40
-60
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)

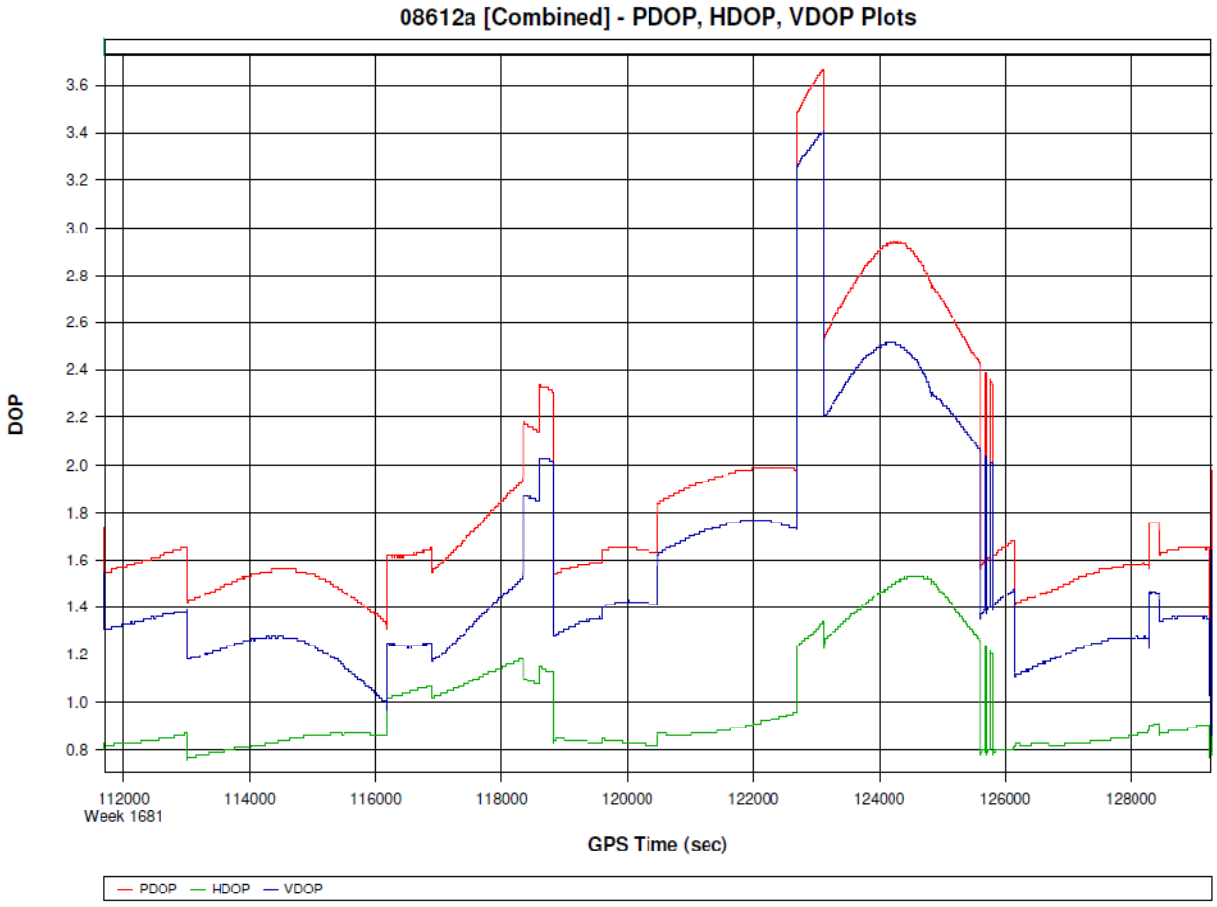

Y Gyro Bias (degrees/hour)
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
-0.2
-0.22
-0.24
-0.26
-0.28
-0.3
-0.32
-0.34
-0.36
-0.38
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)

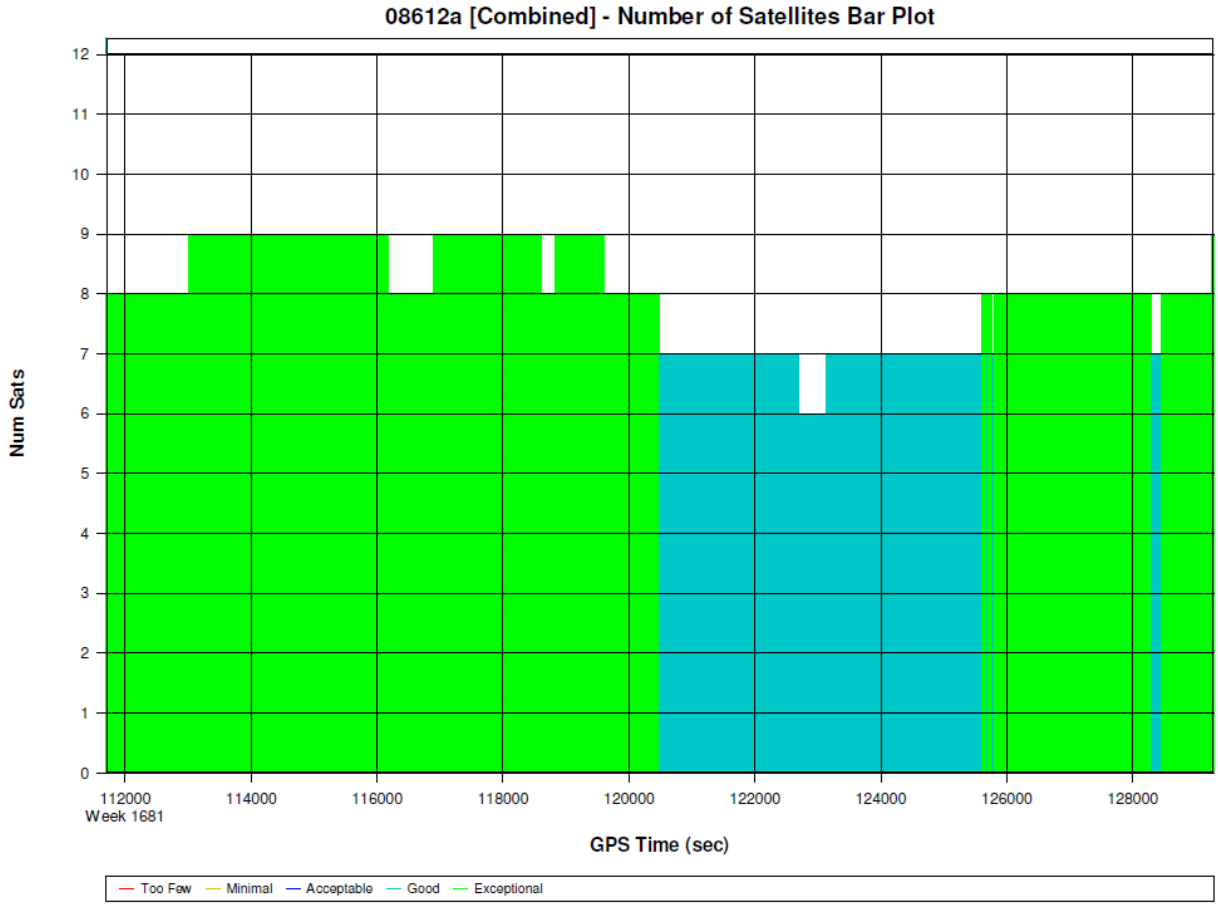

X Gyro Scale Factor Error (ppm)
140
120
100
80
60
40
20
0
-20
-40
-60
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)


Z Gyro Scale Factor Error (ppm)
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
92,000
94,000
96,000
98,000
100,000
102,000
104,000
106,000
Time (seconds)


Combined - Map Run (2)
35 00 00.0000
34 54 00.0000
34 48 00.0000
34 42 00.0000
34 36 00.0000
20 km
92 12 00.0001
92 00 00.0001
91 48 00.0001
91 36 00.0000
Ukn
Q1
Q2
Q3
Q4
Q5
Q6
Master


08612a [Combined] - Forward/Reverse or Combined Separation Plot
Separation (m)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
-0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
-0.18
-0.20
112000
Week 1681
114000
116000
118000
120000
122000
124000
126000
128000
GPS Time (sec)
East
North
Up


08612a [Combined] - PDOP, HDOP, VDOP Plots
DOP
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
112000
Week 1681
114000
116000
118000
120000
122000
124000
126000
128000
GPS Time (sec)
PDOP
HDOP
VDOP



Processing Summary Information

Program: POSGPS
Version: 4.30.3108
Project: G:\Projects\Dewberry\AR\12086a\pos\GPS\08612a.gnv

Solution Type: Combined Fwd/Rev

Number of Epochs:

Total in GPB file: 176096
No processed position: 158498
Missing Fwd or Rev: 3
With bad C/A code: 0
With bad L1 Phase: 0

Measurement RMS Values:

L1 Phase: 0.0198 (m)
C/A Code: 1.01 (m)
L1 Doppler: 0.017 (m/s)
Fwd/Rev Separation RMS Values:
East: 0.011 (m)

North: 0.008 (m)
Height: 0.023 (m)

Fwd/Rev Sep. RMS for 25%-75% weighting (17593 occurrences):

East: 0.011 (m)
North: 0.006 (m)
Height: 0.022 (m)

Quality Number Percentages:

Q 1: 100.0 %
Q 2: 0.0 %
Q 3: 0.0 %
Q 4: 0.0 %
Q 5: 0.0 %
Q 6: 0.0 %

Position Standard Deviation Percentages:

0.00 - 0.10 m: 100.0 %
0.10 - 0.30 m: 0.0 %
0.30 - 1.00 m: 0.0 %
1.00 - 5.00 m: 0.0 %
5.00 m + over: 0.0 %

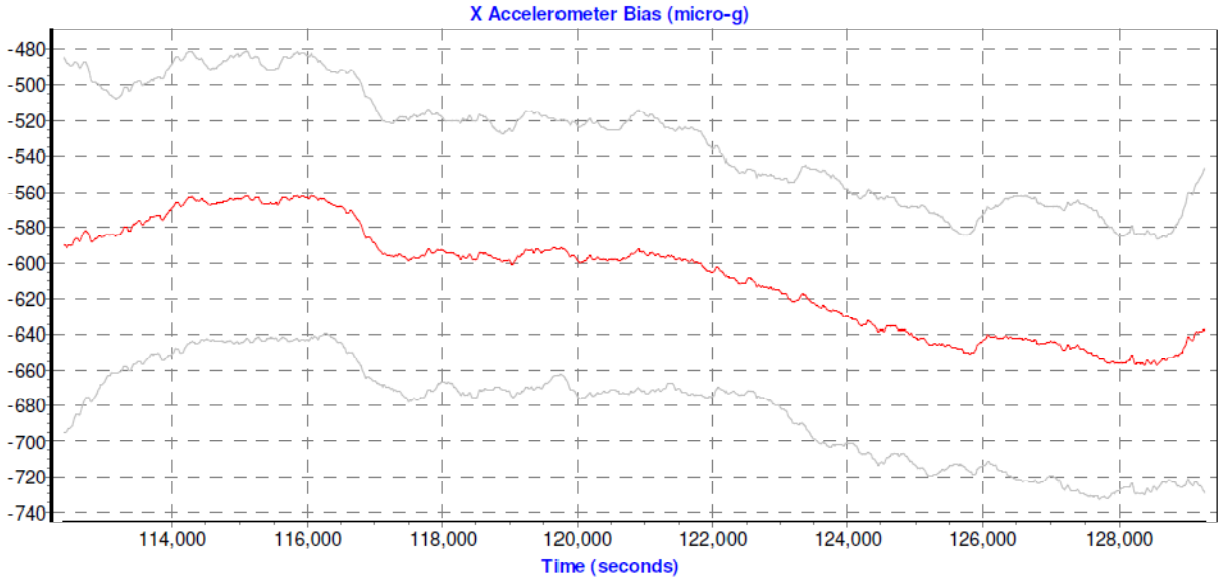
Percentages of epochs with DD_DOP over 10.00:

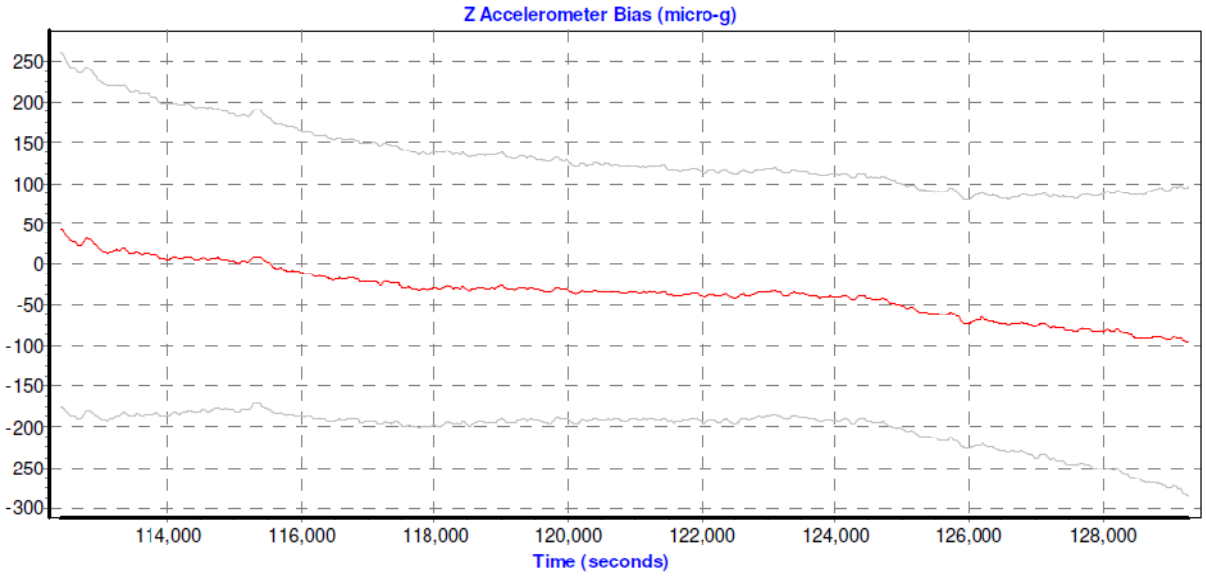
DOP over Tol: 0.0 %

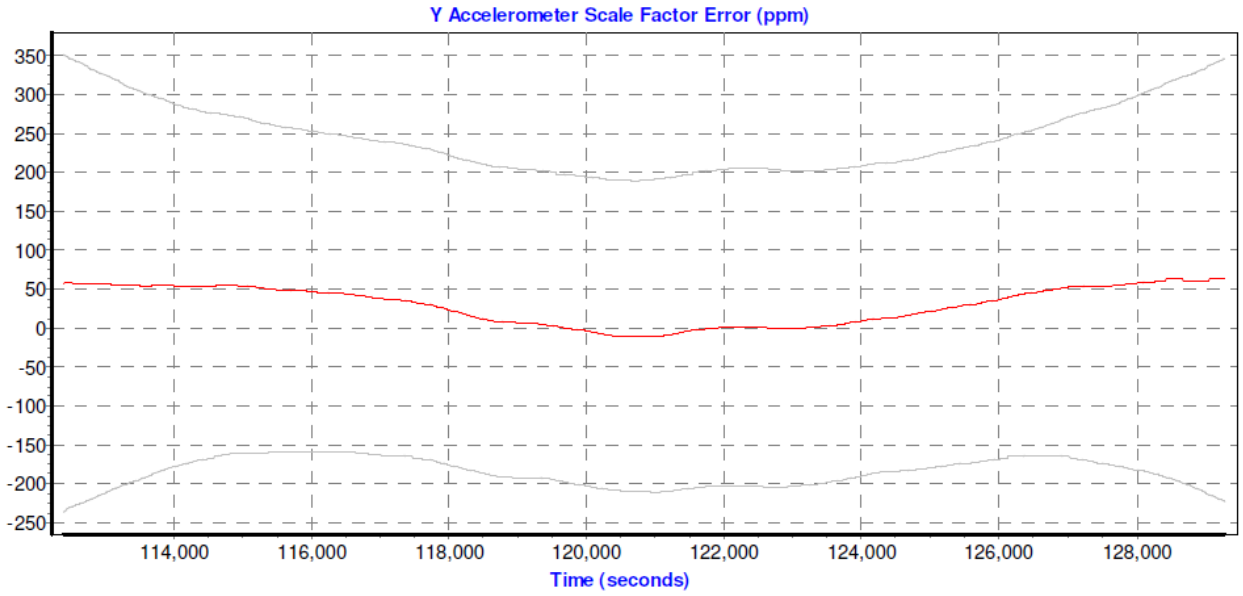
Baseline Distances:

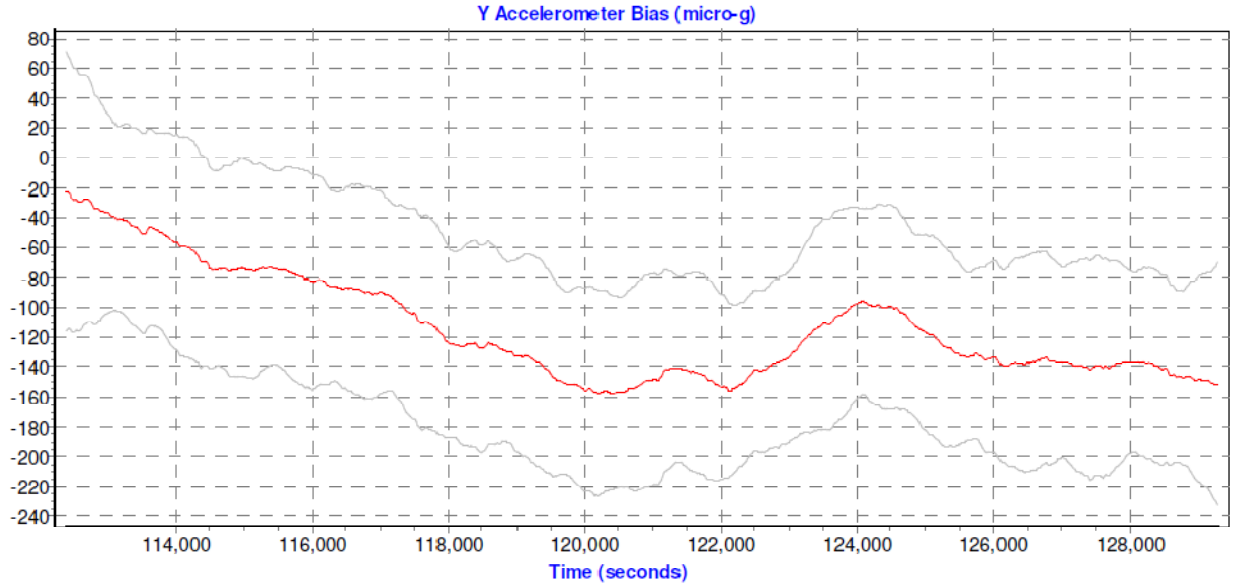
Maximum: 50.280 (km)
Minimum: 2.317 (km)
Average: 19.890 (km)
First Epoch: 36.175 (km)
Last Epoch: 35.866 (km)

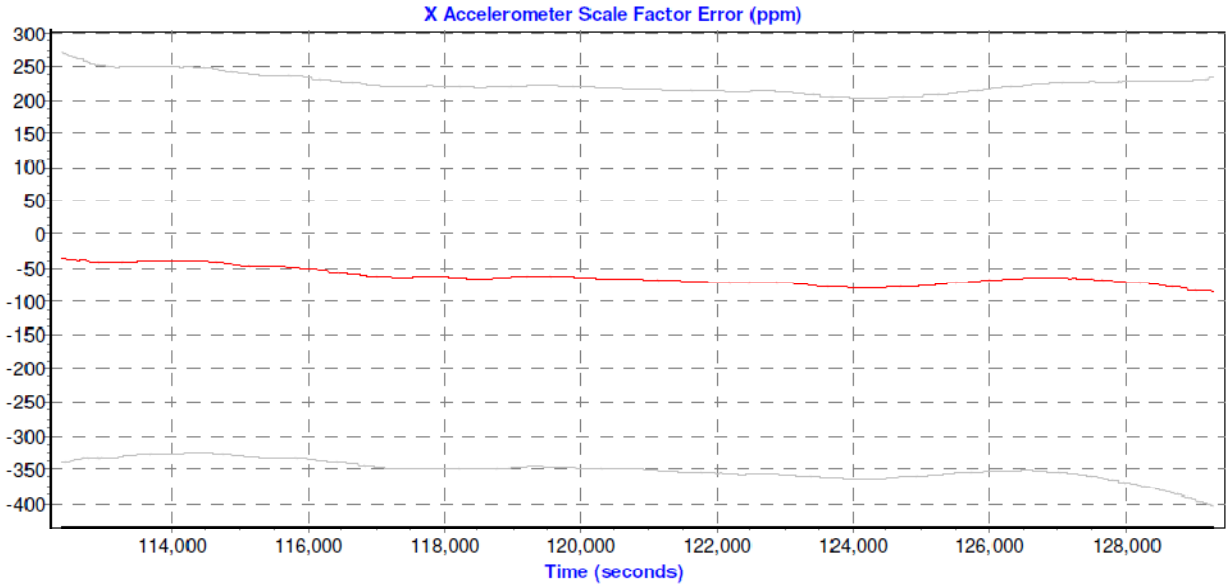
Sensor Errors

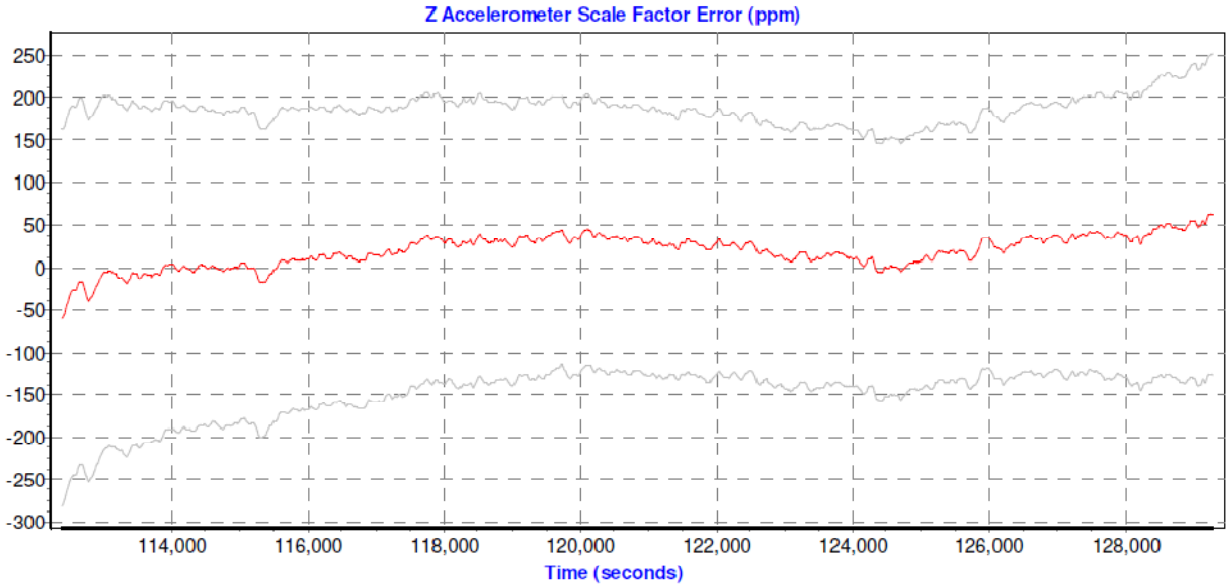


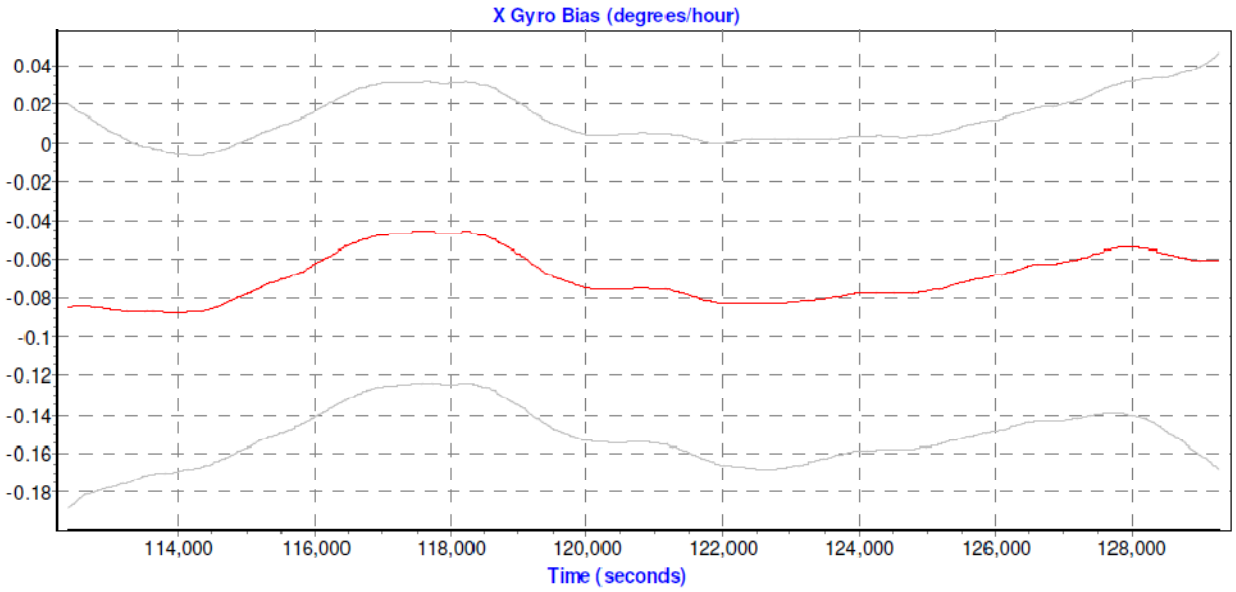


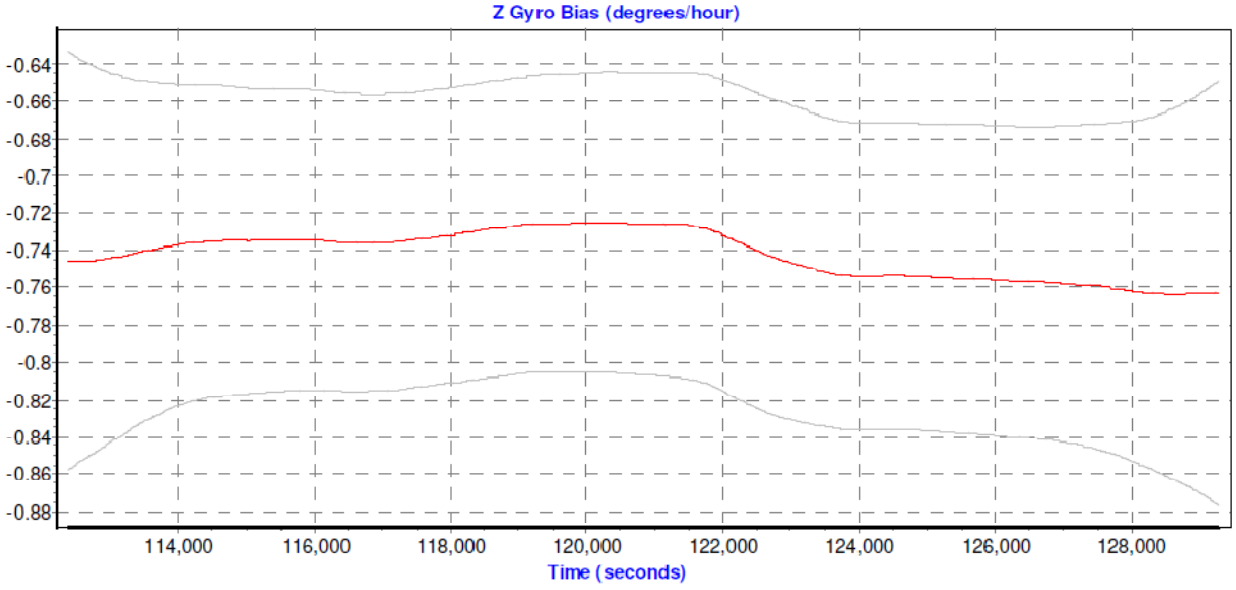

Y Accelerometer Scale Factor Error (ppm)
350
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)

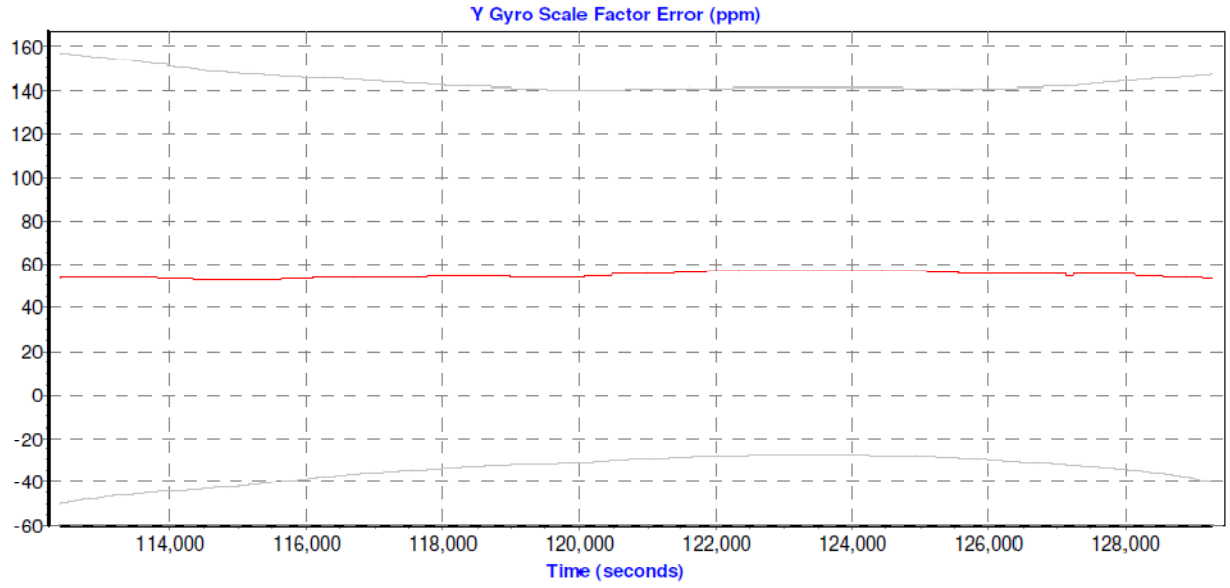

Y Accelerometer Bias (micro-g)
80
60
40
20
0
-20
-40
-60
-80
-100
-120
-140
-160
-180
-200
-220
-240
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)

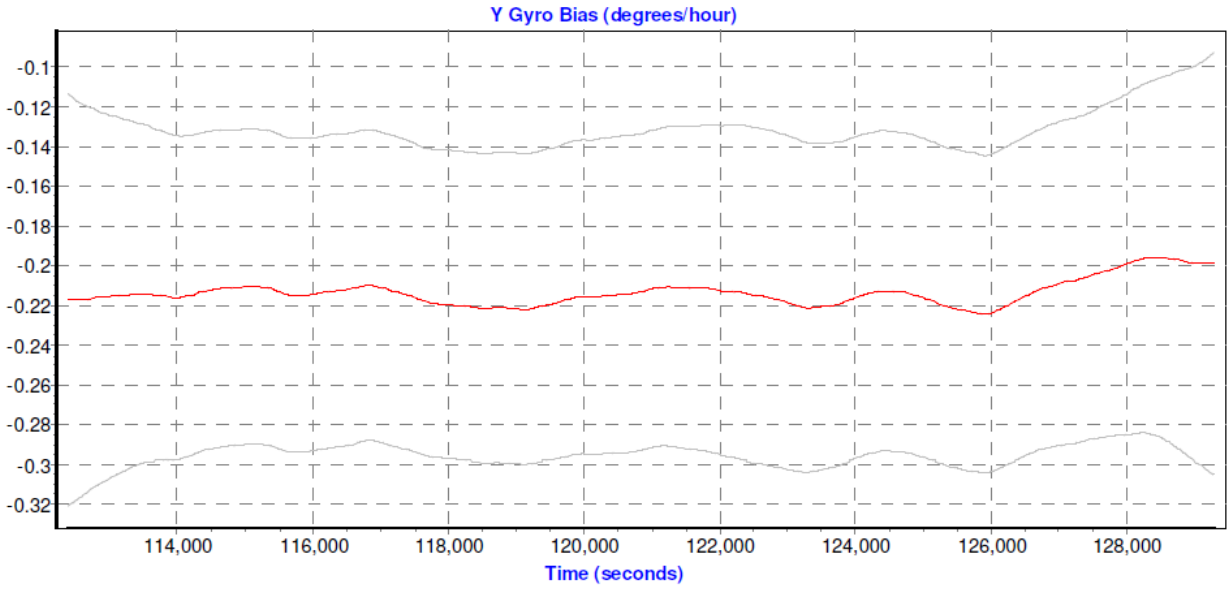

X Accelerometer Scale Factor Error (ppm)
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
-400
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)

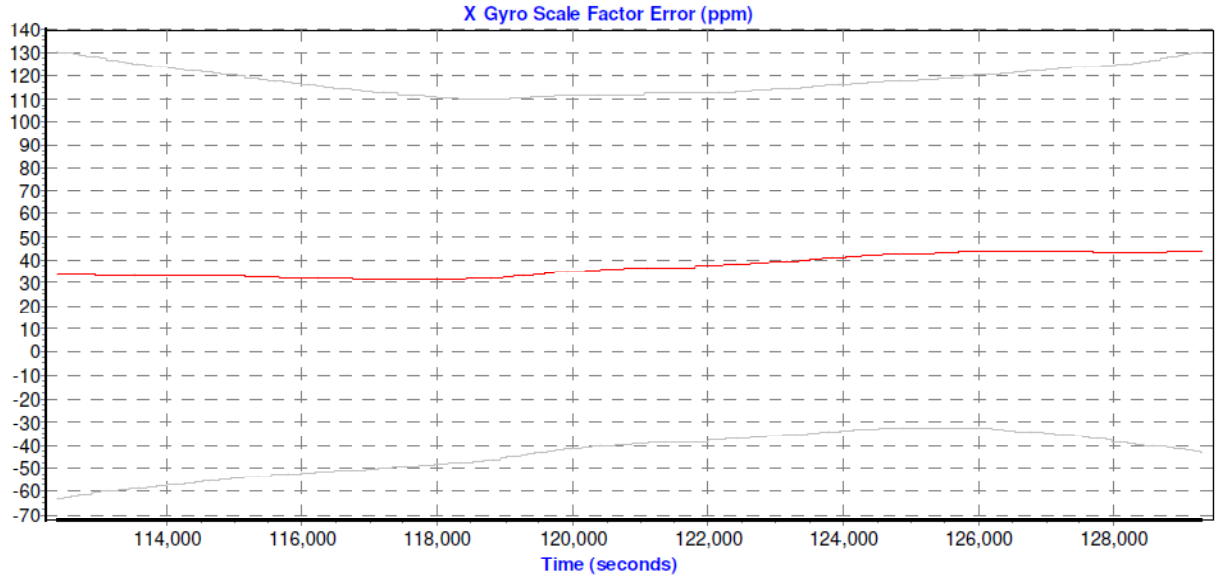

Z Accelerometer Scale Factor Error (ppm)
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)

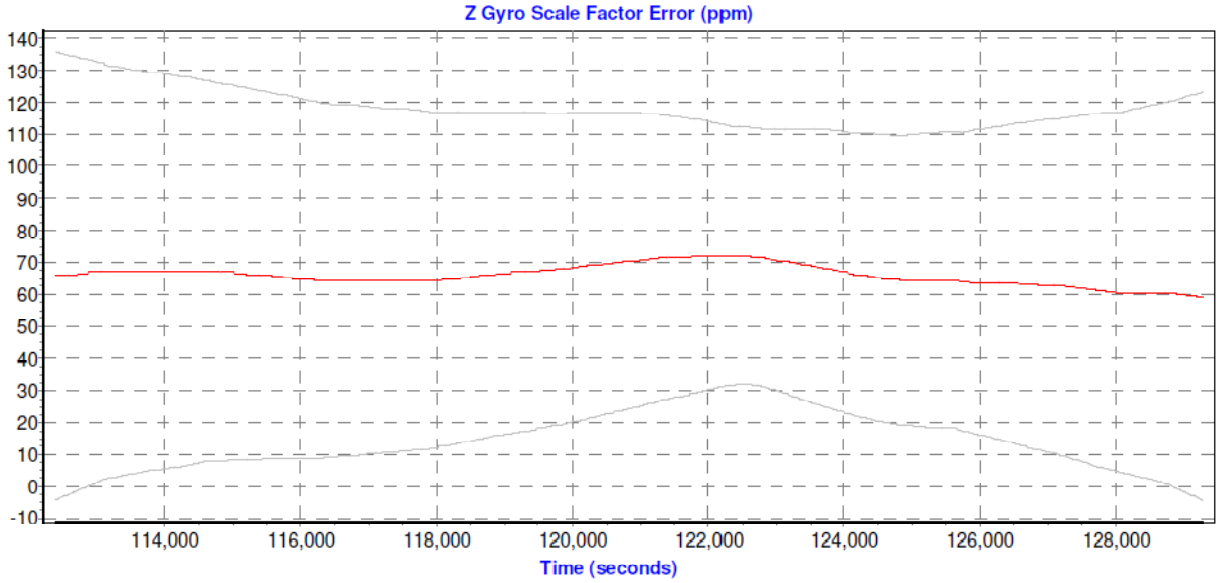

X Gyro Bias (degrees/hour)
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)

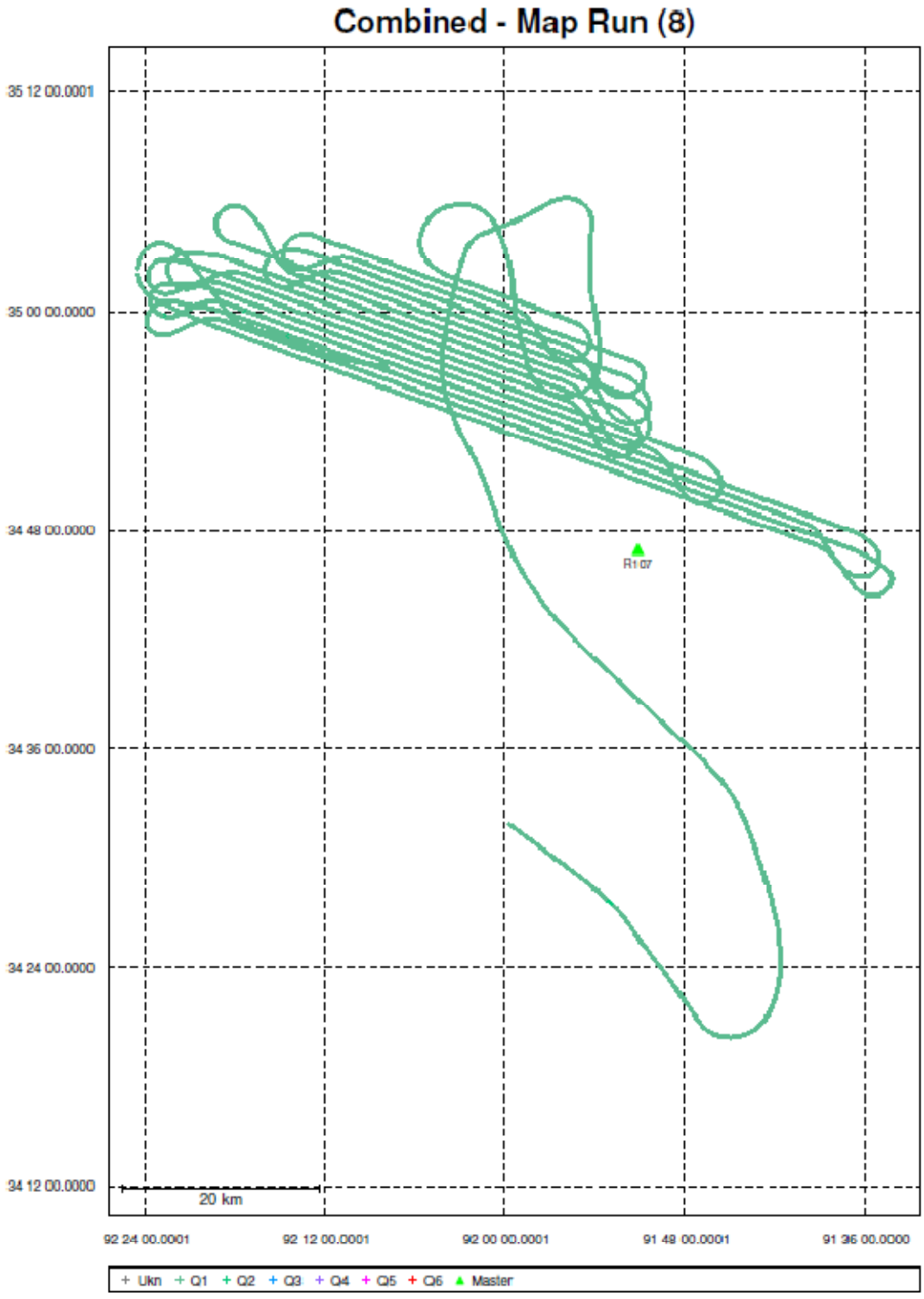

Z Gyro Bias (degrees/hour)
-0.64
-0.66
-0.68
-0.7
-0.72
-0.74
-0.76
-0.78
-0.8
-0.82
-0.84
-0.86
-0.88
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)

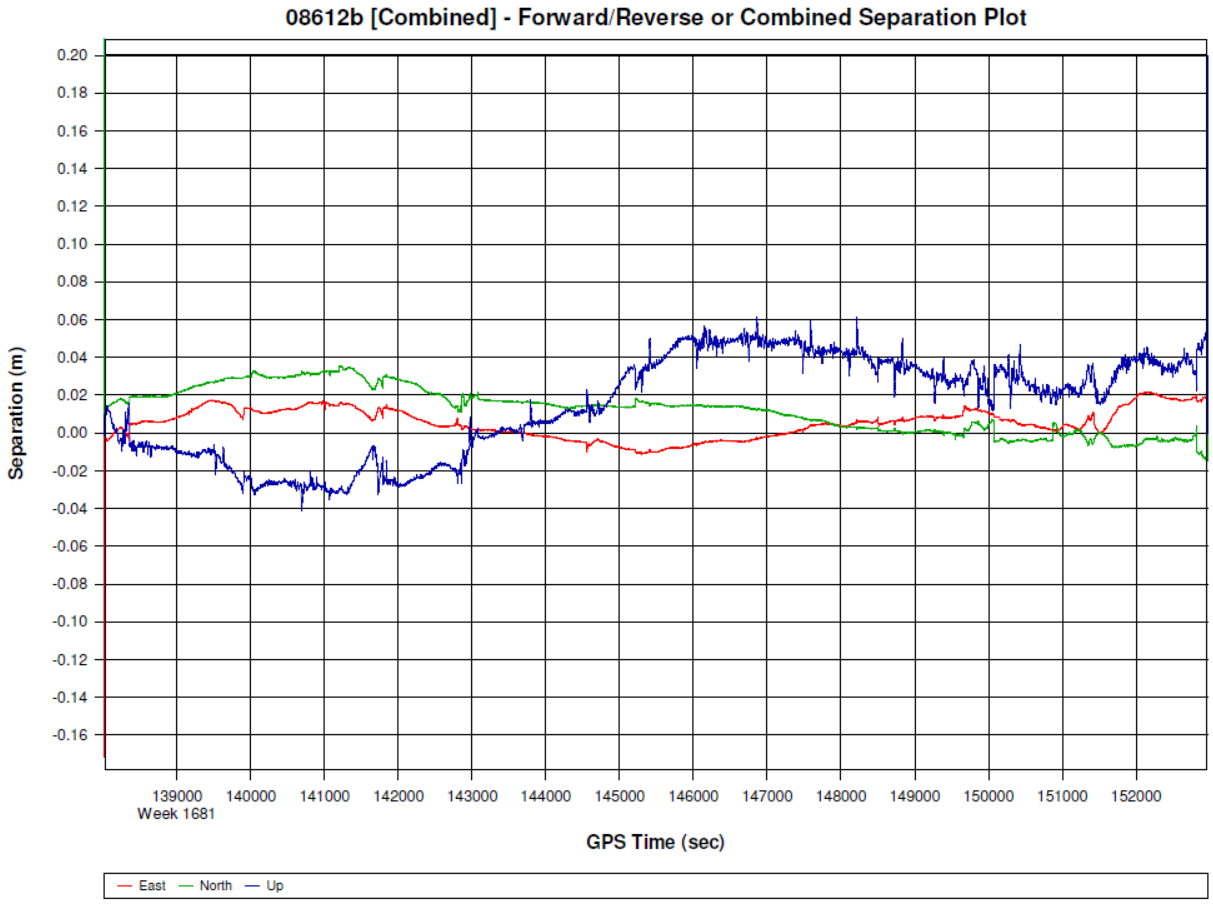

Y Gyro Scale Factor Error (ppm)
160
140
120
100
80
60
40
20
0
-20
-40
-60
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)

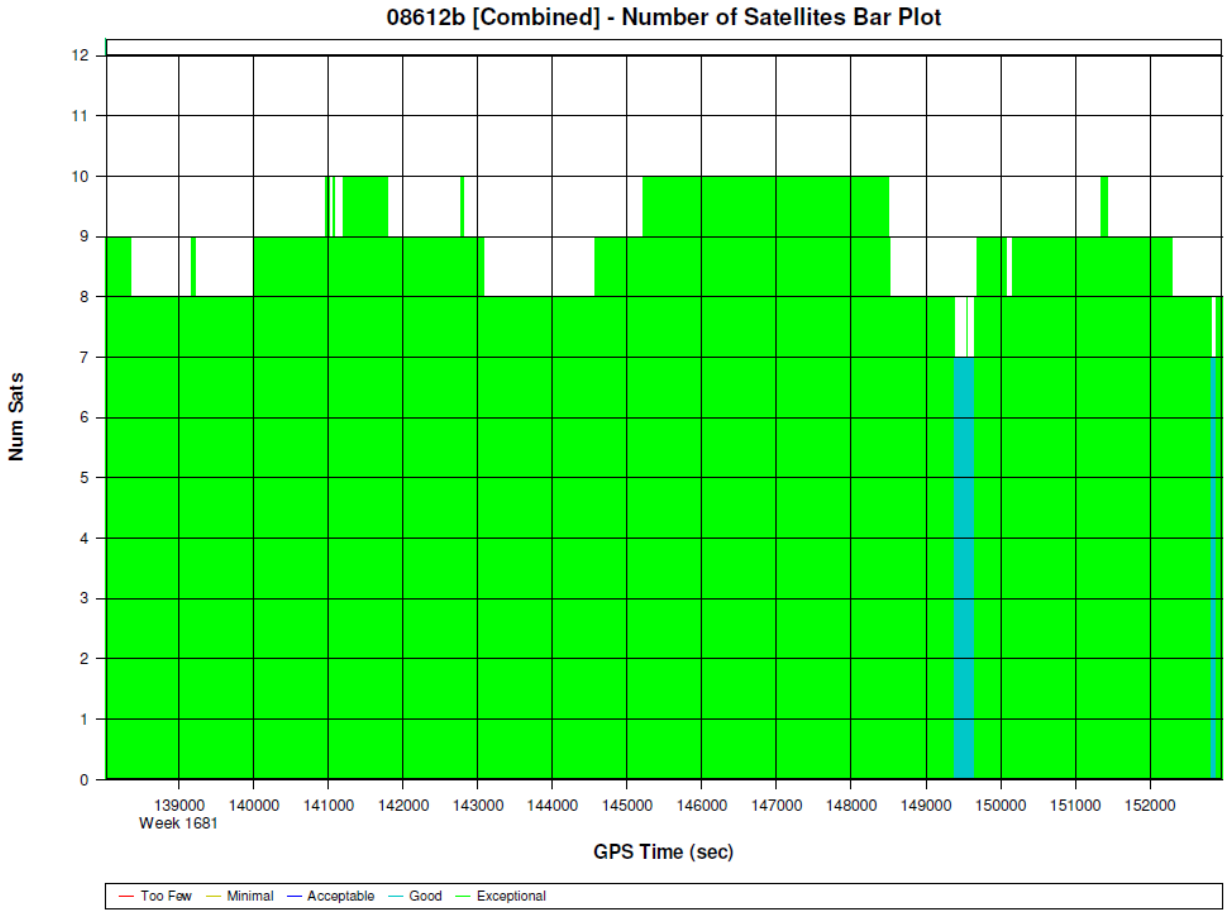

Y Gyro Bias (degrees/hour)
-0.1
-0.12
-0.14
-0.16
-0.18
-0.2
-0.22
-0.24
-0.26
-0.28
-0.3
-0.32
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)

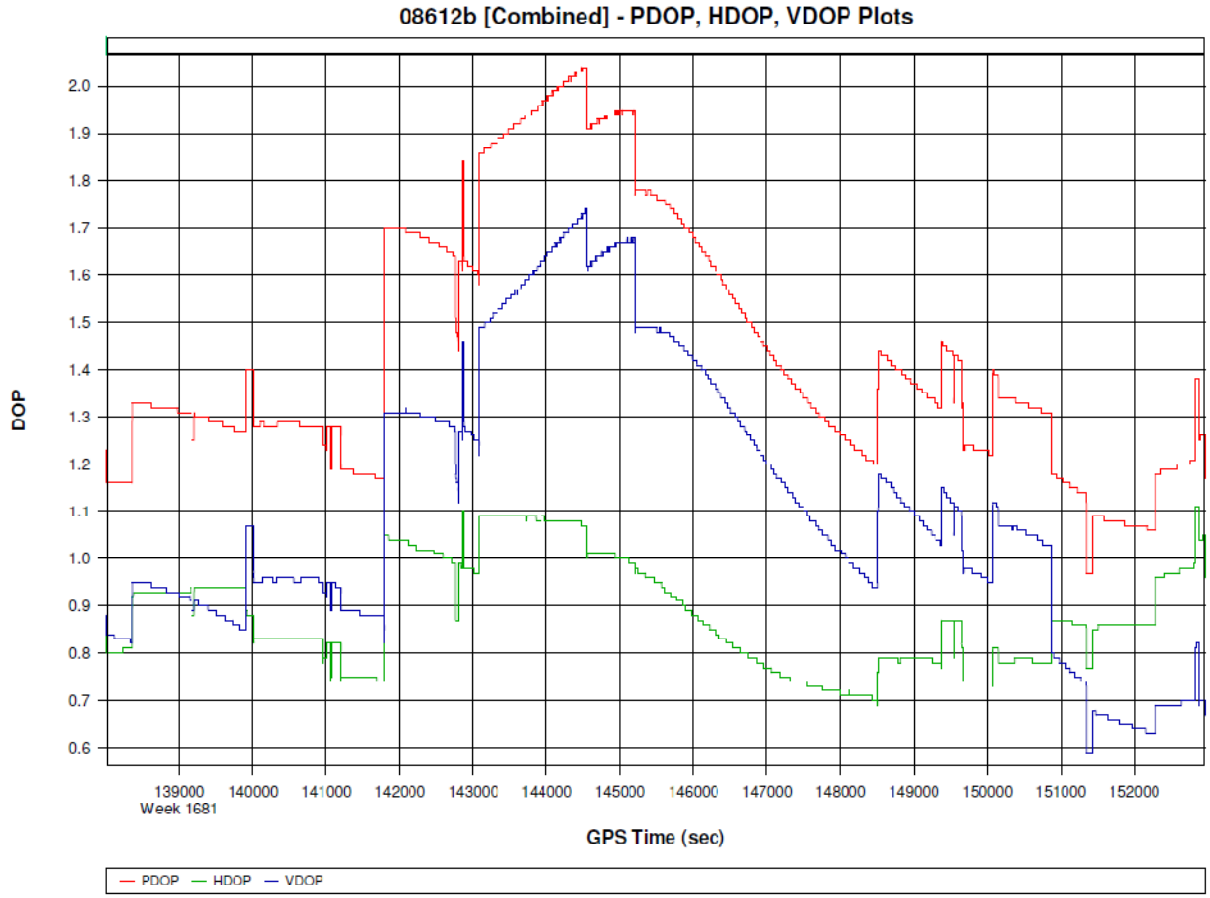

X Gyro Scale Factor Error (ppm)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)


Z Gyro Scale Factor Error (ppm)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
114,000
116,000
118,000
120,000
122,000
124,000
126,000
128,000
Time (seconds)


Combined - Map Run (8)
35 12 00.0001
35 00 00.0000
34 48 00.0000
34 36 00.0000
34 24 00.0000
34 12 00.0000
R107
20 km
92 24 00.0001
92 12 00.0001
92 00 00.0001
91 49 00.0001
91 36 00.0000
Ukn
Q1
Q2
Q3
Q4
Q5
Q6
Master


08612b [Combined] - Forward/Reverse or Combined Separation Plot
Separation (m)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
-0.16
139000
Week 1681
140000
141000
142000
143000
144000
145000
146000
147000
148000
149000
150000
151000
152000
GPS Time (sec)
East
North
Up


08612b [Combined] - Number of Satellites Bar Plot
Num Sats
12
11
10
9
8
7
6
5
4
3
2
1
0
139000
Week 1681
140000
141000
142000
143000
144000
145000
146000
147000
148000
149000
150000
151000
152000
GPS Time (sec)
Too Few
Minimal
Acceptable
Good
Exceptional



Processing Summary Information

Program: POSGPS
Version: 4.30.3108
Project: G:\Projects\Dewberry\AR\12086b\pos\GPS\08612b.gnv

Solution Type: Combined Fwd/Rev

Number of Epochs:

Total in GPB file: 170296
No processed position: 155334
Missing Fwd or Rev: 4
With bad C/A code: 0
With bad L1 Phase: 0

Measurement RMS Values:

L1 Phase: 0.0215 (m)
C/A Code: 1.04 (m)
L1 Doppler: 0.018 (m/s)

Fwd/Rev Separation RMS Values:

East: 0.011 (m)

North: 0.018 (m)
Height: 0.030 (m)
Fwd/Rev Sep. RMS for 25%-75% weighting (14956 occurrences):
East: 0.009 (m)
North: 0.017 (m)
Height: 0.030 (m)

Quality Number Percentages:

Q 1: 99.9 %
Q 2: 0.1 %
Q 3: 0.0 %
Q 4: 0.0 %
Q 5: 0.0 %
Q 6: 0.0 %

Position Standard Deviation Percentages:

0.00 - 0.10 m: 100.0 %
0.10 - 0.30 m: 0.0 %
0.30 - 1.00 m: 0.0 %
1.00 - 5.00 m: 0.0 %
5.00 m + over: 0.0 %

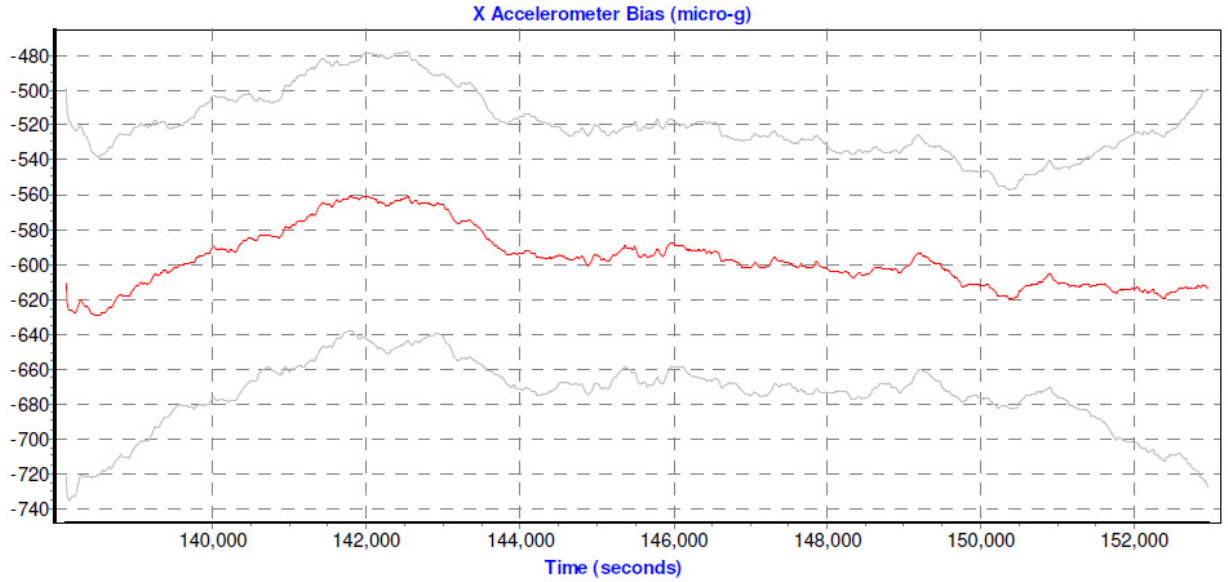
Percentages of epochs with DD_DOP over 10.00:

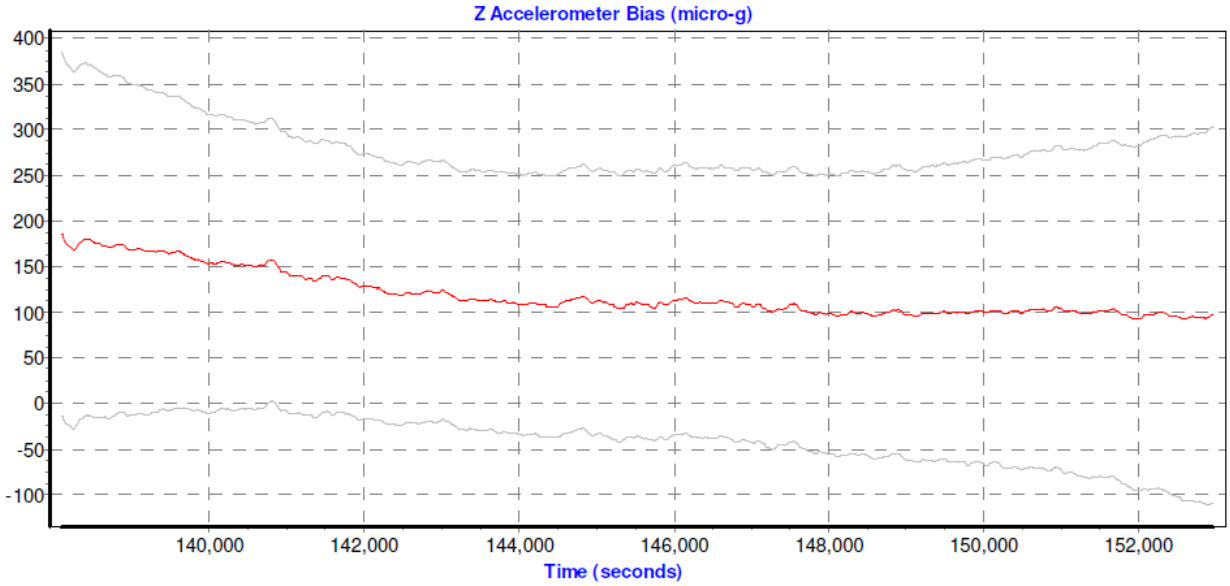
DOP over Tol: 0.0 %

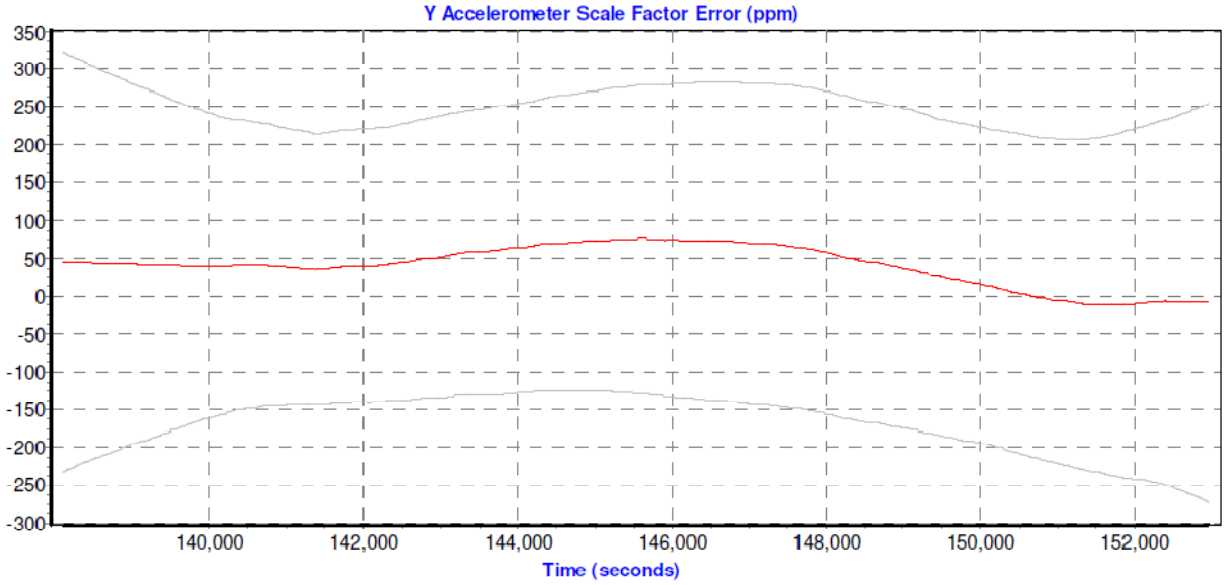
Baseline Distances:

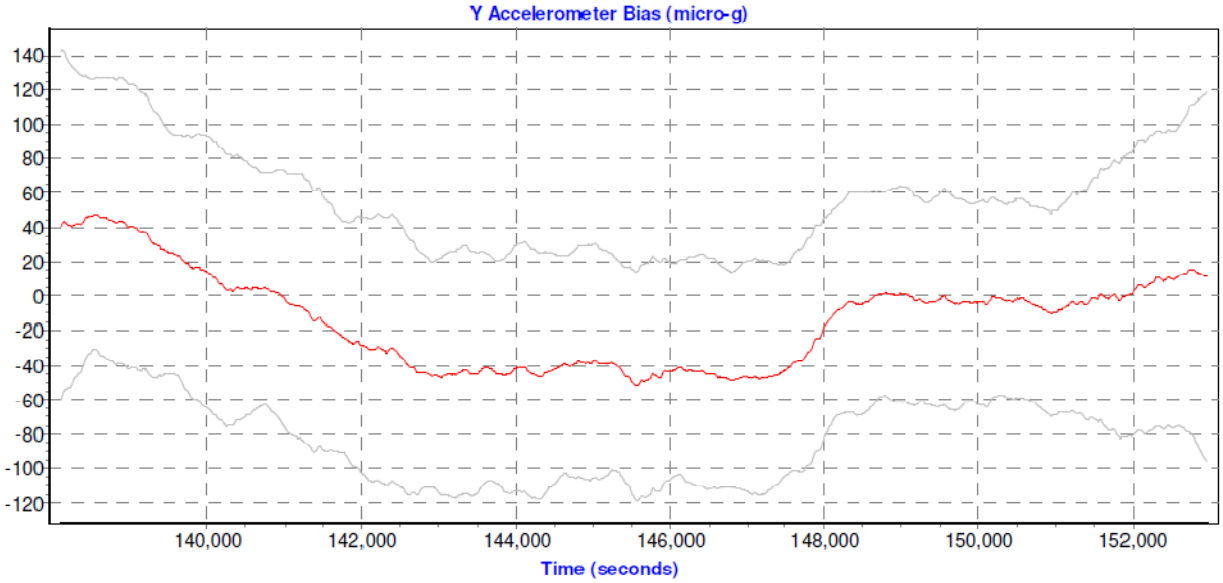
Maximum: 58.713 (km)
Minimum: 7.003 (km)
Average: 29.962 (km)
First Epoch: 31.628 (km)
Last Epoch: 30.822 (km)

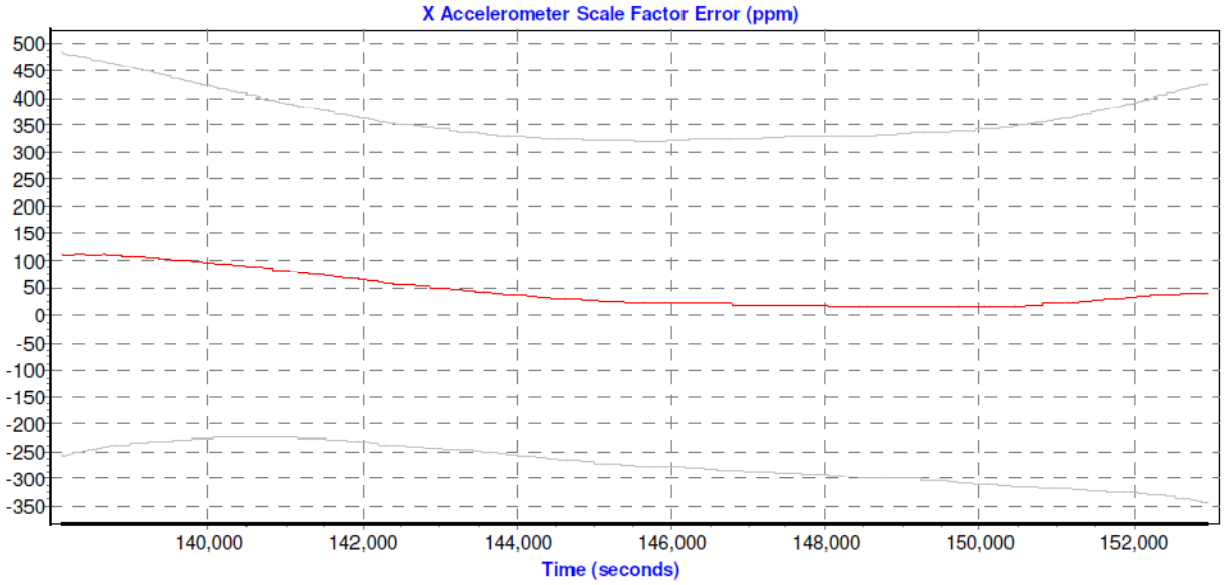
Sensor Errors

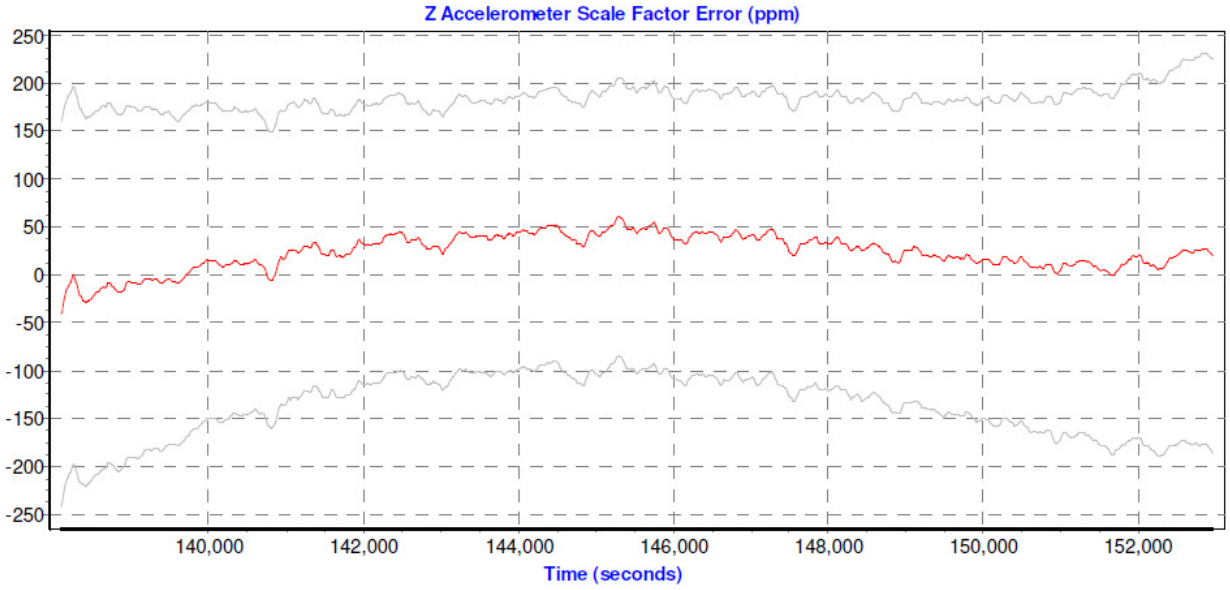


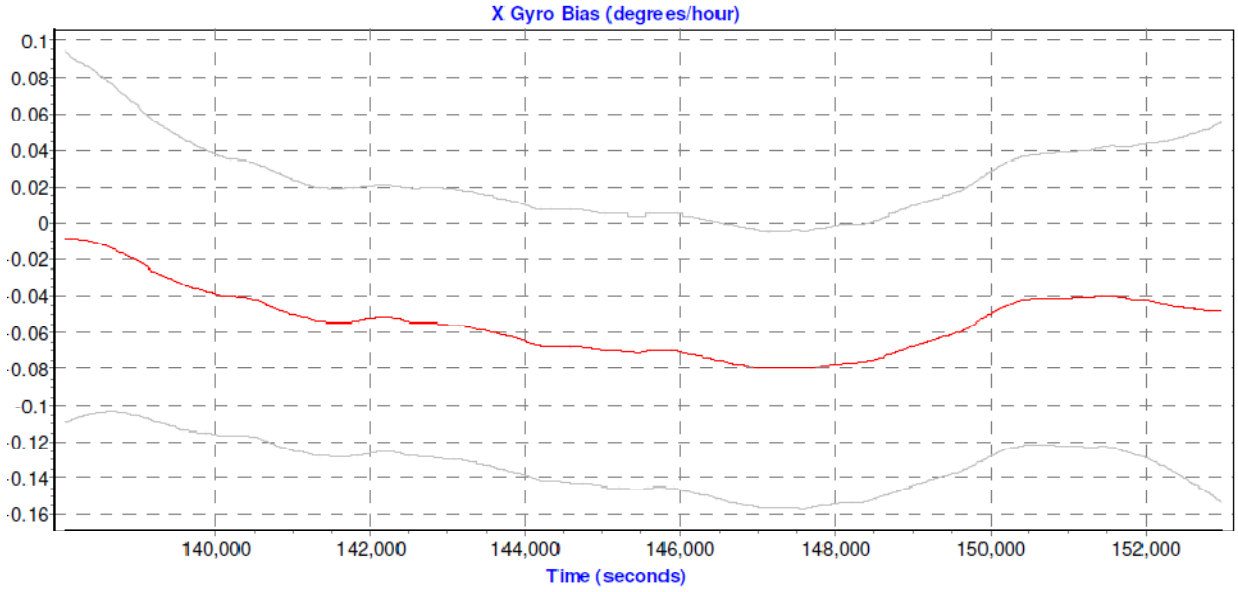


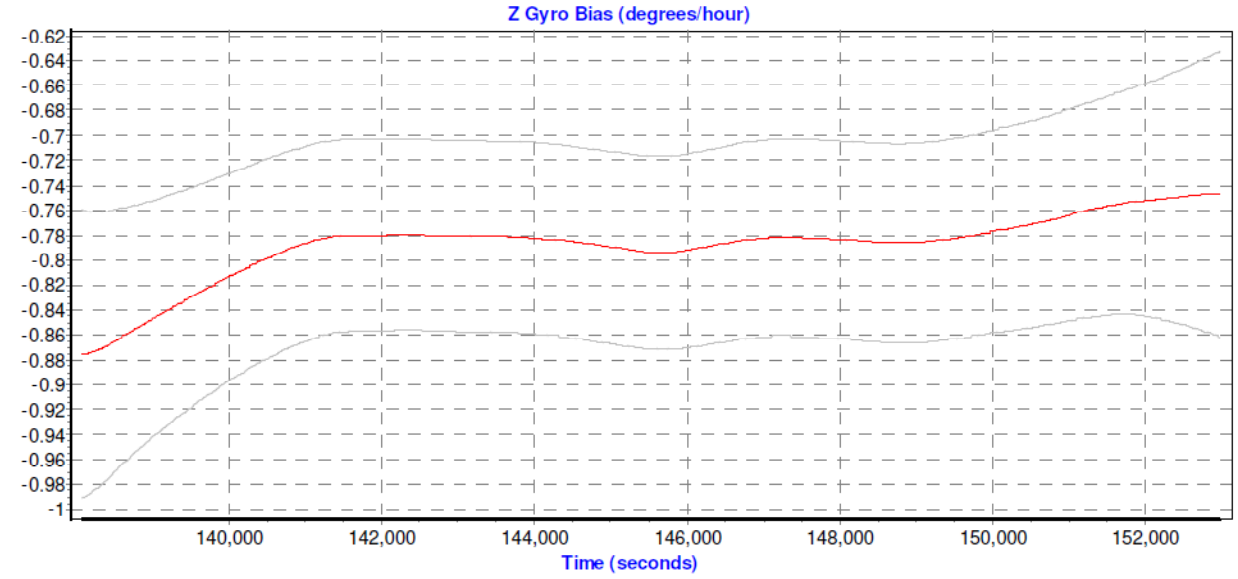

Y Accelerometer Scale Factor Error (ppm)
350
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)

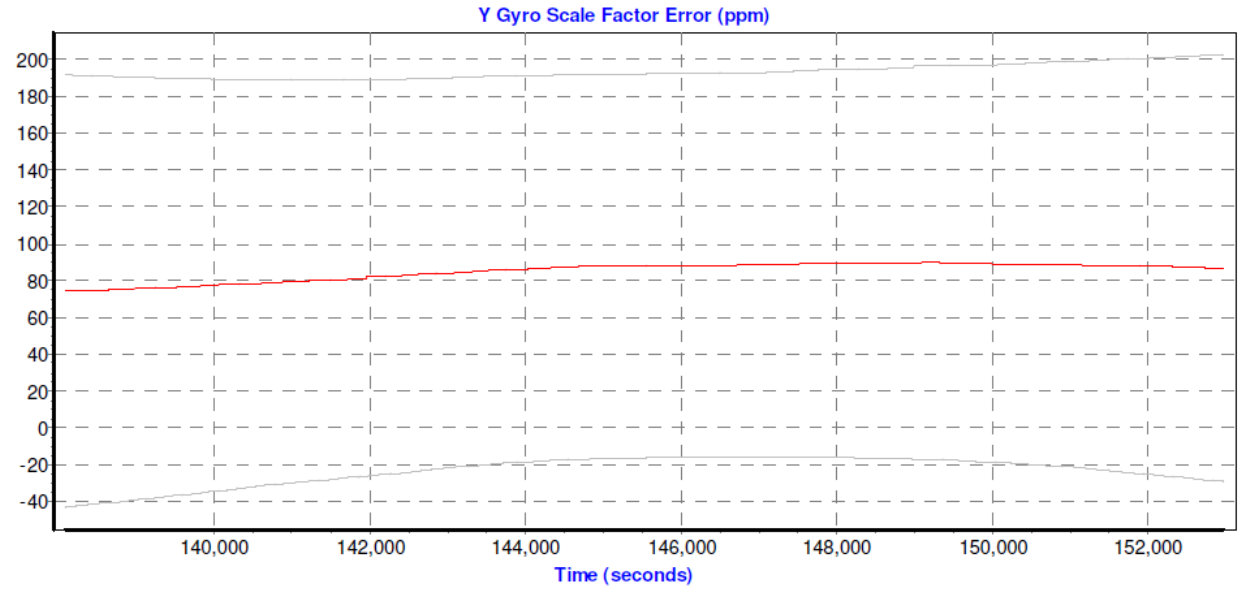

Y Accelerometer Bias (micro-g)
140
120
100
80
60
40
20
0
-20
-40
-60
-80
-100
-120
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)

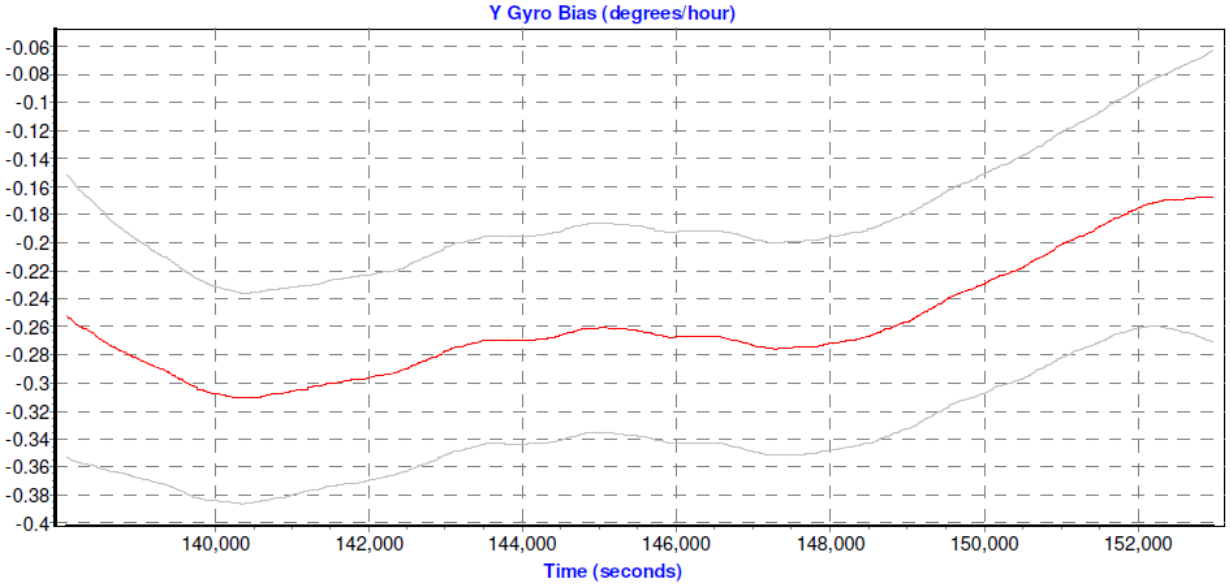

X Accelerometer Scale Factor Error (ppm)
500
450
400
350
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)

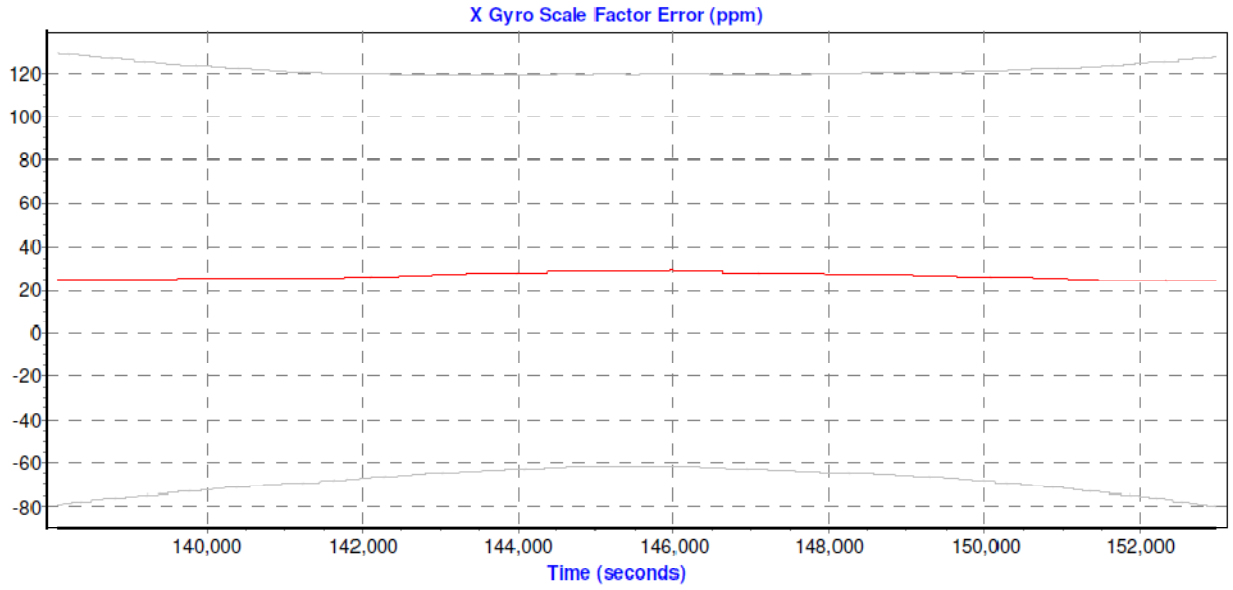

Z Accelerometer Scale Factor Error (ppm)
250
200
150
100
50
0
-50
-100
-150
-200
-250
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)

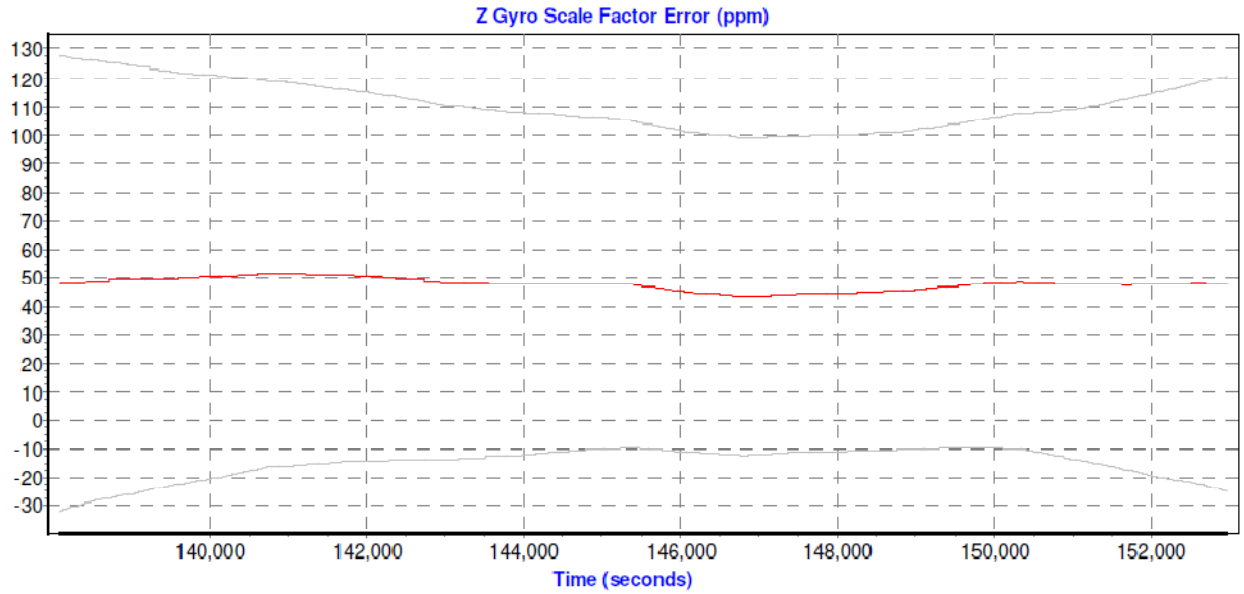

X Gyro Bias (degrees/hour)
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)


Z Gyro Bias (degrees/hour)
-0.62
-0.64
-0.66
-0.68
-0.7
-0.72
-0.74
-0.76
-0.78
-0.8
-0.82
-0.84
-0.86
-0.88
-0.9
-0.92
-0.94
-0.96
-0.98
-1
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)


Y Gyro Scale Factor Error (ppm)
200
180
160
140
120
100
80
60
40
20
0
-20
-40
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)


Y Gyro Bias (degrees/hour)
-0.06
-0.08
-0.1
-0.12
-0.14
-0.16
-0.18
-0.2
-0.22
-0.24
-0.26
-0.28
-0.3
-0.32
-0.34
-0.36
-0.38
-0.4
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)


X Gyro Scale Factor Error (ppm)
120
100
80
60
40
20
0
-20
-40
-60
-80
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)


Z Gyro Scale Factor Error (ppm)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
140,000
142,000
144,000
146,000
148,000
150,000
152,000
Time (seconds)