SAN DIEGO COUNTY, CA

PRE-FLIGHT AERIAL ACQUISITION AND CALIBRATION REPORT

Federal Emergency Management Agency
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Task Order Number: QS S2 R09 15 TO1
Photo Science Job Number: 26965
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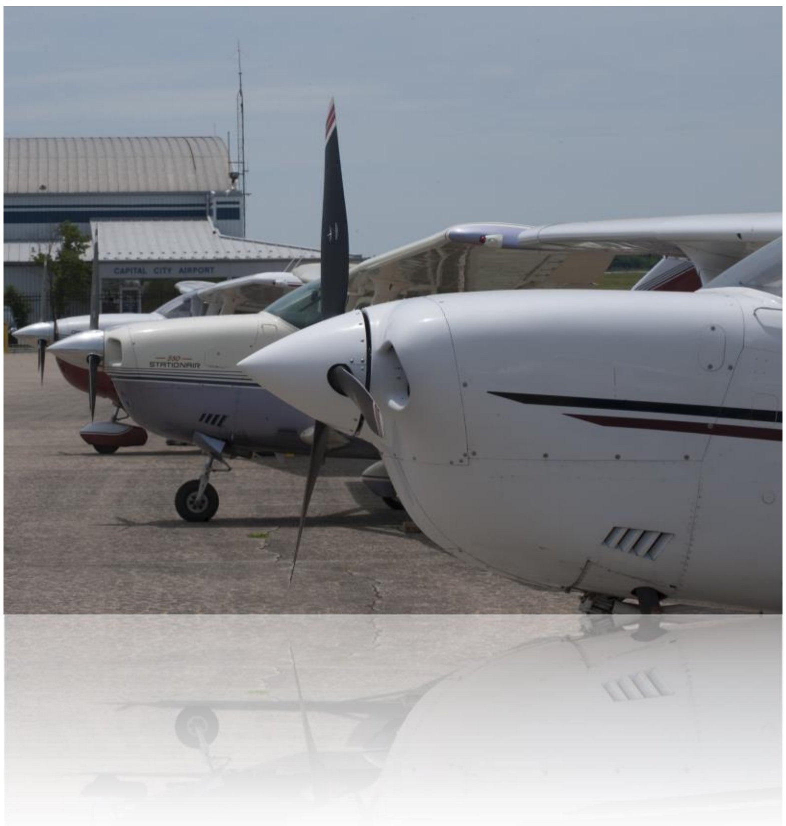

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1. Summary / Scope

1.1. Summary

This report contains a Work Plan and Pre-Op acquisition plan for the LiDAR for San Diego County, CA task order, issued by STARR on behalf of Federal Emergency Management Agency (FEMA). The intent of this document is to provide specific pre-flight information for the data acquisition/collection work completed for the project. Please see the Post-Flight report for details on the actual collection details.

1.2. Scope

The scope of the LiDAR for San Diego County, CA task order included the acquisition of aerial imagery using state of the art technology, along with necessary surveyed ground control points (GCPs) and airborne GPS and inertial navigation systems, for the study area. The aerial data collection was designed with the following specifications listed in Table 1 below.

Table 1. Planned LiDAR Specifications

LiDAR				
Average Point Density	**Flight Altitude (AGL)**	**Field of View**	**Side Overlap**	**RMSEz**
2 pts / m^2	5,577 ft	40.0 degrees	40%	10 cm or better

1.3. Location / Coverage

The San Diego County, CA project boundary consists approximately 1640 square miles as shown in Figure 1.

Figure 1. San Diego County, CA Project Boundary

1.4. ACQIUSITION CONDITIONS

The acquisition will be conducted when the majority of the ground is not obscured by snow, dense haze, fog, dust, floodwater, low cloud cover, or when there are other environmental conditions that could obscure the ground and negatively impact the project's positional accuracy. At the time of the acquisition, the GPS satellite configuration will consist of a minimum of six satellites with a geometry that supports a Positional Dilution of Precision (PDOP) of ≤ 3. The actual PDOP data will be collected and submitted as part of the Post-Flight Aerial Survey and Calibration Report. If a break in the data acquisition flight line should occur, a minimum of 500' overlap data will be collected when resuming the flight line to ensure the integrity of the collected data.

The data will meet or exceed FEMA specifications.

2. PLANNING / EQUIPMENT

The entire target area was broken into seven areas to account for airports and potential GPS Base Stations: Brown, Campo, Descano, Fallbrook, Palomar, Pauma, and Warner. Brown has 47 flight lines and approximately 888 flight line miles; Campo had 38 flight lines and approximately 686 flight line miles; Descanso has 133 flight lines and approximately 2,896 flight line miles; Fallbrook has 18 flight lines and approximately 171 flight line miles; Palomar has 32 flight lines and approximately 538 flight line miles; Pauma has 25 flight lines and approximately 267 flight line miles; and Warner has 106 flight lines and approximately 1674 flight line miles. As a whole, the project area is comprised of 399 planned flight lines and approximately 7120 flight line miles. Please refer to Figures 2 through 9.

Figure 2. Planned Flight Lines: Overview

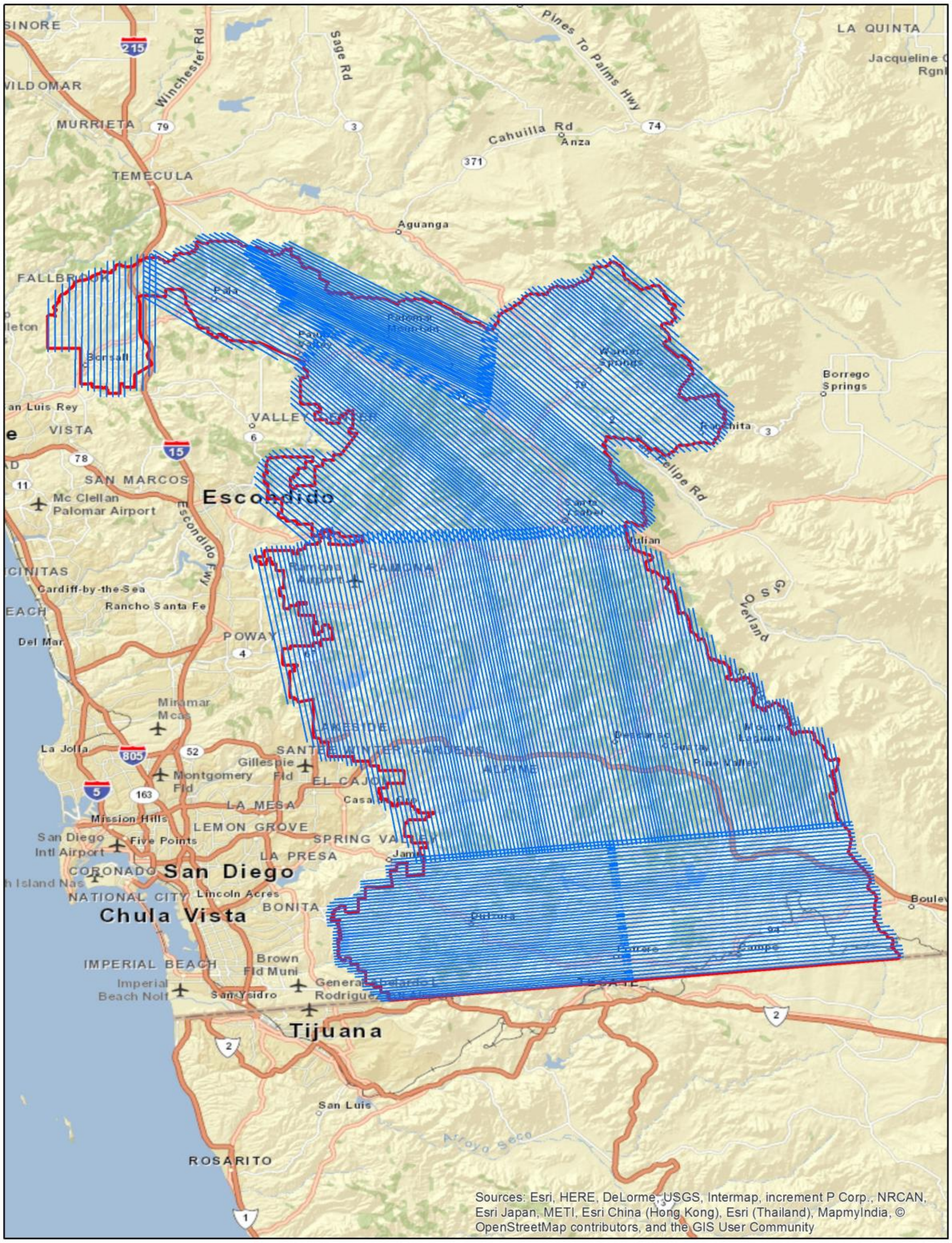

Figure 3. Planned Flight Lines: Brown

Figure 4. Planned Flight Lines: Campo

Figure 5. Planned Flight Lines: Descanso

Figure 6. Planned Flight Lines: Fallbrook

Figure 7. Planned Flight Lines: Palomar

Figure 8. Planned Flight Lines: Pauma

Figure 9. Planned Flight Lines: Warner

Detailed project flight planning calculations were performed for the San Diego County, CA project using Leica Mission planning software. Flight planning was based on the unique project requirements and characteristics of the project site. The basis of planning included: required accuracies, type of development, amount / type of vegetation within project area, required data posting, and potential altitude restrictions for flights in project vicinity. A brief summary of the aerial acquisition parameters for the project are shown in the LiDAR System Specification Table 2 below:

Table 2. LiDAR System Specifications

Area	Collection Blocks
Terrain and Aircraft	**Flying Height AGL:** • Brown: 1747 m; 5732 feet • Campo: 2167 m; 7110 feet • Descanso: 1767 m; 5797 feet • Palomar: 2074 m; 6804 feet • Pauma: 1757 m; 5764 feet • Warner: 1788 m; 5866 feet • Fallbrook: 1807 m; 5928 feet
	Recommended Ground Speed (GS): 115 kts
Scanner	**Field of View (FOV):** 40.0; degrees
	Scan Rate Setting used (SR): 41.8 Hz
Laser	**Laser Pulse Rate used:** 158 kHz
	Multi Pulse in Air Mode: Disabled
Coverage	**Full Swath Width:** 1237.5 m
Point Spacing and Density	**Maximum Point Spacing Across Track:** 1.42 m
	Maximum Point Spacing Along Track: 1.42 m
	Average Point Density: 2.16 pts / m^2

2.1. PLANNED GPS STATIONS

Normally existing high accuracy monuments at airports are utilized if possible. Typically a Primary Airport Control Monument (or Secondary) is available; otherwise any other high accuracy monument can be used. We typically prefer these on the airport grounds as they can be monitored for security by airport staff. If no monument is available or an existing monument is damaged, we will set a monument with re-bar and use OPUS to control the monument. These are then used for initial field processing of the data.

2.2. Calibration plans

Periodic detailed boresighting of the LiDAR sensor is performed at a boresight facility established in Lexington, Kentucky for both our LiDAR and imagery platforms. Over 95 high-accuracy control points are located within this facility. The area also has numerous pitched roofs that are necessary in boresighting LiDAR instruments. Local boresights are also carried out at individual project sites. Typically these are established at local airports and consist of opposing and cross flights conducted at multiple flight elevations. The boresight data is processed by our Lead LiDAR Specialist with the results for all boresight parameters applied to the project acquisition.

2.2.1. Calibration

All of our sensors are calibrated by flying lines at multiple altitudes and at varying directions over features on land, typically at the airport where the acquisition is staged. These lines are used to remove angular errors between the IMU and scanning mirror and to determine the precise positioning of the sensor in relationship with the phase center of the GPS antenna mounted on the fuselage of the aircraft.

2.2.2. Calibration

The raw LiDAR surface is compared against ground points that are established for the calibration of the elevation surface. System biases are identified and removed during this calibration. An early statistical analysis takes place that provides an indication of the precision of the acquired data.

Additionally, each lift requires a cross flight over the lines collected during that flight. This also acts as a daily calibration and is used if any anomalies are discovered with processed data.

2.3. Quality control procedures for flight crews

2.3.1. Acquisition Crews

An experienced and knowledgeable acquisition crew is also critical to a successful LiDAR project. We will bring one capable crew to the project site with four more in reserve should any unexpected health issues or similar complications arise.

Table 3

Sensor Calibration Boresighting
✦ Photo Science routinely performs a Comprehensive Calibration process from our permanent boresighting location at the Capital City Airport in Frankfort, KY, as well as daily, local project specific boresighting locations.
✦ Photo Science established GPS survey points for LiDAR ground truthing and reflective survey analysis.
✦ Our calibration methodology adheres to the basic survey principle of *“working for the whole of the parts”* ensuring that residual values of the calibration are reduced, *not* multiplied.
✦ Photo Science calibration process validates roll, pitch, heading, pitch at swath edge, and torsion.

2.3.2. General Flight Mission Procedures

On a lift by lift basis the flight crew will check cloud conditions, atmospheric conditions (fog or probability of fog) and winds and turbulence. If any of those factors would make acquisition difficult they will wait a few hours and review again.

LiDAR crews can fly at night or during the day. Night flights can be smoother in some cases, but extra care must be used as it is easy to lose orientation with the ground if in very rural areas or over large expanses of water. Additionally, if there are fog probabilities then flights will not take place as fog will block the laser. It must be clear below the aircraft at all times.

The initial item is to set the base station properly over the monument, verify it is secure and running. Prior to setting the crew will have ascertained that it has storage space on the hard drives and full battery life. They will also verify that it is running with proper collection parameters. PDOP is also reviewed as collection will not take place during times of high PDOP.

The LiDAR system (controller hard drives and Laser) is connected to the flight management system and once the project plan is loaded the parameters for collection will load as well. The sensor operator will verify that everything loaded correctly before flight.

Once the LiDAR has been started the crew will taxi to the run up area and wait for the IMU, GPS and the rest of the system level out. They will collect data in a stationary position for about 5-10 minutes until the POS (position and orientation system) provides good level characteristics (Green Lights!).

After this they crew will take off and start collection data, avoiding hard steep turns (banks typically <20 degrees). Collection requires that speeds be maintained, sometimes quite slow depending on the accuracy requirements. Additionally altitudes must be watched closely.

During flights the sensor operator must monitor the laser to sure that temperatures are consistent and within guidelines, that pulsing is taking place correctly and returns are consistent and within guidelines while watching atmospheric conditions, speeds and monitoring the pilot.

2.4. Procedure for tracking, executing and checking re-flights

All daily flights are tracked with specific logs for each area. These include general logs indicating the lines, date flown etc. as well as very specific mission logs concerning the lift, weather conditions, times, speeds and other criteria critical to the performance of the laser. The daily flight logs are faxed to the office on a daily basis and entered into an access database for tracking purposes. This helps determine where next to move crews and overall project status.

After flight each day, the GPS ground base station data is processed and verified and is then is run against the LiDAR POS data in both a forward and reverse sense. The two solutions are then compared against one another for all GPS epochs and the individual differences for the northing, easting, and elevation components are plotted for easy comparison. This data is then run against the LiDAR returns and a point cloud generated. Any anomalies in the data are quickly analyzed, and if required, re-flights take place for the portions of the flight missions that require remediation.

Once the data is checked it is archived, backed up and a set sent to the office via overnight delivery, while the backup copy remains with the crew.

The flight crews do not leave the area of collection until all data has been verified and shipped.

2.5. FLIGHT LOGS

Flight logs were completed by LIDAR sensor technicians for each mission during acquisition. These logs depict various information including:

- Job / Project #
- Flight Date / Lift Number
- FOV (Field of View)
- Scan Rate (HZ)
- Pulse Rate Frequency (Hz)
- Ground Speed
- Altitude
- Base Station
- PDOP avoidance times
- Flight Line #
- Flight Line Start and Stop Times
- Flight Line Altitude (AMSL)
- Heading
- Speed
- Returns
- Crab

Notes: (Visibility, winds, ride, weather, temperature, dew point, pressure, etc). Blank Flight Log example is included in Appendix A.

2.6. EQUIPMENT: AIRCRAFT

The project flights are planned to utilize customized Cessna Caravan Tail Number N840JA.This aircraft provided an ideal, stable aerial base for LiDAR acquisition. This aerial platform has relatively fast cruise speeds which are beneficial for project mobilization / demobilization while maintaining relatively slow stall speeds which proved ideal for collection of the imagery captured by the LiDAR units.

Figure 10. Leica ALS80 LiDAR System.

2.7. LIDAR SENSOR

Quantum Spatial will utilize a Leica ALS80, Serial Number 8146. This system is capable of collecting data at a maximum frequency of 1 MHz, which affords elevation data collection of up to 1,000,000 points per second. The system utilizes a Multi-Pulse in the Air option (MPIA). This sensor is also equipped with the ability to measure an unlimited number of returns per outgoing pulse from the laser. The intensity of the first four returns is also captured during aerial acquisition.

2.8. GROUND CONTROL COLLECTION

Compass Data will be responsible for collecting all control points needed to guarantee the accuracy of the LiDAR dataset. Quantum Spatial requires forty (40) calibration control points. These points will be used to check the dataset for any positional bias that needs to be corrected during the calibration process. These points are shown in figure 12.

In addition to the calibration points, we have selected NVA, VVA, and Horizontal control locations. These locations represent our recommendation in order to meet the proper project specifications. These points can be seen in figures 13-15. There are thirty four (34) recommended horizontal control points, (67) recommended non-vegetated vertical accuracy points (51 bare earth and 16 urban area), and fifty four (54) recommended vegetated vertical accuracy points (5 forested, 2 swamp, and 4 tall weeds). These points support vertical tests on the dataset. Each of these two functions shall remain independent of each other. Independent check or calibration points will need to be three times as accurate as the surface being checked. Therefore, in order to validate a LiDAR surface accurate to 10 cm, the collected elevation control data must be accurate to 3 cm.

The planned point locations are indicated in the graphics below.

Figure 11. Planned Ground Control Point Locations

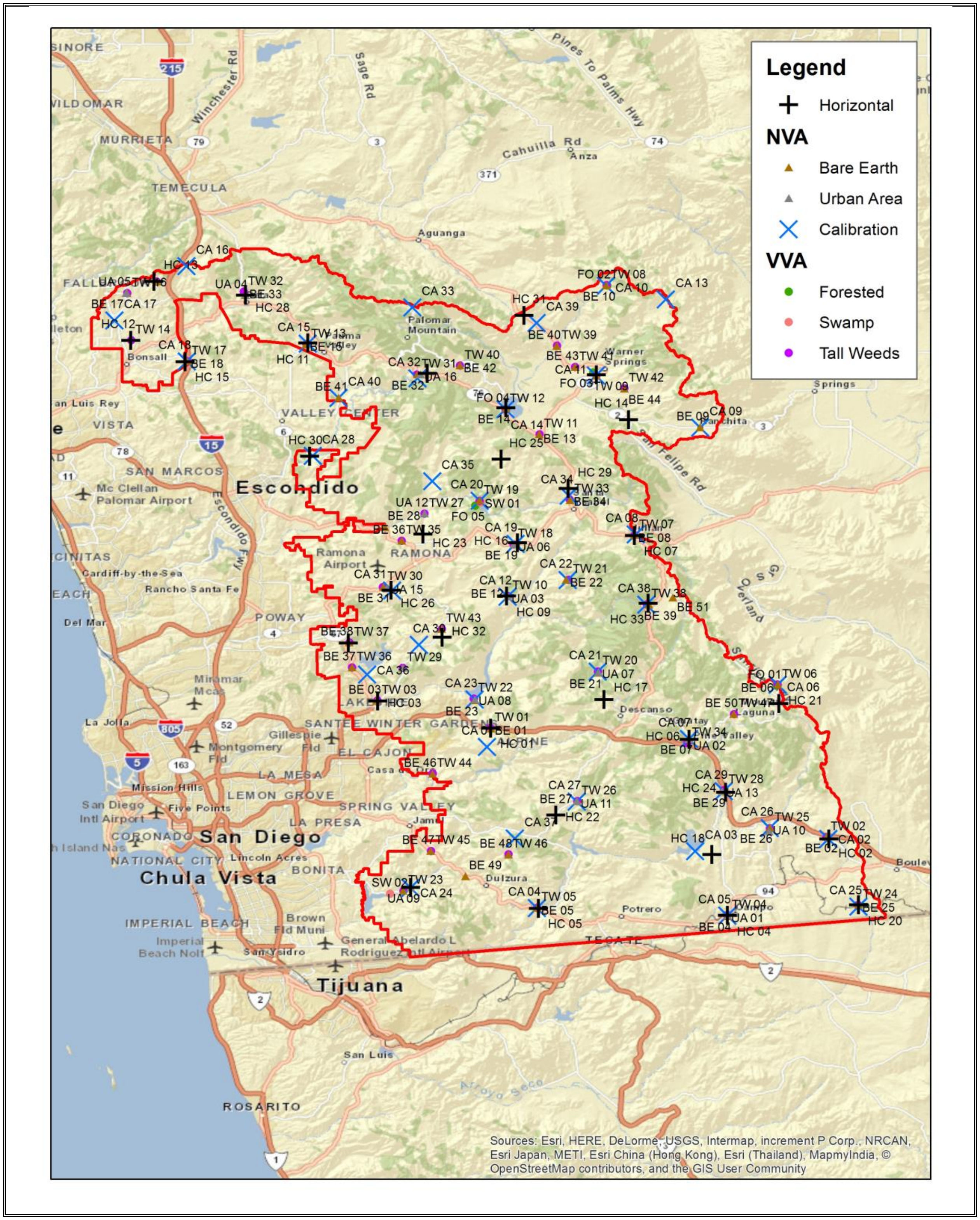

Figure 12. Required Calibration Control Point Locations

Figure 13. Recommended NVA Ground Control Point Locations

Figure 14. Recommended VVA Ground Control Point Locations

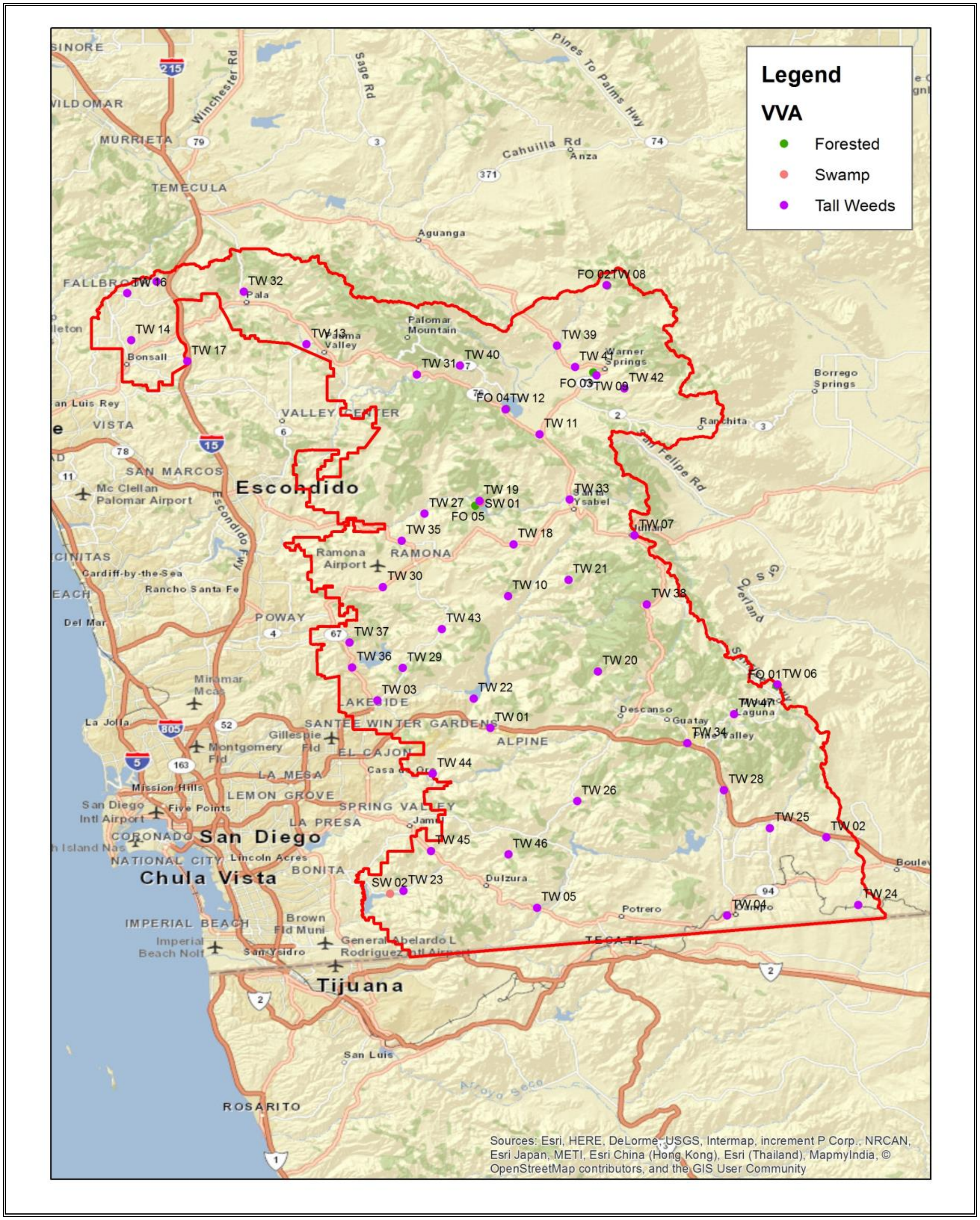

Figure 15.Recommended Horizontal Ground Control Point Locations

San Diego Co., CA FEMA Region IX 2016 QL2 LiDAR Project Report

Submitted: August 5, 2016

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1. Summary / Scope

1.1. Summary

This report contains a summary of the San Diego County, CA FEMA Region IX 2015 LiDAR acquisition task order, issued by the Strategic Alliance for Risk Reduction (STARR II) under their task order issued on October 23, 2015. The task order yielded a project area covering 1,617 square miles over San Diego County, California. The intent of this document is only to provide specific validation information for the data acquisition/collection, processing, and production of deliverables completed as specified in the task order.

1.2. Scope

Aerial topographic LiDAR was acquired using state of the art technology along with the necessary surveyed ground control points (GCPs) and airborne GPS and inertial navigation systems. The aerial data collection was designed with the following specifications listed in Table 1 below.

Table 1. Originally Planned LiDAR Specifications

Average Point Density	Flight Altitude (AGL)	Field of View	Minimum Side Overlap	RMSEz
≥ 2 pts / m^2	5,577 ft	40.0°	40%	≤ 10 cm

1.3. Coverage

The LiDAR project boundary covers 1,617 square miles and encompasses the entirety of San Diego County in southern California. A buffer of 100 meters was created in order to meet task order specifications. LiDAR extents are shown in Figure 1 on the following page.

1.4. Duration

LiDAR data was acquired from October 30, 2015 to November 23, 2016 in 23 total lifts. See "Section: 2.5. Time Period" for more details.

1.5. Issues

There were no issues with this project.

1.6. Deliverables

The following products were produced and delivered:

- Raw LiDAR point cloud data swaths, in LAS 1.4 format
- Hydro-flattened continuous breaklines, in Esri file geodatabase format
- 2.5-foot hydro-flattened bare-earth raster DEMs, tiled, in ERDAS .IMG format
- Tile index, in Esri shapefile format

All geospatial deliverables were produced with a horizontal datum of NAD83 (2011) State Plane California Zone VI, US survey feet and a vertical datum of NAVD88 (Geoid 12B), US survey feet. All tiled deliverables have a tile size of 2,500-feet x 2,500-feet and matches the adjoining USGS/ SANDAG project.

Figure 1. Project Boundary

2. Planning / Equipment

2.1. Flight Planning

Flight planning was based on the unique project requirements and characteristics of the project site. The basis of planning included: required accuracies, type of development, amount / type of vegetation within project area, required data posting, and potential altitude restrictions for flights in project vicinity. Please note that certain values in the table below are listed as "Variable" due to the various flight plans used, as described in "Section: 1.5. Issues" of this document.

Detailed project flight planning calculations were performed for the project using Leica MissionPro planning software. The entire target area was broken into seven areas to account for airports and potential GPS Base Stations: Brown, Campo, Descano, Fallbrook, Palomar, Pauma, and Warner. Brown has 47 flight lines and approximately 888 flight line miles; Campo had 38 flight lines and approximately 686 flight line miles; Descanso has 133 flight lines and approximately 2,896 flight line miles; Fallbrook has 18 flight lines and approximately 171 flight line miles; Palomar has 32 flight lines and approximately 538 flight line miles; Pauma has 25 flight lines and approximately 267 flight line miles; and Warner has 106 flight lines and approximately 1674 flight line miles. As a whole, the project area is comprised of 399 planned flight lines and approximately 7120 flight line miles. See Figure 2 through Figure 9.

2.2. LiDAR Sensor

Quantum Spatial utilized a Leica ALS 80 LiDAR sensor (Figure 3), serial number 8146, during the project. This system is capable of collecting data at a maximum frequency of 1 MHz, which affords elevation data collection of up to 1,000,000 points per second. The system utilizes a Multi-Pulse in the Air option (MPIA). This sensor is also equipped with the ability to measure an unlimited number of returns per outgoing pulse from the laser. The intensity of the first four returns is also captured during aerial acquisition.

A brief summary of the aerial acquisition parameters for the project are shown in the LiDAR System Specifications in Table 2.

Figure 2. Planned Flight Lines - Overview

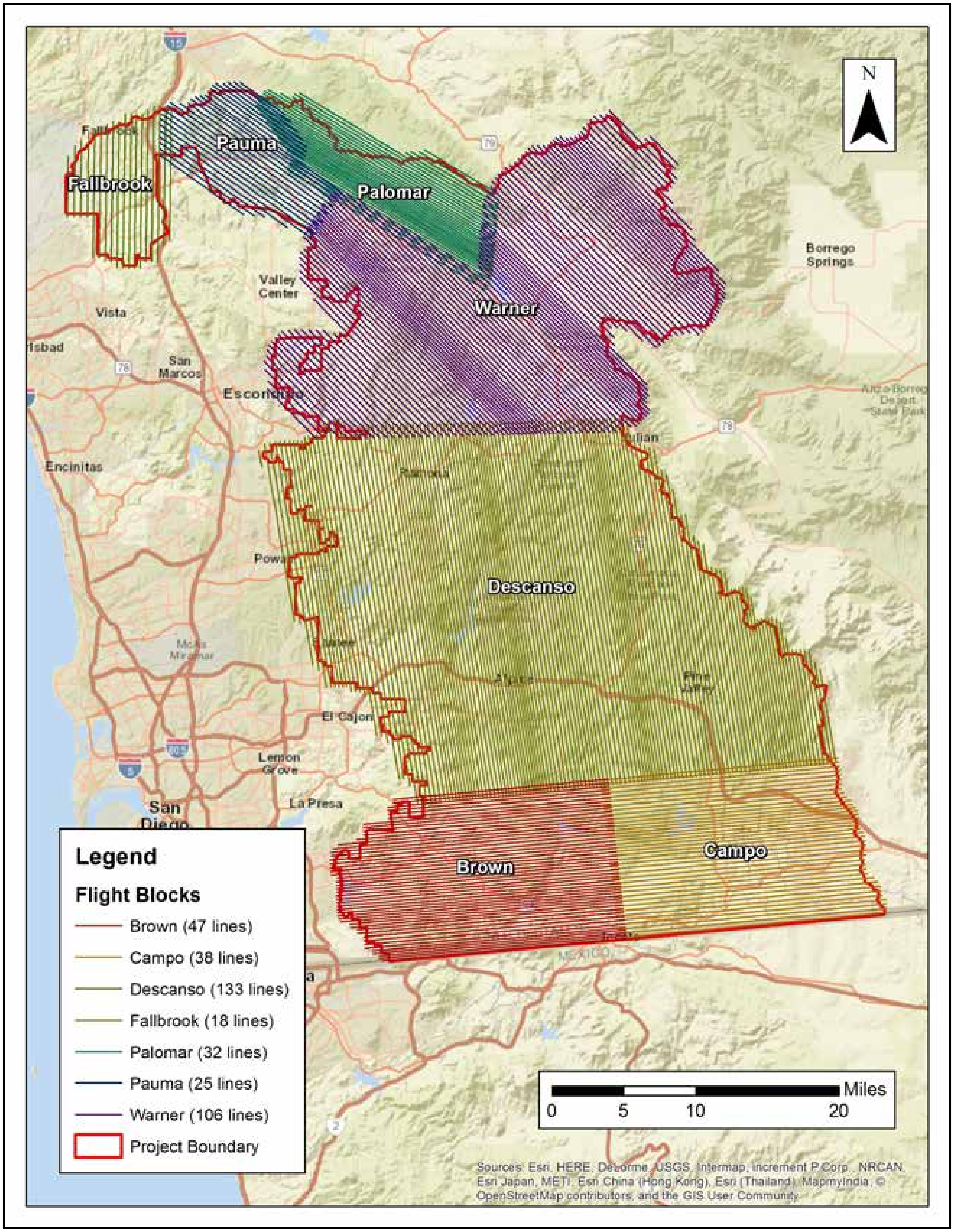


Figure 3. Planned Flight Lines - Brown

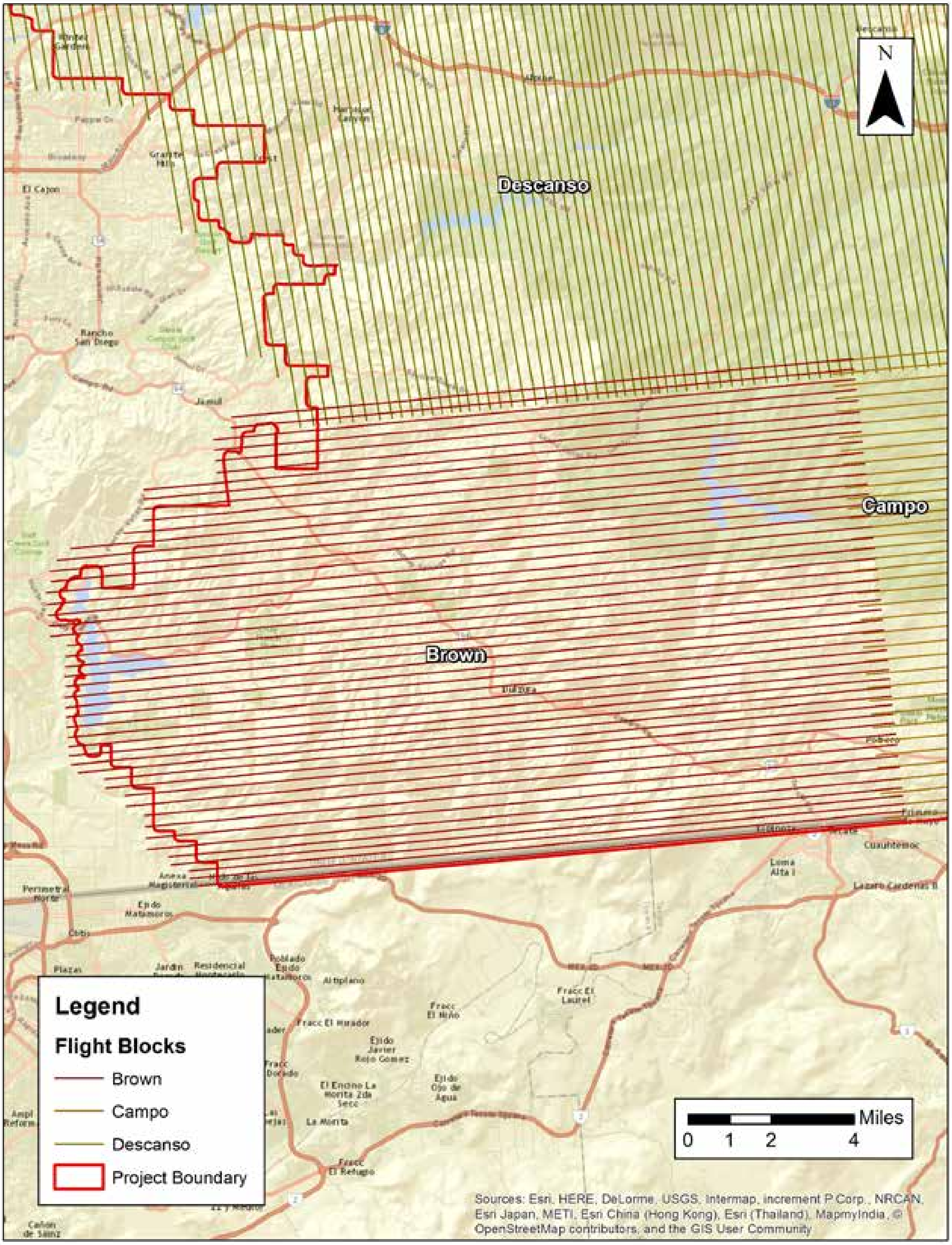


Figure 4. Planned Flight Lines - Campo

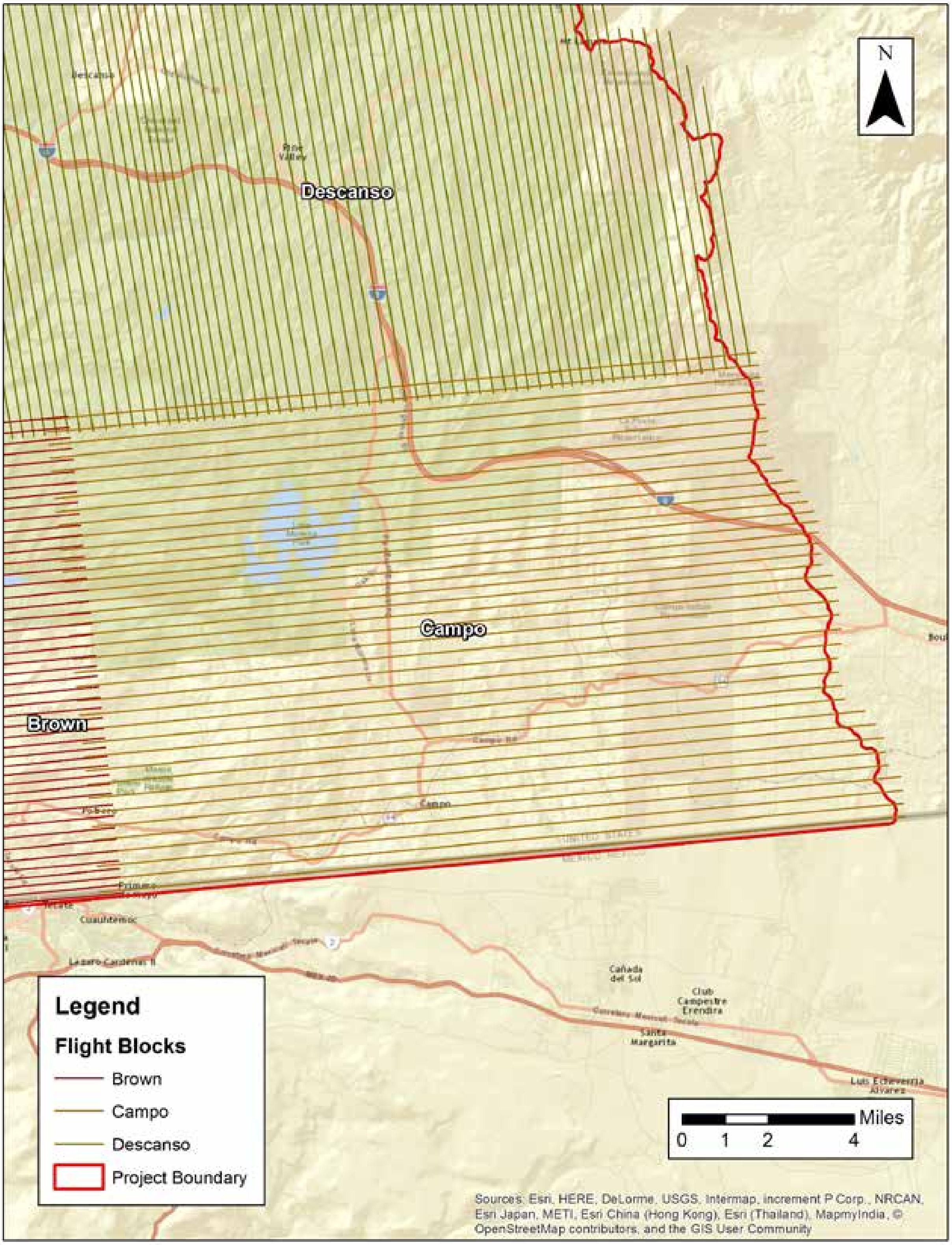


Figure 5. Planned Flight Lines - Descanso

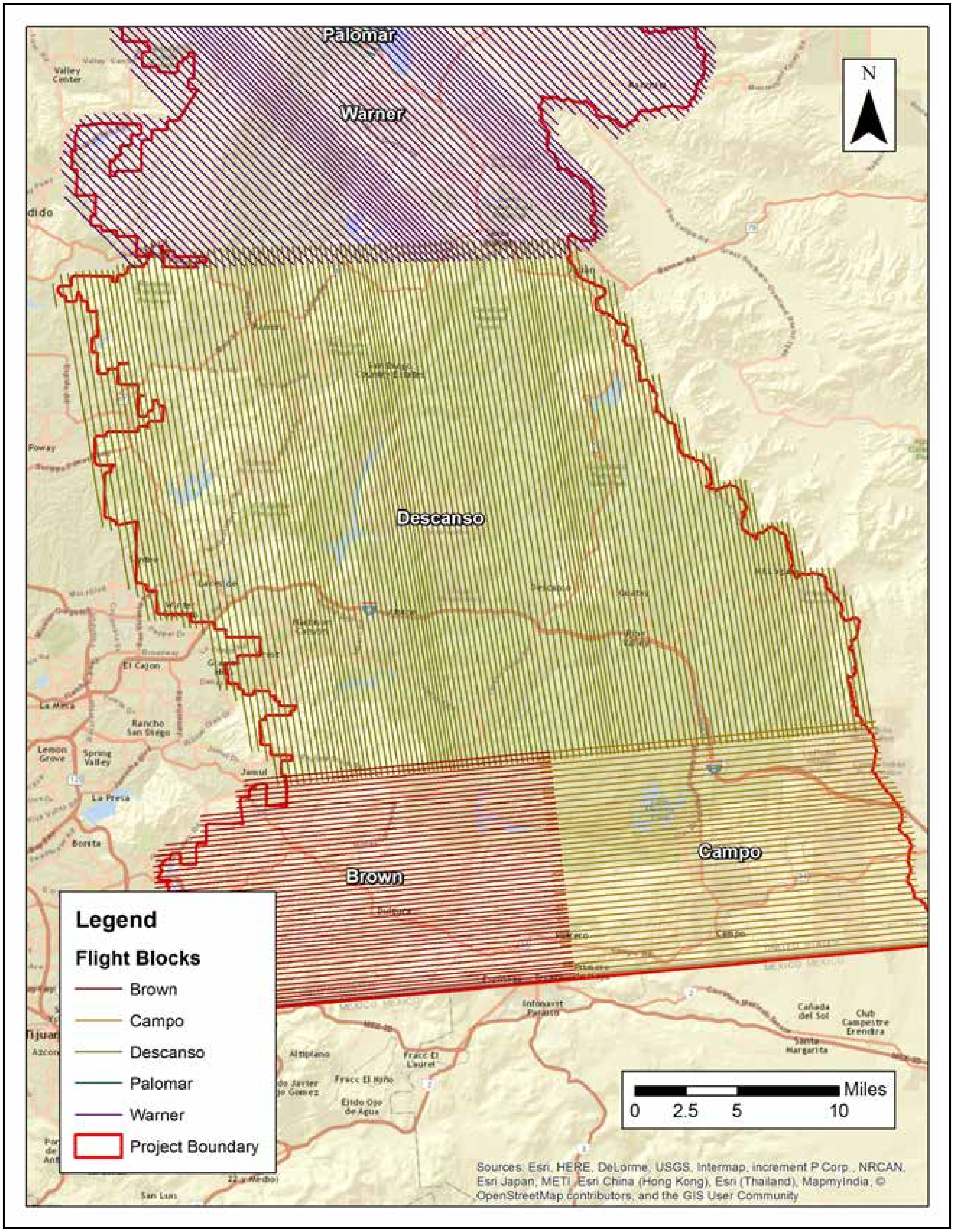


Figure 6. Planned Flight Lines - Fallbrook

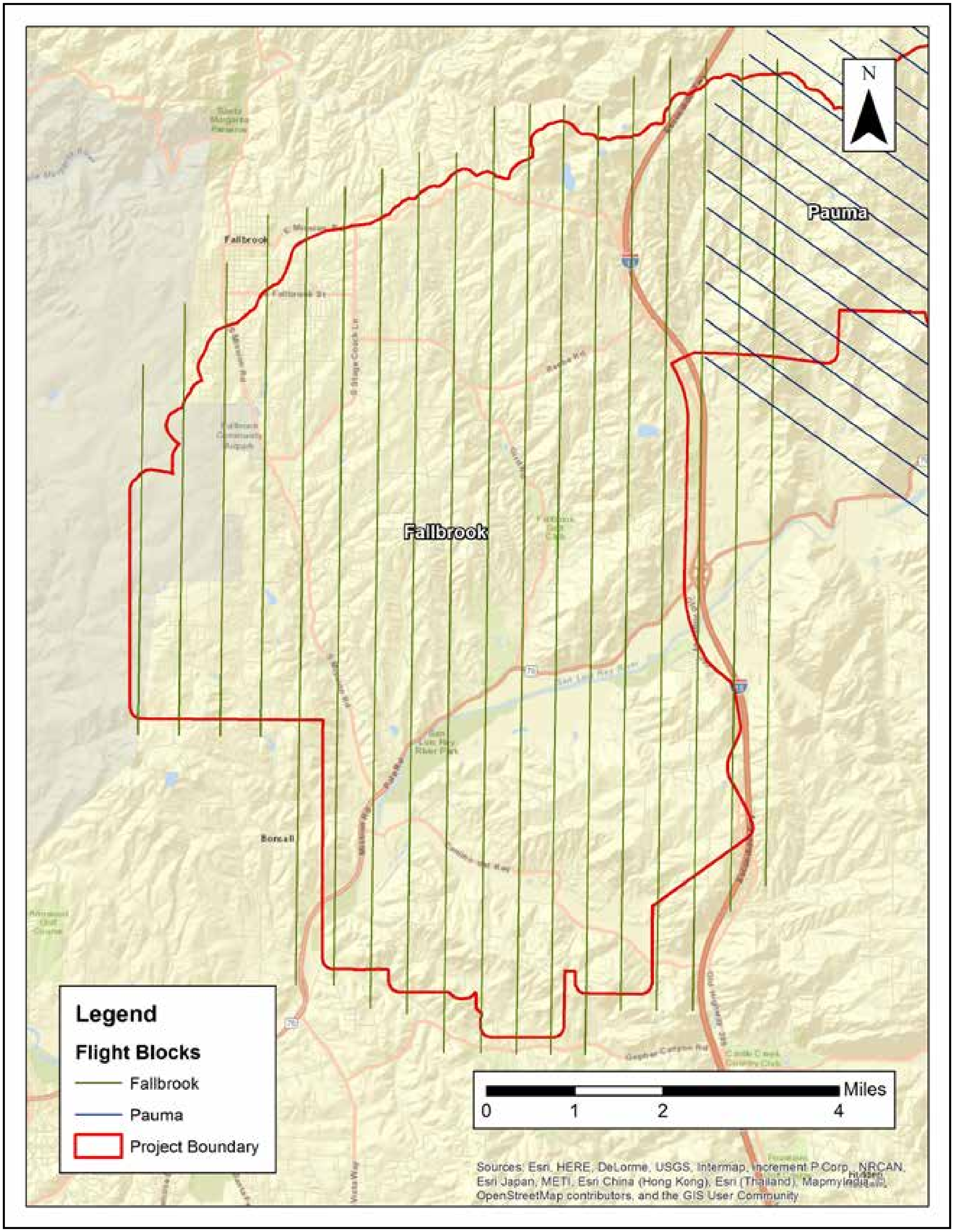


Figure 7. Planned Flight Lines - Palomar

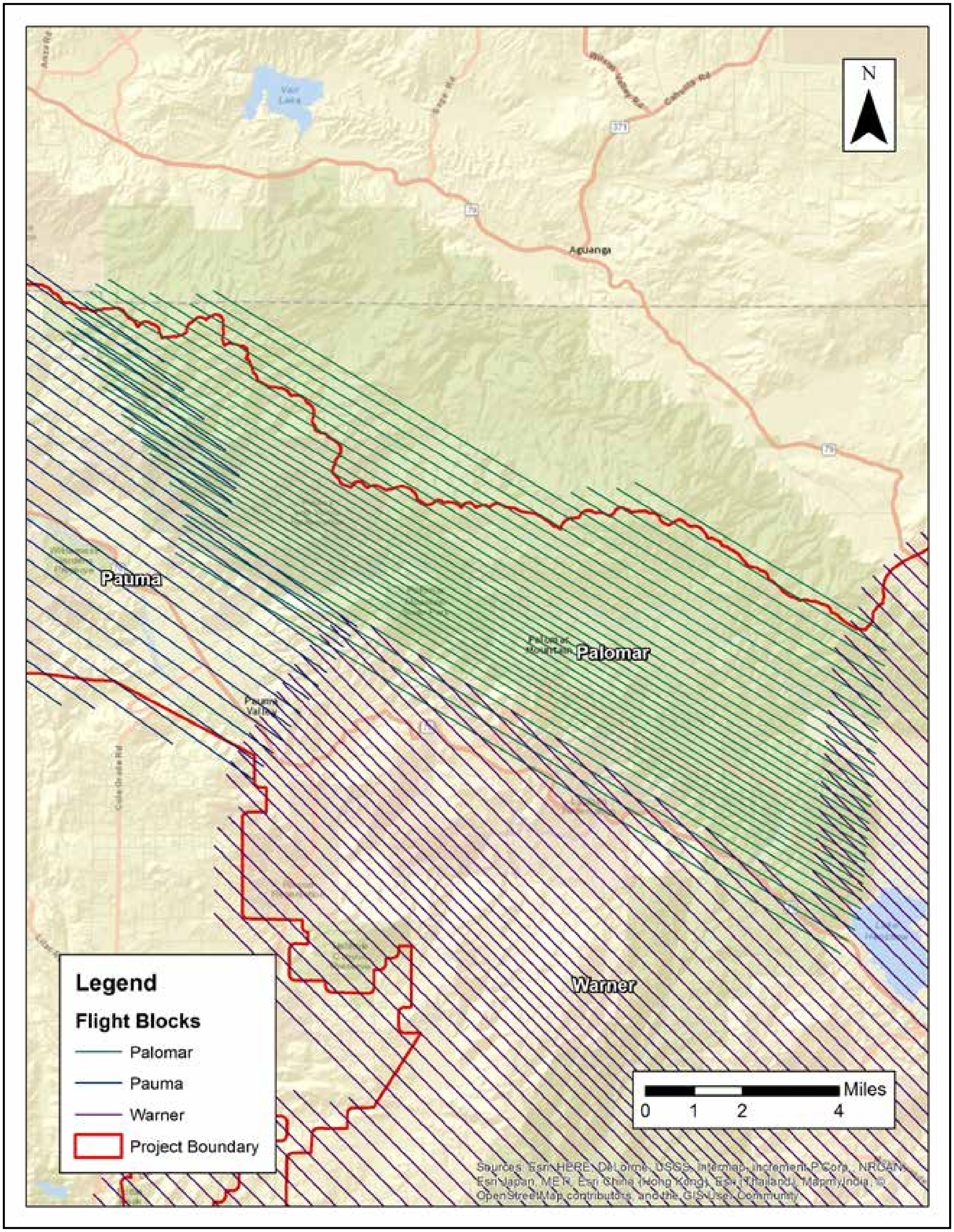


Figure 8. Planned Flight Lines - Pauma

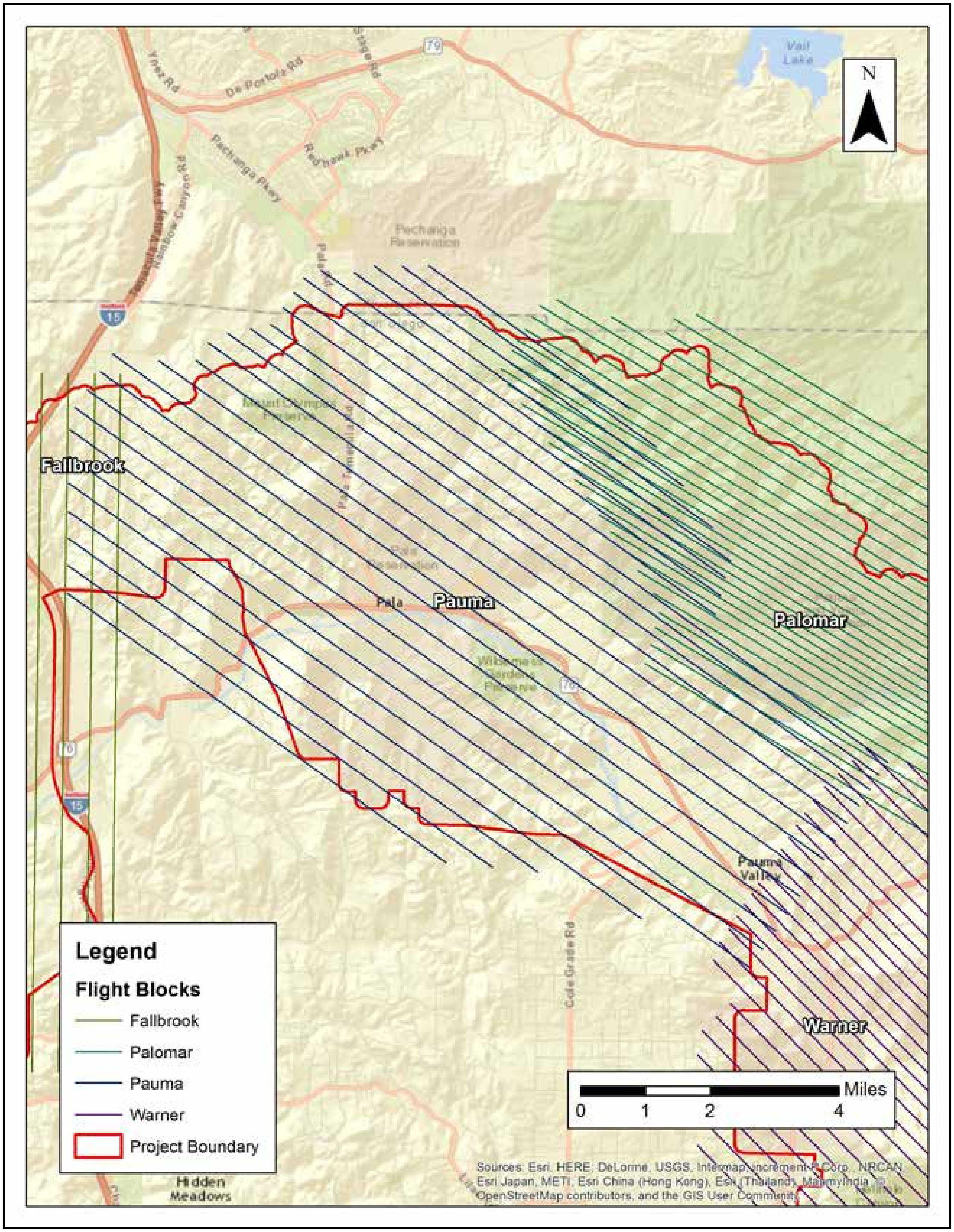


Figure 9. Planned Flight Lines - Warner

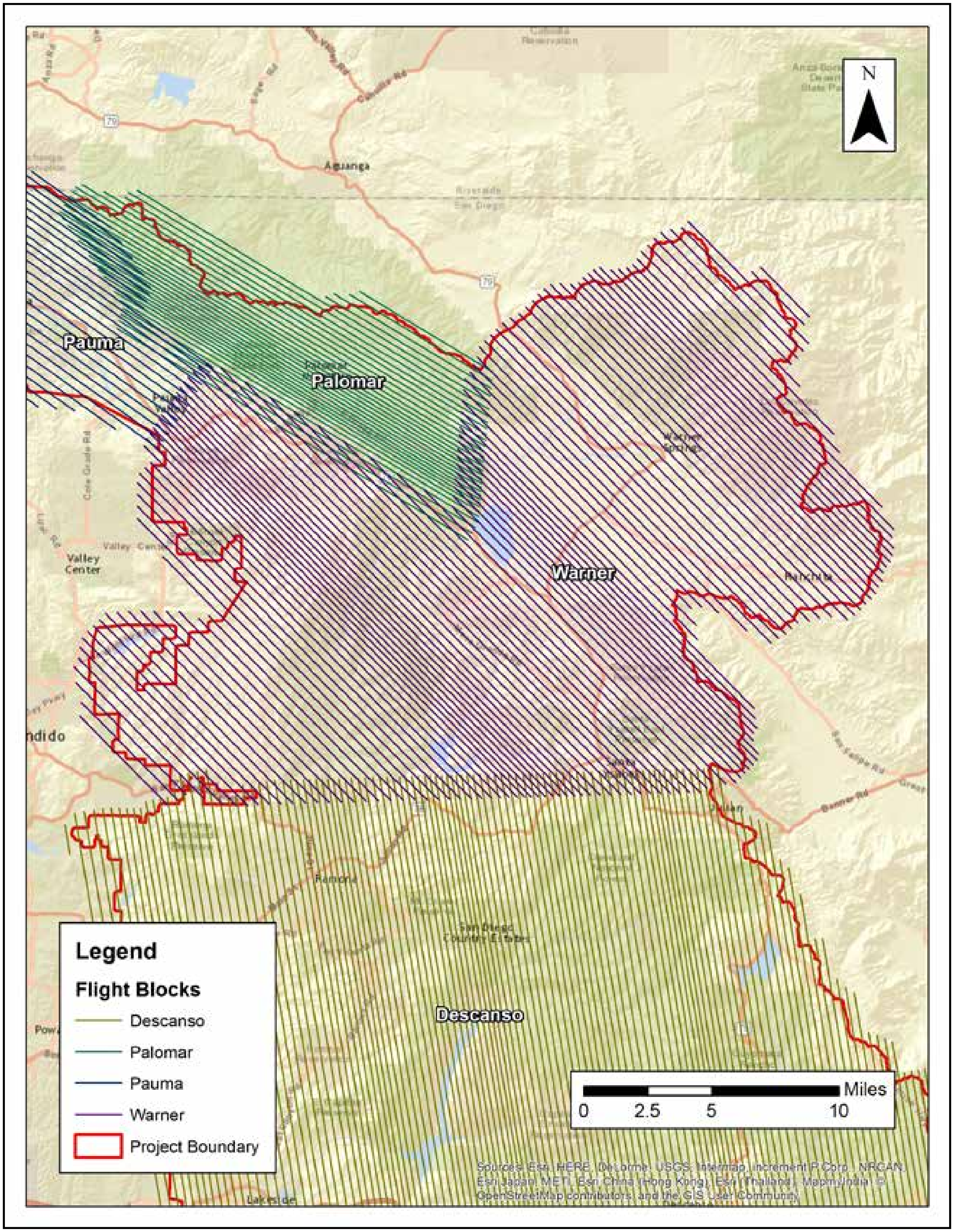


Table 2. Lidar System Specifications

		Brown Block	Campo Block	Descanso Block	Fallbrook Block
Terrain and Aircraft Scanner	Flying Height	1,700 m	1,700 m	1,700 m	1,800 m
	Recommended Ground Speed	115 kts	115 kts	115 kts	140 kts
Scanner	Field of View	40.0°	40.0°	40.0°	40.0°
	Scan Rate Setting Used	41.8 Hz	41.8 Hz	41.8 Hz	52.0 Hz
Laser	Laser Pulse Rate Used	158.0 kHz	158.0 kHz	158.0 kHz	299.0 kHz
	Multi Pulse in Air Mode	Enabled	Enabled	Enabled	Enabled
Coverage	Full Swath Width	1,237.50 m	1,237.50 m	1,237.50 m	1,310.29 m
	Line Spacing	303.38 m	368.39 m	166.19 m	756.08 m
Point Spacing and Density	Maximum Point Spacing Along Track	1.42 m	1.42 m	1.42 m	0.99 m
	Maximum Point Spacing Along Track	1.42 m	1.42 m	1.42 m	1.39 m
	Average Point Density	2.16 pts / m^2	2.16 pts / m^2	2.16 pts / m^2	3.17 pts / m^2

Table 3. Lidar System Specifications

		Palomar Block	Pauma Block	Warner Block
Terrain and Aircraft Scanner	Flying Height	1,700 m	1,700 m	1,700 m
	Recommended Ground Speed	115 kts	115 kts	115 kts
Scanner	Field of View	40.0°	40.0°	40.0°
	Scan Rate Setting Used	41.8 Hz	41.8 Hz	41.8 Hz
Laser	Laser Pulse Rate Used	158.0 kHz	158.0 kHz	158.0 kHz
	Multi Pulse in Air Mode	Enabled	Enabled	Enabled
Coverage	Full Swath Width	1,237.50 m	1,237.50 m	1,237.50 m
	Line Spacing	81.84 m	369.60 m	159.56 m
Point Spacing and Density	Maximum Point Spacing Along Track	1.42 m	1.42 m	1.42 m
	Maximum Point Spacing Along Track	1.42 m	1.42 m	1.42 m
	Average Point Density	2.16 pts / m^2	2.16 pts / m^2	2.16 pts / m^2

Figure 10. Leica ALS 80 LiDAR Sensor

2.3. Aircraft

All flights for the project were accomplished through the use of a customized Cessna Caravan (single turbo-prop), Tail Number N840JA. This aircraft provided an ideal, stable aerial base for LiDAR acquisition. This aerial platform has relatively fast cruise speeds which are beneficial for project mobilization / demobilization while maintaining relatively slow stall speeds which proved ideal for collection of high-density, consistent data posting using a state-of-the-art Leica LiDAR systems.

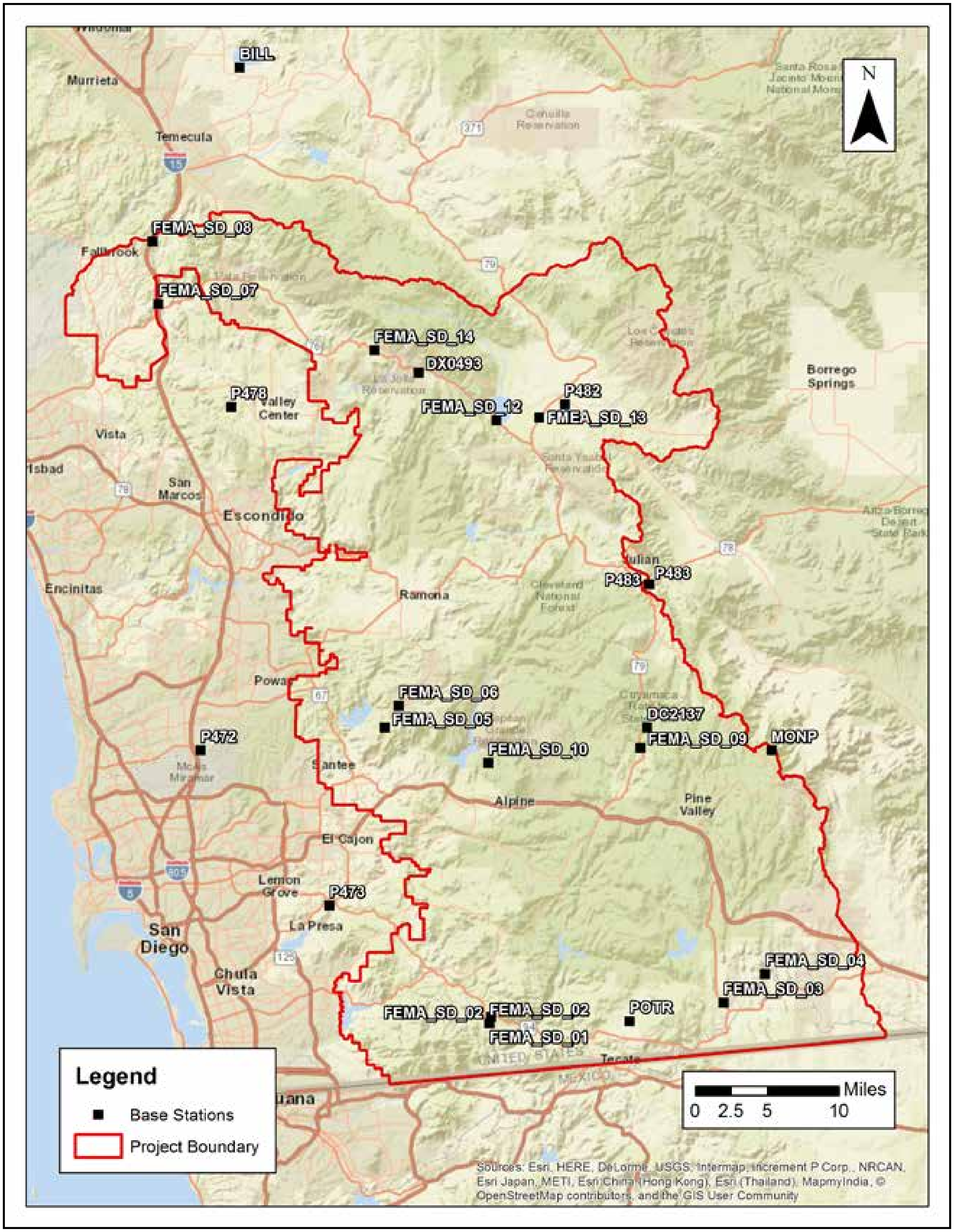
2.4. Base Station Information

GPS base stations were utilized during all phases of flight (Table 4). The base station locations were verified using NGS OPUS service and subsequent surveys. Base station locations are depicted in Figure 11. Data sheets, graphical depiction of base station locations or log sheets used during station occupation are available in Appendix A.

Table 4. Base Station Locations

Base Station	Latitude	Longitude	Ellipsoid Height (m)
P482	33° 14′ 24.63146″	116° 40′ 17.03637″	879.467
P483	33° 3′ 32.97633″	116° 34′ 9.52281″	1376.313
P472	32° 53′ 21.13975″	117° 6′ 16.85407″	138.603
P473	32° 44′ 1.58057″	116° 56′ 58.20691″	189.328
POTR	32° 37′ 6.26918″	116° 35′ 27.05963″	731.041
P478	33° 14′ 8.56044″	117° 4′ 17.67752″	372.326
FEMA_SD_02	32° 36′ 56.04822″	116° 45′ 29.1272″	407.935
FEMA_SD_05	32° 54′ 47.2768″	116° 53′ 4.81516″	441.162
FEMA_SD_10	32° 52′ 41.68683″	116° 45′ 38.89579″	678.325
FEMA_SD_04	32° 39′ 58.37218″	116° 25′ 46.87472″	912.172
FEMA_SD_03	32° 38′ 14.48612″	116° 28′ 45.13172″	799.376
FEMA_SD_02	32° 37′ 19.62403″	116° 45′ 22.34385″	439.361
FEMA_SD_01	32° 36′ 56.04822″	116° 45′ 29.1272″	407.935
FEMA_SD_07	33° 20′ 20.59807″	117° 9′ 36.50077″	67.701

Figure 11. Base Station Locations



2.5. Time Period

Project specific flights were conducted over two months. Twenty-three sorties, or aircraft lifts were completed. Accomplished LiDAR and ortho sorties are listed below.

- Oct 30, 2015-A (N840JA, SN8146)
- Oct 31, 2015-A (N840JA, SN8146)
- Oct 31, 2015-B (N840JA, SN8146)
- Oct 31, 2015-C (N840JA, SN8146)
- Nov 01, 2015-A (N840JA, SN8146)
- Nov 02, 2015-A (N840JA, SN8146)
- Nov 05, 2015-A (N840JA, SN8146)
- Nov 06, 2015-A (N840JA, SN8146)
- Nov 07, 2015-A (N840JA, SN8146)
- Nov 08, 2015-A (N840JA, SN8146)
- Nov 11, 2015-A (N840JA, SN8146)
- Nov 12, 2015-A (N840JA, SN8146)
- Nov 13, 2015-A (N840JA, SN8146)
- Nov 13, 2015-B (N840JA, SN8146)
- Nov 14, 2015-A (N840JA, SN8146)
- Nov 16, 2015-A (N840JA, SN8146)
- Nov 17, 2015-A (N840JA, SN8146)
- Nov 18, 2015-A (N840JA, SN8146)
- Nov 19, 2015-A (N840JA, SN8146)
- Nov 20, 2015-A (N840JA, SN8146)
- Nov 21, 2015-A (N840JA, SN8146)
- Nov 22, 2015-A (N840JA, SN8146)
- Nov 23, 2015-A (N840JA, SN8146)

3. Processing Summary

3.1. Flight Logs

Flight logs were completed by LIDAR sensor technicians for each mission during acquisition. These logs depict a variety of information, including:

- Job / Project #
- Flight Date / Lift Number
- FOV (Field of View)
- Scan Rate (HZ)
- Pulse Rate Frequency (Hz)
- Ground Speed
- Altitude
- Base Station
- PDOP avoidance times
- Flight Line #
- Flight Line Start and Stop Times
- Flight Line Altitude (AMSL)
- Heading
- Speed
- Returns
- Crab

Notes: (Visibility, winds, ride, weather, temperature, dew point, pressure, etc). Project specific flight logs for each sortie are available in Appendix A.

3.2. LiDAR Processing

Inertial Explorer software was used for post-processing of airborne GPS and inertial data (IMU), which is critical to the positioning and orientation of the LiDAR sensor during all flights. Inertial Explorer combines aircraft raw trajectory data with stationary GPS base station data yielding a “Smoothed Best Estimate Trajectory (SBET) necessary for additional post processing software to develop the resulting geo-referenced point cloud from the LiDAR missions.

During the sensor trajectory processing (combining GPS & IMU datasets) certain statistical graphs and tables are generated within the Inertial Explorer processing environment which are commonly used as indicators of processing stability and accuracy. This data for analysis include: Max horizontal / vertical GPS variance, separation plot, altitude plot, PDOP plot, base station baseline length, processing mode, number of satellite vehicles, and mission trajectory. All relevant graphs produced in the Inertial Explorer processing environment for each sortie during the project mobilization are available in Appendix A.

The generated point cloud is the mathematical three dimensional composite of all returns from all laser pulses as determined from the aerial mission. Laser point data are imported into TerraScan and a manual calibration is performed to assess the system offsets for pitch, roll, heading and scale. At this point this data is ready for analysis, classification, and filtering to generate a bare earth surface model in which the above-ground features are removed from the data set. Point clouds were created using the Leica CloudPro software. GeoCue distributive processing software was used in the creation of some files needed in downstream processing, as well as in the tiling of the dataset into more manageable file sizes. TerraScan and TerraModeler software packages were then used for the automated data classification, manual cleanup, and bare earth generation. Project specific macros were developed to classify the ground and remove side overlap between parallel flight lines.

All data was manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler. Global Mapper was used as a final check of the bare earth dataset. GeoCue was used to create the deliverable industry-standard LAS files for both the All Point Cloud Data and the Bare Earth. In-house software was then used to perform final statistical analysis of the classes in the LAS files.

3.3. LAS Classification Scheme

The classification classes are determined by the USGS Version 1.2 specifications and are an industry standard for the classification of LIDAR point clouds. All data starts the process as Class 1 (Unclassified), and then through automated classification routines, the classifications are determined using TerraScan macro processing.

The classes used in the dataset are as follows and have the following descriptions:

- Class 1 – Processed, but Unclassified – These points would be the catch all for points that do not fit any of the other deliverable classes. This would cover features such as vegetation, cars, etc.
- Class 2 – Bare-Earth Ground – This is the bare earth surface
- Class 7 – Low Noise – Low points, manually identified below the surface that could be noise points in point cloud.
- Class 9 – In-land Water – Points found inside of inland lake/ponds
- Class 10 – Ignored Ground – Points found to be close to breakline features. Points are moved to this class from the Class 2 dataset. This class is ignored during the DEM creation process in order to provide smooth transition between the ground surface and hydro flattened surface.
- Class 13 – Hydro-Enforced Ground Points – Points removed during the hydro-enforcement process.
- Class 17 – Bridge Decks – Points falling on bridge decks.
- Class 18 – High Noise – High points, manually identified above the surface that could be noise points in point cloud.

3.4. Classified LAS Processing

The bare earth surface is then manually reviewed to ensure correct classification on the Class 2 (Ground) points. After the bare-earth surface is finalized, it is then used to generate all hydro-breaklines through heads-up digitization.

All ground (ASPRS Class 2) LiDAR data inside of the Lake Pond and Double Line Drain hydro flattening breaklines were then classified to water (ASPRS Class 9) using TerraScan macro functionality. A buffer of 3 feet was also used around each hydro-flattened feature to classify these ground (ASPRS Class 2) points to Ignored ground (ASPRS Class 10). All Lake Pond Island and Double Line Drain Island features were checked to ensure that the ground (ASPRS Class 2) points were reclassified to the correct classification after the automated classification was completed.

All overlap data was processed through automated functionality provided by TerraScan to classify the overlapping flight line data to approved classes by USGS. Overlap points were flagged using the overlap bit, per LAS 1.4 specifications.

All data was manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler. Global Mapper was used as a final check of the bare earth dataset. GeoCue was then used to create the deliverable industry-standard LAS files for both the All Point Cloud Data and the Bare Earth. Quantum Spatial proprietary software was used to perform final statistical analysis of the classes in the LAS files, on a per tile level to verify final classification metrics and full LAS header information.

3.5. Hydro-Flattened Breakline Creation

Class 2 LiDAR was used to create a bare earth surface model. The surface model was then used to heads-up digitize 2D breaklines of Inland Streams and Rivers with a 100 foot nominal width and Inland Ponds and Lakes of 2 acres or greater surface area.

Elevation values were assigned to all Inland Ponds and Lakes, Inland Pond and Lake Islands, Inland Streams and Rivers and Inland Stream and River Islands using TerraModeler functionality.

Elevation values were assigned to all Inland streams and rivers using Quantum Spatial proprietary software.

All ground (ASPRS Class 2) LiDAR data inside of the collected inland breaklines were then classified to water (ASPRS Class 9) using TerraScan macro functionality. A buffer of 3 feet was also used around each hydro flattened feature. These points were moved from ground (ASPRS Class 2) to Ignored Ground (ASPRS Class 10).

The breakline files were then translated to Esri file-geodatabase format using Esri conversion tools.

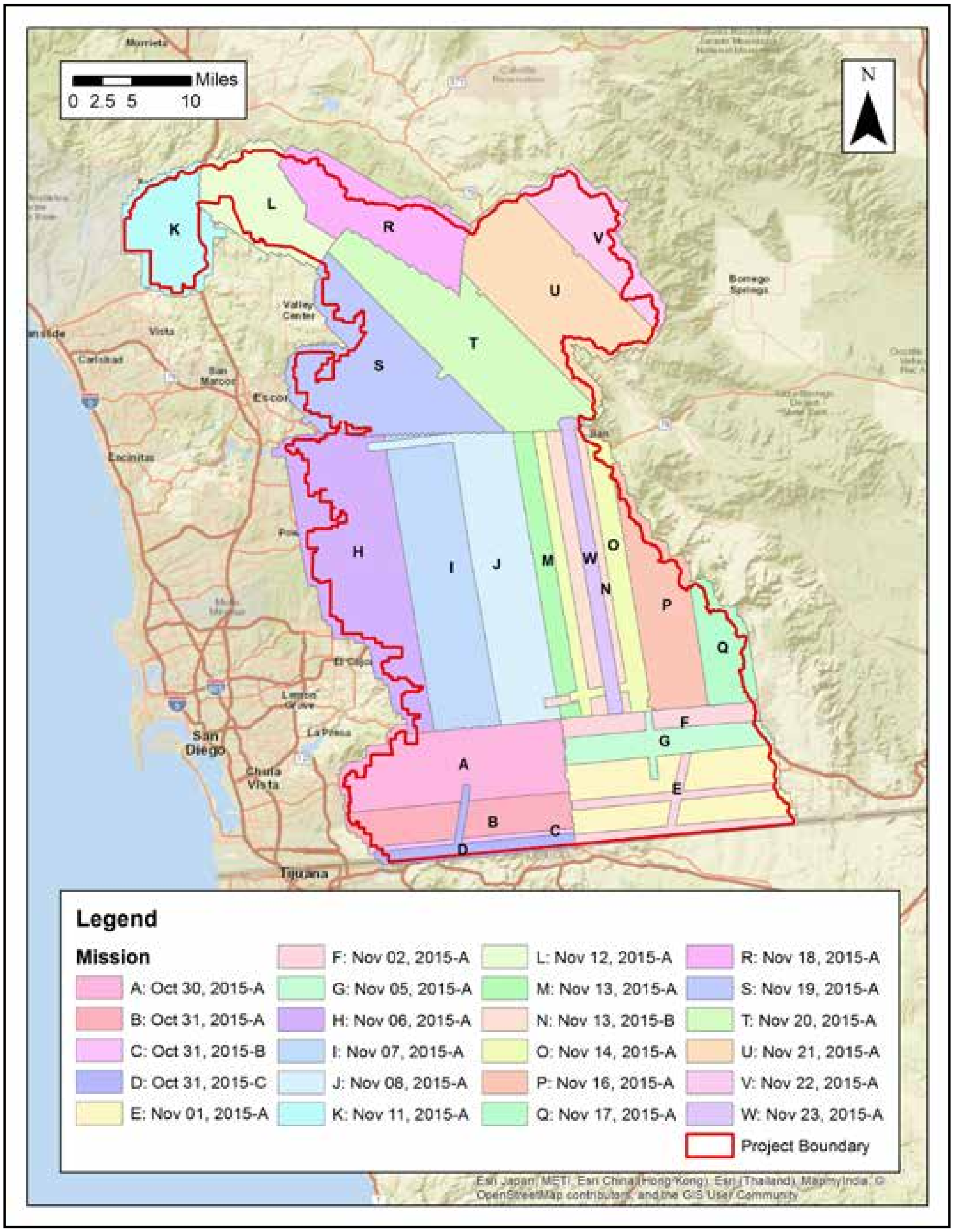
3.6. Hydro-Flattened Bare-Earth Raster DEM Creation

Class 2 LiDAR in conjunction with the hydro breaklines were used to create a 2.5-foot bare-earth raster DEM. Using automated scripting routines within ArcMap, an ERDAS Imagine .IMG file was created for each tile. Each surface is reviewed using Global Mapper to check for any surface anomalies or incorrect elevations found within the surface.

4. Project Coverage Verification

Coverage verification was performed by comparing coverage of processed .LAS files captured during project collection to generate project shape files depicting boundaries of specified project areas. Please refer to Figure 12.

Figure 12. Flightline Swath LAS File Coverage



5. Ground Control and Check Point Collection

Quantum Spatial partnered with Compass Data to complete a field survey of 39 ground control (calibration) points along with 119 blind QA points in Vegetated and Non-Vegetated land cover classifications (total of 158 points) as an independent test of the accuracy of this project.

The required accuracy testing was performed on the LiDAR dataset (both the LiDAR point cloud and derived DEM's) according to the USGS LiDAR Base Specification Version 1.2 (2014). In this document, horizontal coordinates for ground control and QA points for all LiDAR classes are reported in NAD83 (2011) State Plane California Zone VI, US survey feet; NAVD88 (Geoid 12B), US survey feet.

5.1. Calibration Control Point Testing

Figure 11 shows the location of each bare earth calibration point for the project area. Table 6 depicts the Control Report for the LiDAR bare earth calibration points, as computed in TerraScan as a quality assurance check. Note that these results of the surface calibration are not an independent assessment of the accuracy of these project deliverables, but the statistical results do provide additional feedback as to the overall quality of the elevation surface.

5.2. Point Cloud Testing

Raw Nonvegetated Vertical Accuracy (Raw NVA): The tested Raw NVA for the dataset was found to be 0.045 meters (0.147 feet) in terms of the RMSEz. The resulting NVA stated as the 95% confidence level (RMSEz x 1.96) is 0.087 meters (0.287 feet). This dataset meets the required NVA of 0.196 meters (0.060 feet) at the 95% confidence level (according to the National Standard for Spatial Database Accuracy (NSSDA)), based on TINs derived from the final calibrated and controlled LiDAR swath data. See Figure 14 and Table 6.

5.3. Digital Elevation Model (DEM) Testing

The tested Non-Vegetated Vertical Accuracy (NVA) for the dataset captured from the DEM using bi-linear interpolation to derive the DEM elevations was found to be # meters (# feet) in terms of the RMSEz. The resulting accuracy stated as the 95% confidence level (RMSEz x 1.96) is # meters (# feet). This dataset meets the required NVA of 0.196 meters (0.643 feet) at the 95% confidence level (based on NSSDA). See Figure 15 and Table 7.

The tested Vegetated Vertical Accuracy (VVA) for the dataset captured from the DEM using bi-linear interpolation for all classes (including the bare earth class) was found to be 0.184 meters (0.604 feet), which is stated in terms of the 95th percentile error. Therefore the data meets the required VVA of 0.184 meters (0.604 feet). This test was based on the 95th percentile error (based on ASPRS guidelines) across all land cover categories. See Figure 16 and Table 8.

Figure 13. Calibration Control Point Locations

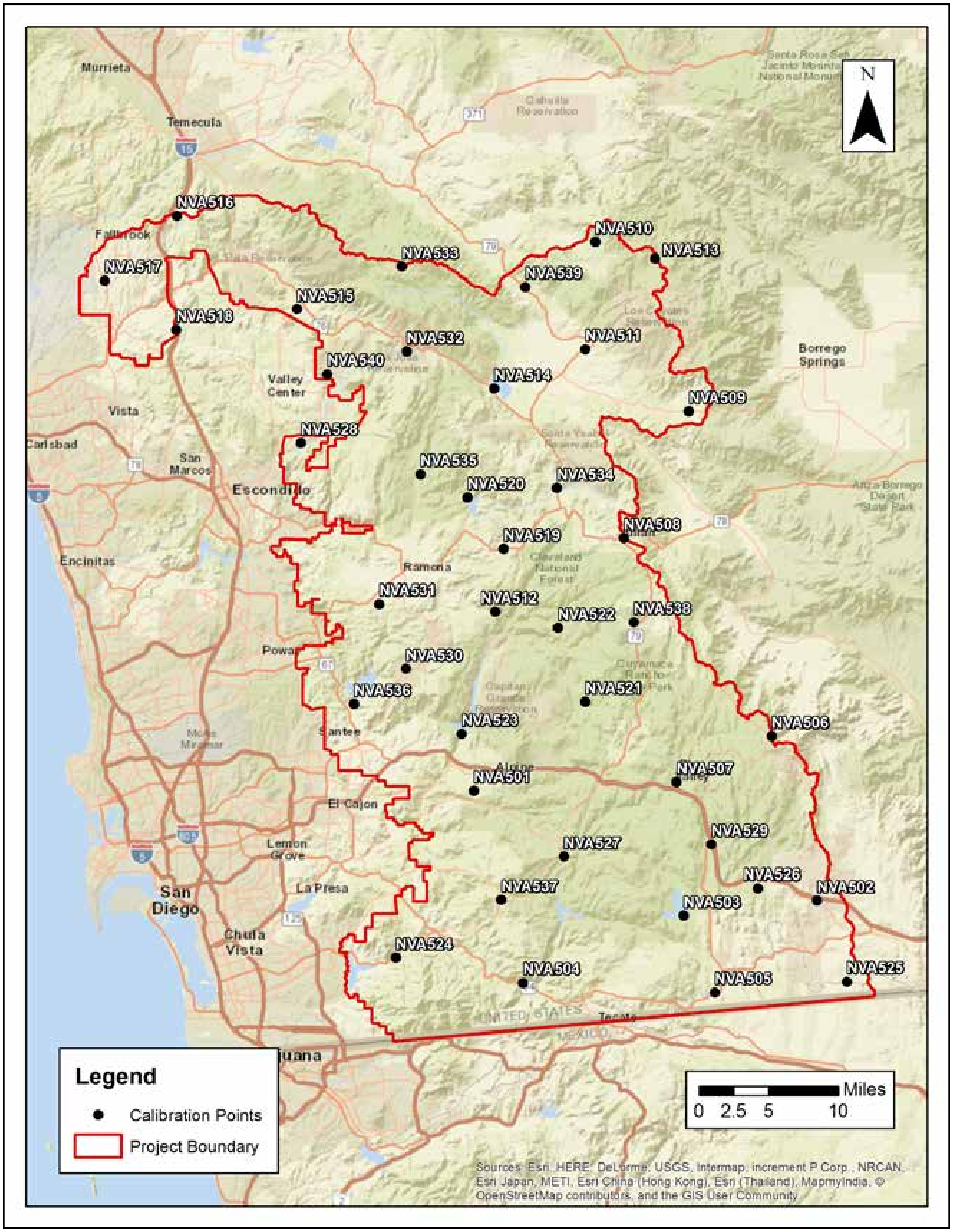


Table 5. Calibration Control Point Report

Units = US survey feet

Number	Easting	Northing	Known Z	Laser Z	Dz
NVA501	6398884.191	1876733.532	1810.15	1810.1	-0.05
NVA502	6528821.481	1835195.149	4139.87	4139.89	0.02
NVA503	6478251.828	1829346.948	3044.42	3044.26	-0.16
NVA504	6417540.022	1804041.914	1023.29	removed	*
NVA505	6490078.832	1800371.819	2482.96	2483.08	0.12
NVA506	6511737.687	1897307.494	6044.43	6044.23	-0.2
NVA507	6475601.38	1879969.496	3717.35	3717.15	-0.2
NVA508	6455742.463	1972182.261	4235.69	4235.72	0.03
NVA509	6480331.333	2020256.338	4072.8	4072.72	-0.08
NVA510	6444895.934	2084314.116	4665.38	4665.2	-0.18
NVA511	6441120.21	2043720.777	3045.05	3045.05	0
NVA512	6406952.046	1944408.011	1725.8	1725.9	0.1
NVA513	6467478.206	2077974.103	4872.32	4872.01	-0.31
NVA514	6406640.057	2028819.844	2713.6	2713.66	0.06
NVA515	6331946.739	2058808.511	746.54	746.53	-0.01
NVA516	6286464.407	2094112.851	1062.53	1062.54	0.01
NVA517	6259193.211	2069693.585	472.5	472.48	-0.02
NVA518	6286156.992	2051135.038	794.61	794.61	0
NVA519	6410102.61	1968164.843	2494.25	2494.44	0.19
NVA520	6396493.704	1987585.2	2064.57	2064.82	0.25
NVA521	6441091.204	1910382.74	3132.56	3132.41	-0.15
NVA522	6430699.536	1938284.149	2939	2939.06	0.06
NVA523	6394220.581	1898168.374	720.51	720.56	0.05
NVA524	6369433.208	1813505.754	558.56	558.6	0.04
NVA525	6539986.454	1804460.766	3630.01	3630.04	0.03
NVA526	6506319.544	1839817.937	3415.78	3415.75	-0.03
NVA527	6432916.568	1851813.186	2479.88	2479.76	-0.12
NVA528	6333515.051	2008240.034	1525.77	1525.91	0.14
NVA529	6488871.496	1856496.862	3252.84	3252.73	-0.11

Number	Easting	Northing	Known Z	Laser Z	Dz
NVA530	6373167.141	1922849.088	1337.05	1337.19	0.14
NVA531	6363112.121	1947301.185	1429.84	1429.92	0.08
NVA532	6373411.159	2042837.173	2218.26	2218.05	-0.21
NVA533	6371658.08	2074935.443	5443.99	5443.99	0
NVA534	6430292.875	1991177.712	2944.51	2944.3	-0.21
NVA535	6378679.201	1996445.875	1027.13	1027.4	0.27
NVA536	6353504.977	1909540.145	451.46	451.72	0.26
NVA537	6409285.474	1835486.816	2623.78	2623.73	-0.05
NVA538	6459550.919	1940424.758	4653.49	4653.5	0.01
NVA539	6418327.673	2067295.323	3094.79	3094.79	0
NVA540	6343487.848	2034302.297	991.26	991.5	0.24
	Average Dz	0.00 ft			
	Minimum Dz	-0.312 ft			
	Maximum Dz	0.27 ft			
	Root Mean Square	0.139 ft			
	Std. Deviation	0.141 ft			

Figure 14. QC Checkpoint Locations - Raw NVA

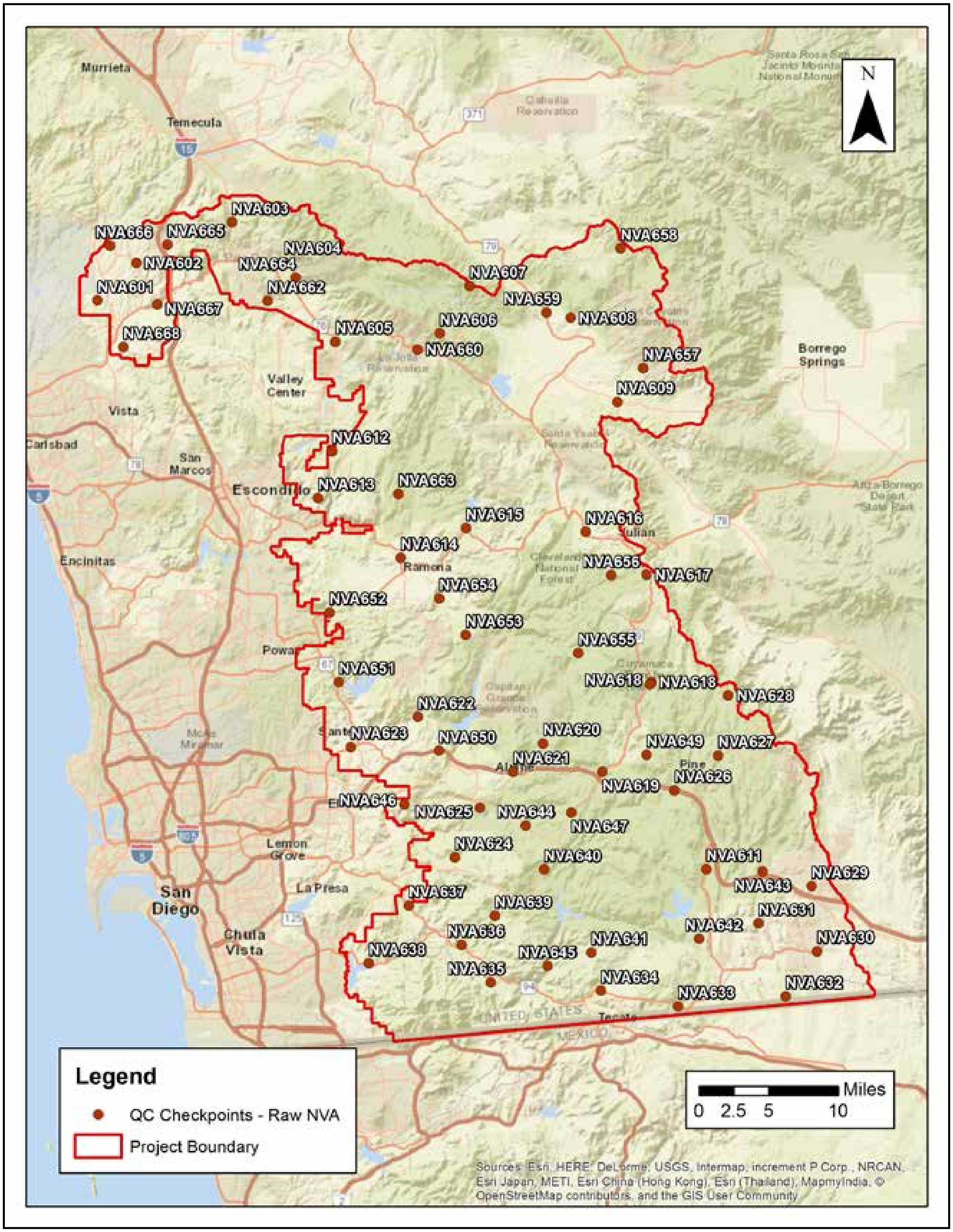


Table 6. QC Checkpoint Report - Raw NVA

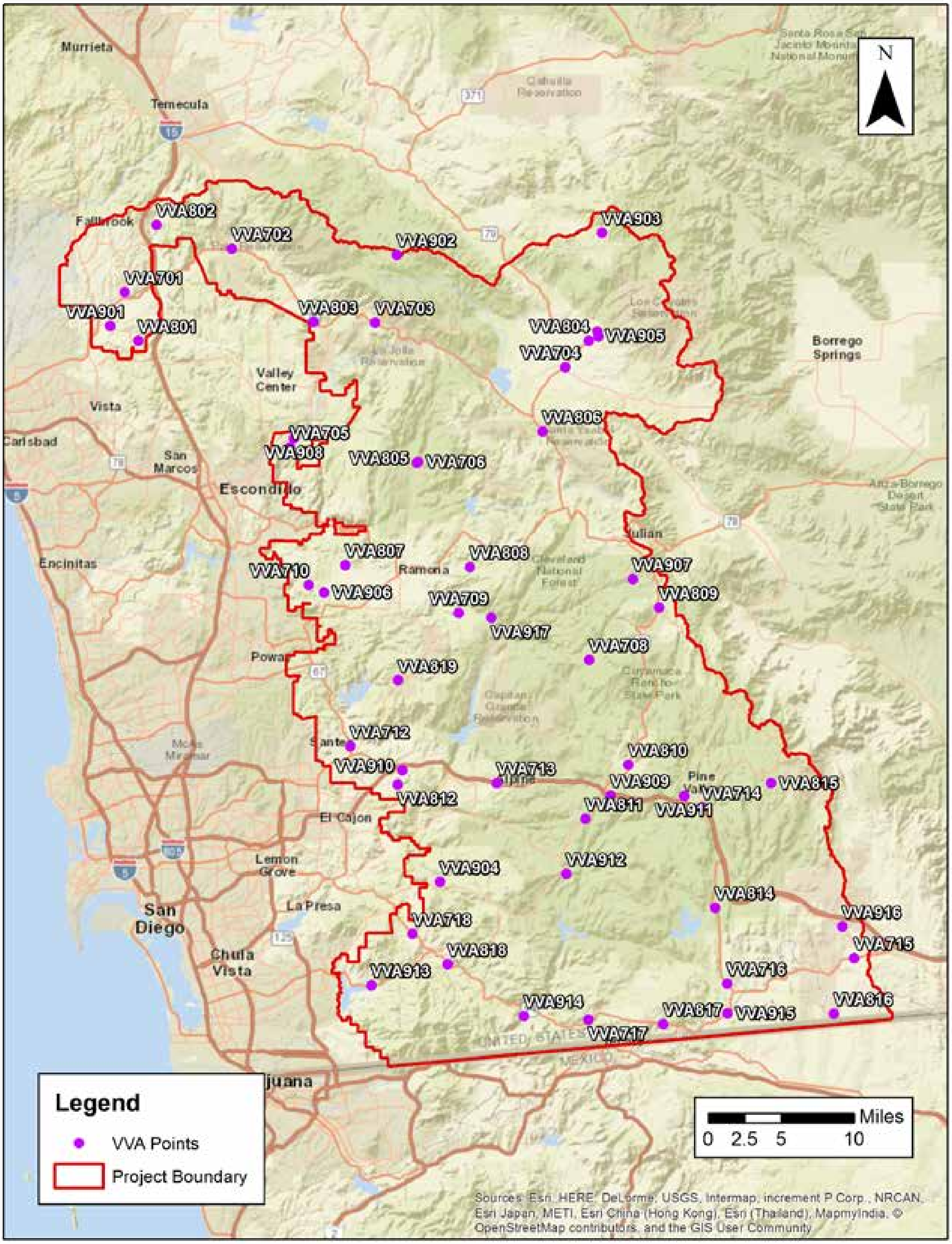
Units = US survey feet

Number	Easting	Northing	Known Z	Laser Z	Dz
NVA601	6256462.32	2062162.163	524.83	524.87	0.037
NVA602	6271173.346	2076426.527	544.29	544.21	-0.077
NVA603	6307328.911	2091828.175	864.06	864.15	0.095
NVA604	6327144.91	2076714.468	1109.34	1109.45	0.11
NVA605	6346475.926	2046513.192	944.64	944.97	0.334
NVA606	6386022.887	2049642.925	4637.87	4637.89	0.018
NVA607	6397388.141	2067629.101	5154.4	5154.43	0.029
NVA608	6435459.878	2055607.392	2980.22	2980.14	-0.077
NVA609	6453189.724	2023791.462	3351.92	3351.9	-0.017
NVA611	6486801.872	1846988.974	3145.61	3145.52	-0.089
NVA612	6345266.674	2005150.67	1911.47	1911.62	0.151
NVA613	6339966.61	1987411.414	1548.06	1548.03	-0.033
NVA614	6371176.962	1964780.074	1537.49	1537.74	0.255
NVA615	6395861.32	1976006.041	2303.17	2303.41	0.242
NVA616	6441194.97	1974587.714	3632.27	3632.42	0.15
NVA617	6464216.811	1958323.931	4681.61	4681.8	0.195
NVA618	6466038.908	1917741.072	4112.41	4112.21	-0.198
NVA619	6447538.983	1883797.035	3316.2	3316.18	-0.02
NVA620	6425112.544	1894532.844	2508.29	2508.22	-0.071
NVA621	6413819.266	1883906.857	2191.82	2191.85	0.031
NVA622	6377638.858	1904594.822	505.78	505.93	0.154
NVA623	6352309.861	1893313.847	385.57	385.71	0.145
NVA624	6391722.754	1851465.008	1933.15	1933.06	-0.086
NVA625	6401276.976	1870299.818	1681.54	1681.6	0.059
NVA626	6474789.679	1876860.298	3882.44	3882.47	0.031
NVA627	6491398.697	1889967.903	5081.93	5082.06	0.127
NVA628	6495196.63	1912771.992	5340.35	5340.22	-0.127
NVA629	6526772.29	1840629.207	4336.49	4336.29	-0.198
NVA630	6528764.591	1815973.796	3392.44	3392.45	0.013
NVA631	6506669.596	1826537.492	3225.08	3224.97	-0.107
NVA632	6516935.808	1798955.702	3519.05	3518.94	-0.11
NVA633	6476237.915	1795154.265	2206.1	2206.16	0.059

Number	Easting	Northing	Known Z	Laser Z	Dz
NVA634	6447046.63	1801040.399	2288.28	2288.13	-0.154
NVA635	6405276.219	1804132.368	1431.7	1431.79	0.091
NVA636	6394268.24	1818338.567	863.47	863.49	0.017
NVA637	6374371.195	1833237.842	818.52	818.55	0.034
NVA638	6359159.557	1811410.813	512.37	512.28	-0.087
NVA639	6406856.546	1829377.113	2116.43	2116.18	-0.253
NVA640	6425562.643	1846901.278	2222.56	2222.57	0.009
NVA641	6443399.374	1815461.655	2588.32	2588.38	0.065
NVA642	6484206.602	1820652.378	3073.11	3073.13	0.023
NVA643	6508154.303	1846103.967	3378.61	3378.53	-0.082
NVA644	6418496.661	1863539.739	2049.41	2049.63	0.221
NVA645	6426763.451	1810398.446	912.49	912.51	0.022
NVA646	6372674.467	1871530.302	1513.01	1513.22	0.208
NVA647	6435772.949	1868362.333	2826.76	2826.74	-0.023
NVA649	6464224.951	1890249.661	3870.64	3869.57	-1.066
NVA650	6385617.879	1891825.806	1279.42	1279.55	0.134
NVA651	6347757.279	1917828.016	1082.22	1082.31	0.093
NVA652	6344350.196	1944087.34	1842.21	1842.37	0.161
NVA653	6395850.973	1935590.098	1947.3	1947.18	-0.118
NVA654	6385842.921	1949330.164	1446.75	1446.7	-0.054
NVA655	6438428.83	1928767.035	3151.58	3151.47	-0.106
NVA656	6450949.222	1958193.127	4386.68	4386.6	-0.078
NVA657	6462963.24	2036485.349	3881.09	3881.04	-0.052
NVA658	6454404.094	2081851.185	4922.95	4922.78	-0.169
NVA659	6426348.075	2057637.559	2927.53	2927.61	0.077
NVA660	6377533.231	2043604.592	2193.97	2193.69	-0.278
NVA662	6320846.734	2062077.031	999.08	999.03	-0.047
NVA663	6370374.024	1988927	1668.8	1669.02	0.216
NVA664	6331389.656	2070822.861	1182.57	1182.73	0.162
NVA665	6282895.743	2083319.881	531.62	531.89	0.269
NVA666	6261153.143	2082847.808	738.22	738.56	0.341
NVA667	6279157.478	2060649.955	245.64	245.54	-0.096
NVA668	6266314.626	2044479.011	596.37	596.03	-0.338
NVA618	6465561.863	1916996.536	4144.48	4144.29	-0.187

Number	Easting	Northing	Known Z	Laser Z	Dz
	Average Dz	0.02 ft			
	Minimum Dz	-0.338 ft			
	Maximum Dz	0.341 ft			
	Root Mean Square	0.147 ft			
	95% Confidence Level	0.287 ft			

Figure 15. QC Checkpoint Locations - VVA



Project Report Appendices

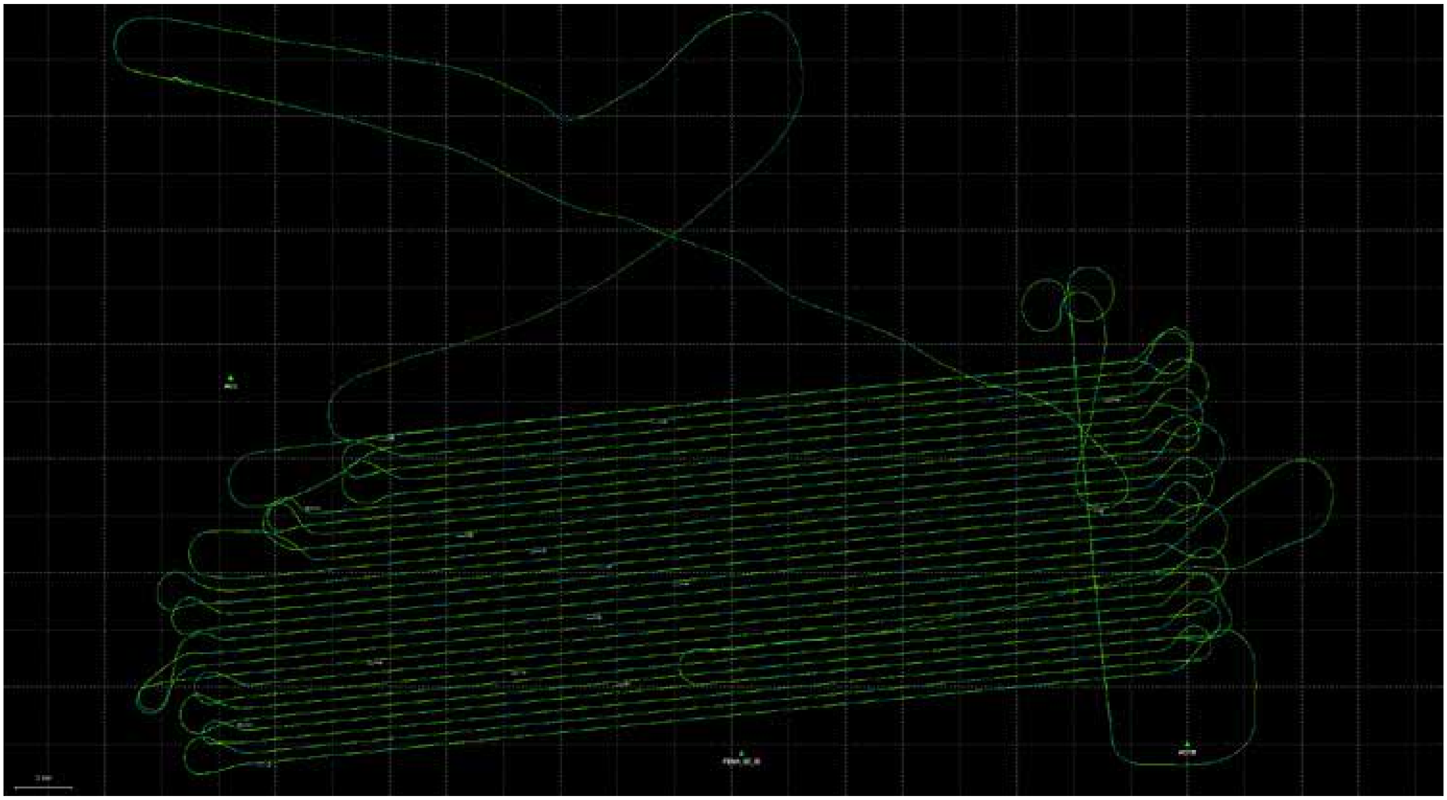
The following section contains the appendices as listed in the San Diego County, CA FEMA Region IX 2016 QL2 LiDAR Project Report.

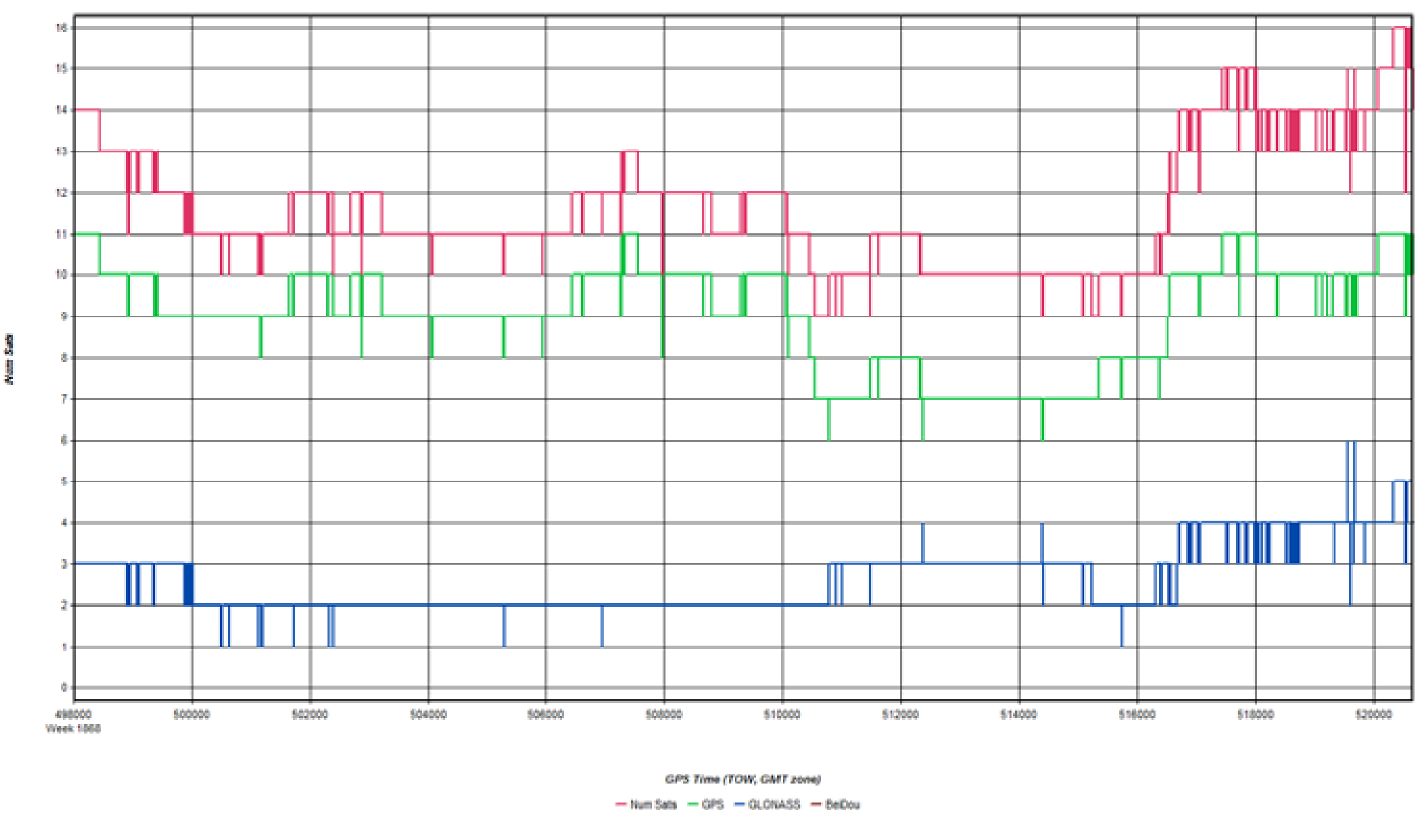
Appendix A

GPS/IMU Processing Statistics
Flight Logs

There were 23 total lifts. Graph reports generated from processing software and flight logs are found on the following pages.

Oct 30, 2015-A

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GPS Time (TOW, GMT zone)
Week 1868
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500000
502000
504000
506000
508000
510000
512000
514000
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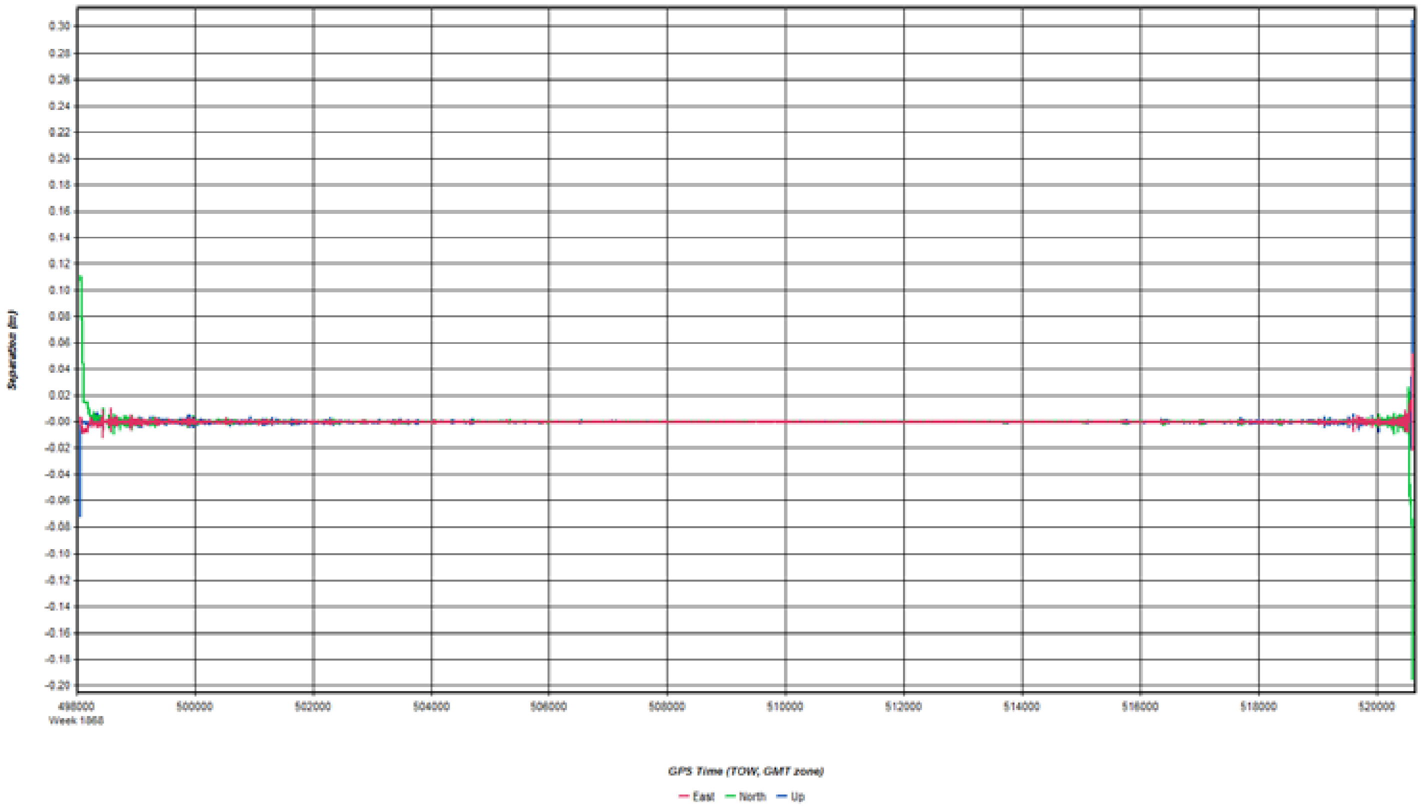
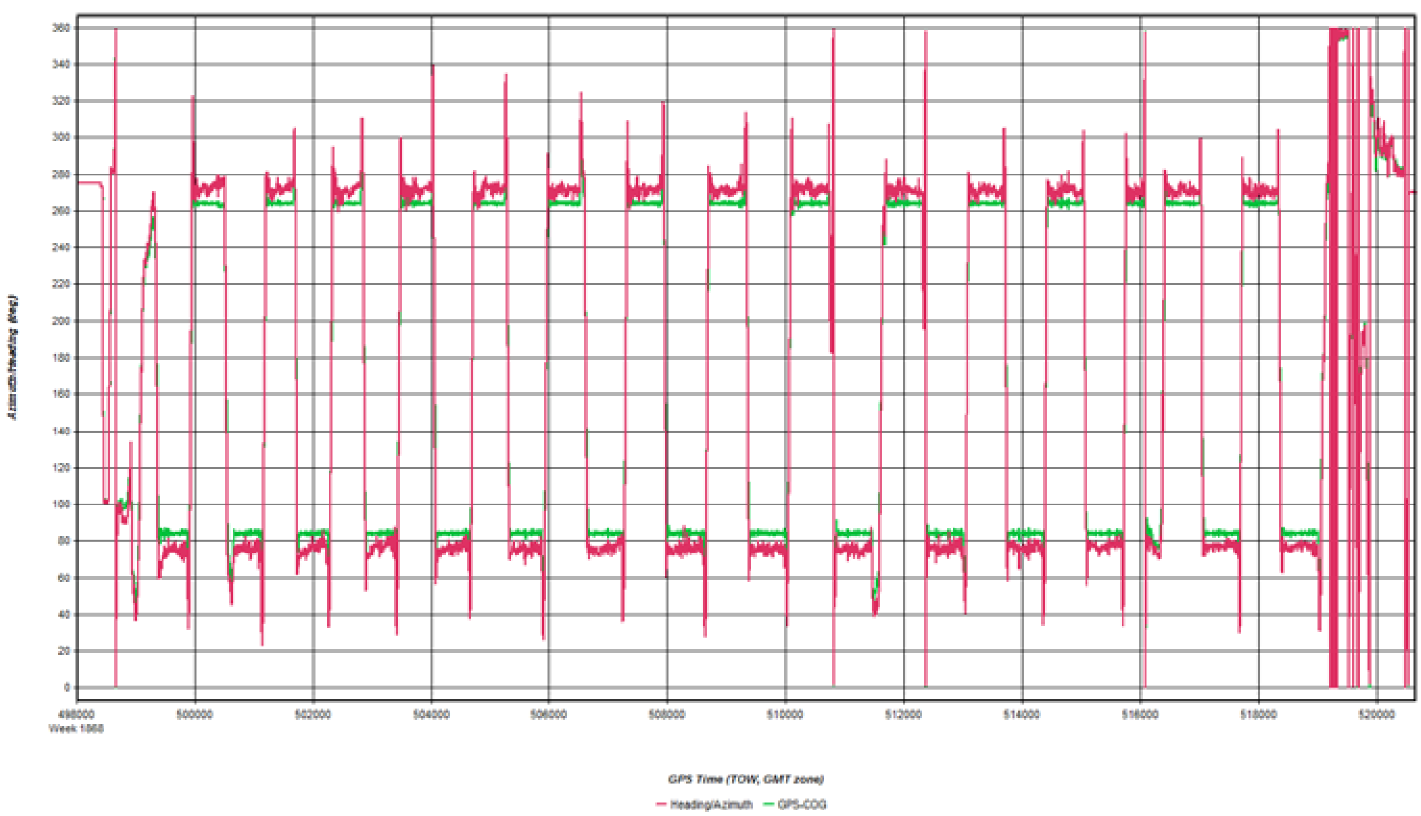
Num Sats
GPS
GLONASS
BeiDou


Separation (m)
GPS Time (TOW, GMT zone)
East
North
Up
Week 1868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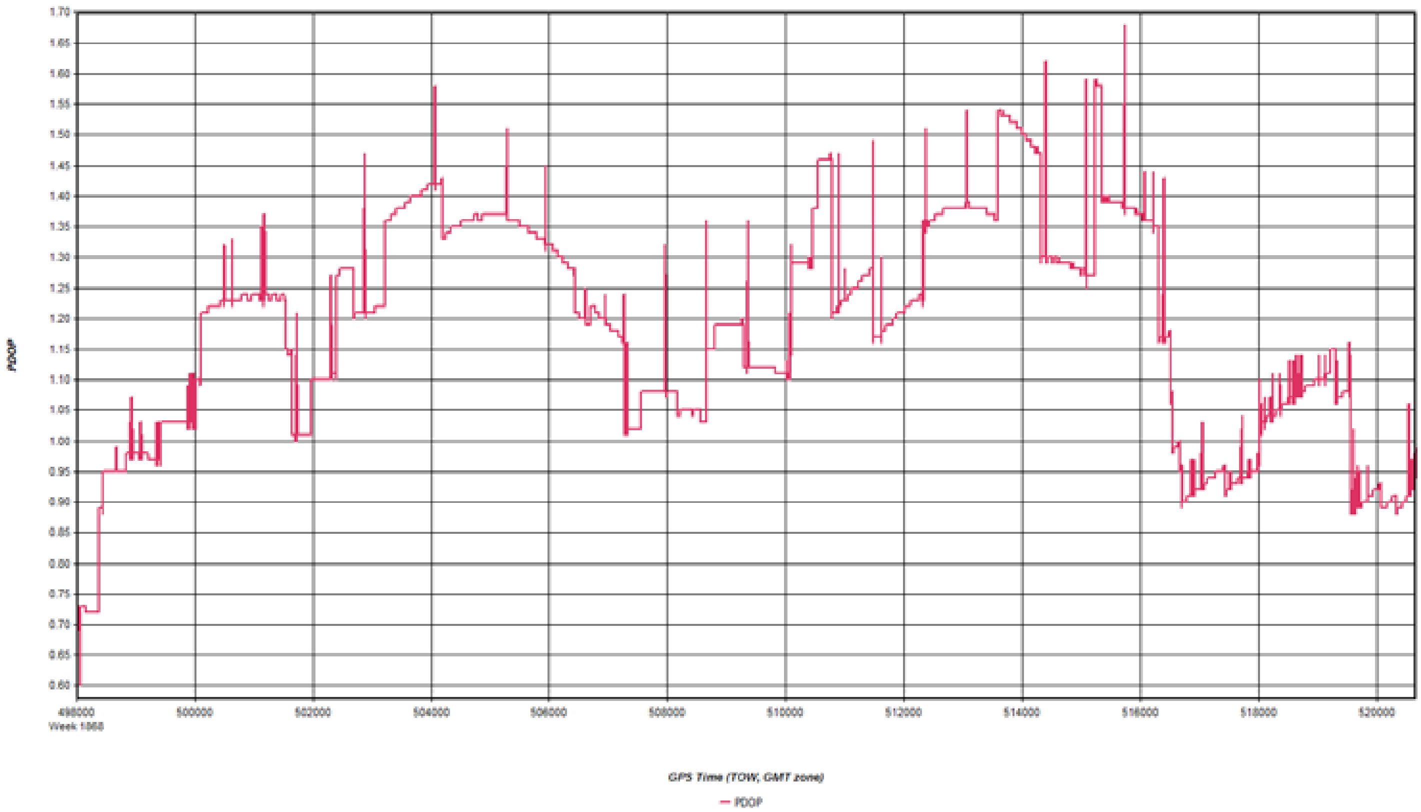
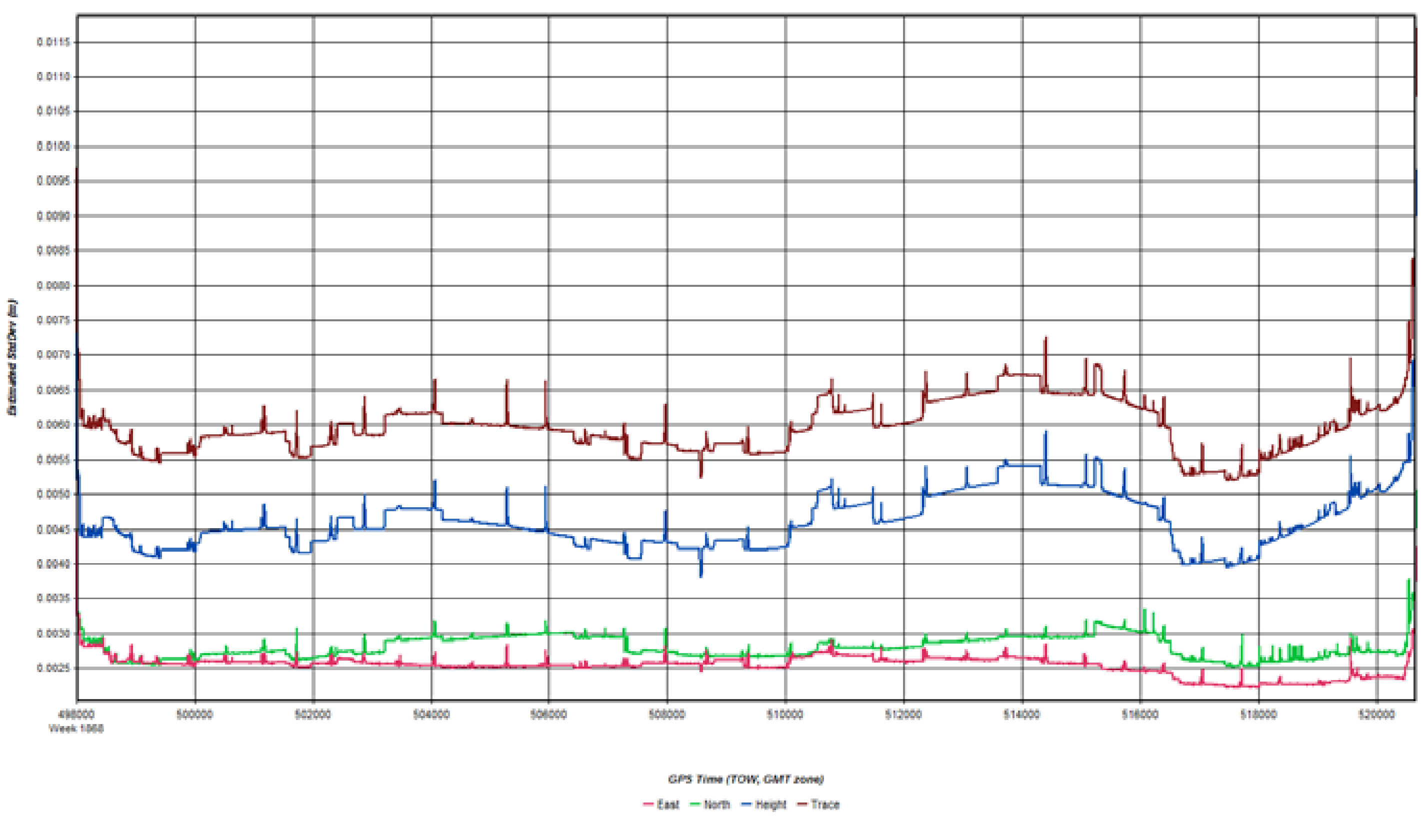
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG
Week 1868


PDOP
GPS Time (TOW, GMT zone)
Week 1868
PDOP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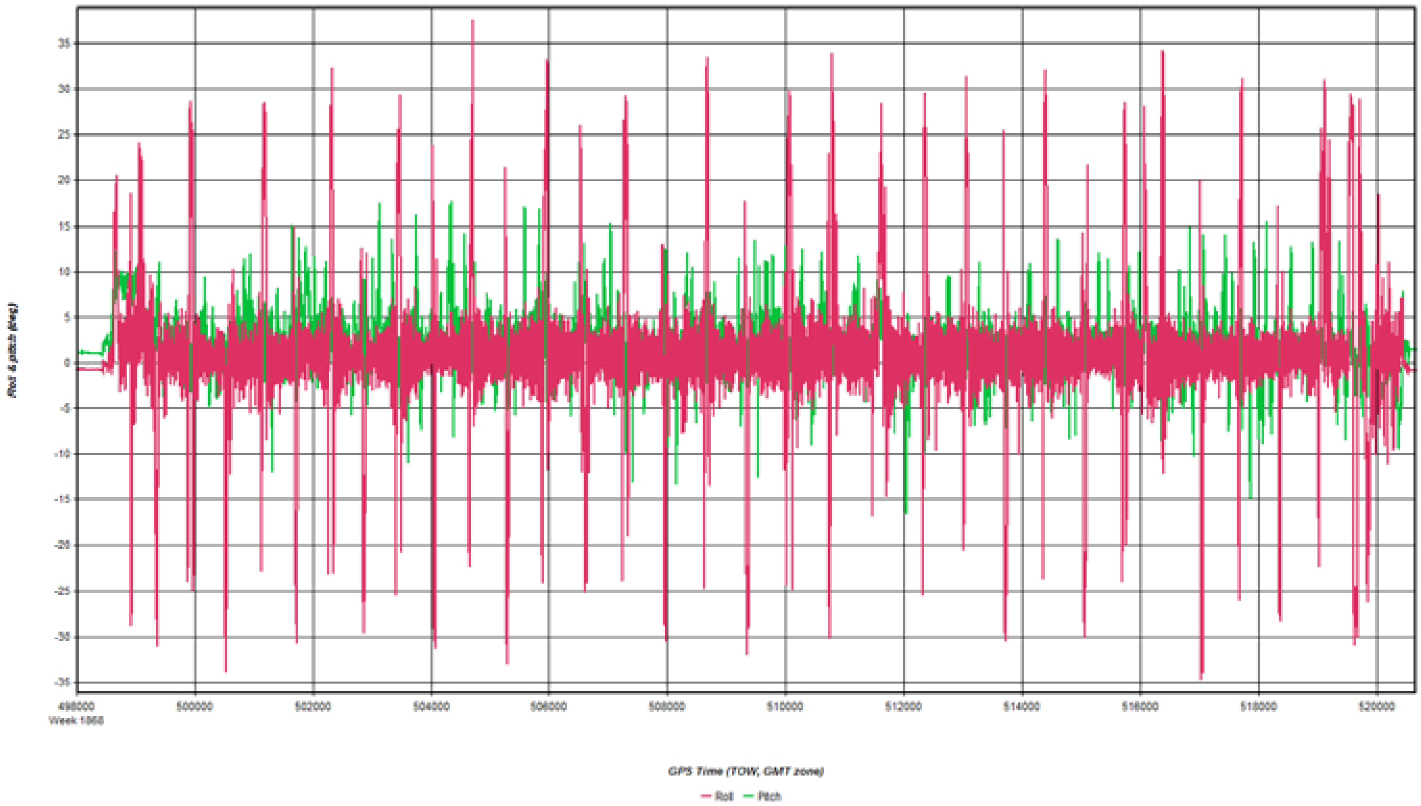
Week 1868
East
North
Height
Trace


Roll & pitch (deg)
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30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
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Week 1868
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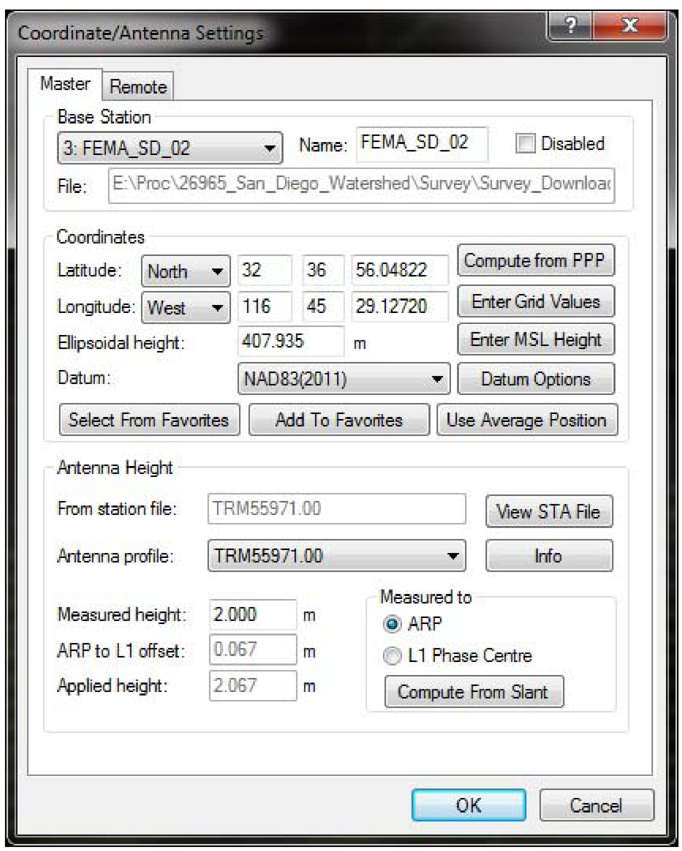
Roll
Pitch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File:
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Coordinates
Latitude:
North
32
36
56.04822
Compute from PPP
Longitude:
West
116
45
29.12720
Enter Grid Values
Ellipsoidal height:
407.935
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM55971.00
Info
Measured to
Measured height:
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m
ARP
ARP to L1 offset:
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m
L1 Phase Centre
Applied height:
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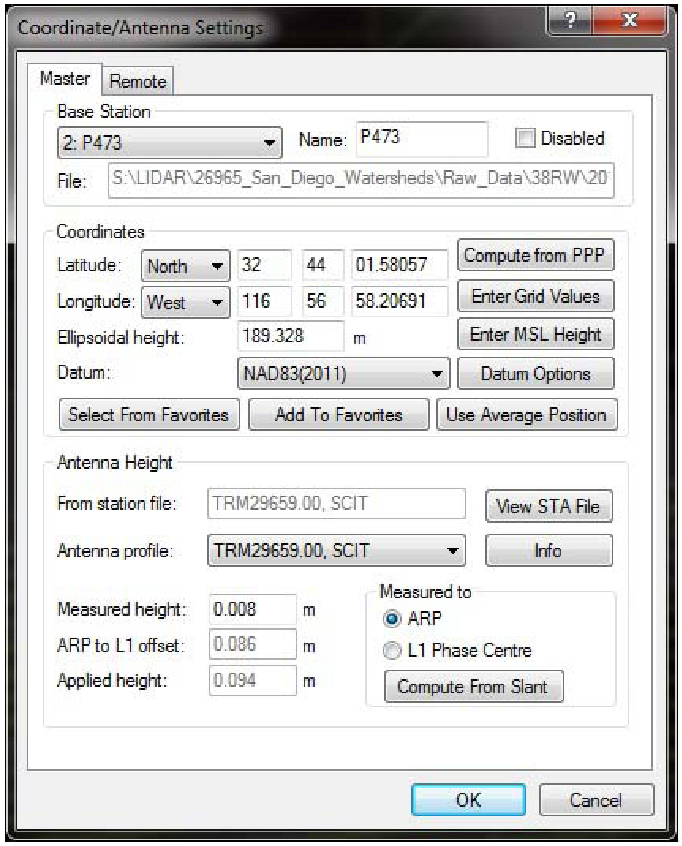
m
Compute From Slant
OK
Cancel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Remote
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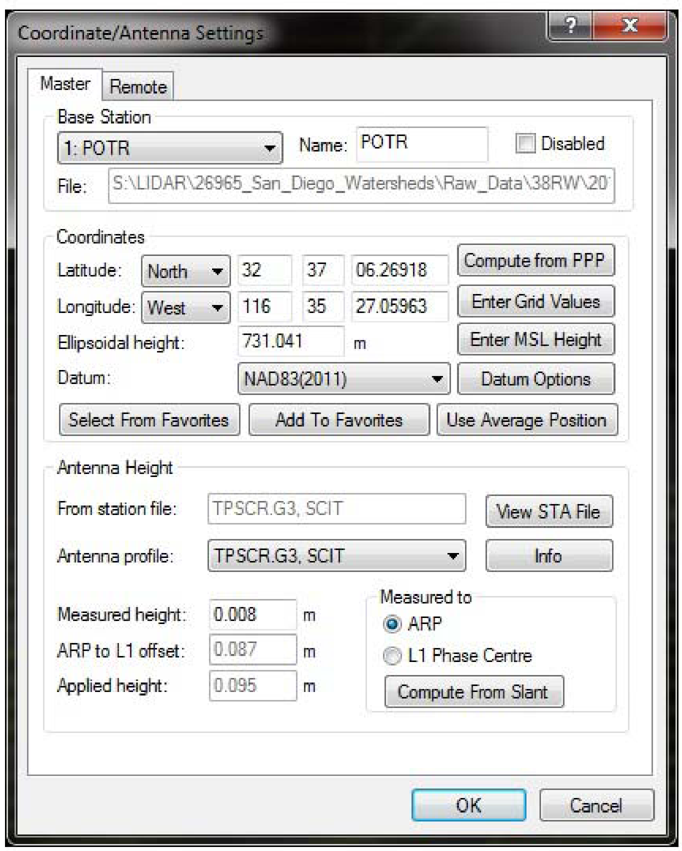
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Raw_Data\38RW\20
Coordinates
Latitude: North 32 44 01.58057
Longitude: West 116 56 58.20691
Ellipsoidal height: 189.328 m
Datum: NAD83(2011)
Compute from PPP
Enter Grid Values
Enter MSL Height
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM29659.00, SCIT
View STA File
Antenna profile: TRM29659.00, SCIT
Info
Measured height: 0.008 m
ARP to L1 offset: 0.086 m
Applied height: 0.094 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: POTR
Name: POTR
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Raw_Data\38RW\20
Coordinates
Latitude: North 32 37 06.26918
Longitude: West 116 35 27.05963
Ellipsoidal height: 731.041 m
Datum: NAD83(2011)
Compute from PPP
Enter Grid Values
Enter MSL Height
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TPSCR.G3, SCIT
View STA File
Antenna profile: TPSCR.G3, SCIT
Info
Measured height: 0.008 m
ARP to L1 offset: 0.087 m
Applied height: 0.095 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	A001
Stop Line Name	A020
Turn Time (min)	3
Buffer (%)	10
Acquisition Time (hrs)	#N/A

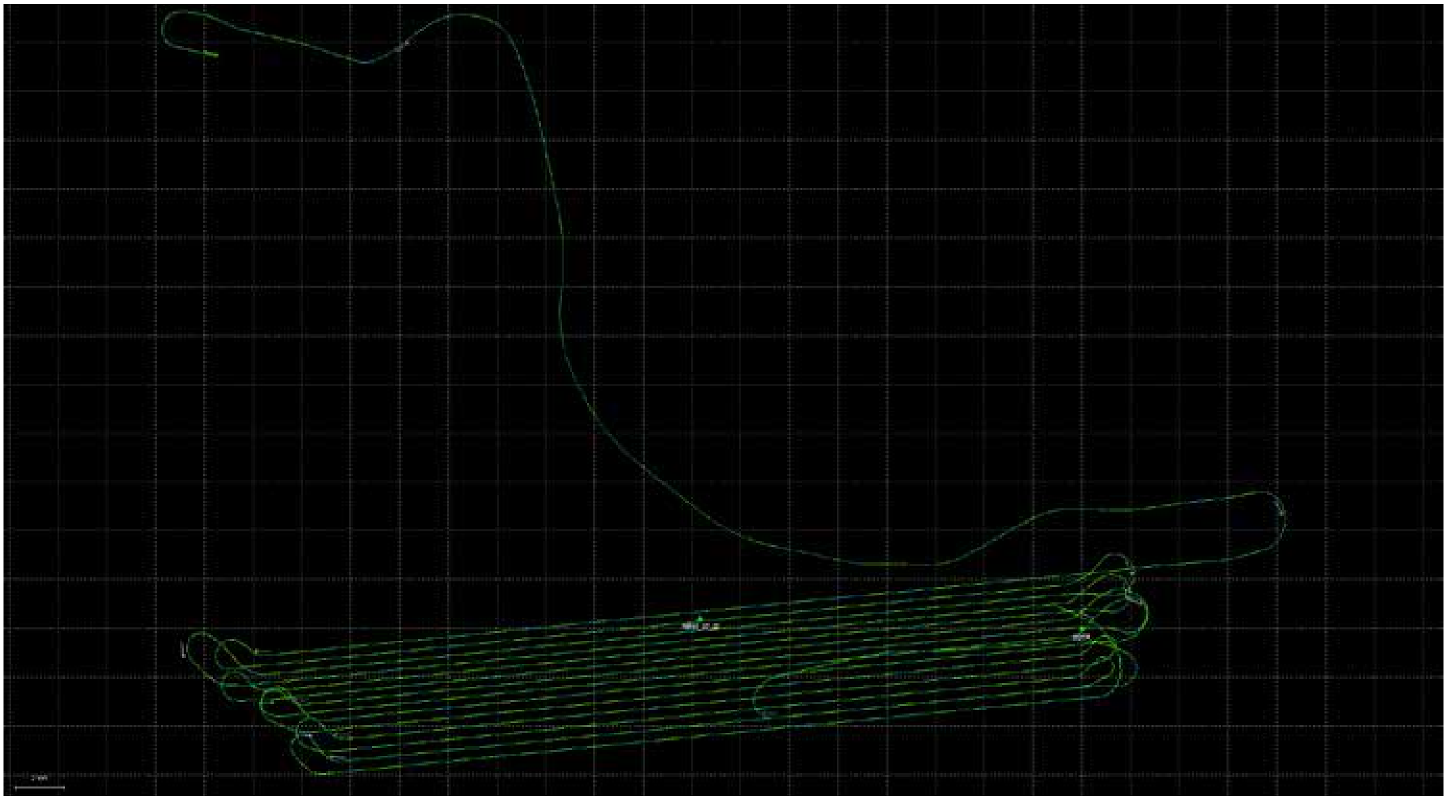
Other Acquisition Notes:

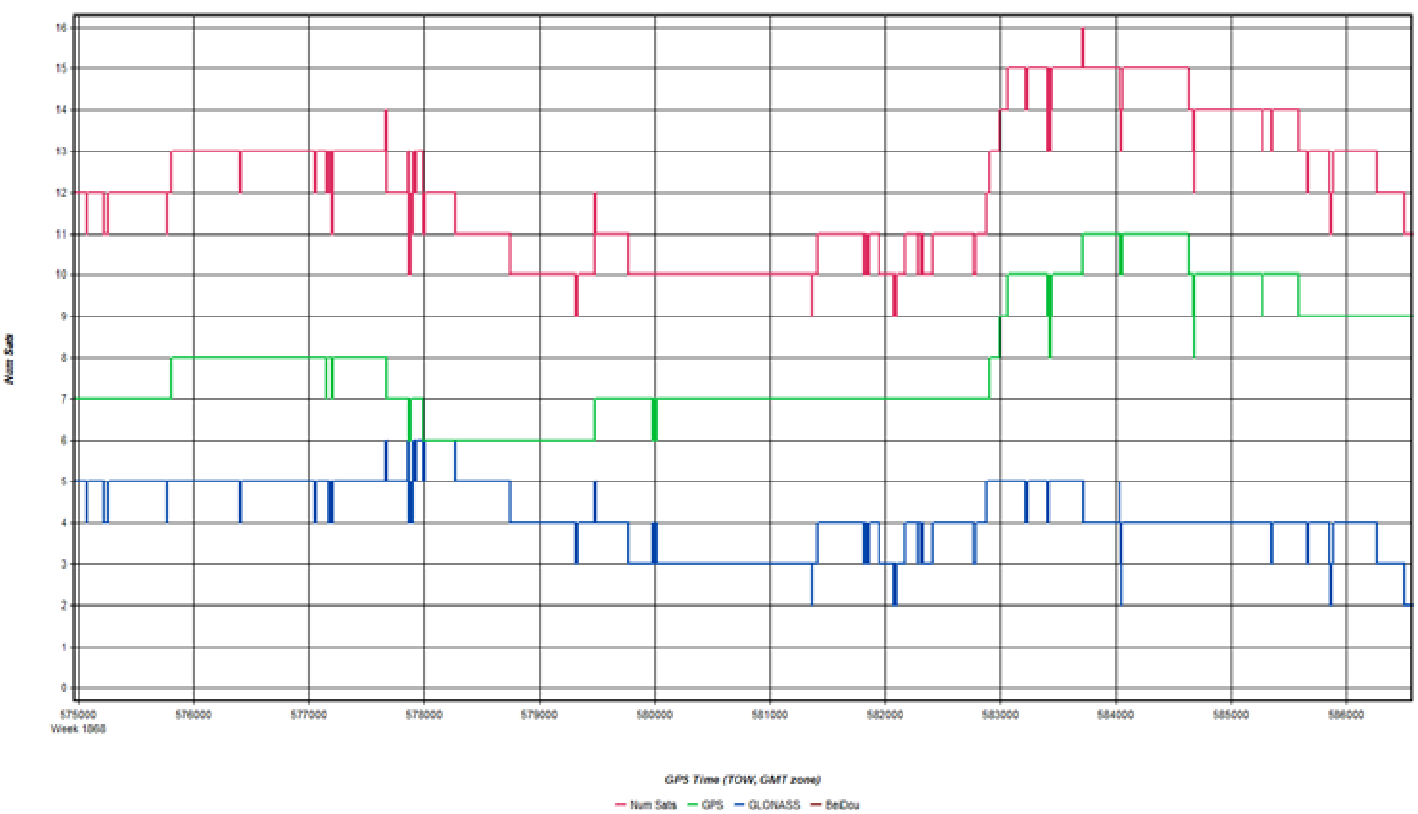
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

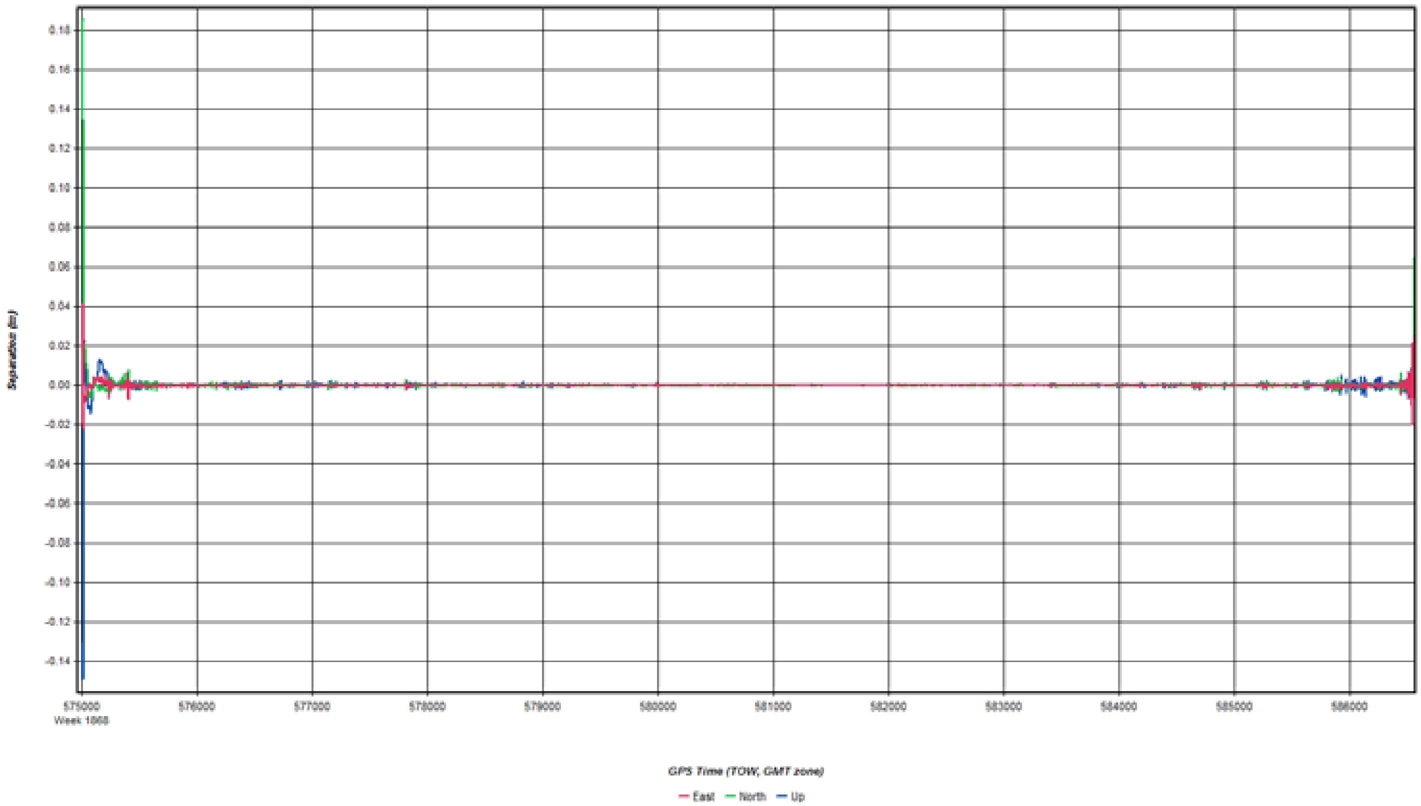
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

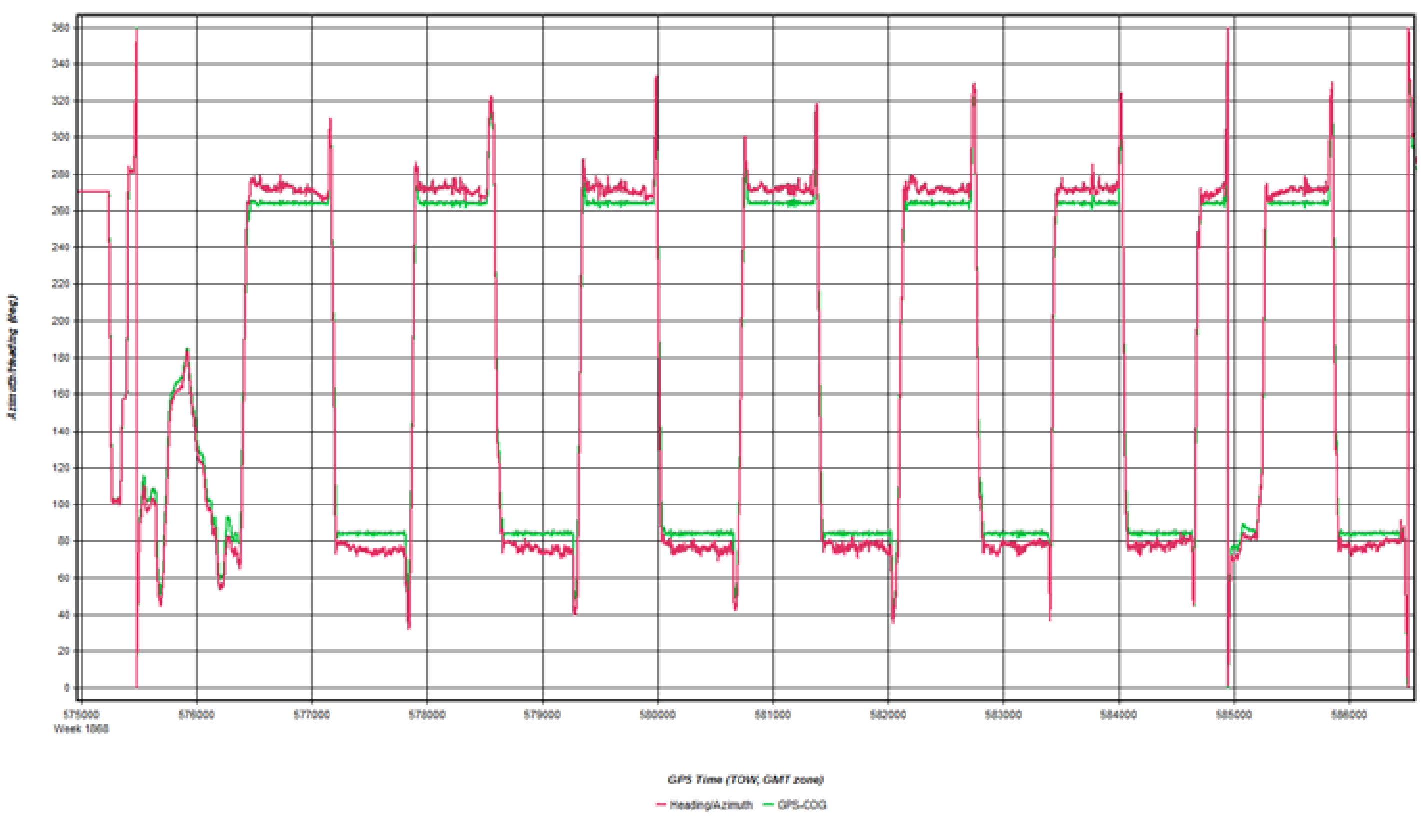
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
190	13.02	6378	184347	185259		Flew line while collecting kinematic W to E, Refly E to W
191	13.06	6336	190429			w to e
192	13.45	6316	191334			e to w
193	13.46	6293	192245			
194	13.46	6270	193235			
195	13.47	6260	194153			
196	15.02	6244	195137			
197	15.04	6224	200139			
198	15.07	6211	201210			e to w
199	15.1	6191	202221			
200	15.54	6139	203309			
201	16.67	6024	204419			
202	16.99	6017	205530			
203	17.15	6001	210645			
204	17.16	5991	211820			
205	17.28	5978	212944			w to e
206	17.29	5958	214151			
207	17.29	5932	215422			
208	17.3	5932	220840			
209	17.3	5932	222016			Crossline: 001311
210	16.97	5925	223147			
211	17.03	5919	224235			
212	17.05	5919	225346			
213	17.1	5919	230457			
214	17.1	5919	231606	232707		Pulled off line for traffic e to w, refly e to w
215	17.15	5925	233742			
216	17.15	5925	234845			
217	17.17	5850	235956			Final Line W to E

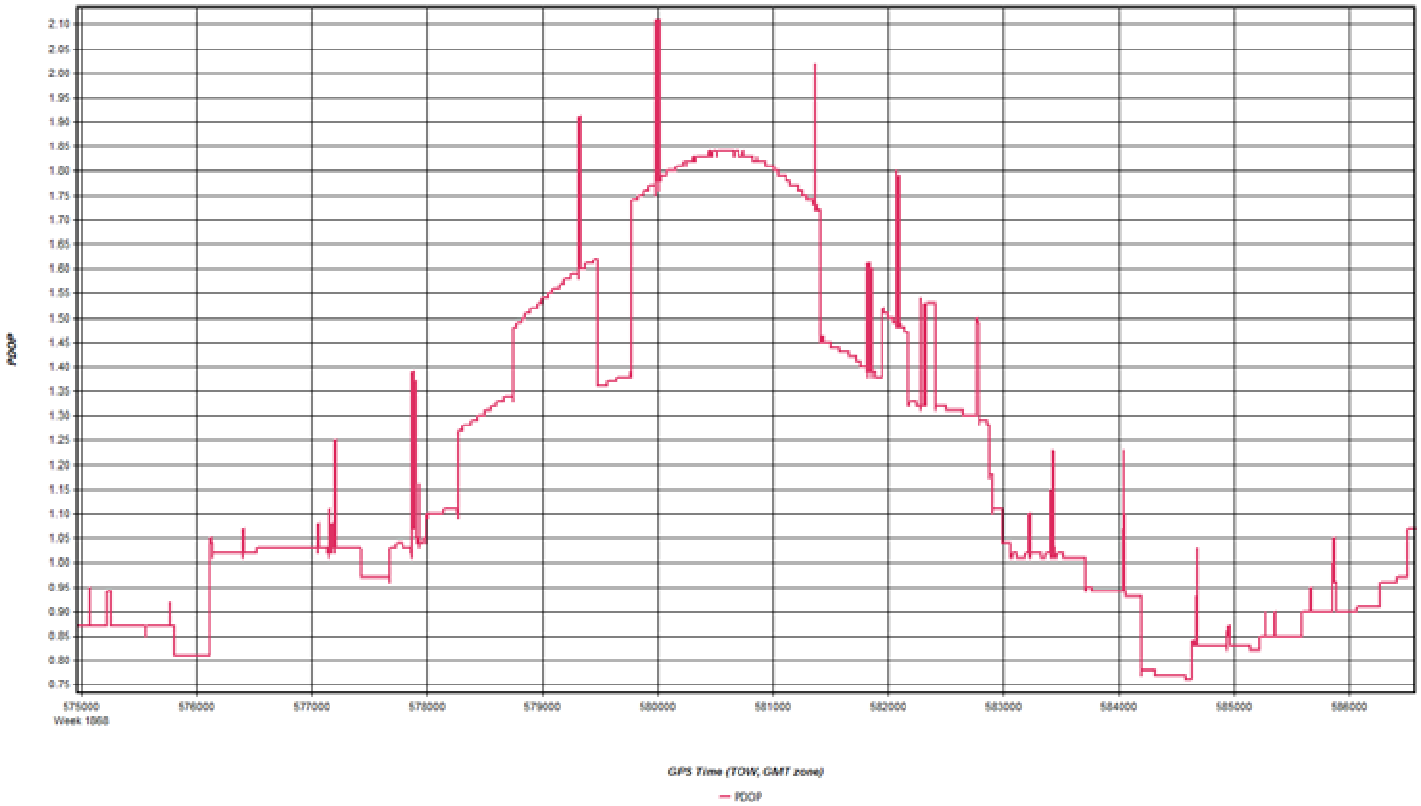
Oct 31, 2015-A

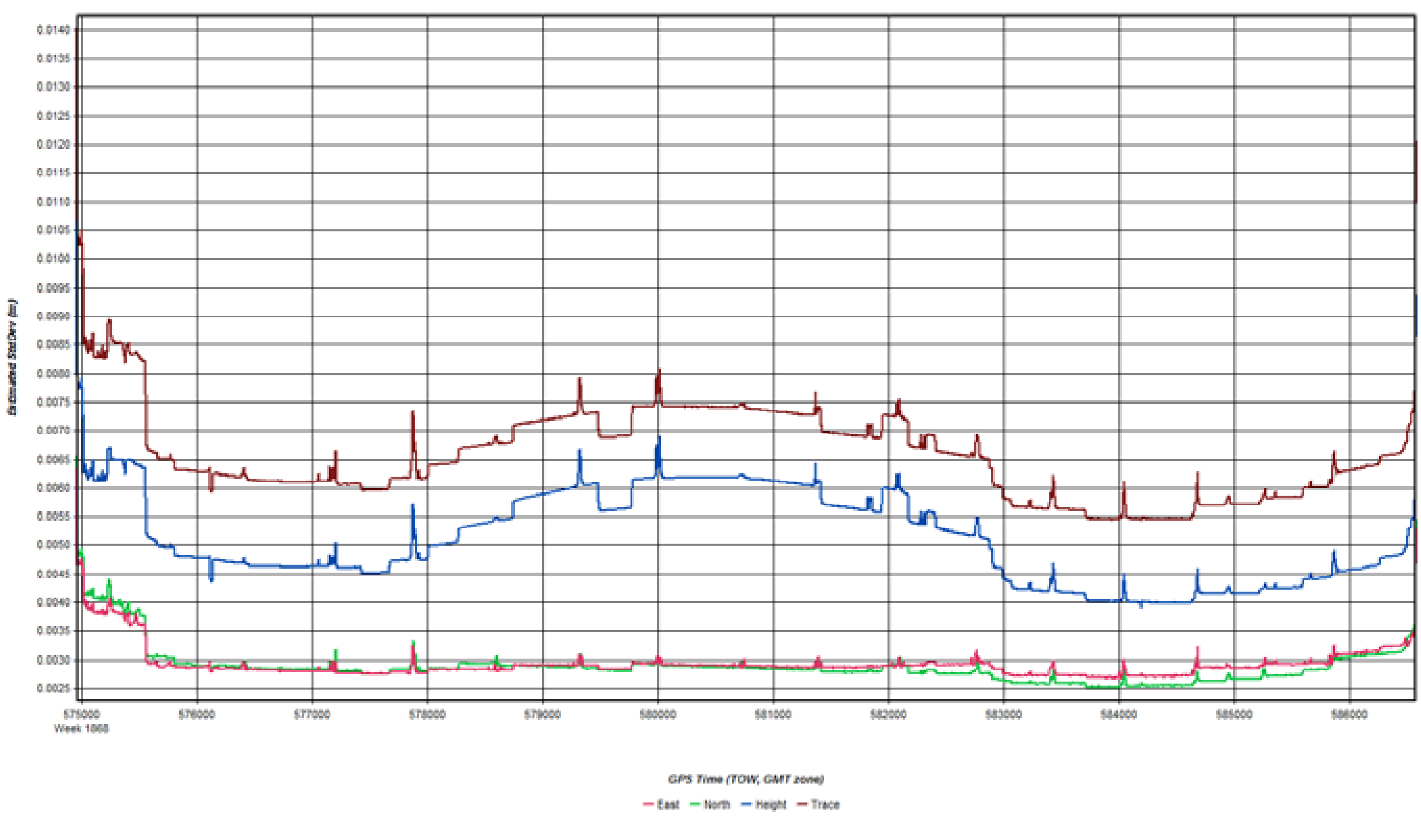



16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
575000
Week 1868
576000
577000
578000
579000
580000
581000
582000
583000
584000
585000
586000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

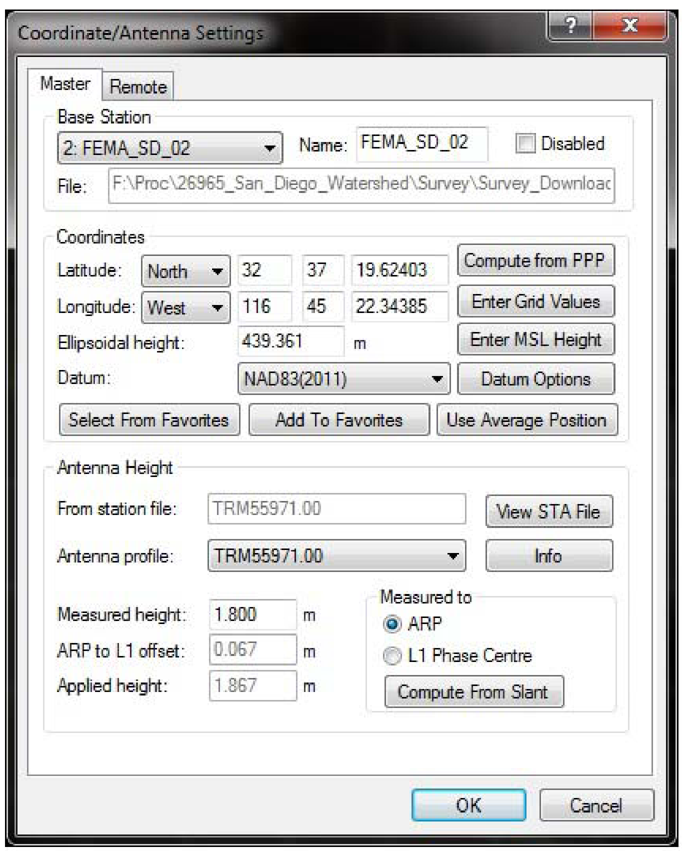

Separation (m)
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
575000
Week 1868
576000
577000
578000
579000
580000
581000
582000
583000
584000
585000
586000
GPS Time (TOW, GMT zone)
East
North
Up


Azimuth/Heading (deg)
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
575000
Week 1868
576000
577000
578000
579000
580000
581000
582000
583000
584000
585000
586000
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG

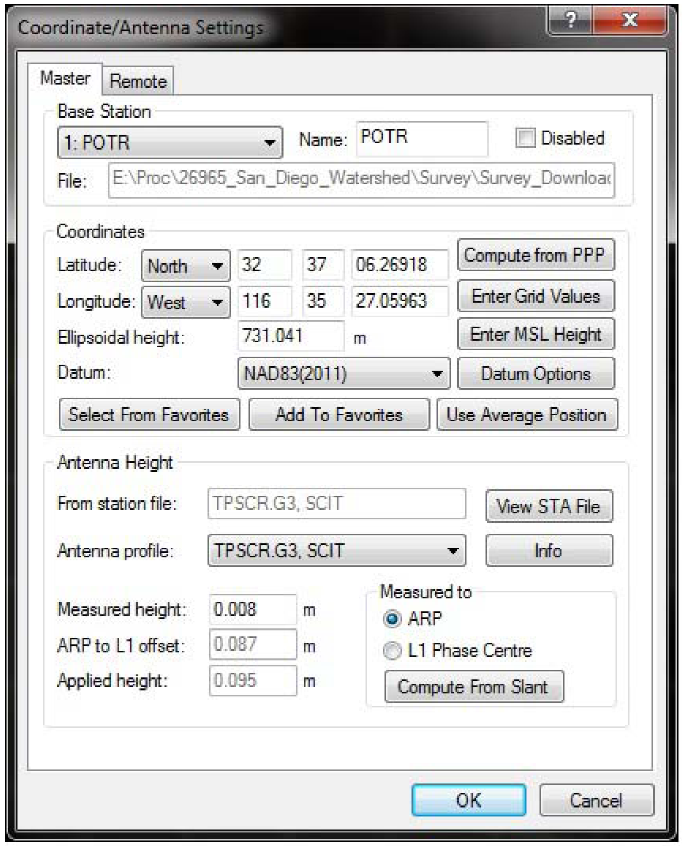

PDOP
GPS Time (TOW, GMT zone)
Week 1868
PDOP


Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1868
East
North
Height
Trace

Roll & pitch (deg)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
575000
Week 1068
576000
577000
578000
579000
580000
581000
582000
583000
584000
585000
586000
GPS Time (TOW, GMT zone)
Roll
Pitch



Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_02
Name:
FEMA_SD_02
Disabled
File:
F:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude:
North
32
37
19.62403
Compute from PPP
Longitude:
West
116
45
22.34385
Enter Grid Values
Ellipsoidal height:
439.361
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM55971.00
Info
Measured height:
1.800
m
ARP to L1 offset:
0.067
m
Applied height:
1.867
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: POTR
Name:
POTR
Disabled
File:
E:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude:
North
32
37
06.26918
Compute from PPP
Longitude:
West
116
35
27.05963
Enter Grid Values
Ellipsoidal height:
731.041
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TPSCR.G3, SCIT
View STA File
Antenna profile:
TPSCR.G3, SCIT
Info
Measured to
ARP
L1 Phase Centre
Compute From Slant
Measured height:
0.008
m
ARP to L1 offset:
0.087
m
Applied height:
0.095
m
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	A001
Stop Line Name	A020
Turn Time (min)	3
Buffer (%)	10
Acquisition Time (hrs)	#N/A

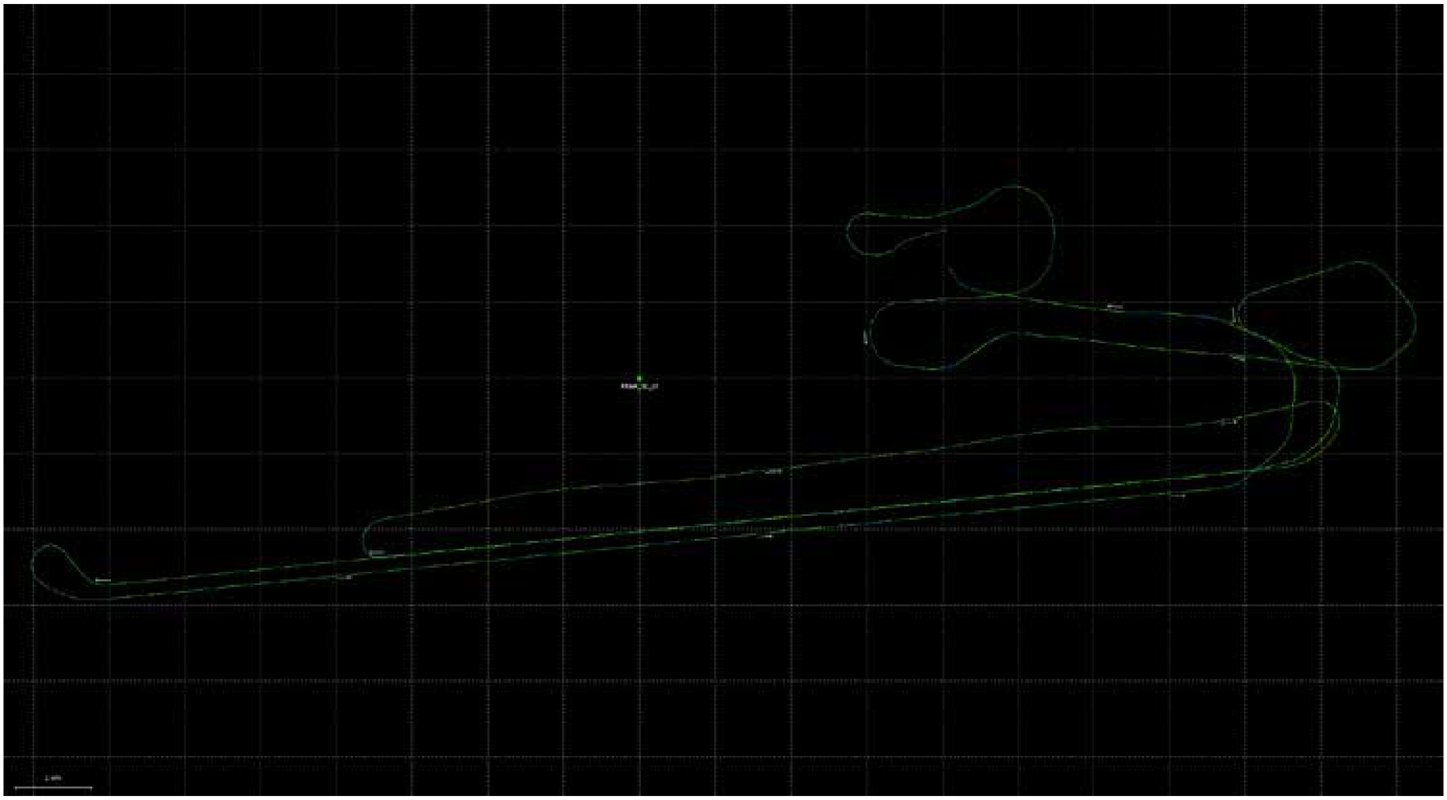
Other Acquisition Notes:

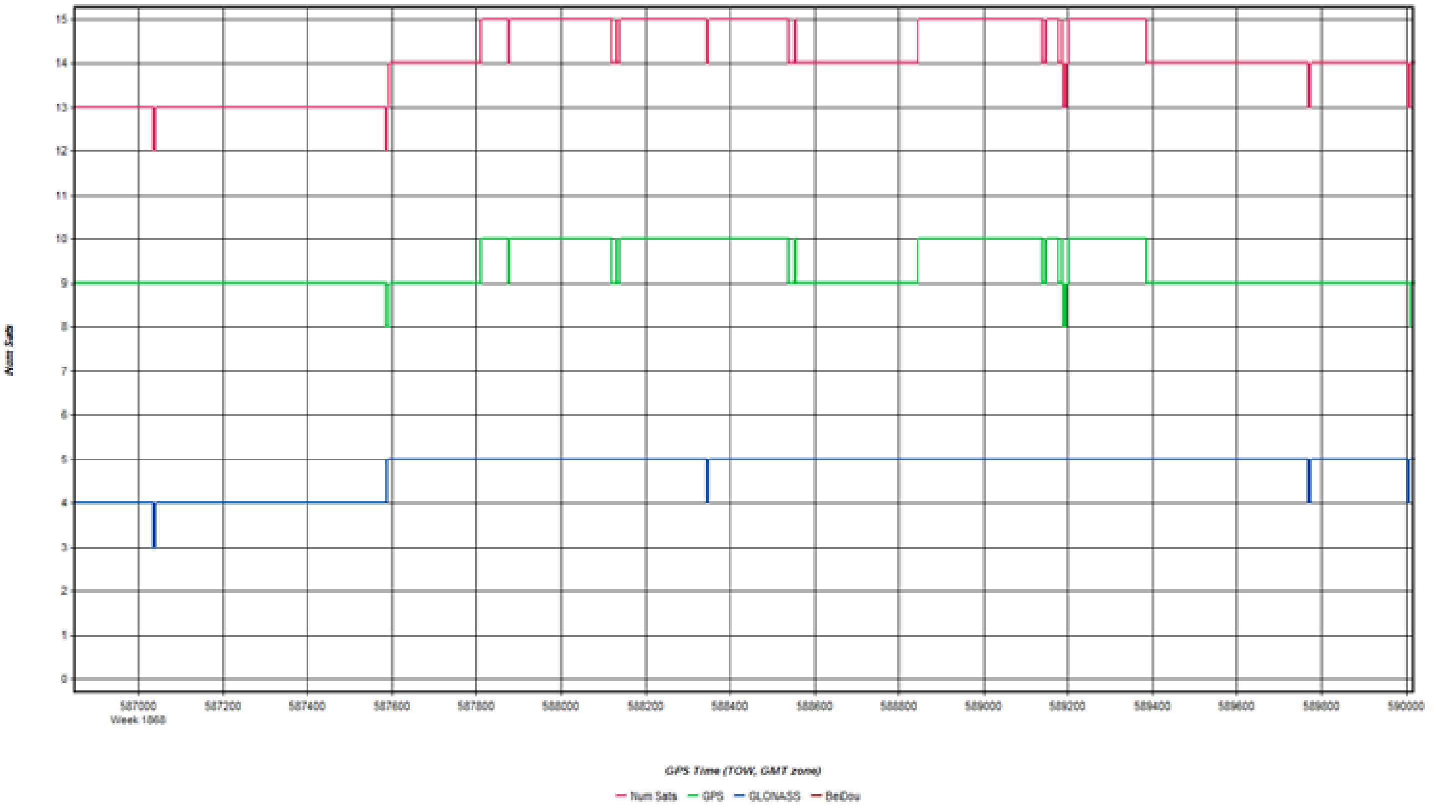
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

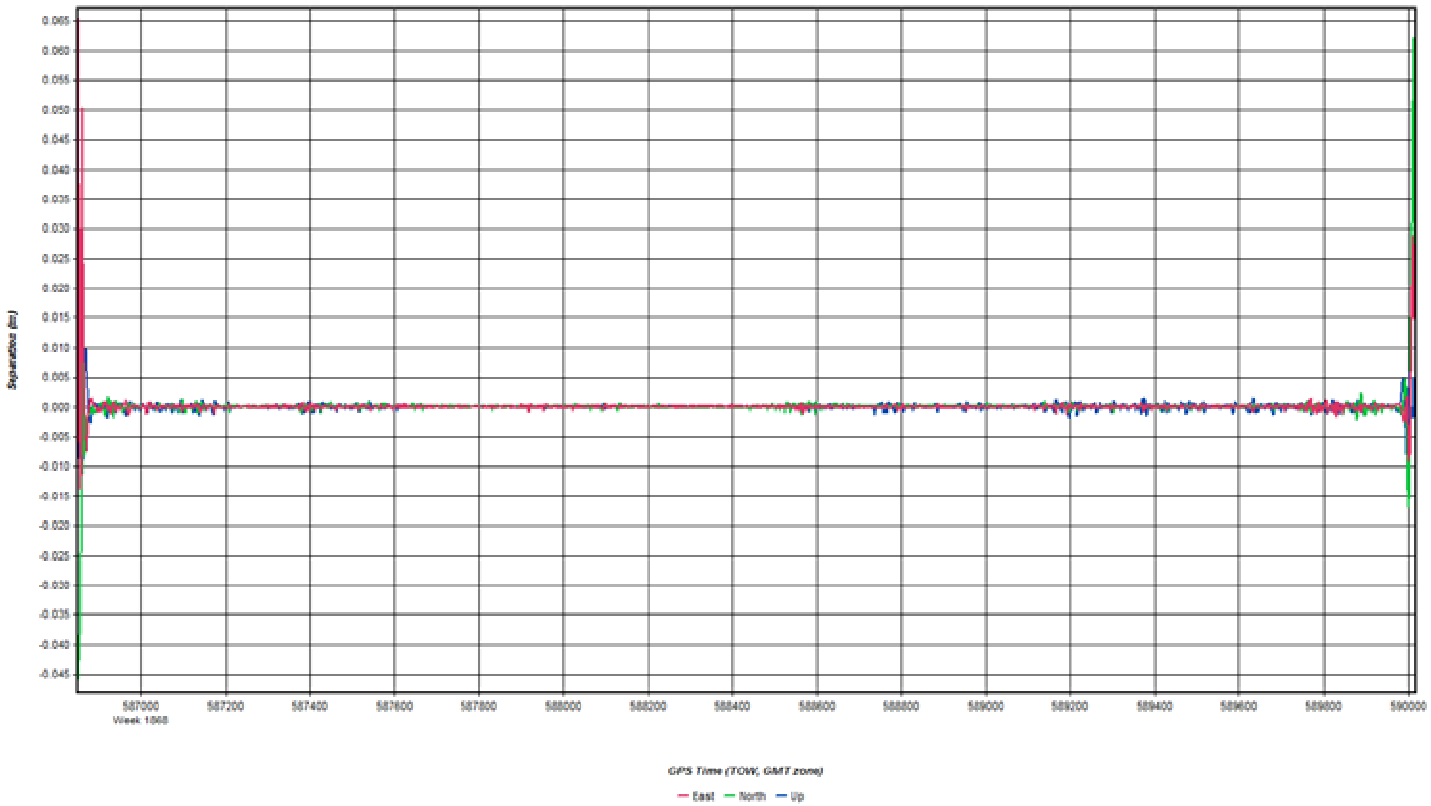
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

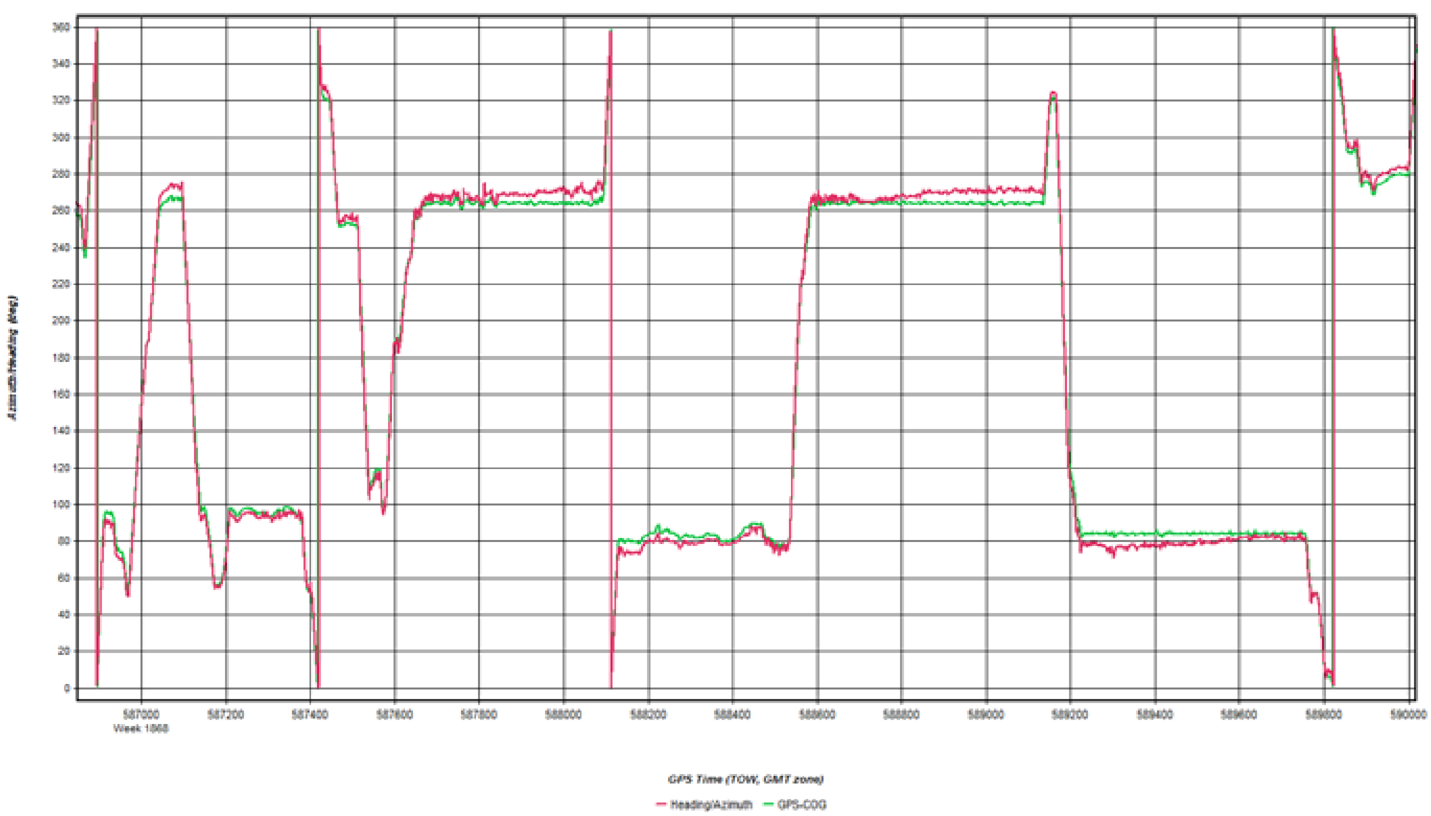
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
218	17.17	5781	160910			Start Line E to W
219	17.18	5732	162021			
220	17.18	5732	163154			
221	17.18	5732	164414			
222	17.17	5732	156605			
223	17.04	5794	170728			w to e
224	16.51	6037	171941			
225	16.51	5909	173032			
226	16.12	6063	174238			e to w
227	16.13	6119	175337			
228	15.77	6113	180413			CROSSLINE: 213355
229	15.78	6086	181435			
230	15.78	6070	182459			Pulled off line for traffic, e to w
231	15.79	6027	184509			W to E, Ranges Froze at end of line. System Restart 11:50-12:12, Refly E to W

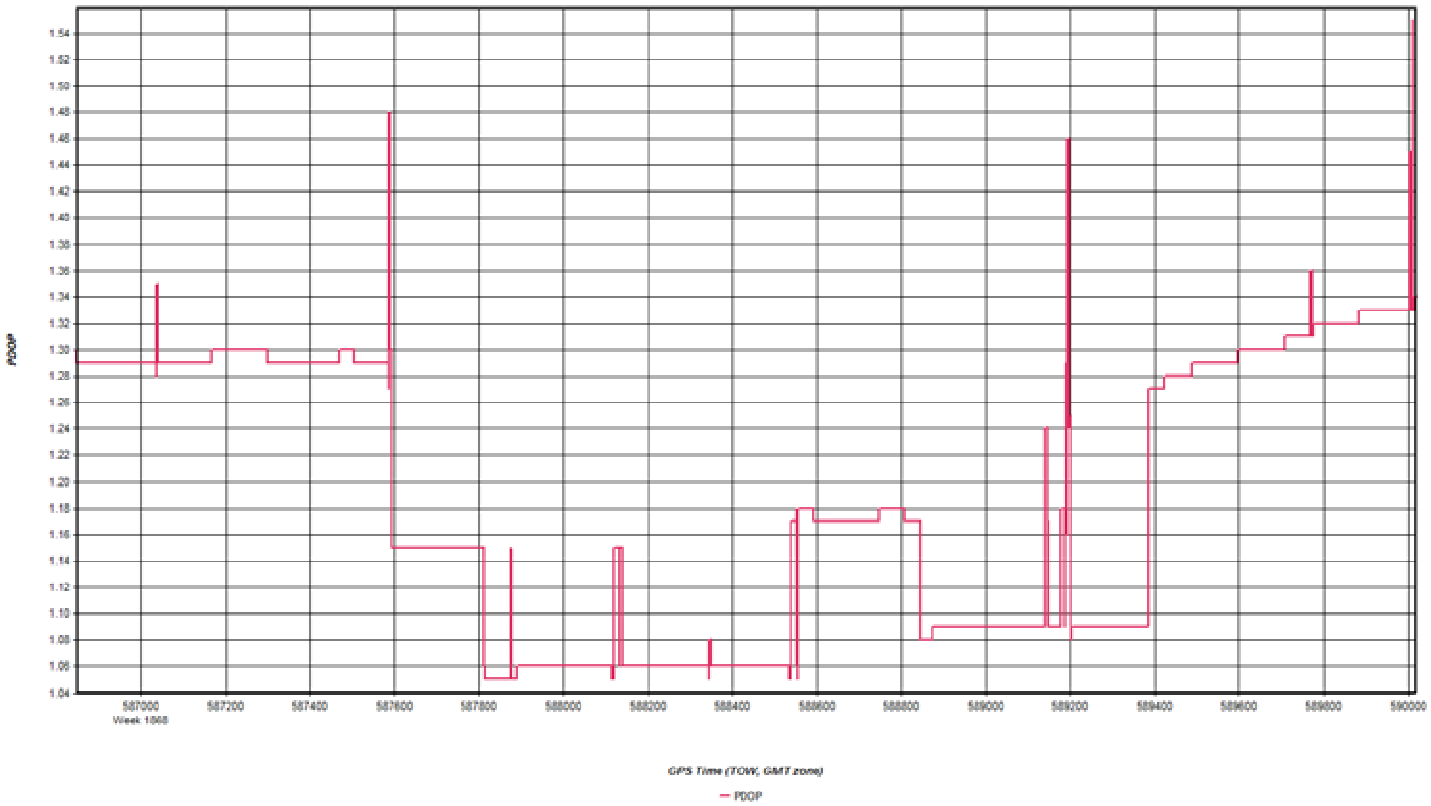
Oct 31, 2015-B

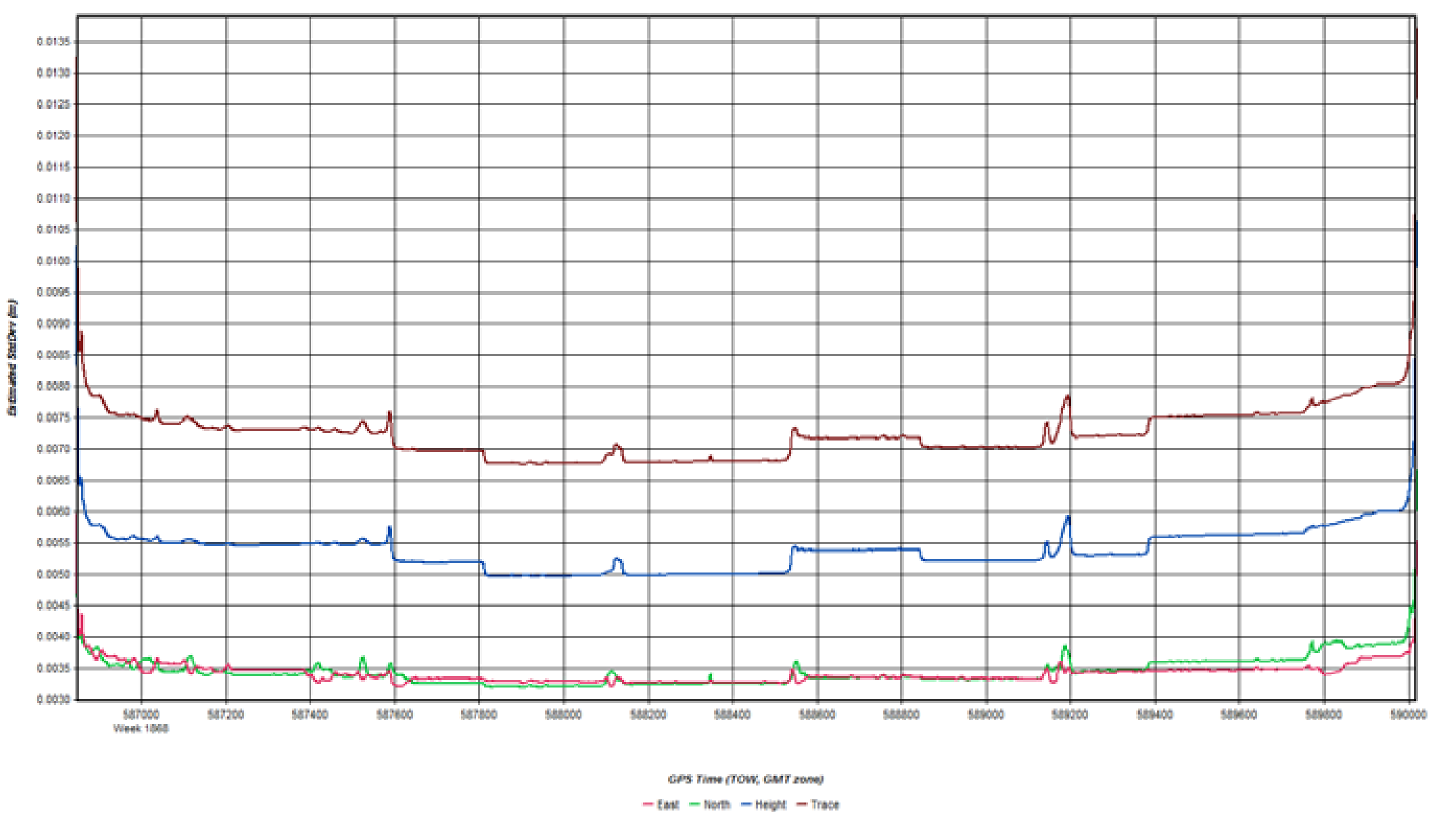



15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
587000
Week 1868
587200
587400
587600
587800
588000
588200
588400
588600
588800
589000
589200
589400
589600
589800
590000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

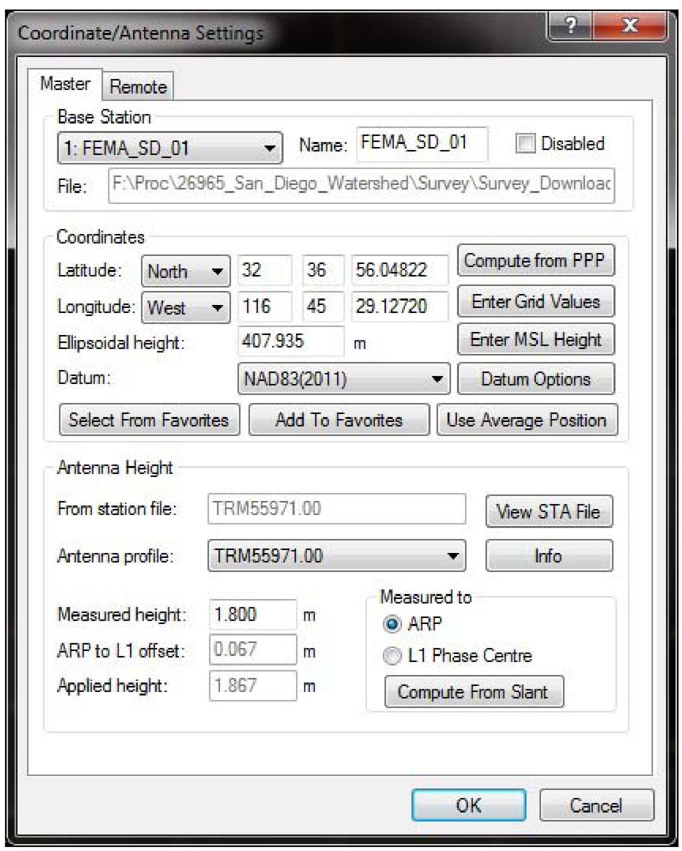

Separation (m)
GPS Time (TOW, GMT zone)
Week 1868
East
North
Up


Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Week 1868
Heading/Azimuth
GPS-COG


PDOP
1.54
1.52
1.50
1.48
1.46
1.44
1.42
1.40
1.38
1.36
1.34
1.32
1.30
1.28
1.26
1.24
1.22
1.20
1.18
1.16
1.14
1.12
1.10
1.08
1.06
1.04
587000
Week 1868
587200
587400
587600
587800
588000
588200
588400
588600
588800
589000
589200
589400
589600
589800
590000
GPS Time (TOW, GMT zone)
PDOP


Estimated StdDev (m)
0.0135
0.0130
0.0125
0.0120
0.0115
0.0110
0.0105
0.0100
0.0095
0.0090
0.0085
0.0080
0.0075
0.0070
0.0065
0.0060
0.0055
0.0050
0.0045
0.0040
0.0035
0.0030
587000
Week 1868
587200
587400
587600
587800
588000
588200
588400
588600
588800
589000
589200
589400
589600
589800
590000
GPS Time (TOW, GMT zone)
East
North
Height
Trace


Roll & pitch (deg)
GPS Time (TOW, GMT zone)
Week 1868
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
1: FEMA_SD_01
Name: FEMA_SD_01
Disabled
File: F:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude: North 32 36 56.04822
Longitude: West 116 45 29.12720
Ellipsoidal height: 407.935 m
Datum: NAD83(2011)
Compute from PPP
Enter Grid Values
Enter MSL Height
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM55971.00
Info
Measured height: 1.800 m
ARP to L1 offset: 0.067 m
Applied height: 1.867 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	A001
Stop Line Name	A020
Turn Time (min)	3
Buffer (%)	10
Acquisition Time (hrs)	#N/A

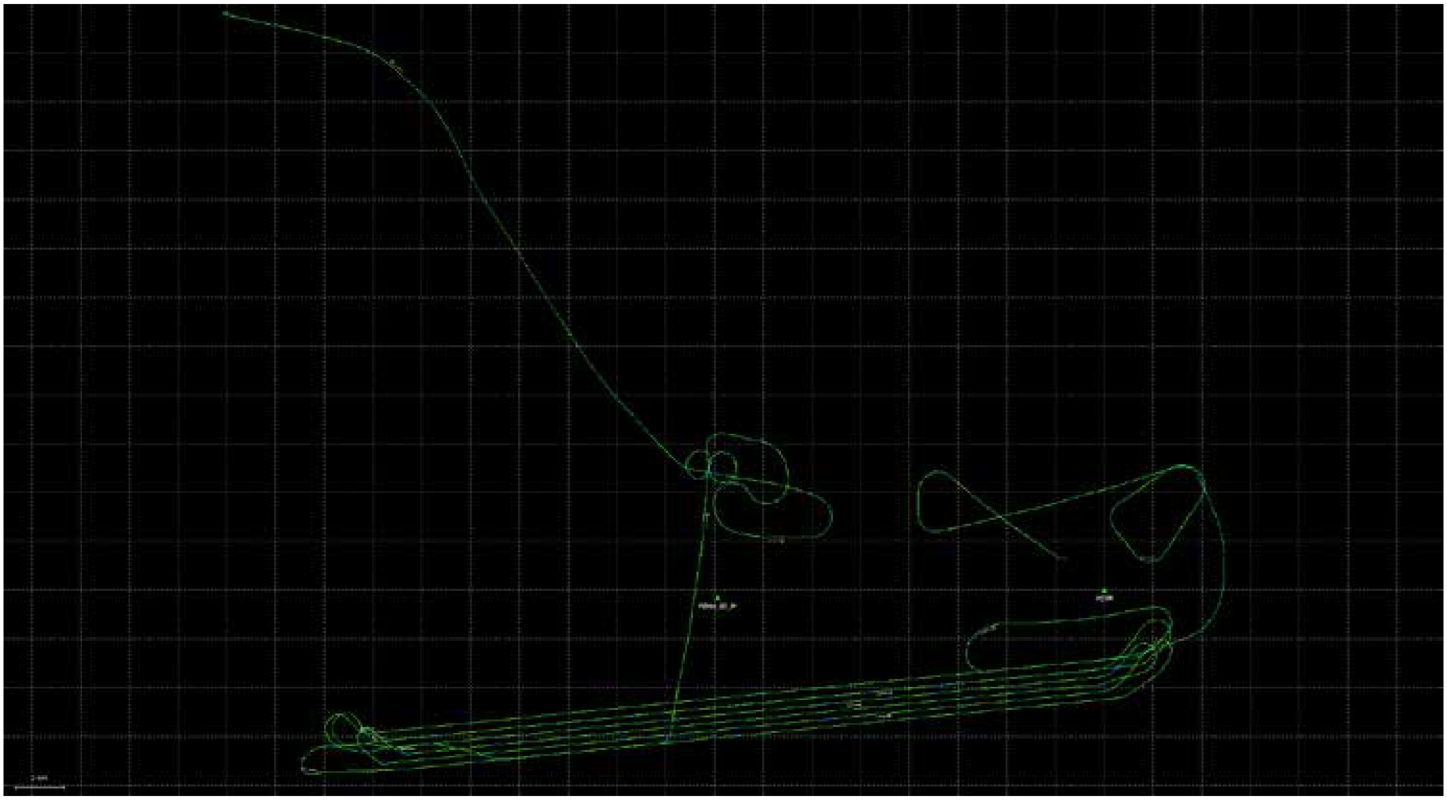
Other Acquisition Notes:

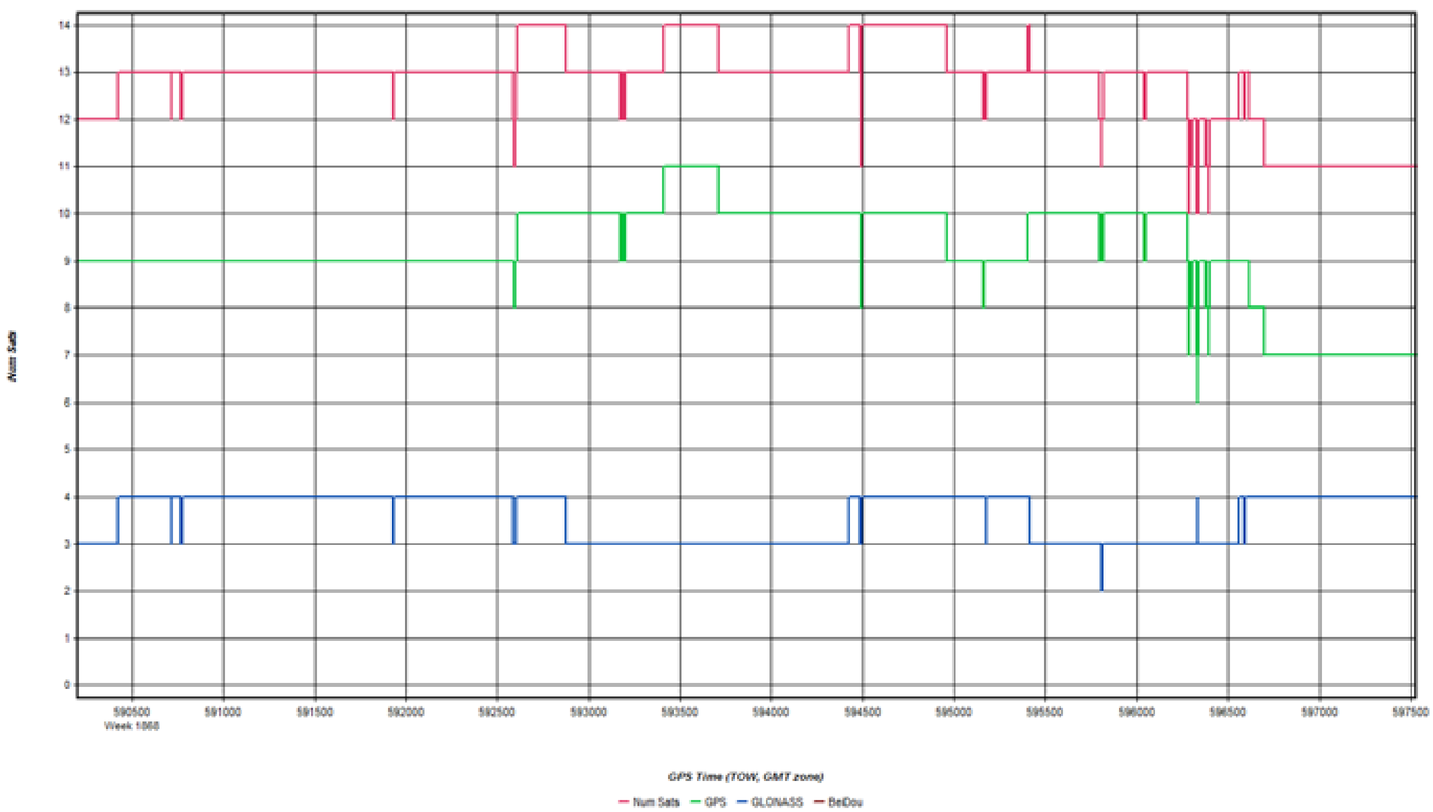
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

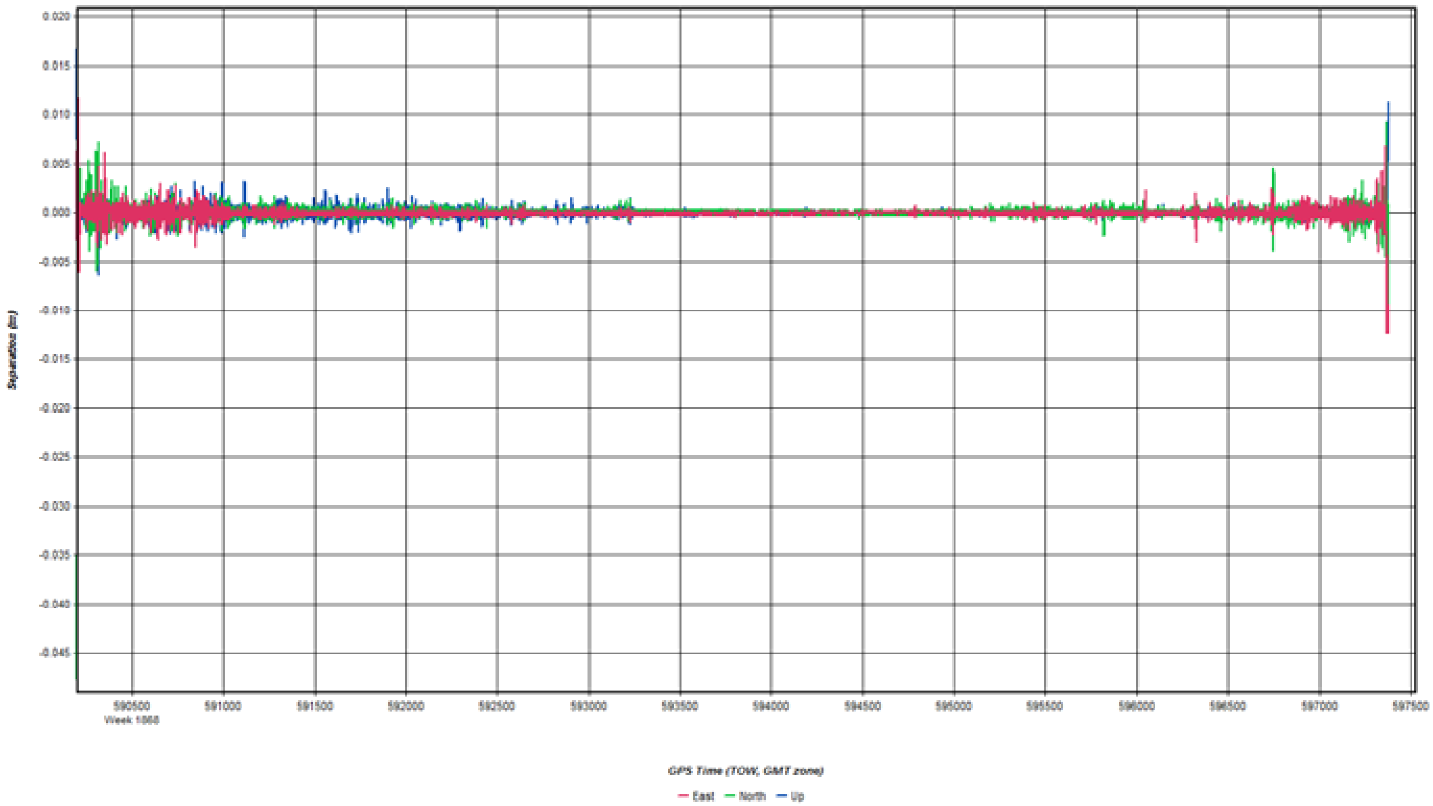
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
231	15.79	6027	184509	191419		Upon 1st system restart, started to refly 231 again; Then had traffic and had to stop midline, Finally reflew line.
232	15.37	6001	194018	210912		System Error- Flight I/O Shutdown, Then had to refly again starting at 231

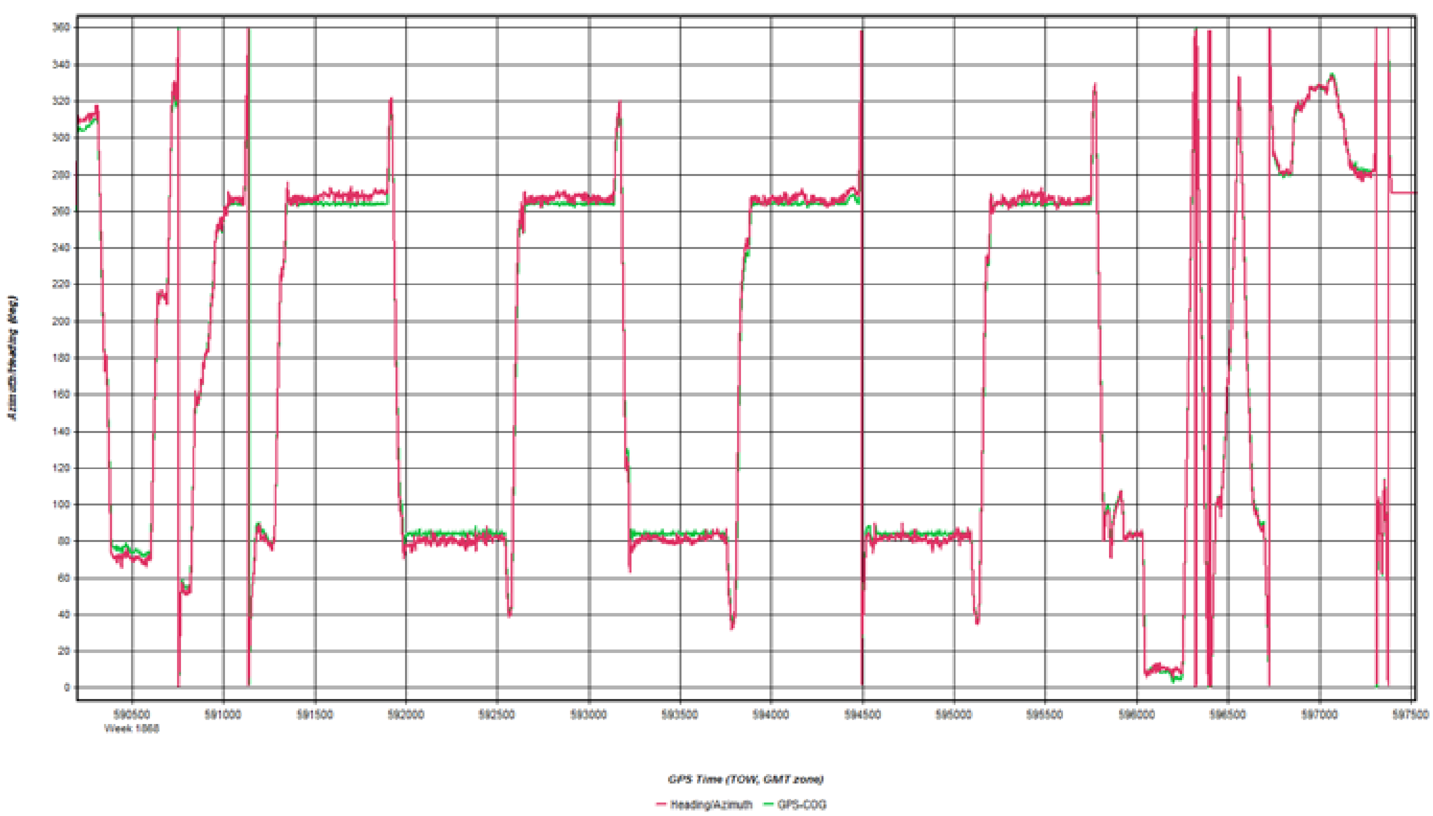
Oct 31, 2015-C



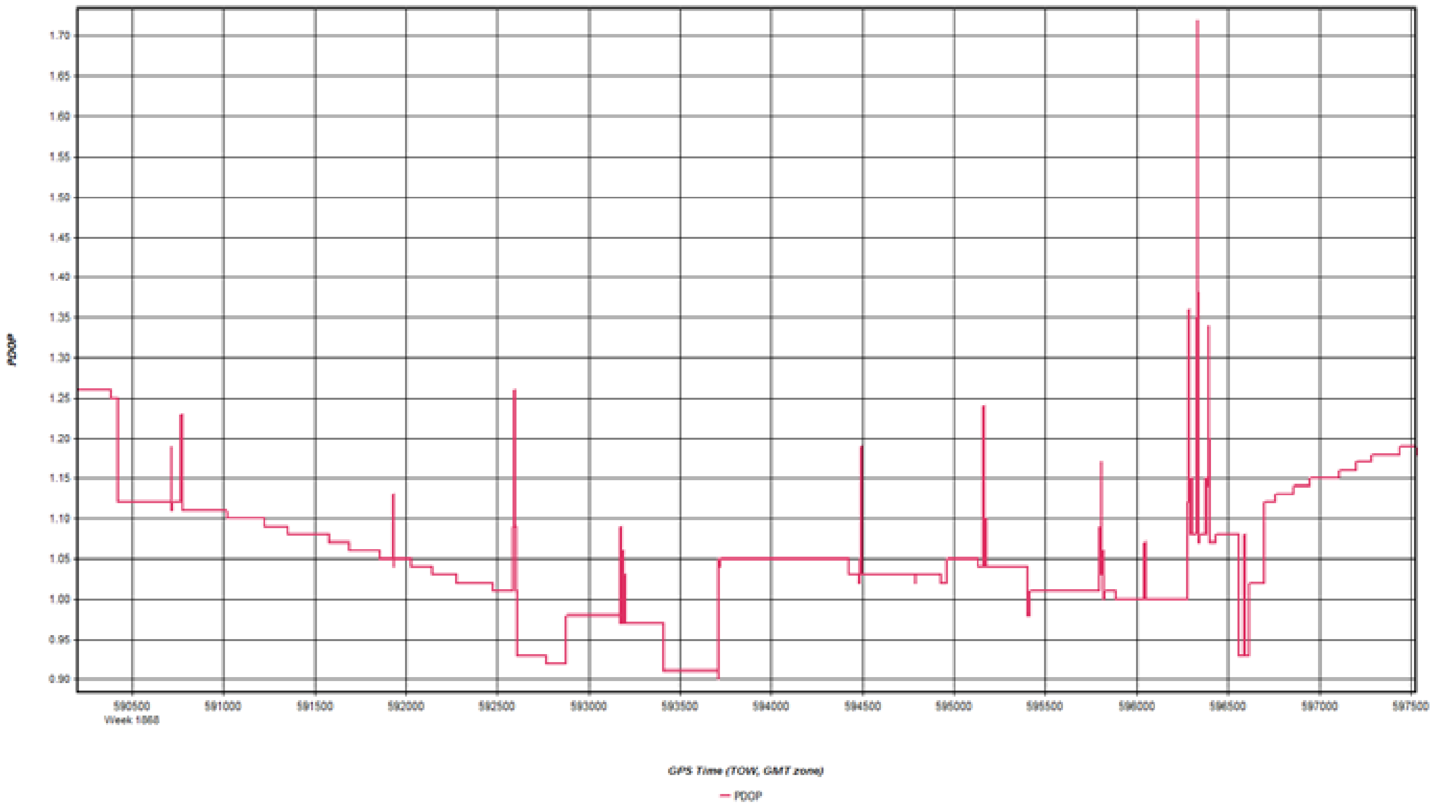

Num Sats
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
590500
Week 1868
591000
591500
592000
592500
593000
593500
594000
594500
595000
595500
596000
596500
597000
597500
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

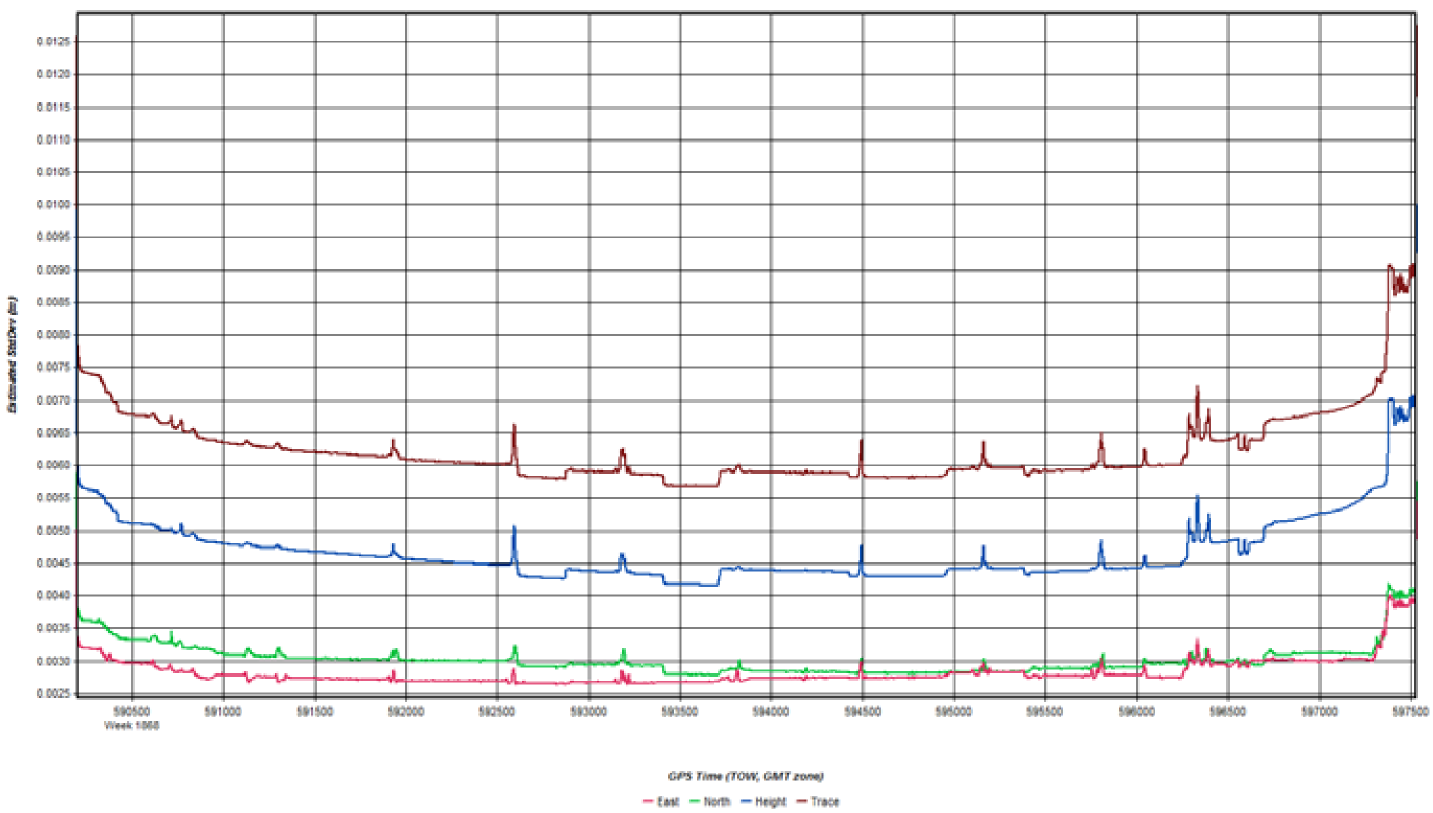


Separation (m)
0.020
0.015
0.010
0.005
0.000
-0.005
-0.010
-0.015
-0.020
-0.025
-0.030
-0.035
-0.040
-0.045
590500
Week 1868
591000
591500
592000
592500
593000
593500
594000
594500
595000
595500
596000
596500
597000
597500
GPS Time (TOW, GMT zone)
East
North
Up

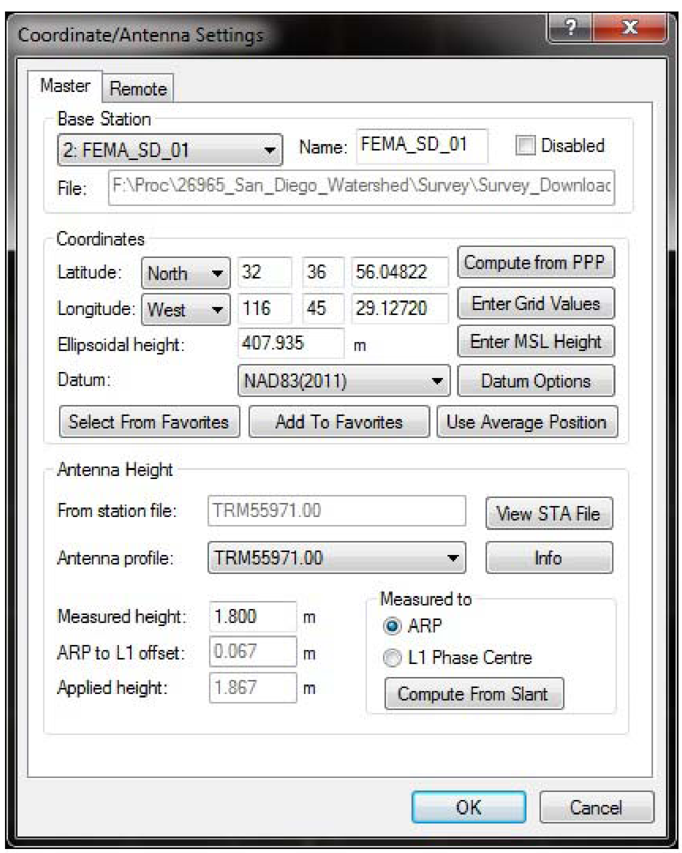


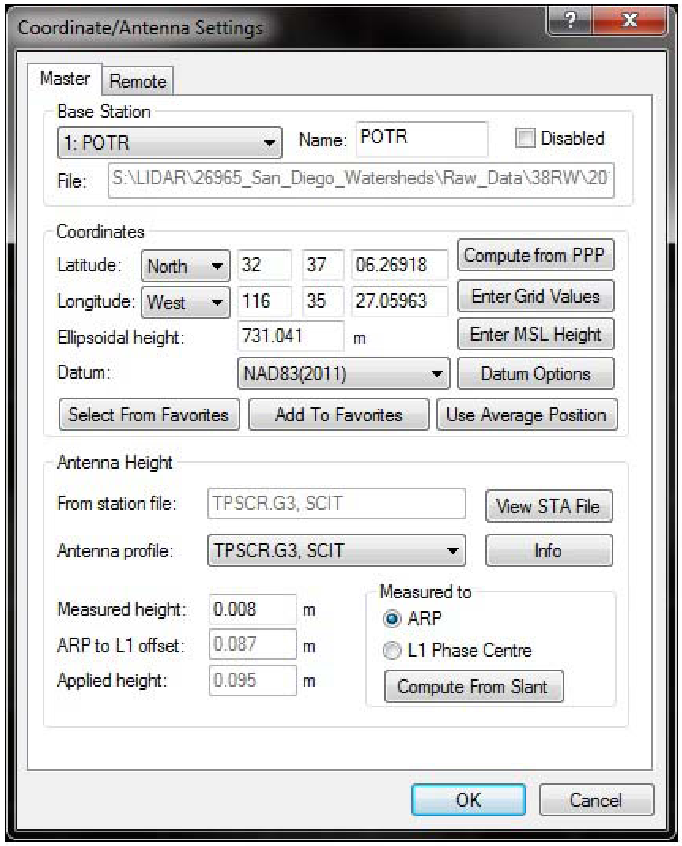
Azimuth/Heading (deg)
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
590500
Week 1868
591000
591500
592000
592500
593000
593500
594000
594500
595000
595500
596000
596500
597000
597500
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG


1.70
1.65
1.60
1.55
1.50
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
0.90
PDOP
590500
Week 1868
591000
591500
592000
592500
593000
593500
594000
594500
595000
595500
596000
596500
597000
597500
GPS Time (TOW, GMT zone)
PDOP


0.0125
0.0120
0.0115
0.0110
0.0105
0.0100
0.0095
0.0090
0.0085
0.0080
0.0075
0.0070
0.0065
0.0060
0.0055
0.0050
0.0045
0.0040
0.0035
0.0030
0.0025
Estimated StdDev (m)
590500
Week 1868
591000
591500
592000
592500
593000
593500
594000
594500
595000
595500
596000
596500
597000
597500
GPS Time (TOW, GMT zone)
East
North
Height
Trace


Roll & pitch (deg)
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_01
Name:
FEMA_SD_01
Disabled
File:
F:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude:
North
32
36
56.04822
Compute from PPP
Longitude:
West
116
45
29.12720
Enter Grid Values
Ellipsoidal height:
407.935
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM55971.00
Info
Measured height:
1.800
m
ARP to L1 offset:
0.067
m
Applied height:
1.867
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: POTR
Name:
POTR
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Raw_Data\38RW\20
Coordinates
Latitude:
North
32
37
06.26918
Compute from PPP
Longitude:
West
116
35
27.05963
Enter Grid Values
Ellipsoidal height:
731.041
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TPSCR.G3, SCIT
View STA File
Antenna profile:
TPSCR.G3, SCIT
Info
Measured height:
0.008
m
ARP to L1 offset:
0.087
m
Applied height:
0.095
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000
*Shading = Auto-calculated		

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	A001
Stop Line Name	A020
Turn Time (min)	3
Buffer (%)	10
Acquisition Time (hrs)	#N/A

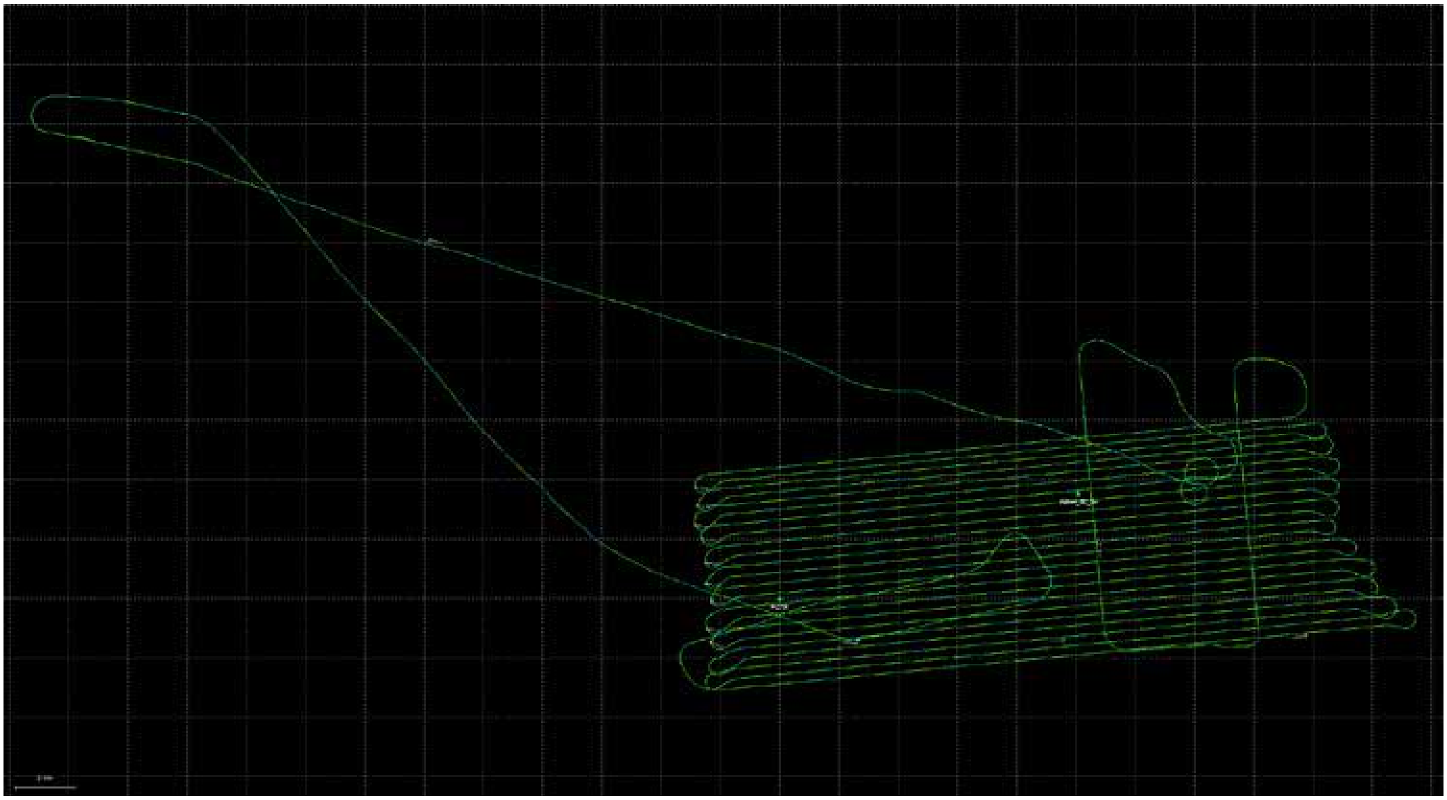
Other Acquisition Notes:

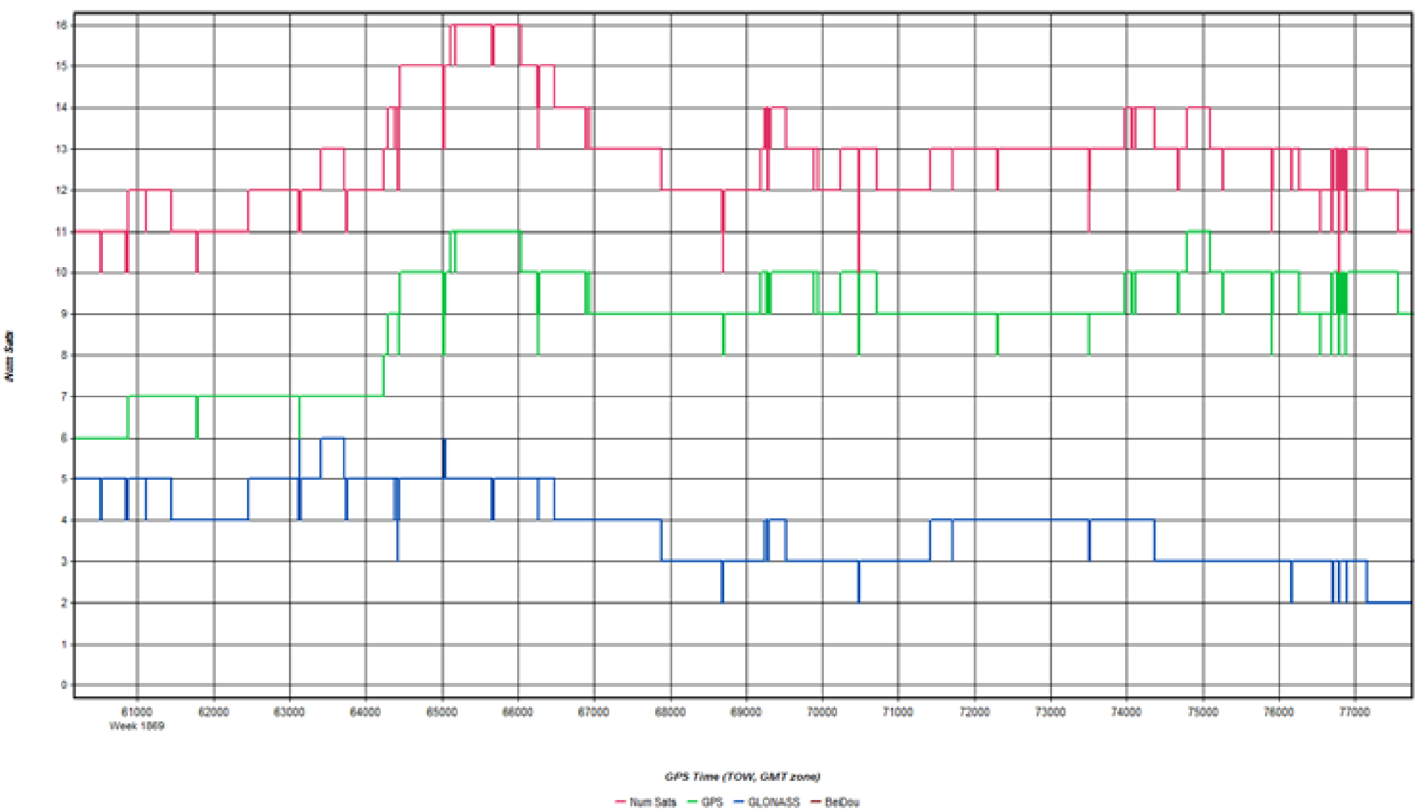
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

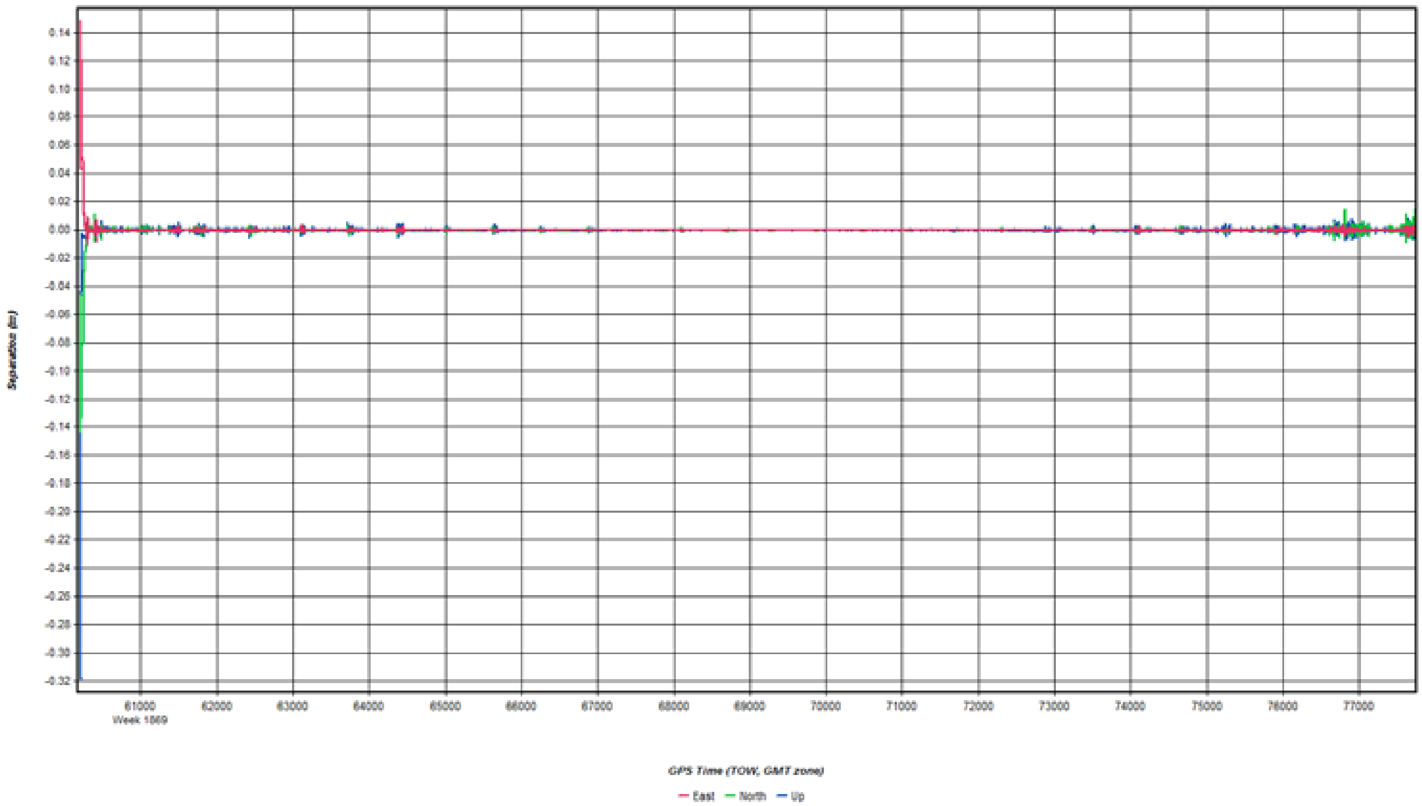
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

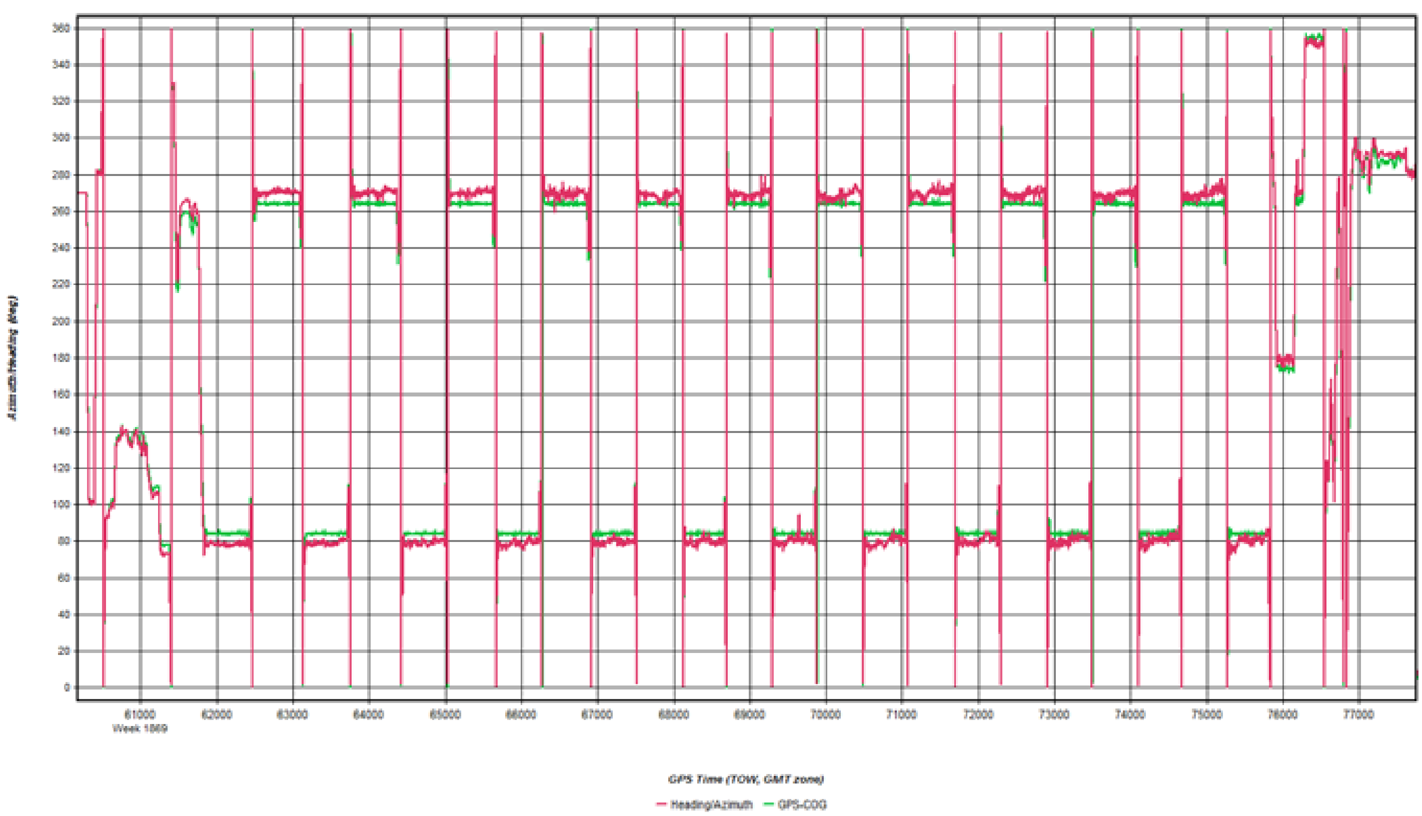
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
231	15.79	6027	184509	191419	192957	After 2nd restart, 201015 e to w, shutter closed due to detecting something too close; Refly again 201553
232	15.37	6001	194018	210912	212011.00	During the reflies on 2nd shutdown, system went from 231 to 233 and I did not notice, so we had to go back and refly 232 in both directions
233	15.34	5991	202623			w to e
234	14.97	5850	203713			e to w
235	14.97	5820	204710			w to e
236	14.83	5775	205804			e to w finish

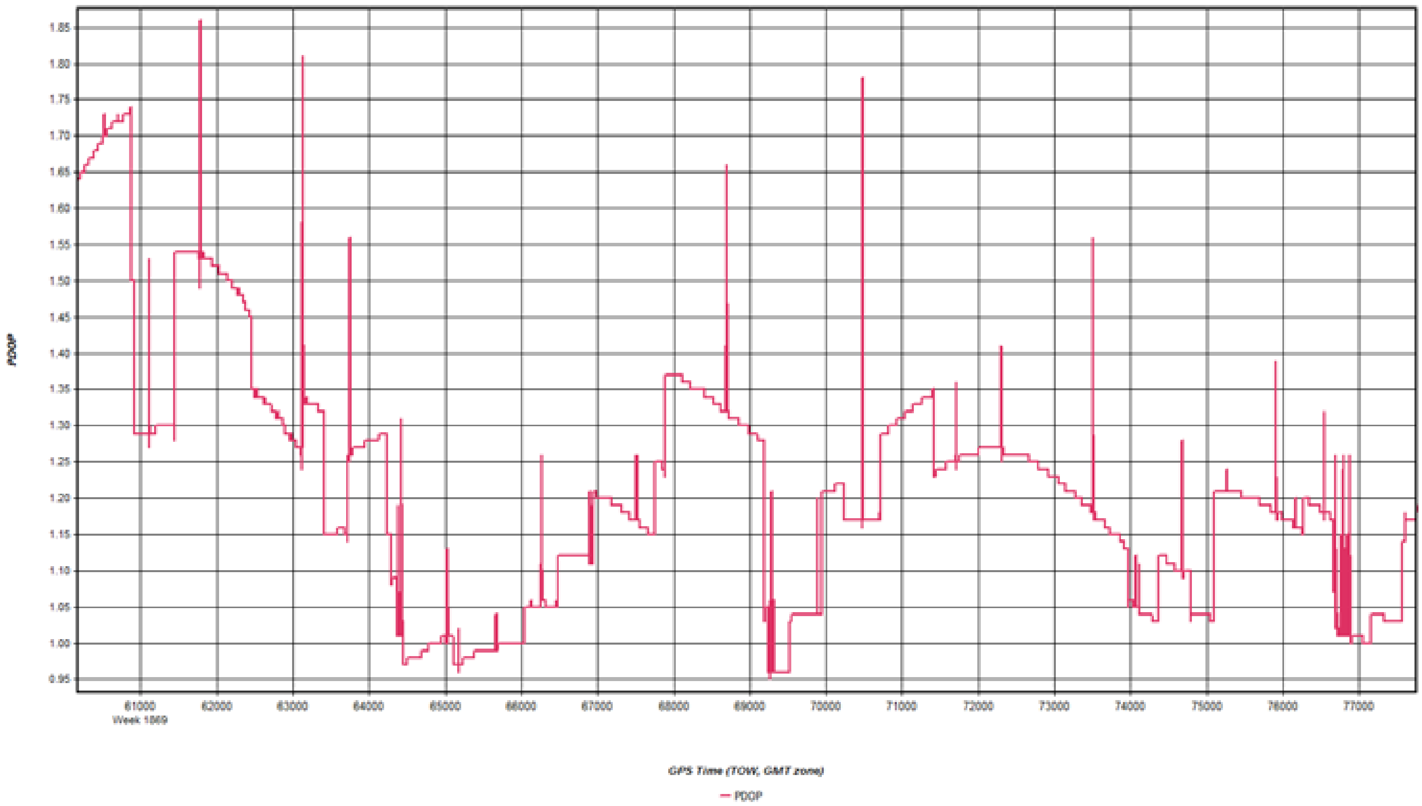
Nov 01, 2015-A

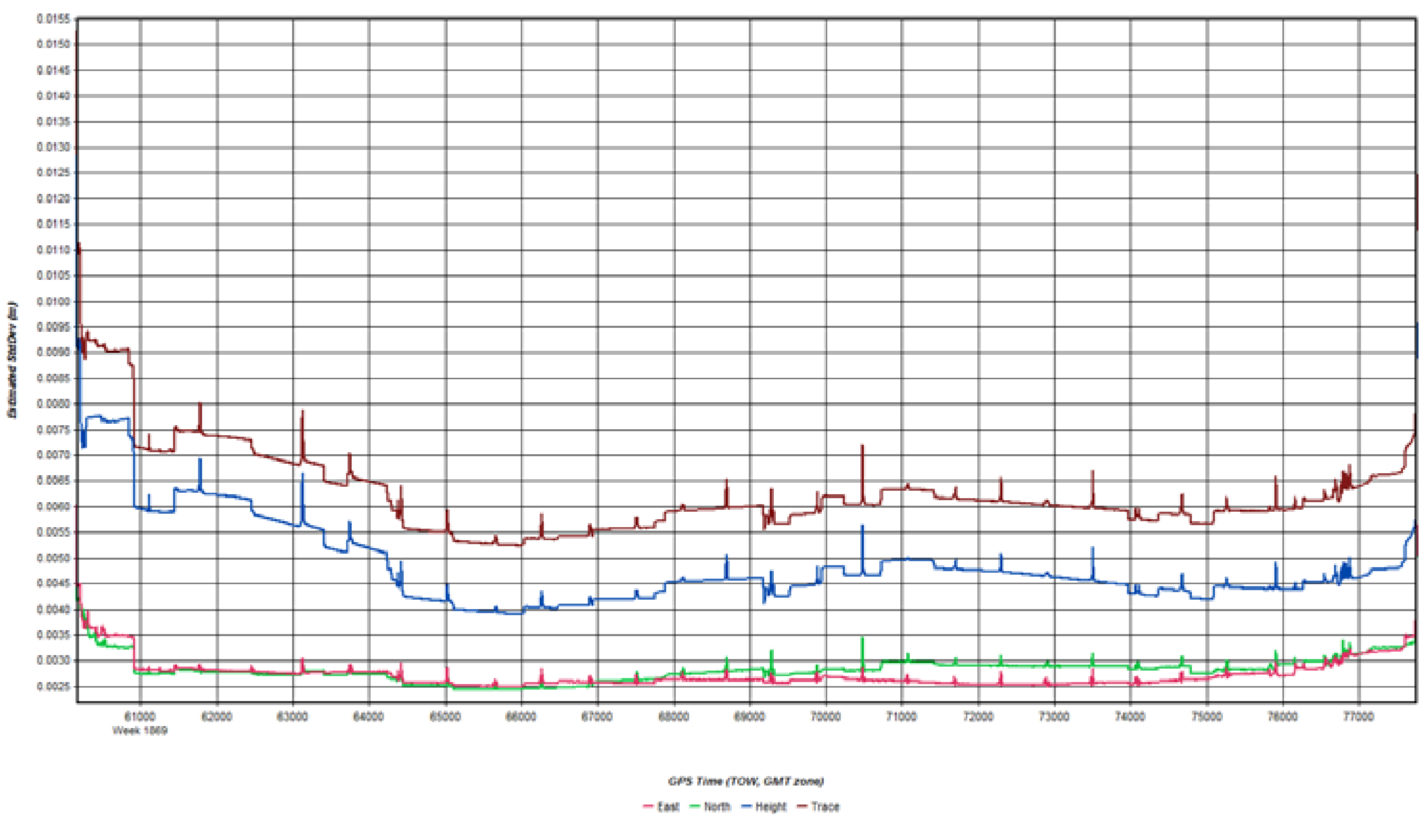


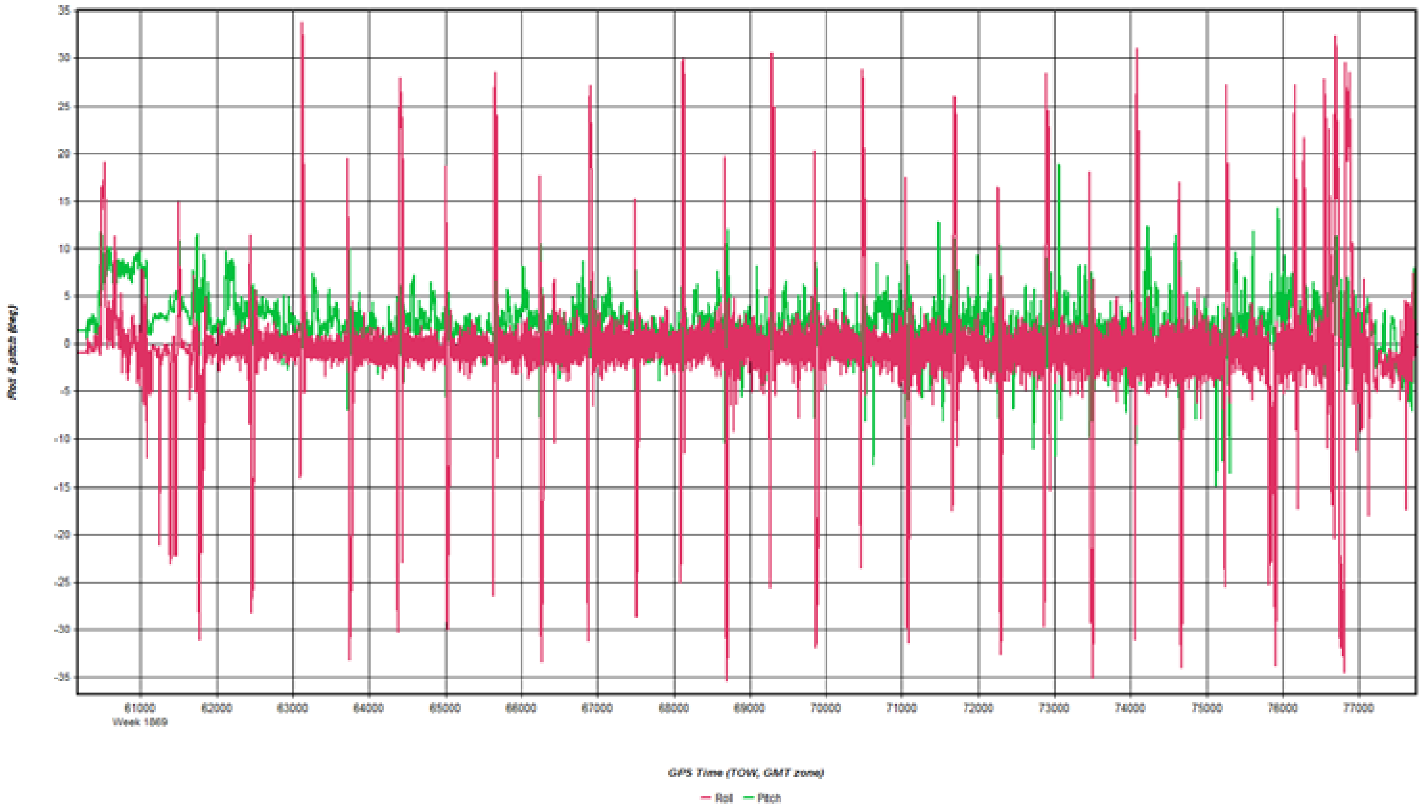

16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
61000
Week 1869
62000
63000
64000
65000
66000
67000
68000
69000
70000
71000
72000
73000
74000
75000
76000
77000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

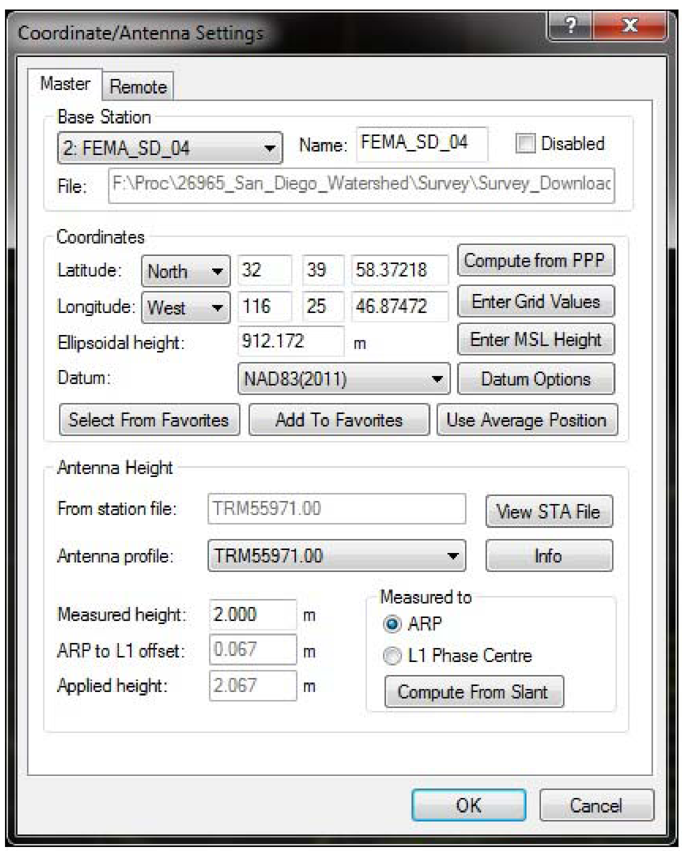

Separation (m)
GPS Time (TOW, GMT zone)
Week 1869
East
North
Up

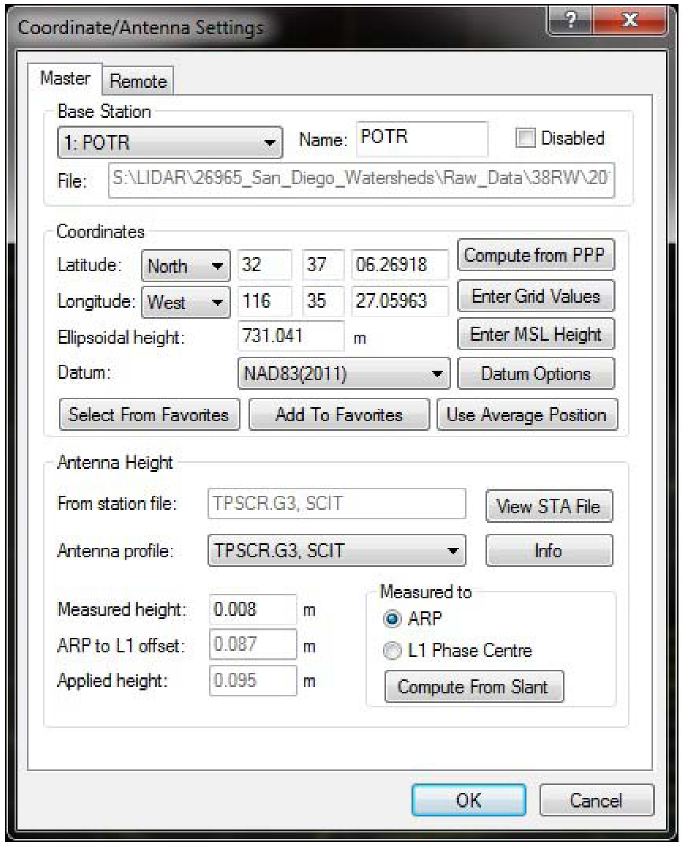

Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Week 1869
Heading/Azimuth
GPS-COG


PDOP
1.85
1.80
1.75
1.70
1.65
1.60
1.55
1.50
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
61000
Week 1869
62000
63000
64000
65000
66000
67000
68000
69000
70000
71000
72000
73000
74000
75000
76000
77000
GPS Time (TOW, GMT zone)
PDOP


Estimated Std Dev (m)
0.0155
0.0150
0.0145
0.0140
0.0135
0.0130
0.0125
0.0120
0.0115
0.0110
0.0105
0.0100
0.0095
0.0090
0.0085
0.0080
0.0075
0.0070
0.0065
0.0060
0.0055
0.0050
0.0045
0.0040
0.0035
0.0030
0.0025
61000
Week 1869
62000
63000
64000
65000
66000
67000
68000
69000
70000
71000
72000
73000
74000
75000
76000
77000
GPS Time (TOW, GMT zone)
East
North
Height
Trace


35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
Roll & pitch (deg)
61000
Week 1869
62000
63000
64000
65000
66000
67000
68000
69000
70000
71000
72000
73000
74000
75000
76000
77000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_04
Name:
FEMA_SD_04
Disabled
File:
F:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude:
North
32
39
58.37218
Compute from PPP
Longitude:
West
116
25
46.87472
Enter Grid Values
Ellipsoidal height:
912.172
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM55971.00
Info
Measured height:
2.000
m
ARP to L1 offset:
0.067
m
Applied height:
2.067
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: POTR
Name:
POTR
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Raw_Data\38RW\20
Coordinates
Latitude:
North
32
37
06.26918
Compute from PPP
Longitude:
West
116
35
27.05963
Enter Grid Values
Ellipsoidal height:
731.041
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TPSCR.G3, SCIT
View STA File
Antenna profile:
TPSCR.G3, SCIT
Info
Measured height:
0.008
m
ARP to L1 offset:
0.087
m
Applied height:
0.095
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	A001
Stop Line Name	A020
Turn Time (min)	3
Buffer (%)	10
Acquisition Time (hrs)	#N/A

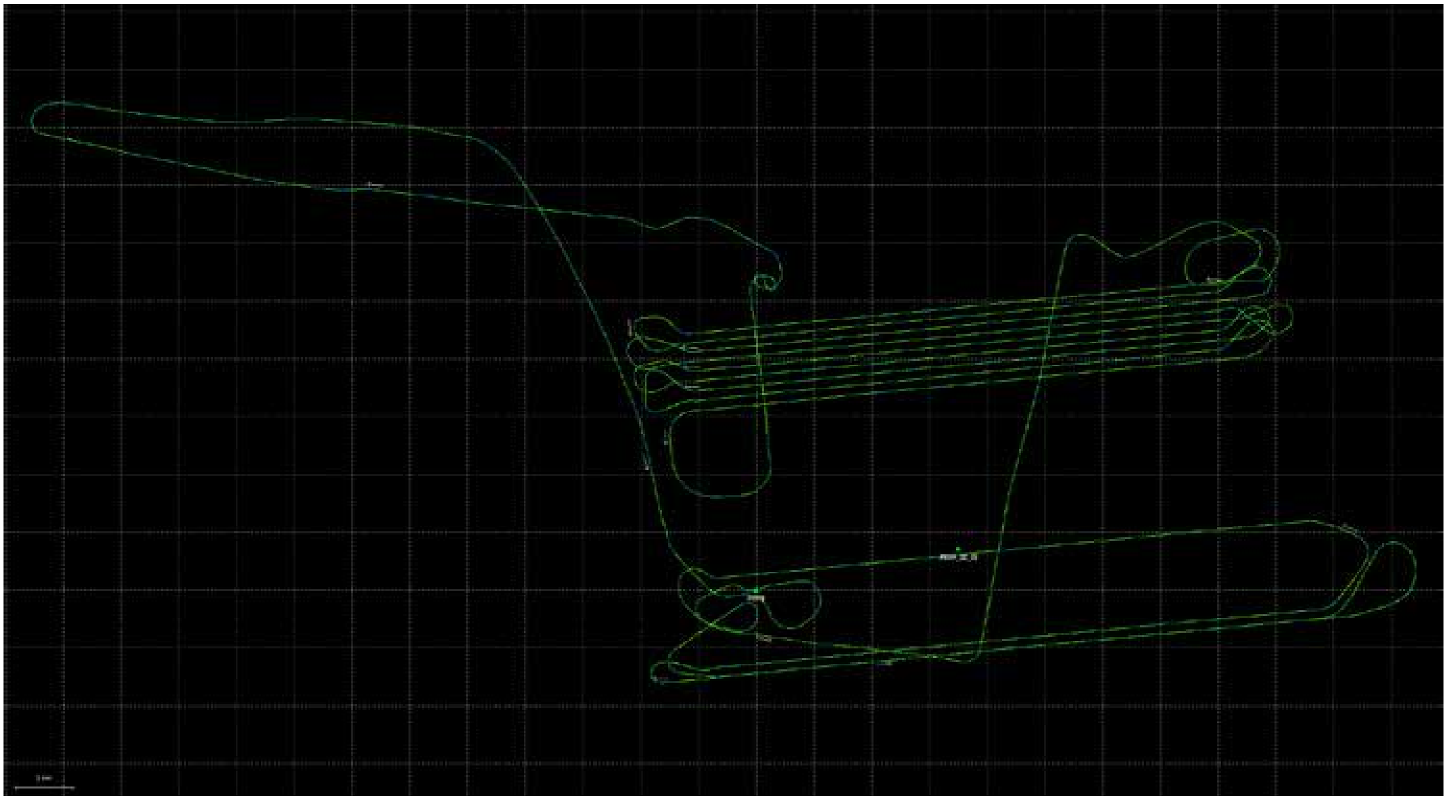
Other Acquisition Notes:

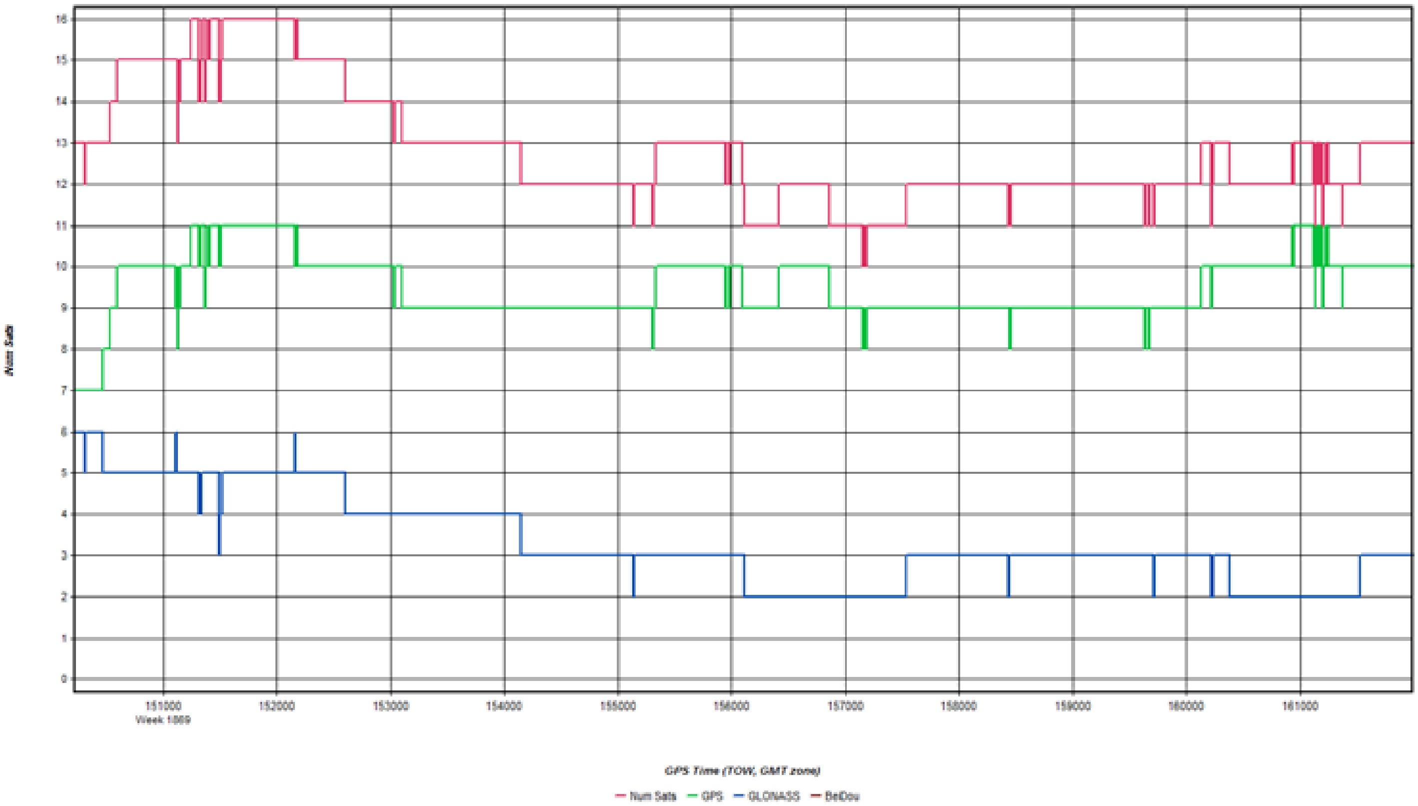
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

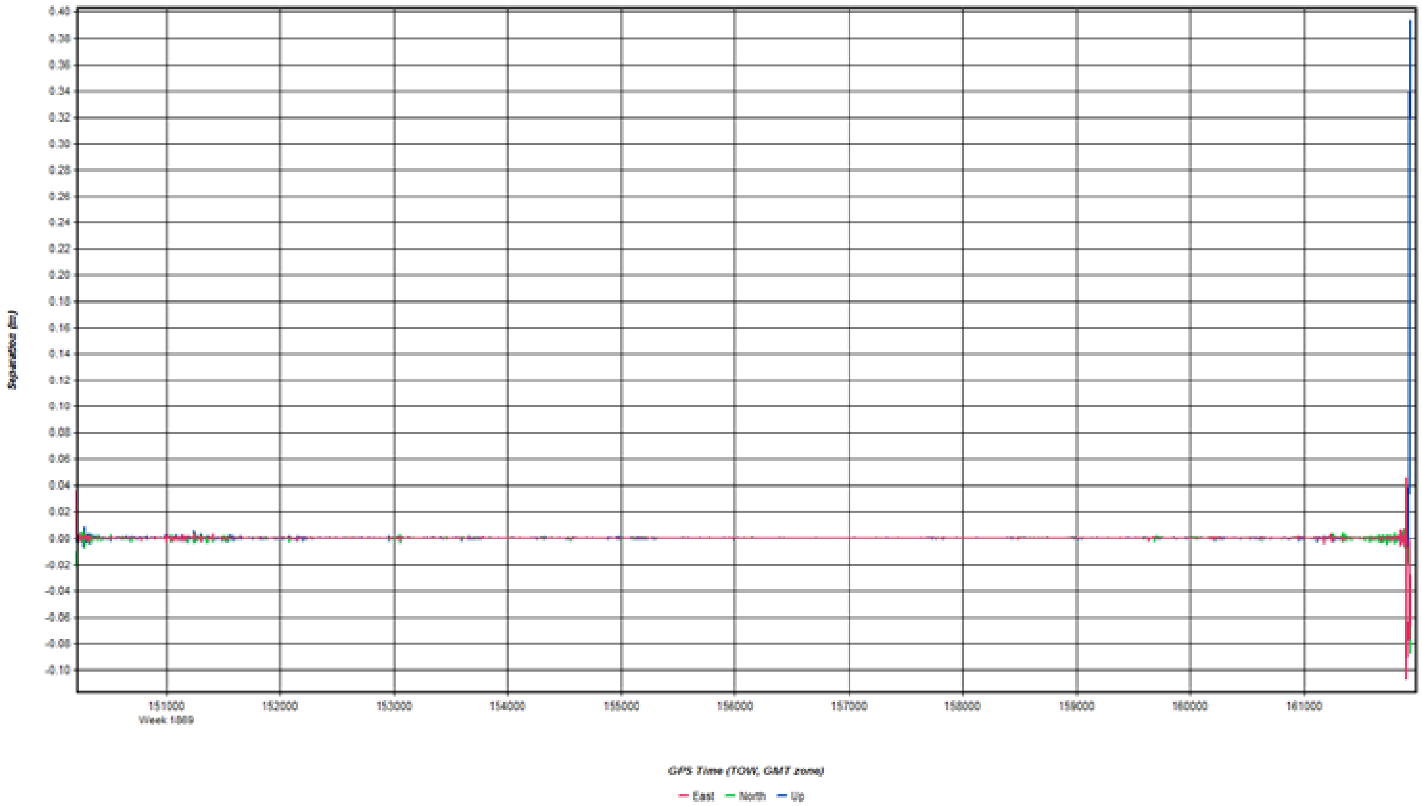
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

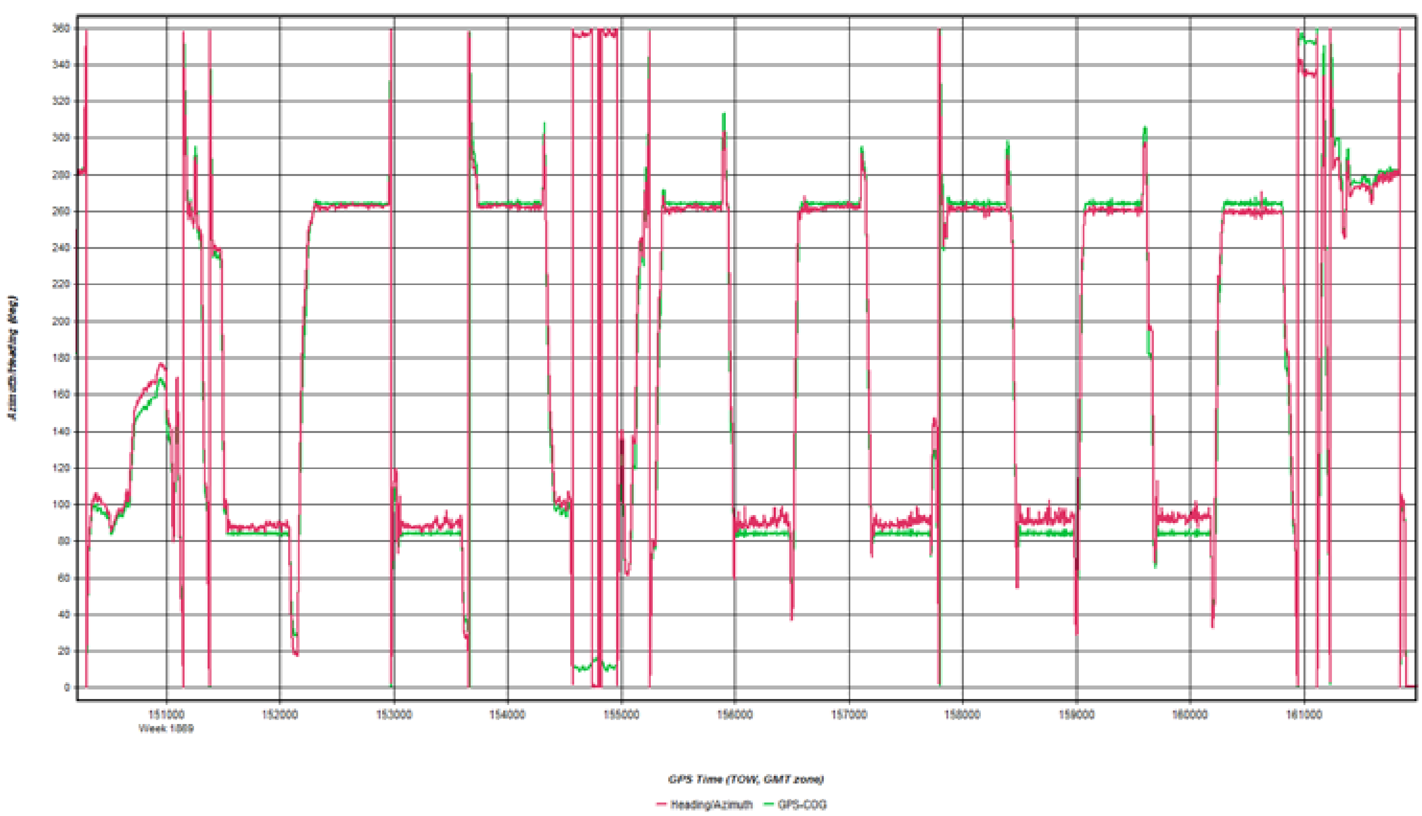
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
167	15.23	7110	205449			W to E last line
168	15.23	7116	204452			
169	15.22	7166	203514			
170	15.22	7261	202519			
171	15.4	7441	201529			
172	15.47	7664	200515			Crossline:210505
173	15.47	7766	195514			Crossline: 211115
174	15.46	7861	194456			
175	15.46	7858	193508			w to e
176	15.43	7845	192502			
177	15.32	7822	191511			
178	15.32	7822	190512			
179	15.35	7769	185537			
180	15.38	7769	184546			
181	15.75	7769	183536			
182	15.94	7812	182458			e to w
183	16.08	7868	181447			
184	16.07	7815	18419			
185	16.1	7582	175405			
186	16.33	7523	174312			
187	16.33	7392	173243			
188	16.32	7317	172157			e to w
189	16.32	7271	171040			Start line w to e

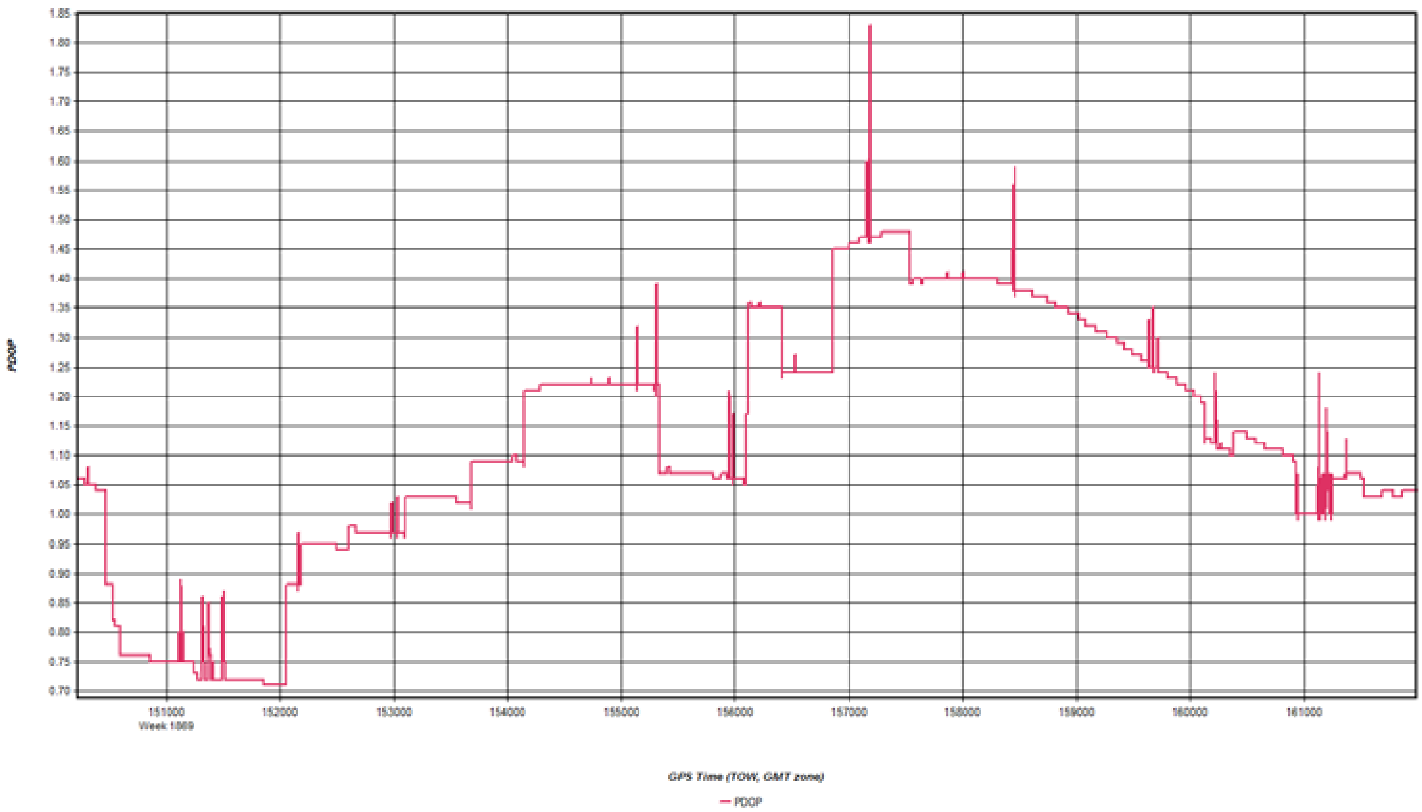
Nov 02, 2015-A

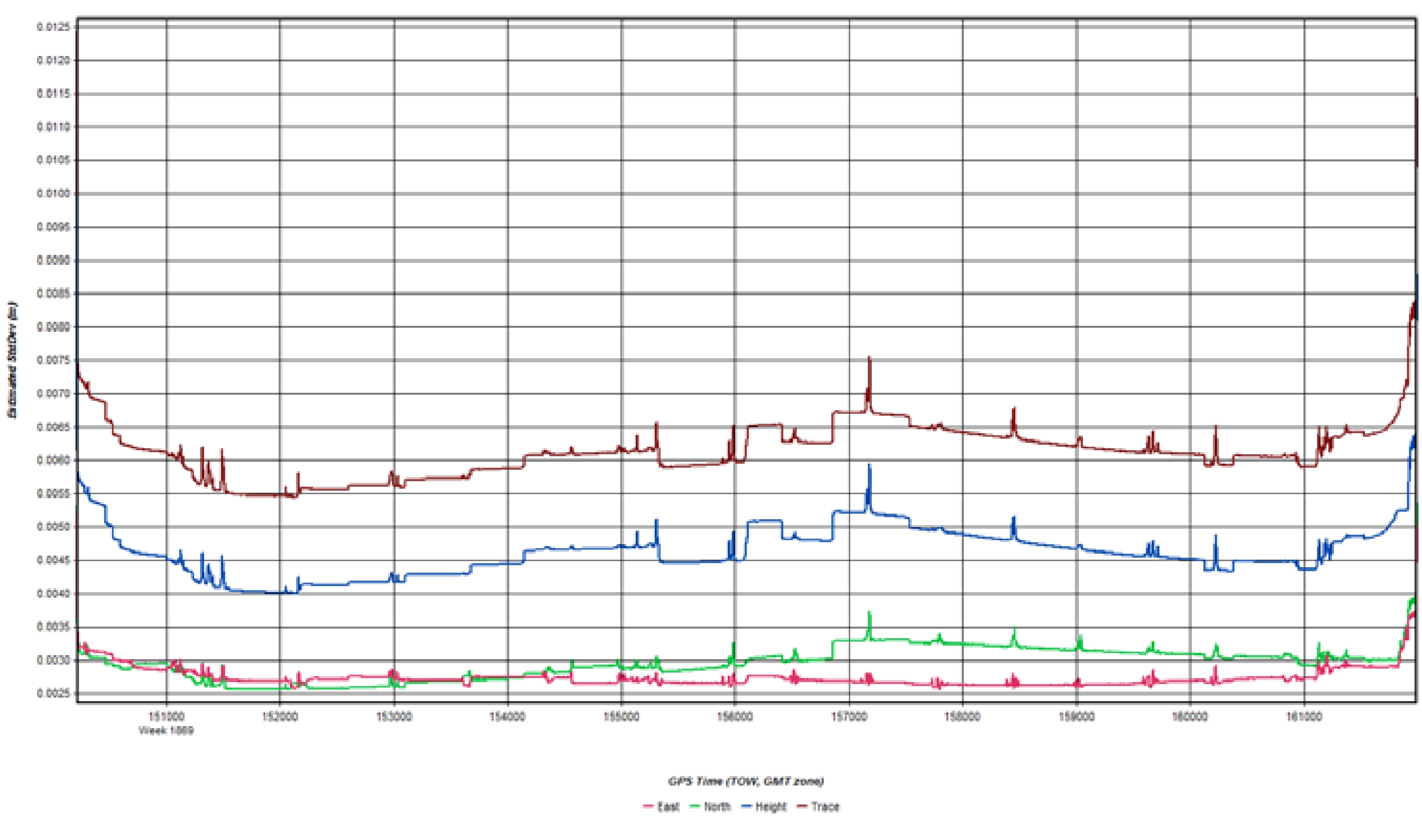



Num Sats
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
151000
Week 1889
152000
153000
154000
155000
156000
157000
158000
159000
160000
161000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

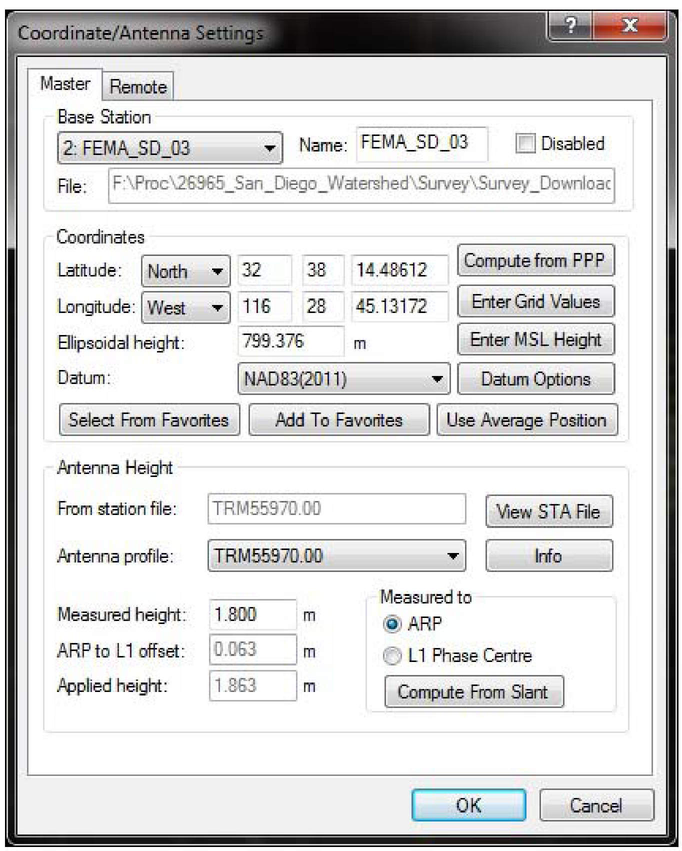

Separation (m)
GPS Time (TOW, GMT zone)
Week 1869
East
North
Up

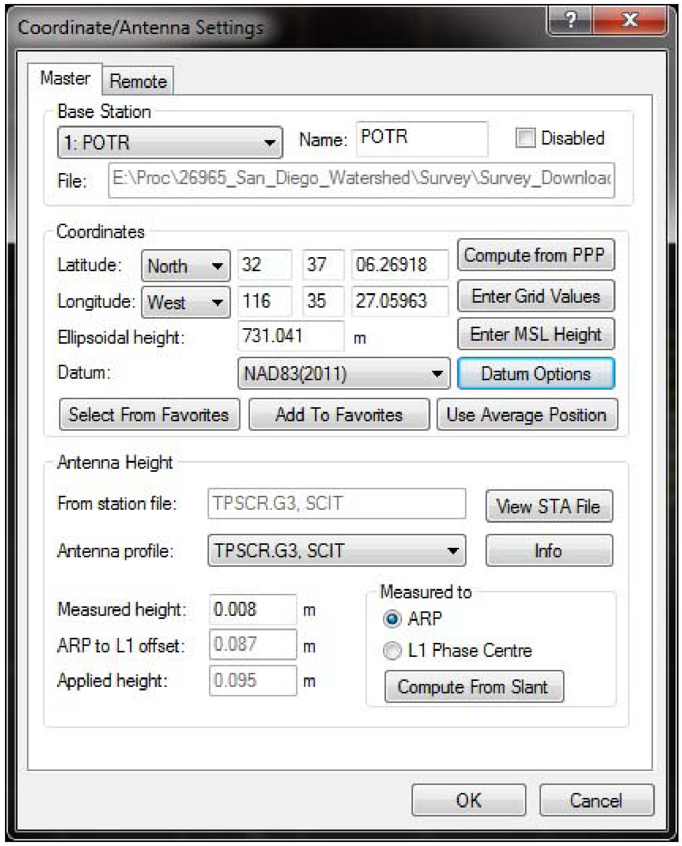

Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Week 1869
Heading/Azimuth
GPS-COG


PDOP
GPS Time (TOW, GMT zone)
Week 1869
PDOP


Estimated StdDev (m)
GPS Time (TOW, GMT zone)
Week 1869
East
North
Height
Trace


Roll & pitch (deg)
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
151000
Week 1889
152000
153000
154000
155000
156000
157000
158000
159000
160000
161000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_03
Name: FEMA_SD_03
Disabled
File: F:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude: North 32 38 14.48612
Compute from PPP
Longitude: West 116 28 45.13172
Enter Grid Values
Ellipsoidal height: 799.376 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55970.00
View STA File
Antenna profile: TRM55970.00
Info
Measured height: 1.800 m
ARP to L1 offset: 0.063 m
Applied height: 1.863 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: POTR
Name:
POTR
Disabled
File:
E:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude:
North
32
37
06.26918
Compute from PPP
Longitude:
West
116
35
27.05963
Enter Grid Values
Ellipsoidal height:
731.041
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TPSCR.G3, SCIT
View STA File
Antenna profile:
TPSCR.G3, SCIT
Info
Measured to
Measured height:
0.008
m
ARP
ARP to L1 offset:
0.087
m
L1 Phase Centre
Applied height:
0.095
m
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	A001
Stop Line Name	A020
Turn Time (min)	3
Buffer (%)	10
Acquisition Time (hrs)	#N/A

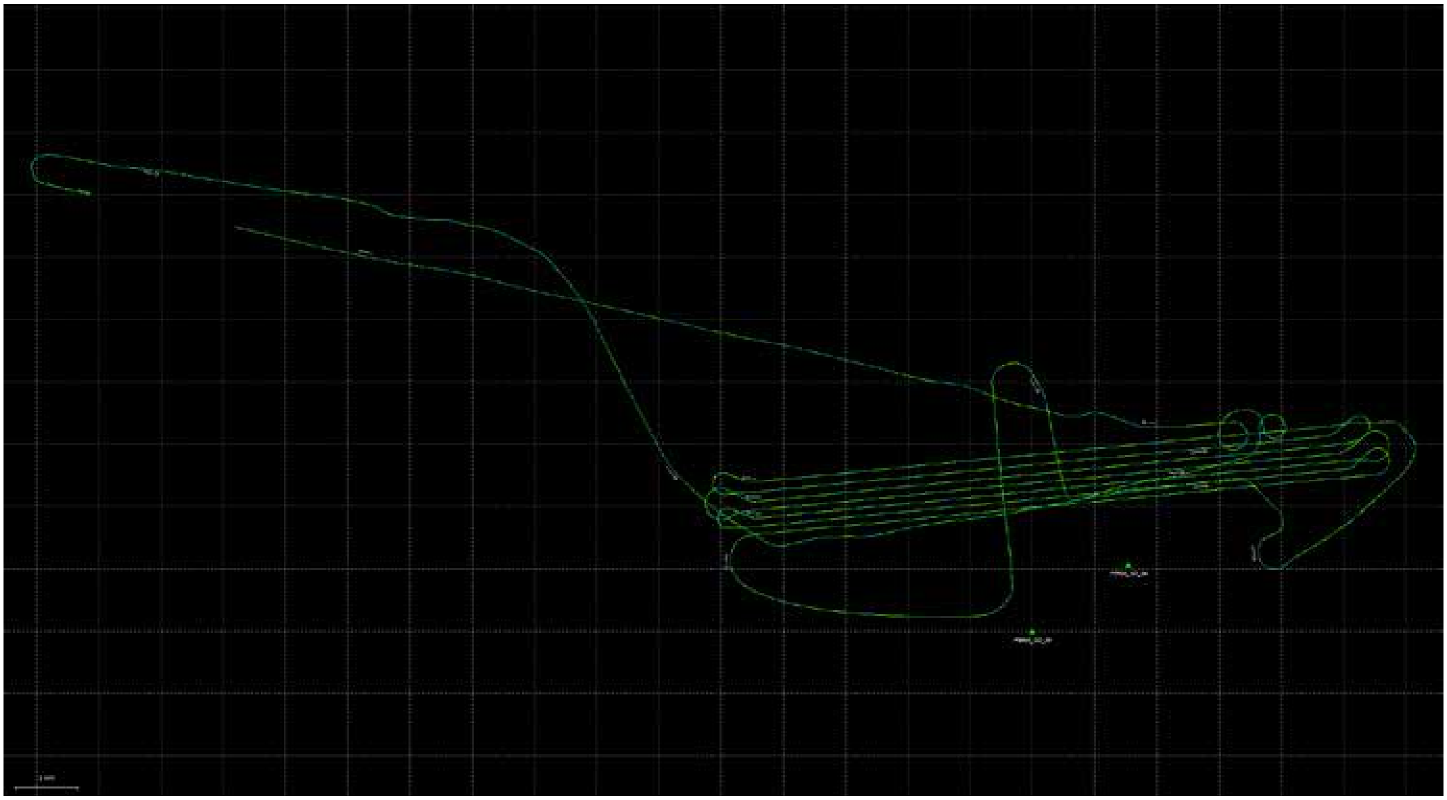
Other Acquisition Notes:

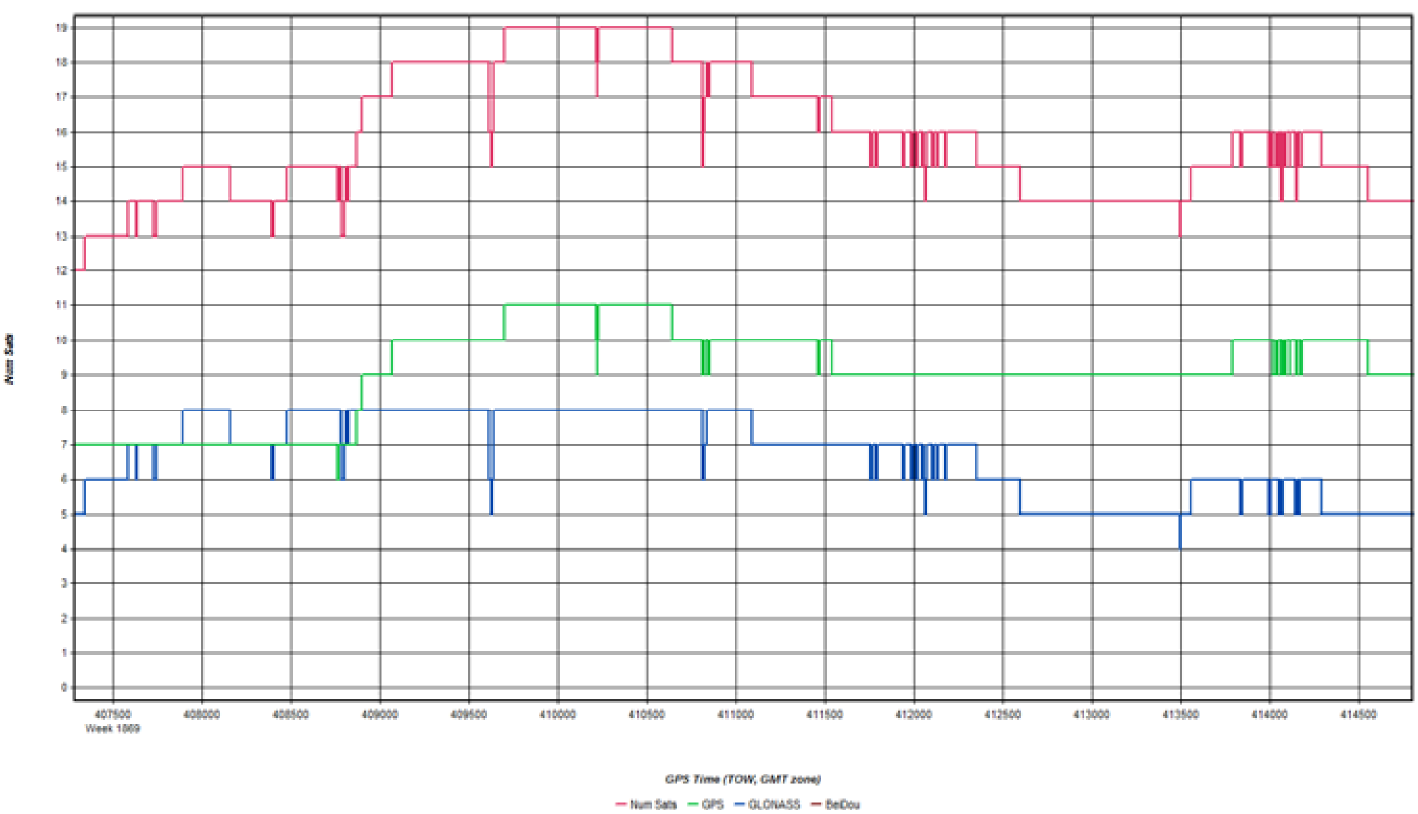
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

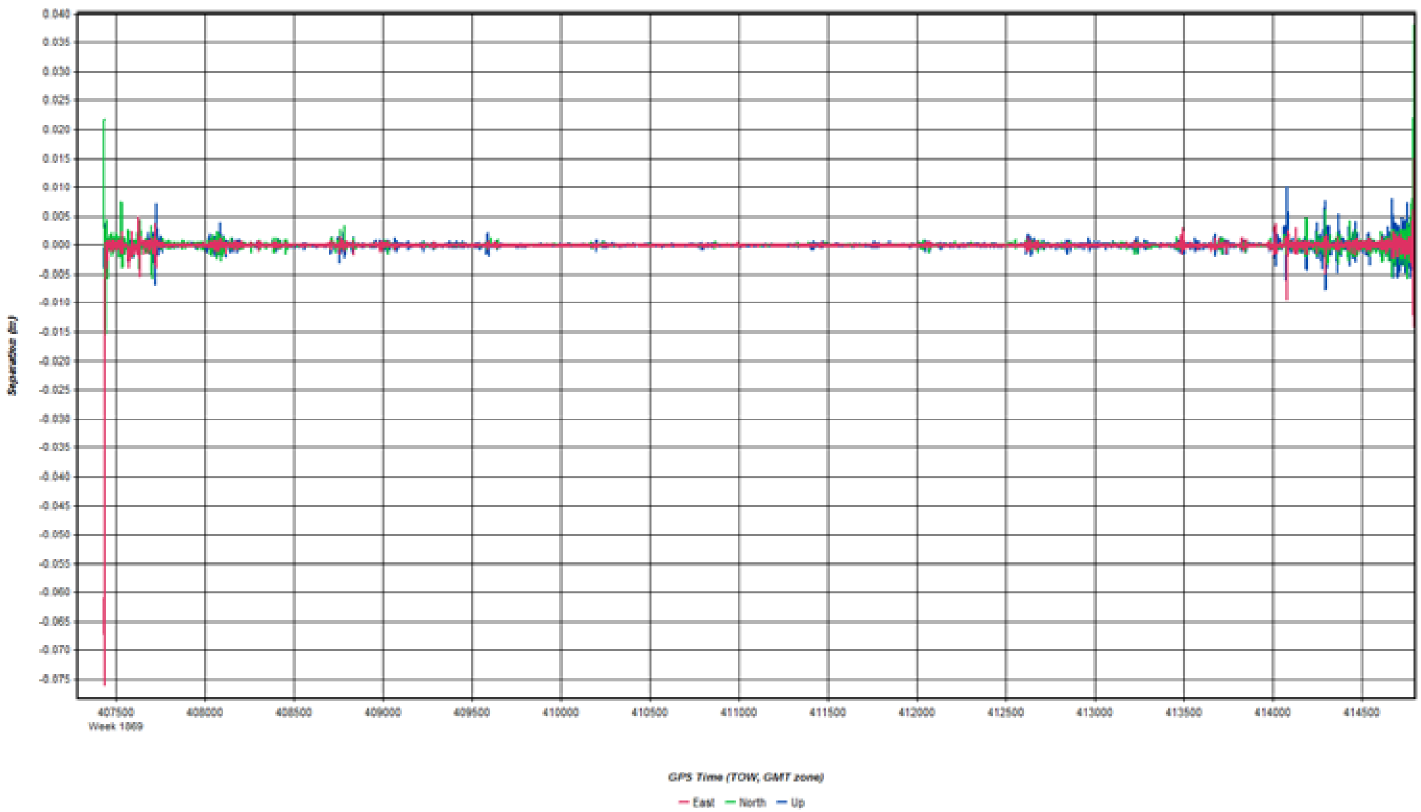
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

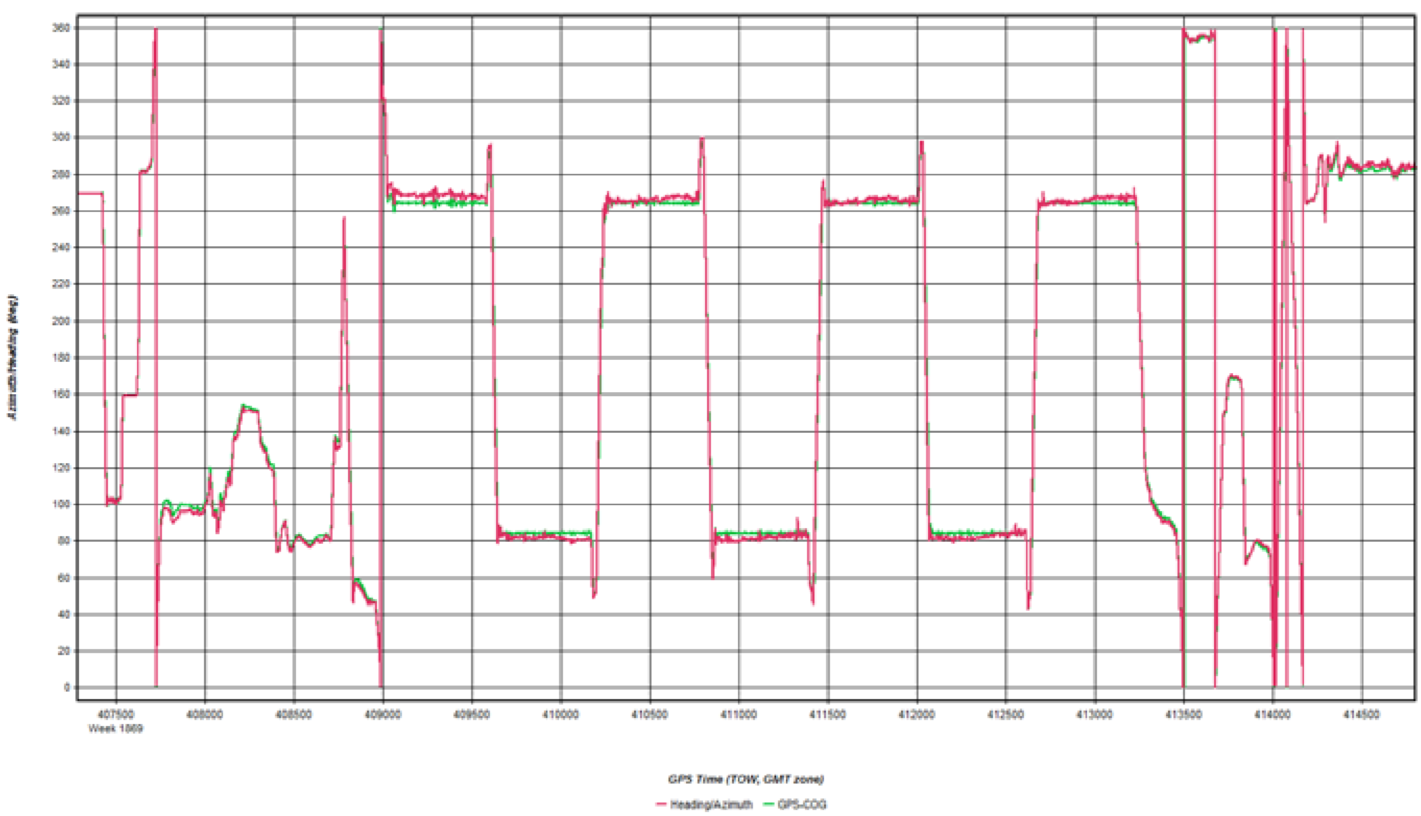
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
152	14.37	8373	190637	190949		E to w start, refly wind blew off line at the start
153	14.41	8245	191951			
154	14.42	8160	192945			E to w
155	14.46	8160	194012			w to e
156	14.45	8242	195111			
157	14.45	8242	200130			Crossline: 185559
158	14.44	8242	201118			Crossline: 204226
159	14.39	8301	202136			
160	14.49	8301	203130	173748		Finish E to W
179	15.35	7769	185537	184238		missing chunk from 11/1, refly e to w
188	16.32	7317	172157	183036		refly w to e
189	16.32	7271	171040	180524	181829.00	dropouts from 11/1, refly w to e, over speed at start; refly again e to w

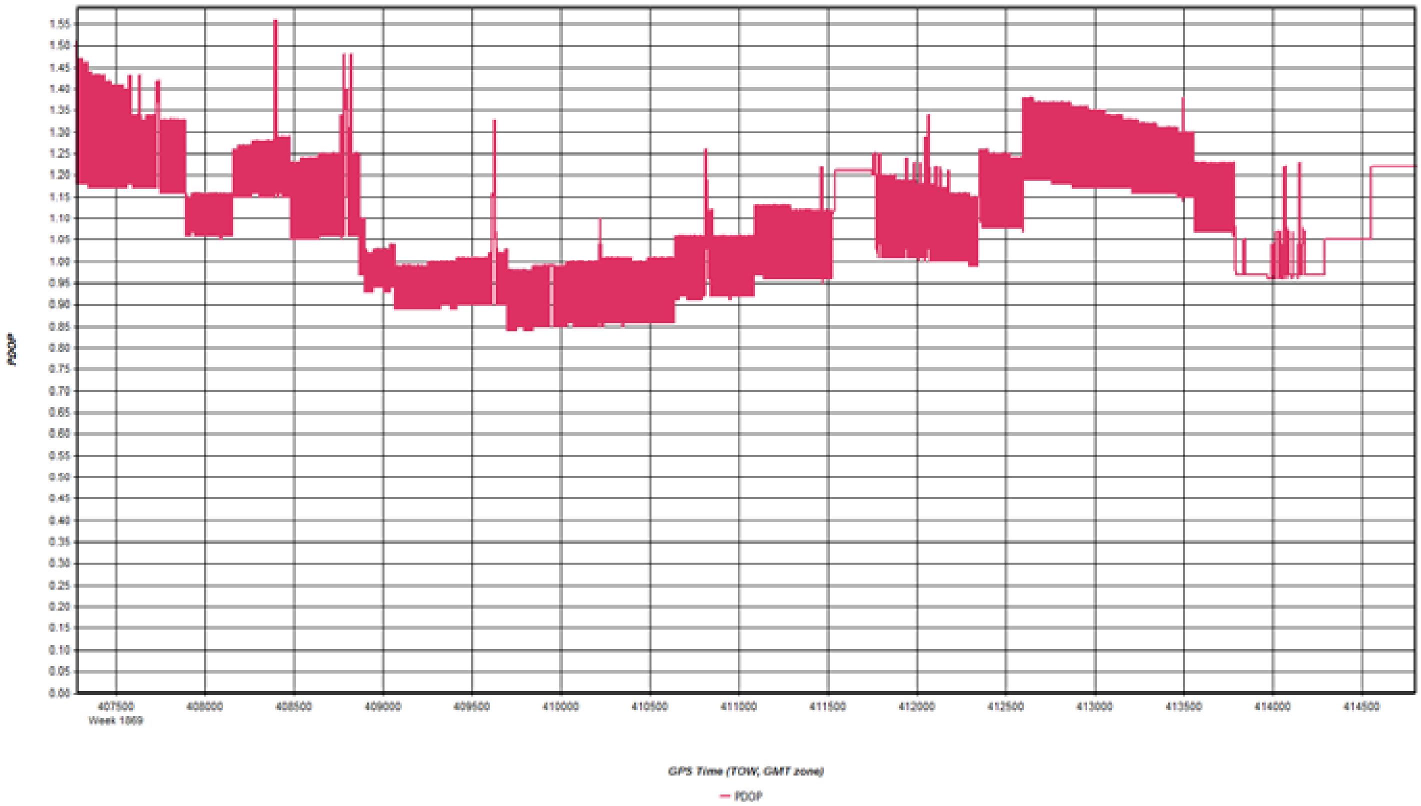
Nov 05, 2015-A

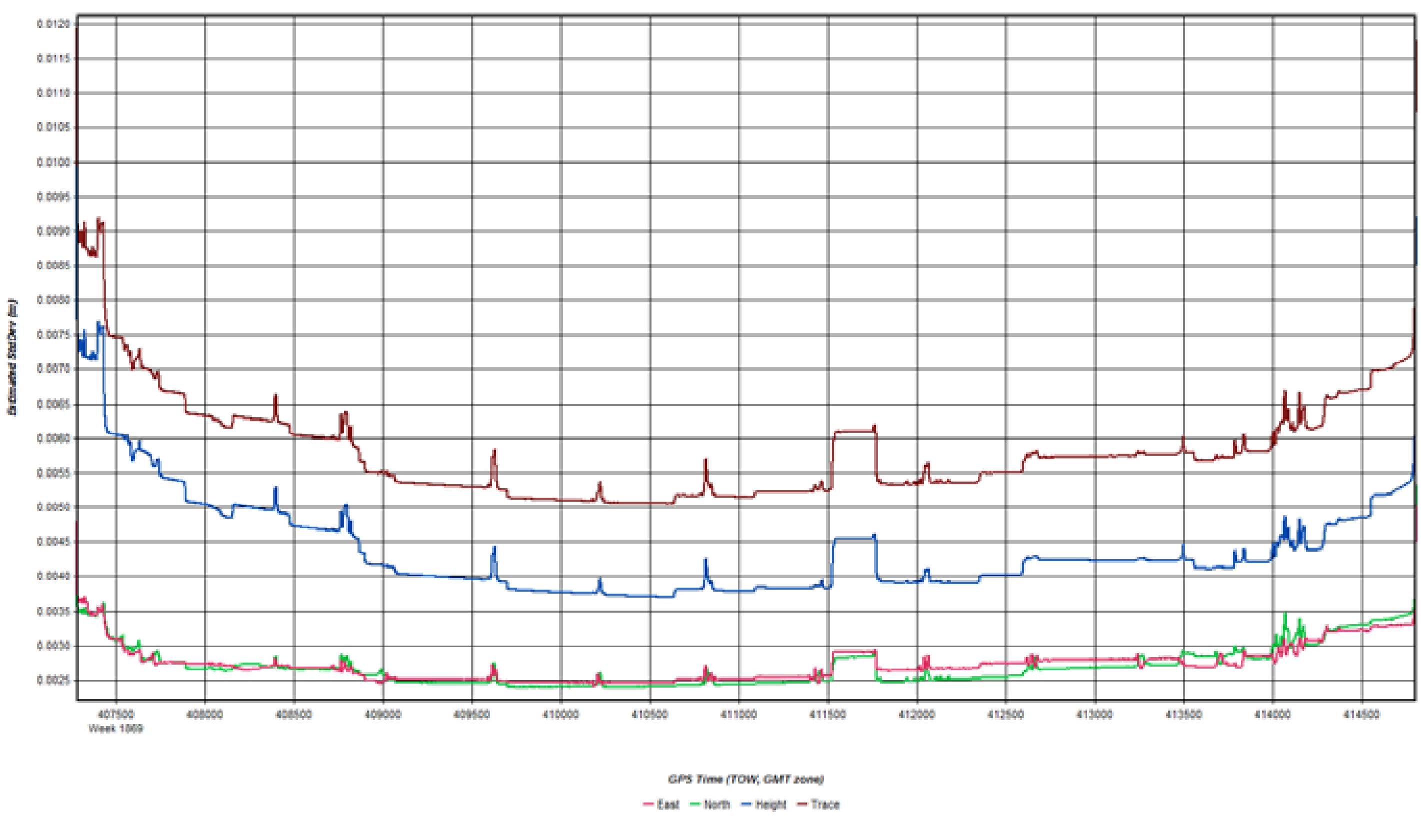


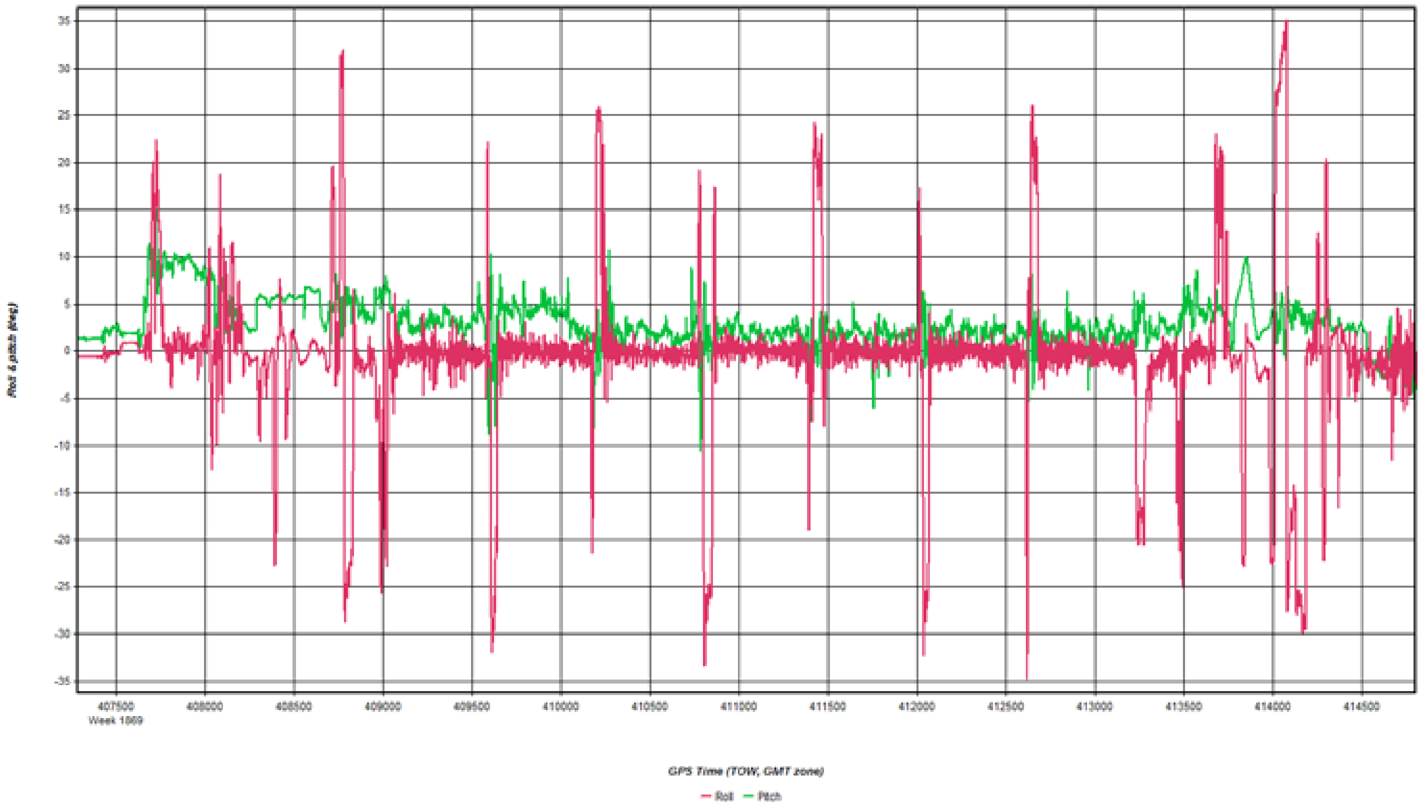

Num Sats
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
407500
Week 1869
408000
408500
409000
409500
410000
410500
411000
411500
412000
412500
413000
413500
414000
414500
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

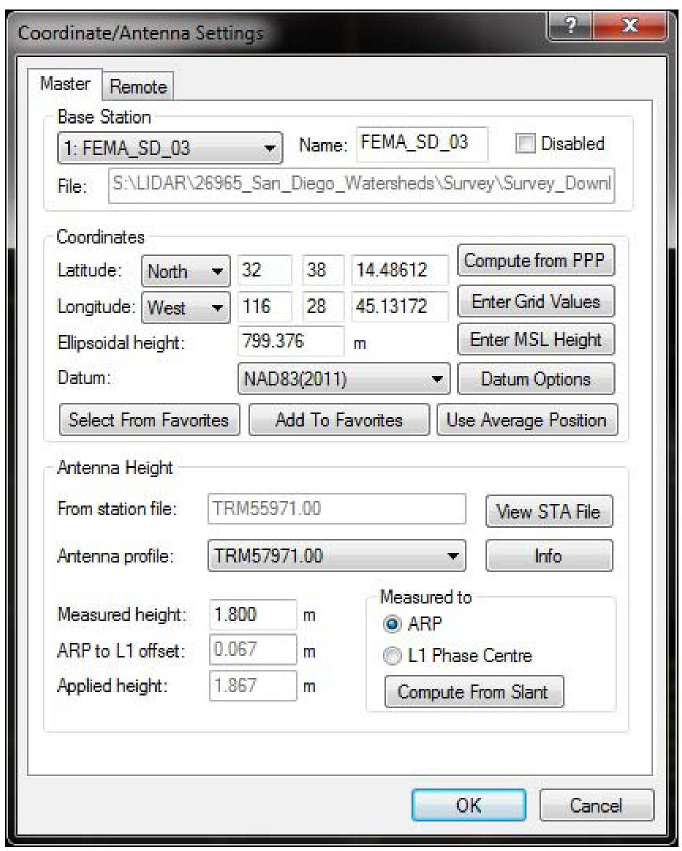

Separation (m)
GPS Time (TOW, GMT zone)
Week 1869
East
North
Up

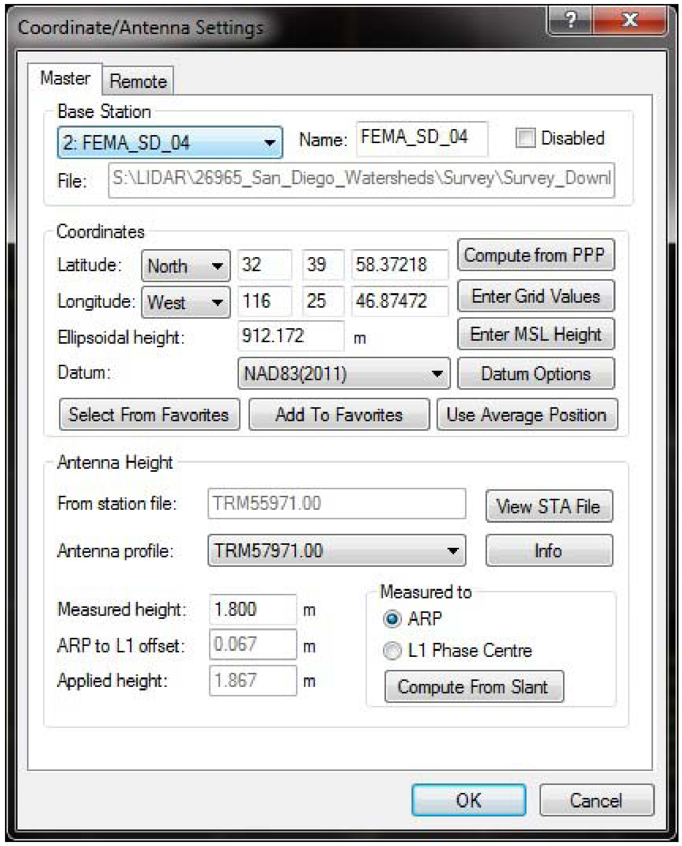

Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Week 1869
Heading/Azimuth
GPS-COG


PDOP
407500
Week 1869
408000
408500
409000
409500
410000
410500
411000
411500
412000
412500
413000
413500
414000
414500
GPS Time (TOW, GMT zone)
PDOP


Estimated Std Dev (m)
407500
Week 1869
408000
408500
409000
409500
410000
410500
411000
411500
412000
412500
413000
413500
414000
414500
GPS Time (TOW, GMT zone)
East
North
Height
Trace


Roll & pitch (deg)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
407500
Week 1869
408000
408500
409000
409500
410000
410500
411000
411500
412000
412500
413000
413500
414000
414500
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
1: FEMA_SD_03
Name:
FEMA_SD_03
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
38
14.48612
Compute from PPP
Longitude:
West
116
28
45.13172
Enter Grid Values
Ellipsoidal height:
799.376
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.800
m
ARP to L1 offset:
0.067
m
Applied height:
1.867
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_04
Name: FEMA_SD_04
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 32 39 58.37218
Compute from PPP
Longitude: West 116 25 46.87472
Enter Grid Values
Ellipsoidal height: 912.172 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.800 m
ARP to L1 offset: 0.067 m
Applied height: 1.867 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	089
Stop Line Name	091
Turn Time (min)	2
Buffer (%)	0
Acquisition Time (hrs)	0.7

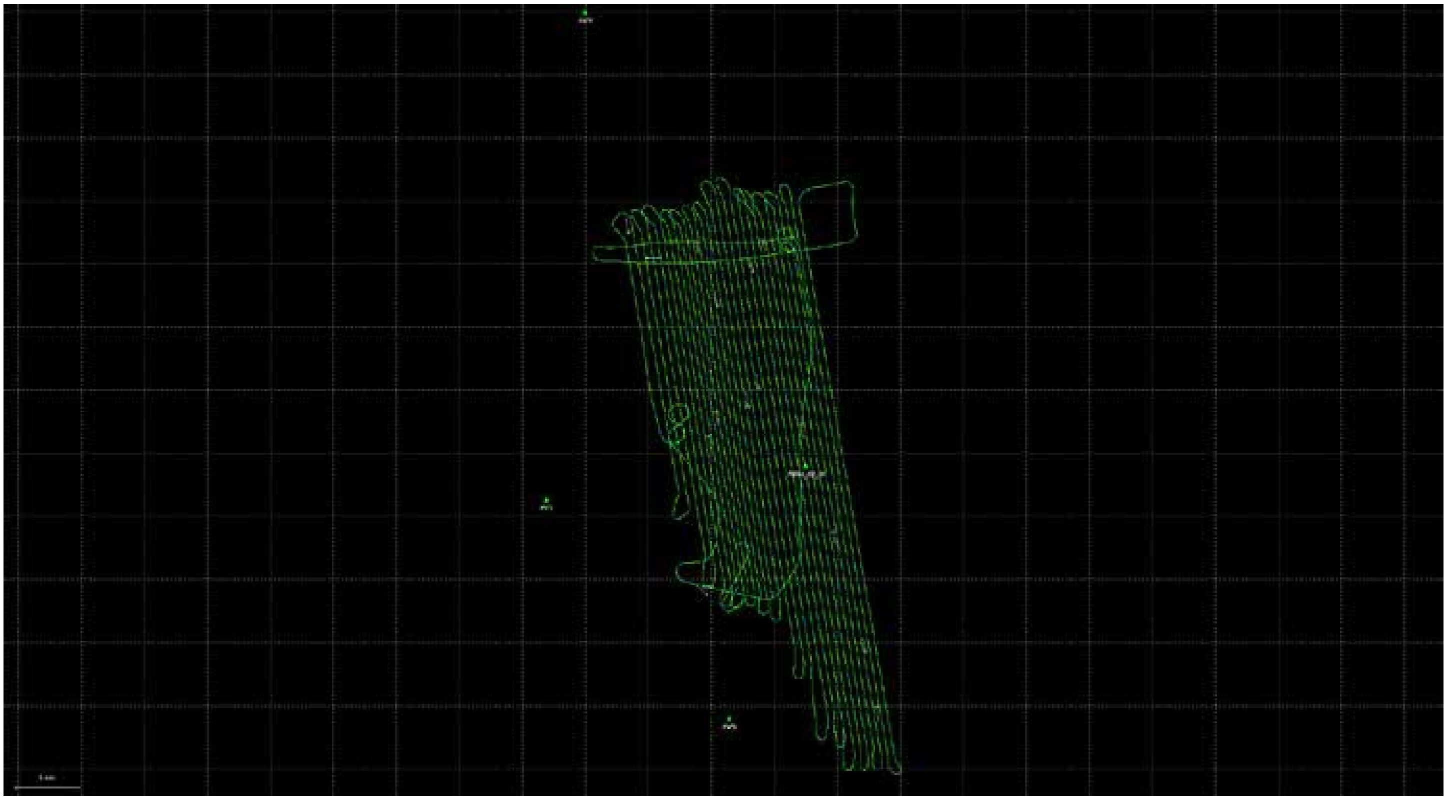
Other Acquisition Notes:

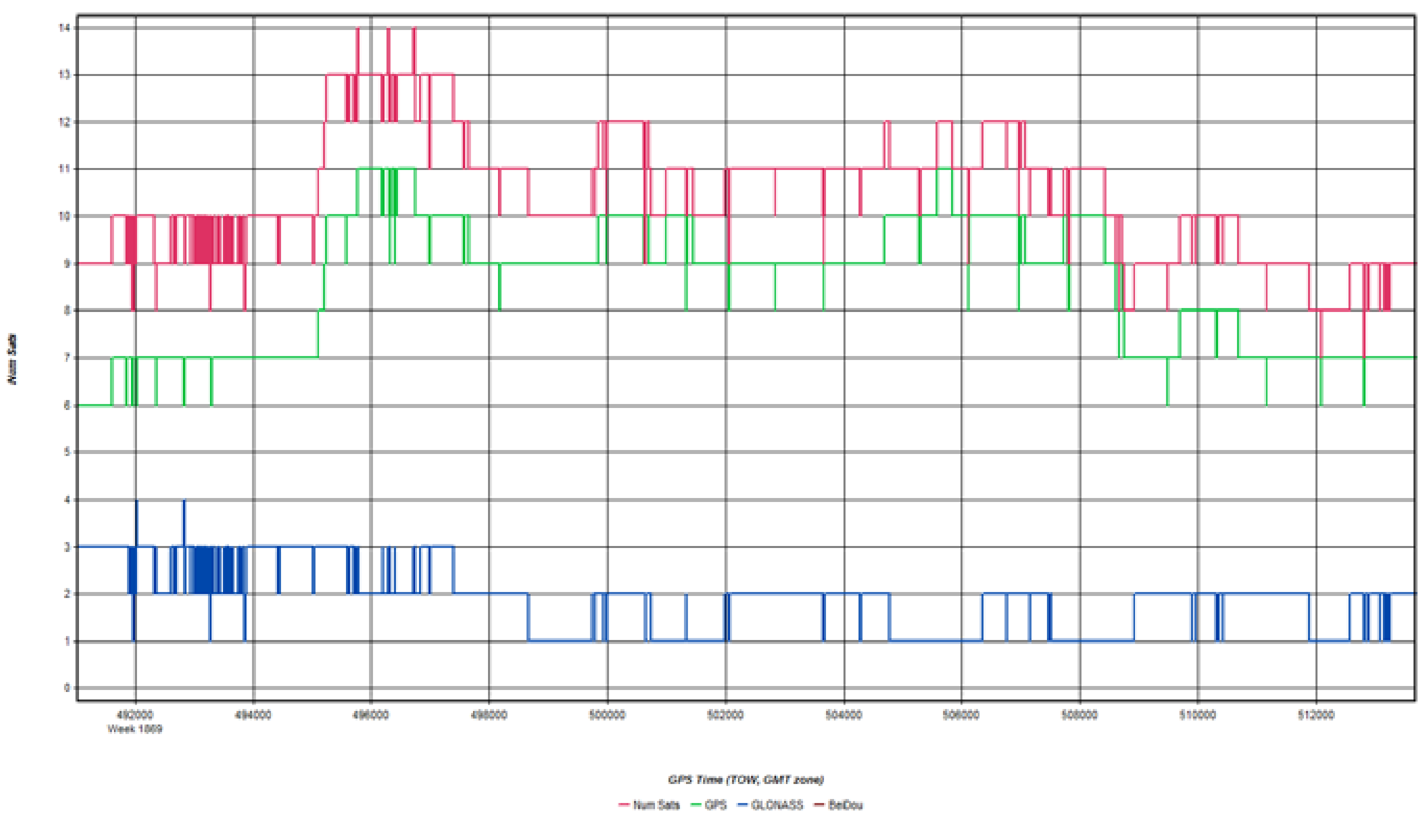
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

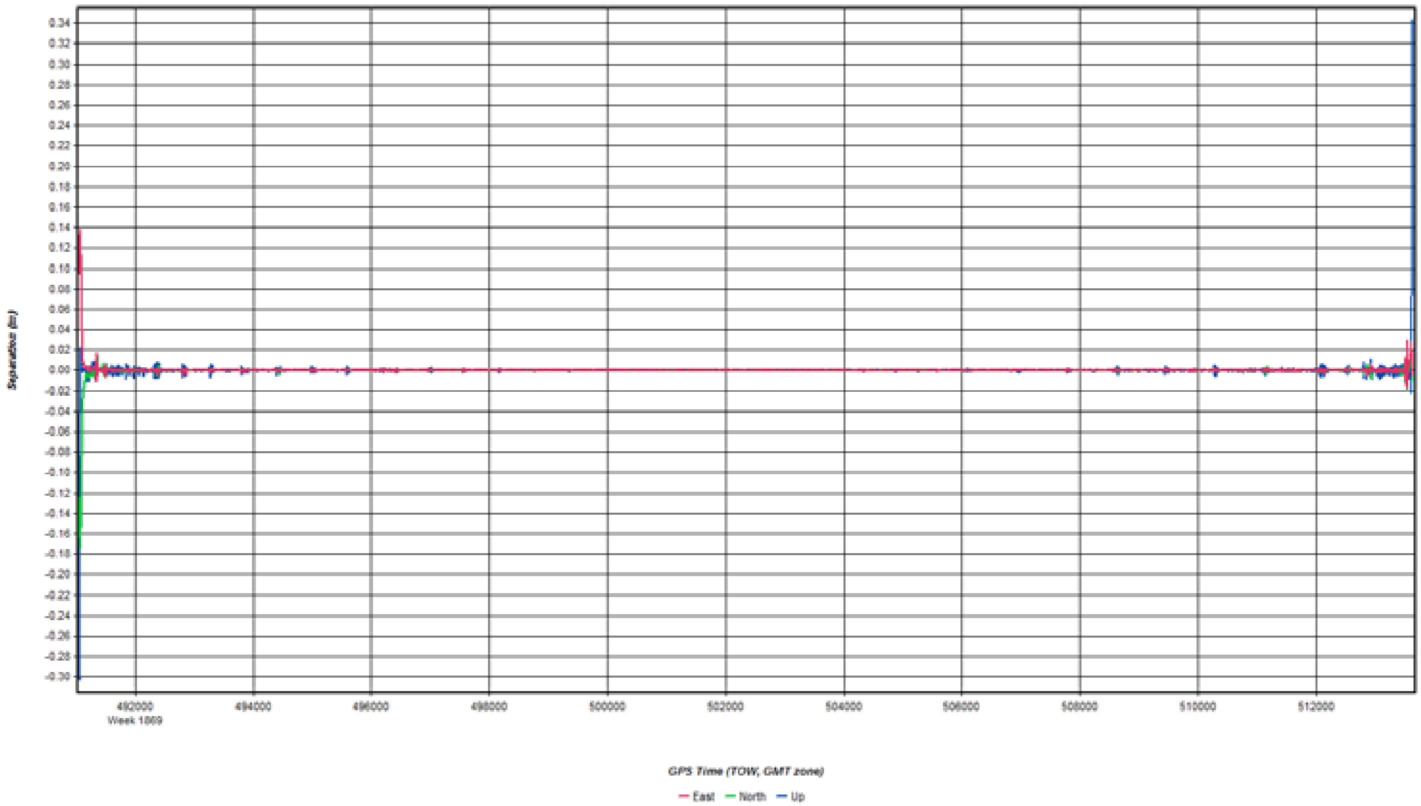
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

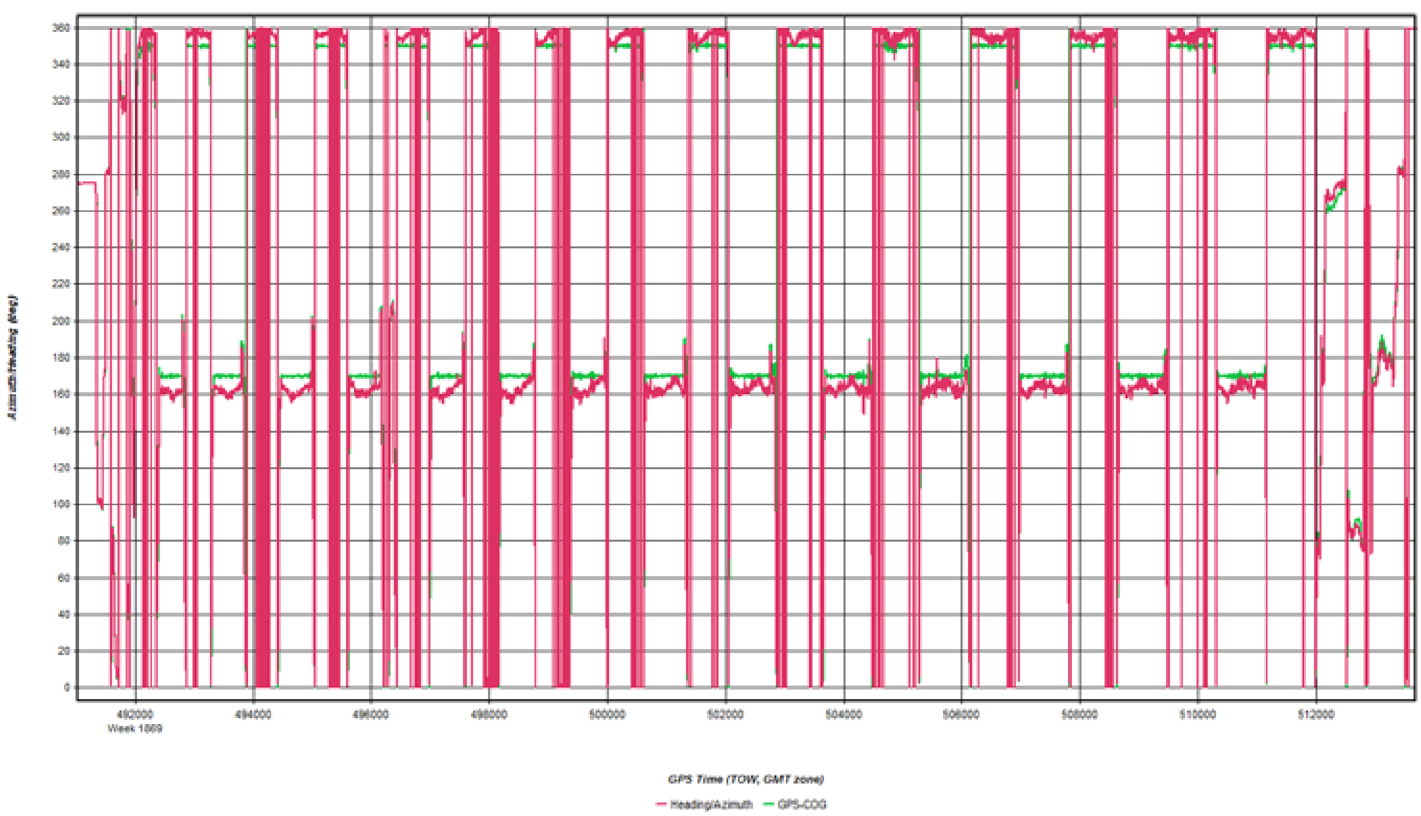
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
160	14.49	8301	203130	173748		Refly Just in case not enough kinematic at end of 11/2 flight; Refly e to w start
161	14.65	8048	174733			w to e
162	14.88	7691	175725			
163	14.95	7422	180738			Crossline: 185120
164	15.09	7139	181758			
165	15.19	7110	182758			
166	15.24	7110	183807			E to w last line

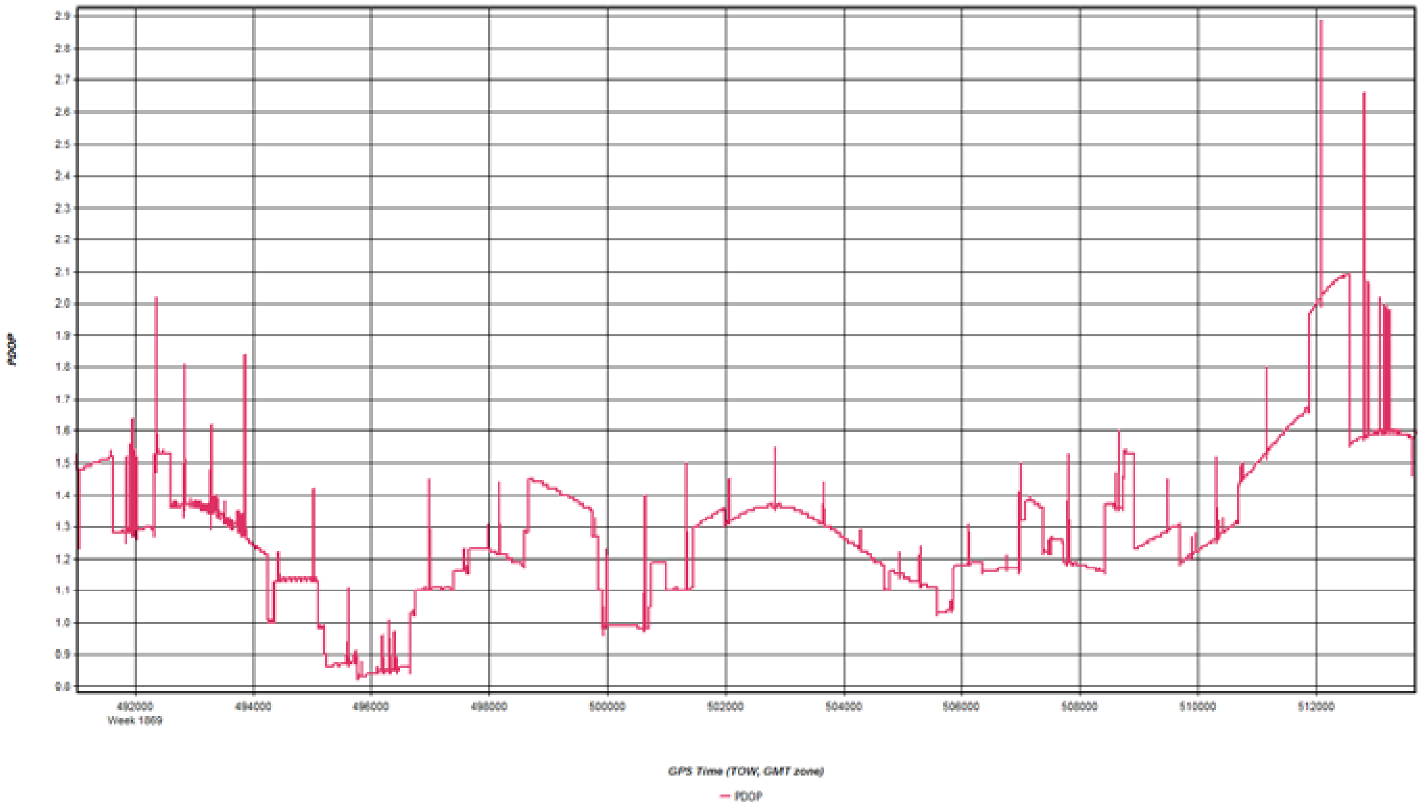
Nov 06, 2015-A

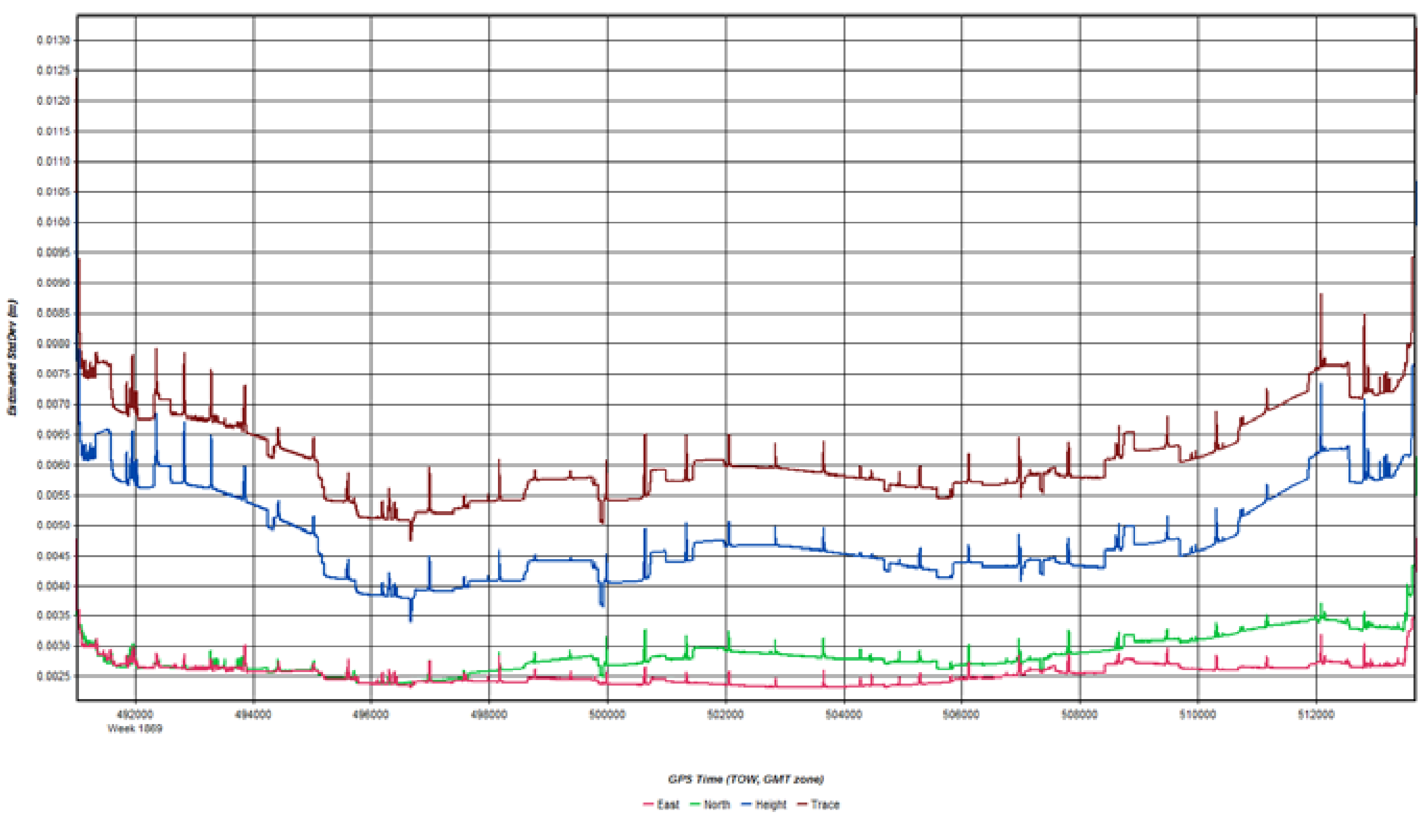


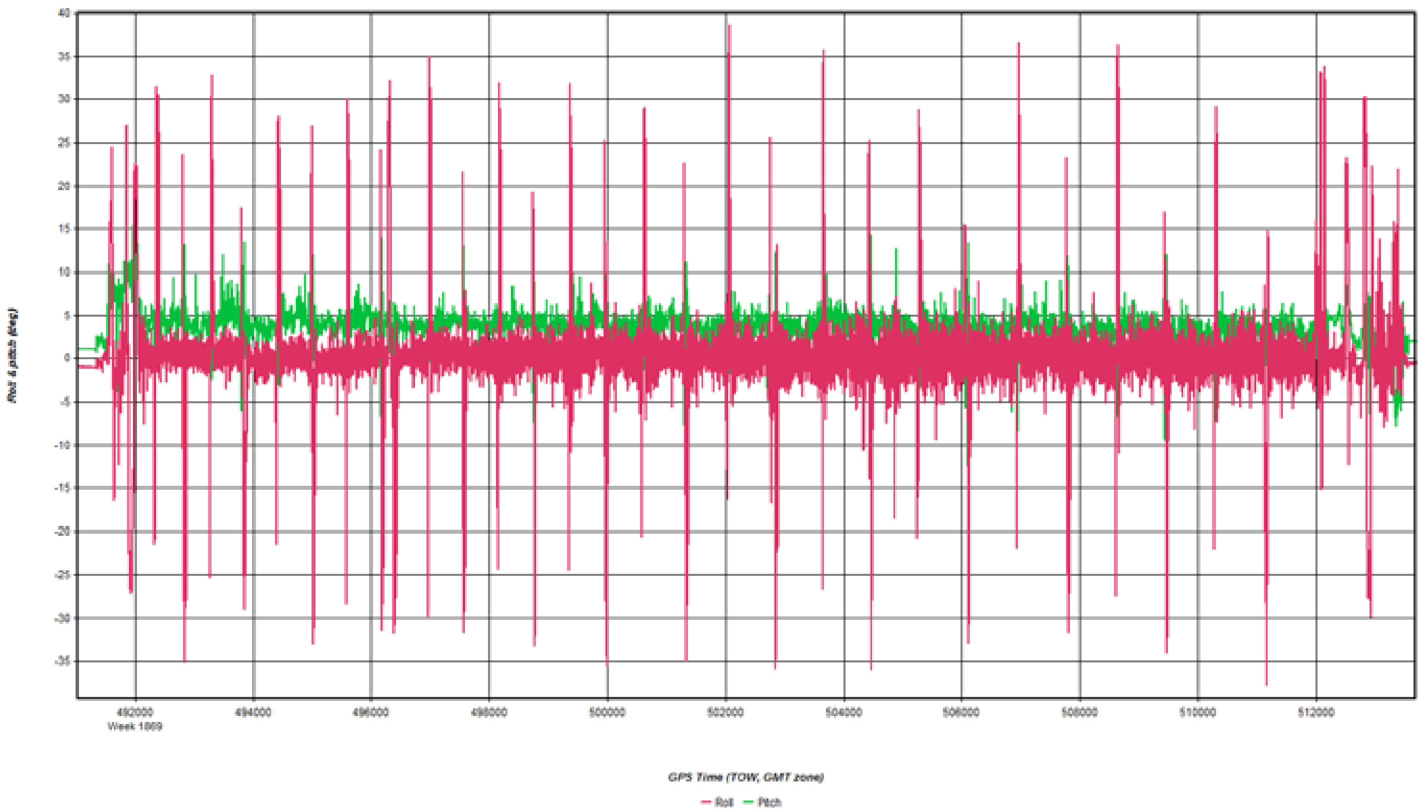

14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
492000
Week 1869
494000
496000
498000
500000
502000
504000
506000
508000
510000
512000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

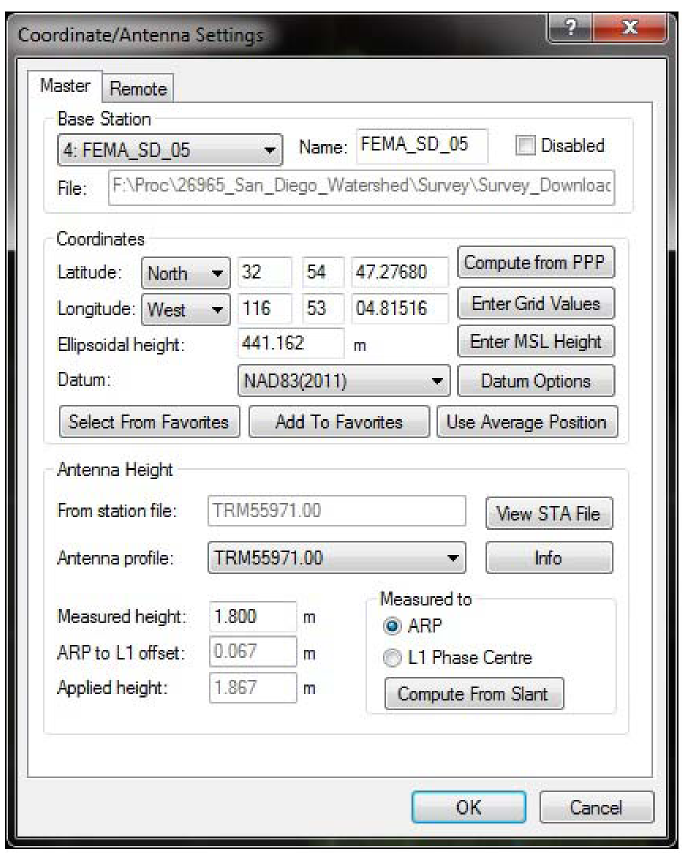

Separation (m)
GPS Time (TOW, GMT zone)
Week 1869
East
North
Up

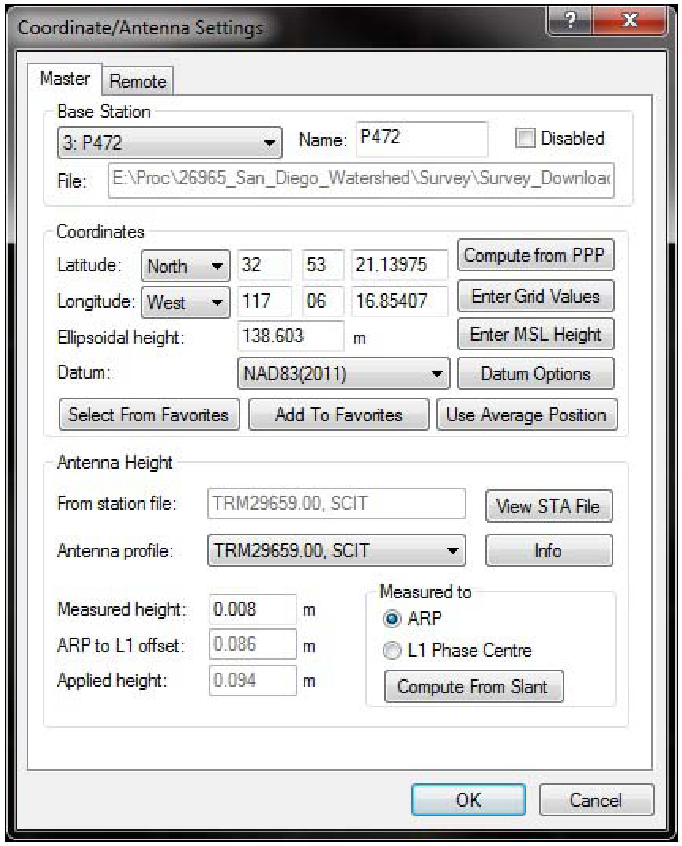

Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Week 1869
Heading/Azimuth
GPS-COG

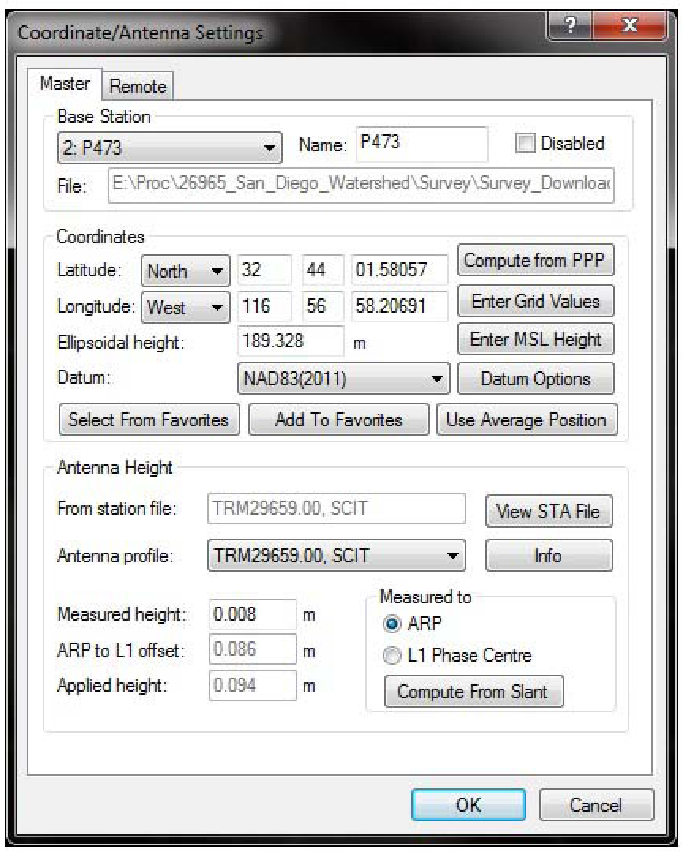

PDOP
GPS Time (TOW, GMT zone)
Week 1869
— PDOP

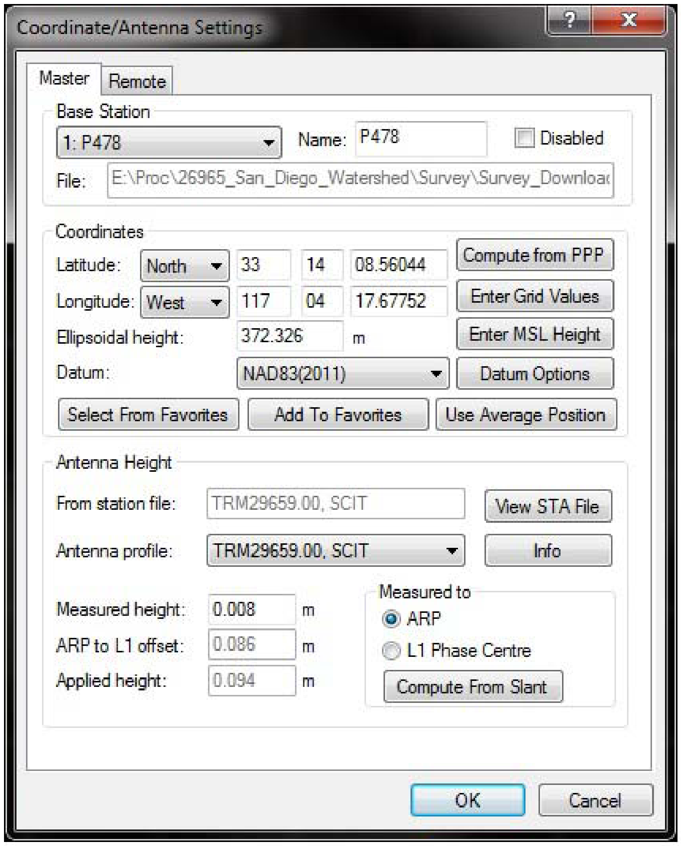

Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1869
— East — North — Height — Trace


Roll & pitch (deg)
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
492000
Week 1869
494000
496000
498000
500000
502000
504000
506000
508000
510000
512000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
4: FEMA_SD_05
Name:
FEMA_SD_05
Disabled
File:
F:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude:
North
32
54
47.27680
Compute from PPP
Longitude:
West
116
53
04.81516
Enter Grid Values
Ellipsoidal height:
441.162
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM55971.00
Info
Measured height:
1.800
m
ARP to L1 offset:
0.067
m
Applied height:
1.867
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
3: P472
Name:
P472
Disabled
File:
E:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude:
North
32
53
21.13975
Compute from PPP
Longitude:
West
117
06
16.85407
Enter Grid Values
Ellipsoidal height:
138.603
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM29659.00, SCIT
View STA File
Antenna profile:
TRM29659.00, SCIT
Info
Measured height:
0.008
m
ARP to L1 offset:
0.086
m
Applied height:
0.094
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: P473
Name:
P473
Disabled
File:
E:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude:
North
32
44
01.58057
Compute from PPP
Longitude:
West
116
56
58.20691
Enter Grid Values
Ellipsoidal height:
189.328
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM29659.00, SCIT
View STA File
Antenna profile:
TRM29659.00, SCIT
Info
Measured height:
0.008
m
ARP to L1 offset:
0.086
m
Applied height:
0.094
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: P478
Name: P478
Disabled
File: E:\Proc\26965_San_Diego_Watershed\Survey\Survey_Downloac
Coordinates
Latitude: North 33 14 08.56044
Longitude: West 117 04 17.67752
Ellipsoidal height: 372.326 m
Datum: NAD83(2011)
Compute from PPP
Enter Grid Values
Enter MSL Height
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM29659.00, SCIT
View STA File
Antenna profile: TRM29659.00, SCIT
Info
Measured height: 0.008 m
ARP to L1 offset: 0.086 m
Applied height: 0.094 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	070
Stop Line Name	133
Turn Time (min)	3
Buffer (%)	10
Acquisition Time (hrs)	14.4

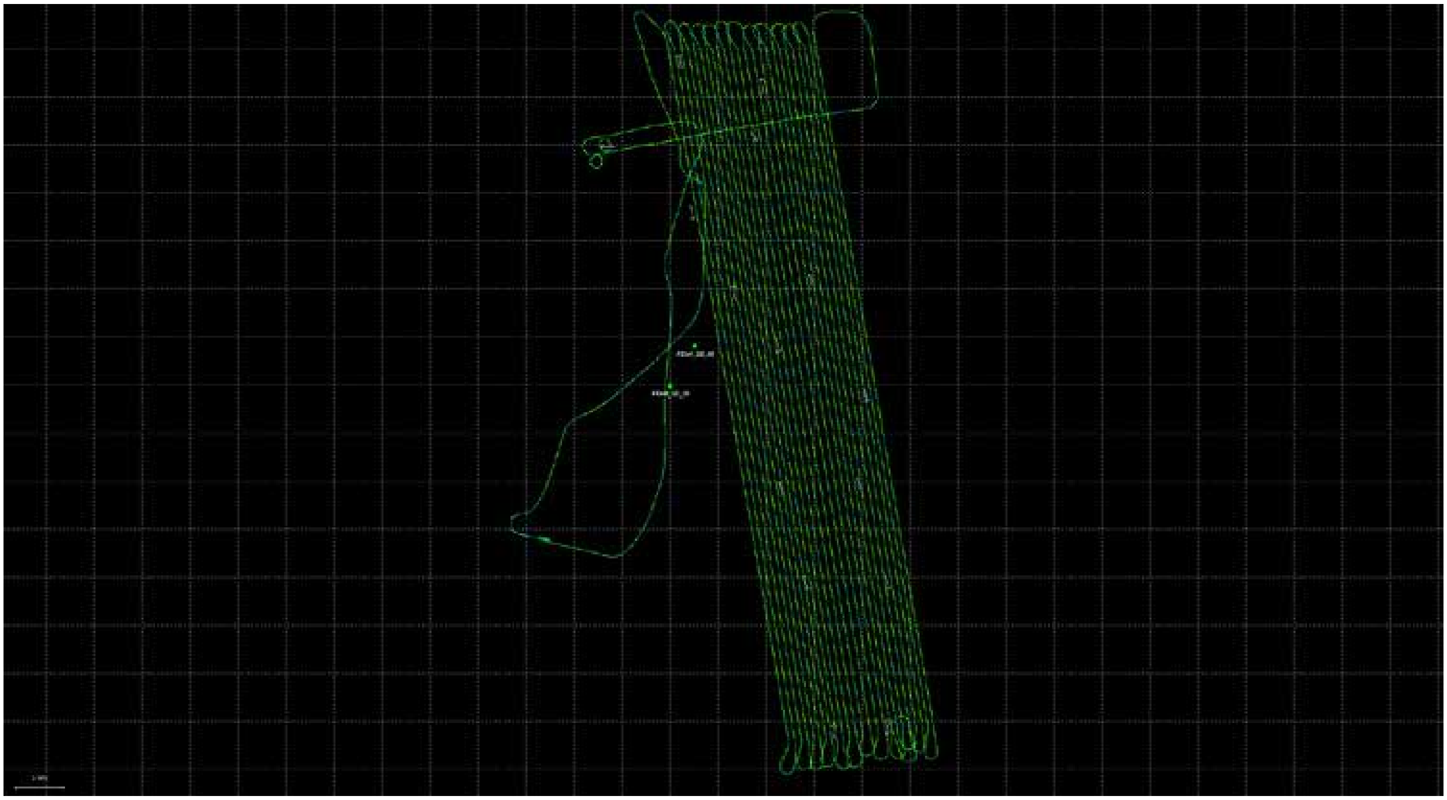
Other Acquisition Notes:

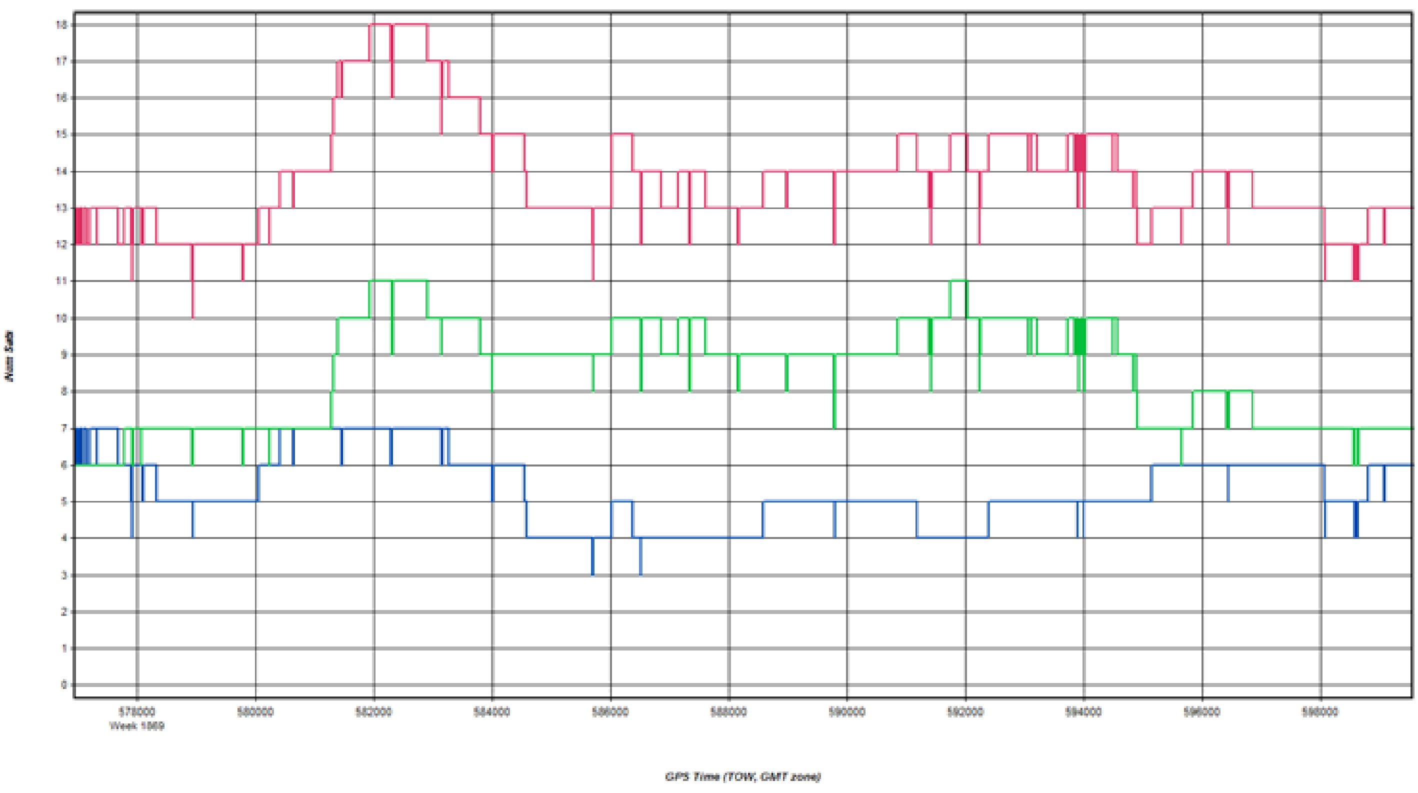
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

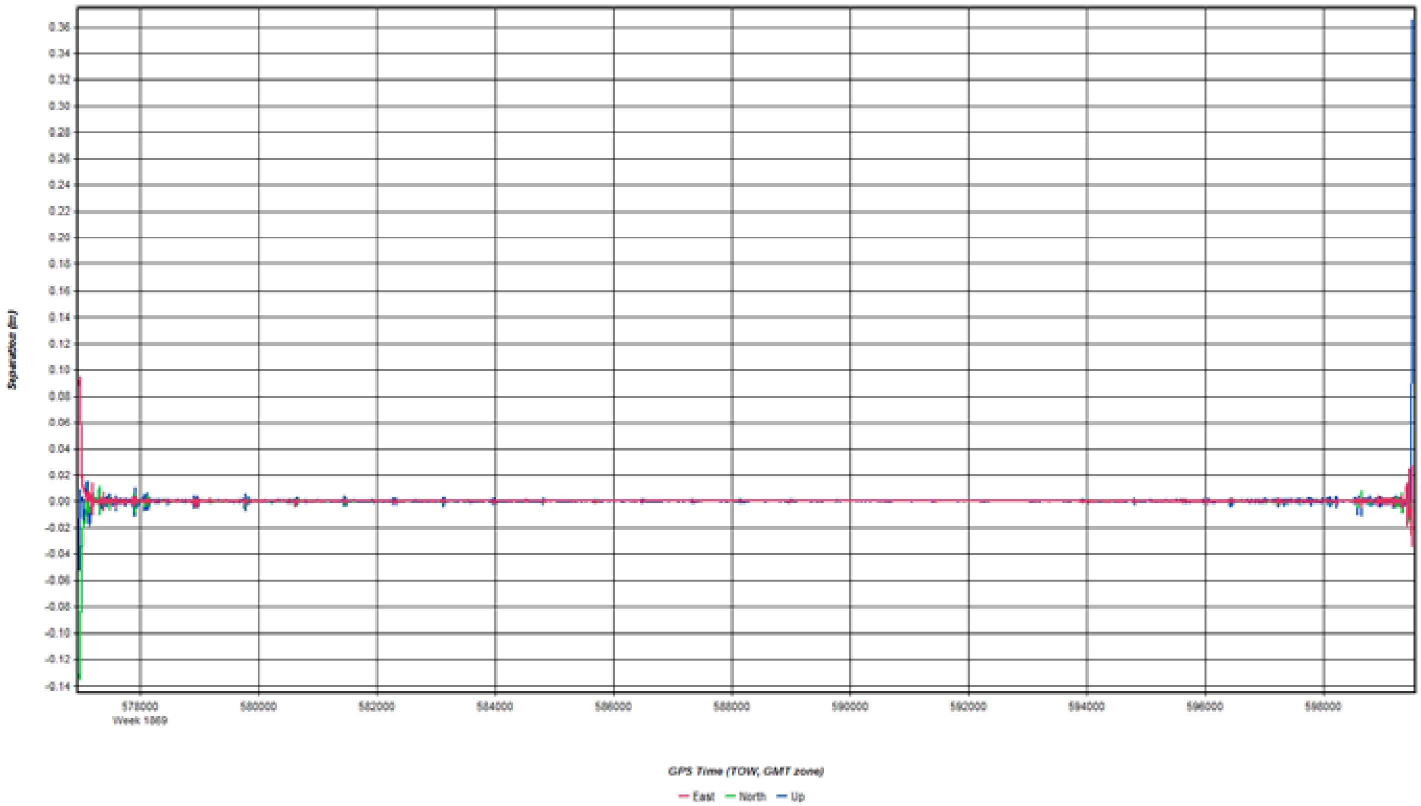
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

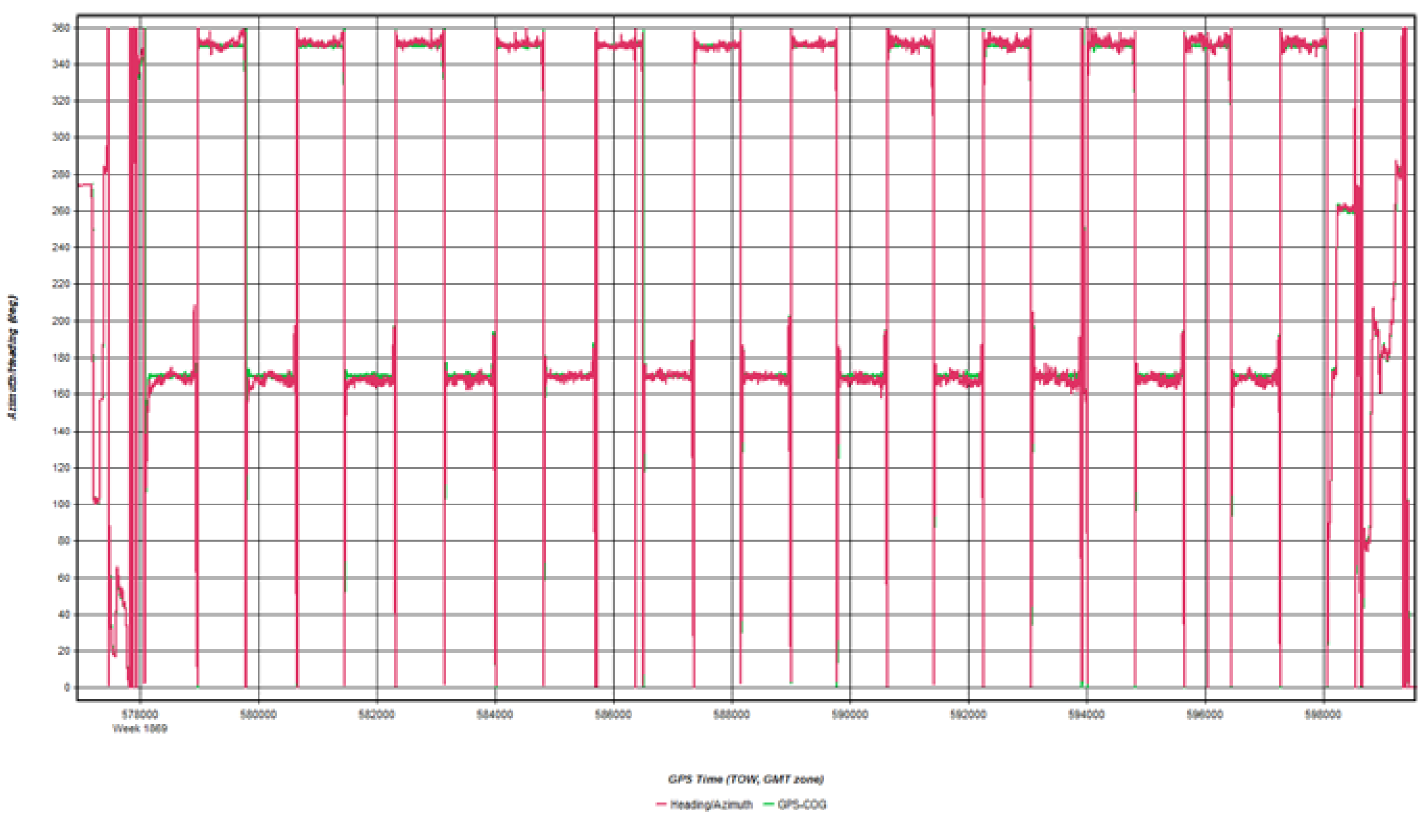
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
001	1.02	5798	164431			s to n start
002	10.87	5798	164654			
003	11.08	5798	165431			
004	13.68	5820	170206			n to s
005	14.07	5804	171133			
006	15.09	5798	172102			
007	15.09	5798	173046			
008	15.09	5801	174032			
009	15.08	5804	175021	175352		Pulled off line for traffic, s to n
010	15.08	5817	180335			
011	15.32	5817	181318			
012	15.69	5817	182311			
013	15.73	5817	183312			s to n
014	15.8	5837	184316			
015	16.42	5843	185324			
016	19.25	5843	190405			n to s
017	19.3	5866	191601			
018	19.81	5866	192806			
019	22.04	5866	194116			
020	21.13	5876	195457			
021	21.56	5876	200817	202203		Refly got ~100 feet lateral off line
022	22.66	5893	203545			
023	22.97	5903	204951			
024	22.99	5903	210351			
025	23.01	5922	211736			CROSSLINE: 221548
026	23.03	5922	213133			
027	23.04	5939	214529			
028	23.02	5948	215957			S to N last line

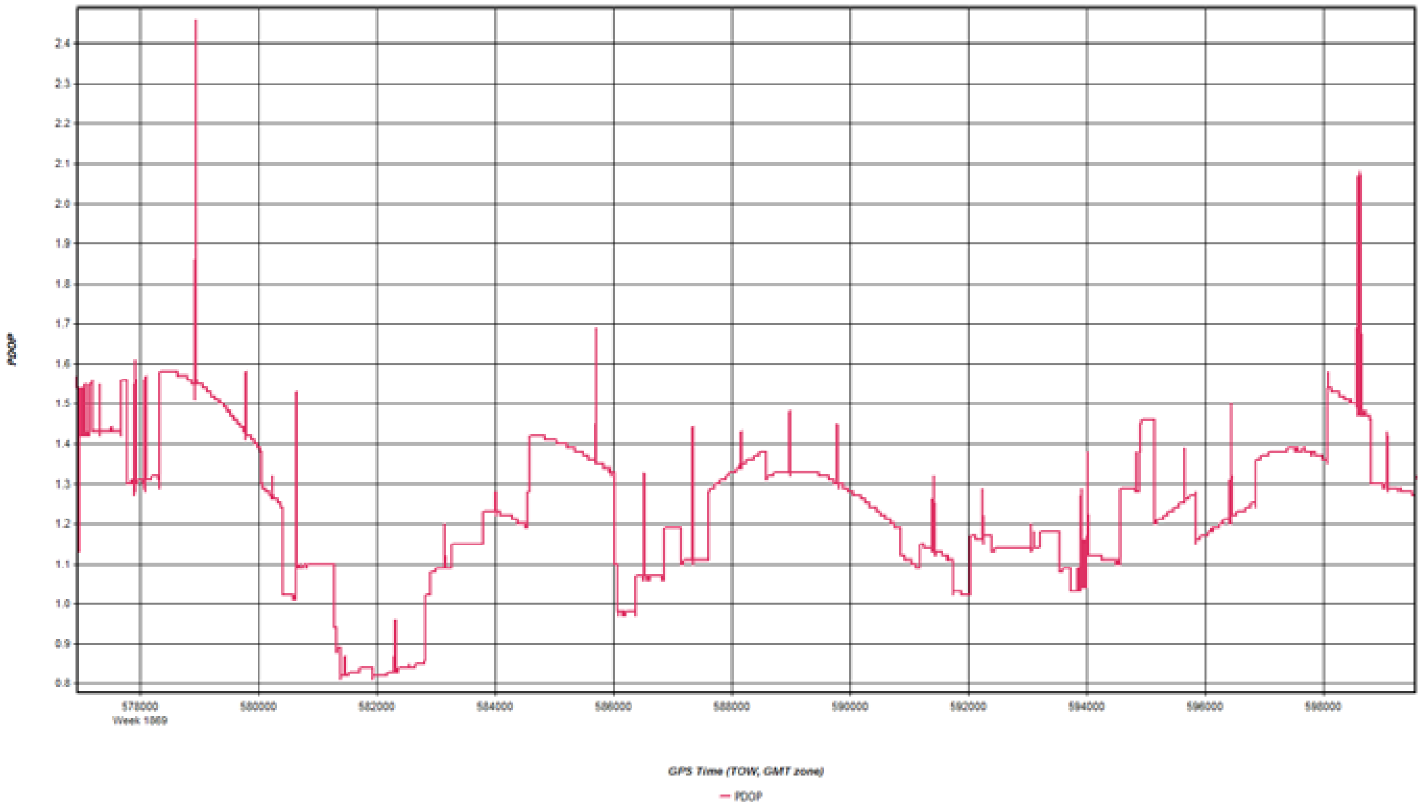
Nov 07, 2015-A

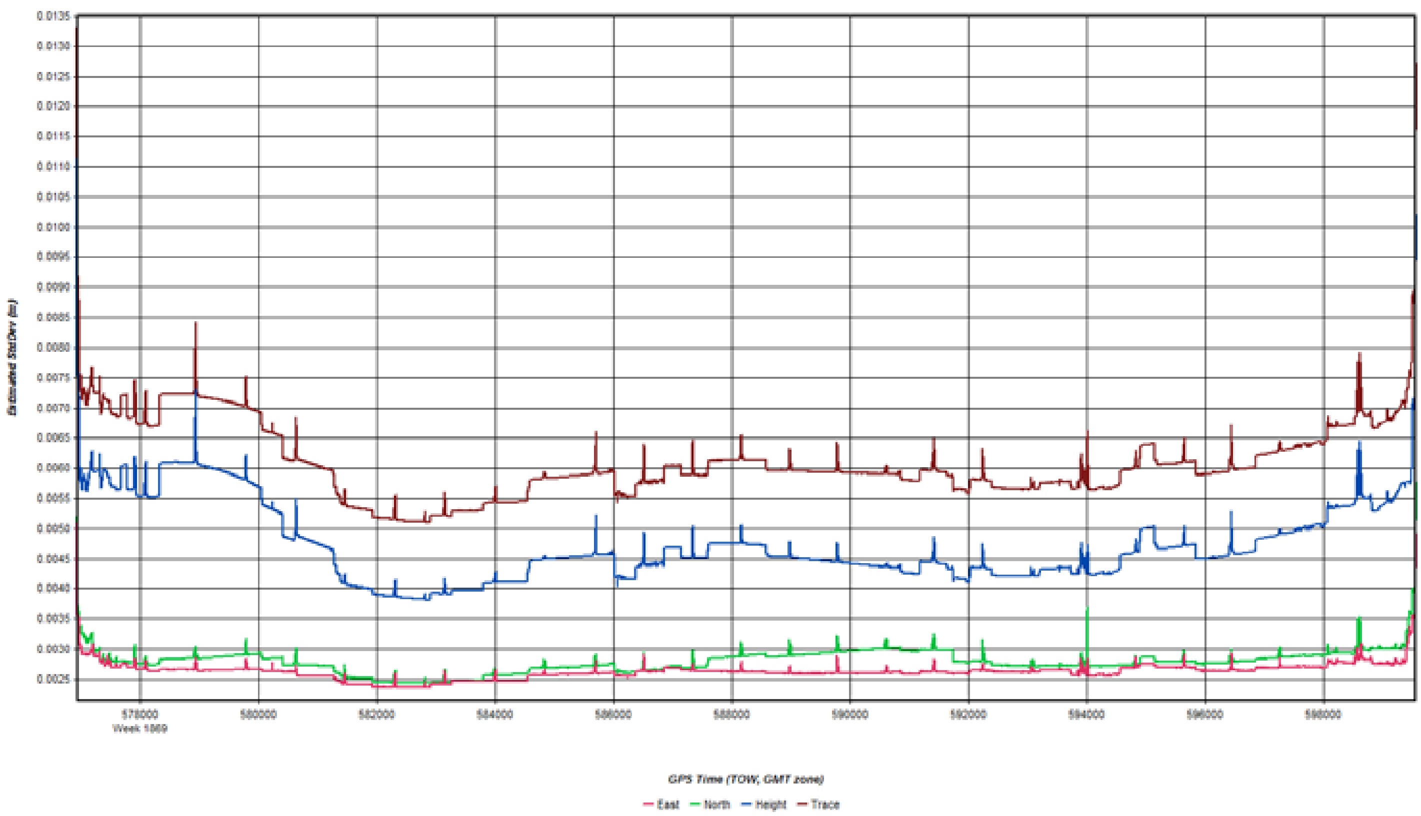


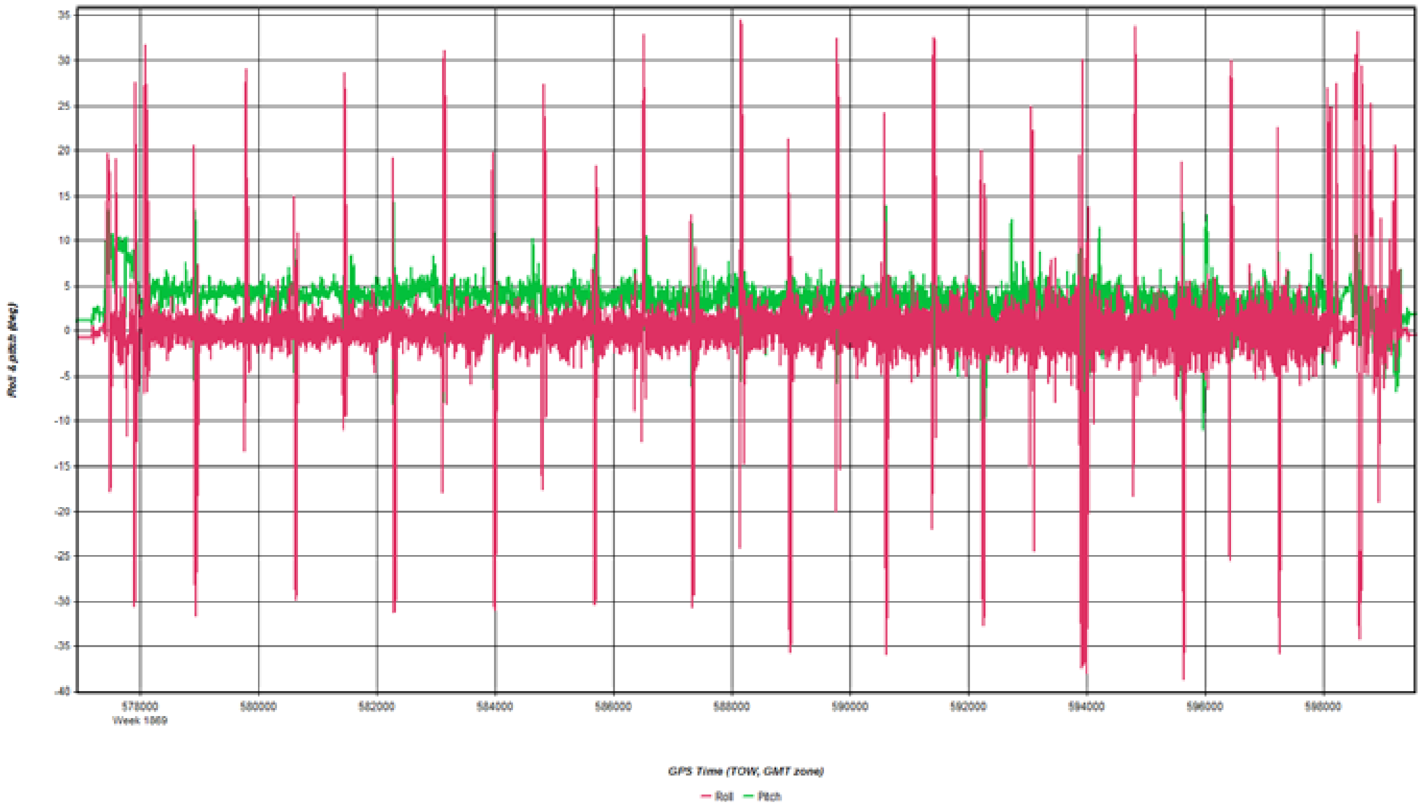

Num Sats
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
578000
Week 1869
580000
582000
584000
586000
588000
590000
592000
594000
596000
598000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

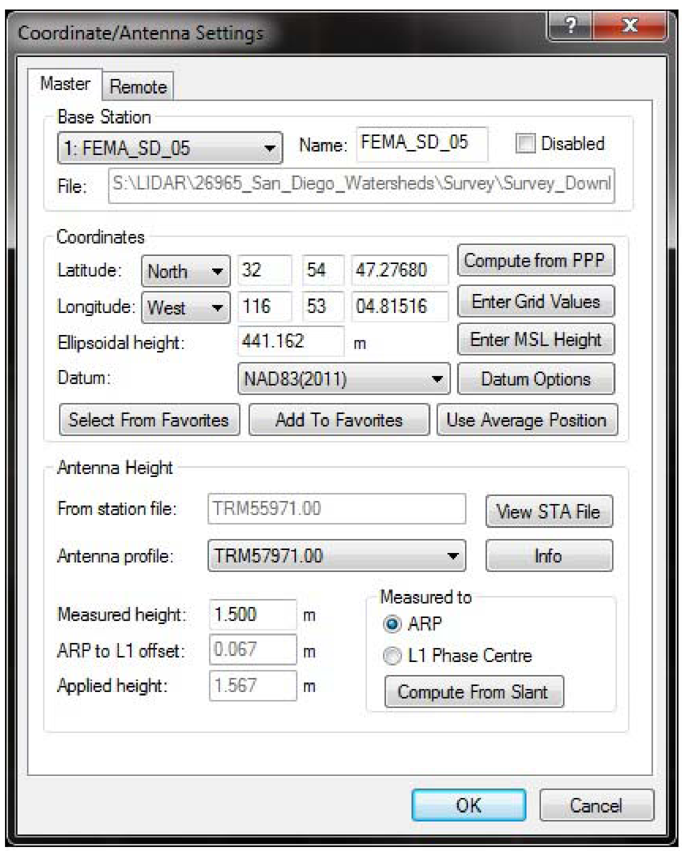

Separation (m)
GPS Time (TOW, GMT zone)
Week 1869
East
North
Up

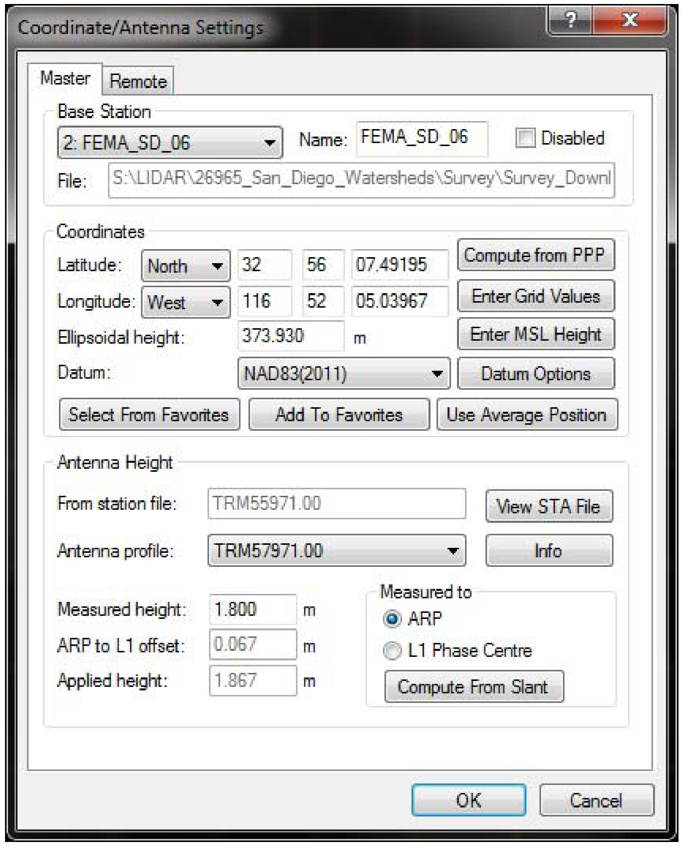

Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Week 1869
Heading/Azimuth
GPS-COG


PDOP
GPS Time (TOW, GMT zone)
Week 1869
PDOP


Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1869
East
North
Height
Trace


Roll & pitch (deg)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
578000
Week 1869
580000
582000
584000
586000
588000
590000
592000
594000
596000
598000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
1: FEMA_SD_05
Name:
FEMA_SD_05
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
54
47.27680
Compute from PPP
Longitude:
West
116
53
04.81516
Enter Grid Values
Ellipsoidal height:
441.162
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.500
m
ARP to L1 offset:
0.067
m
Applied height:
1.567
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_06
Name: FEMA_SD_06
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 32 56 07.49195
Longitude: West 116 52 05.03967
Ellipsoidal height: 373.930 m
Datum: NAD83(2011)
Compute from PPP
Enter Grid Values
Enter MSL Height
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.800 m
ARP to L1 offset: 0.067 m
Applied height: 1.867 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	062
Stop Line Name	133
Turn Time (min)	3
Buffer (%)	10
Acquisition Time (hrs)	19.7

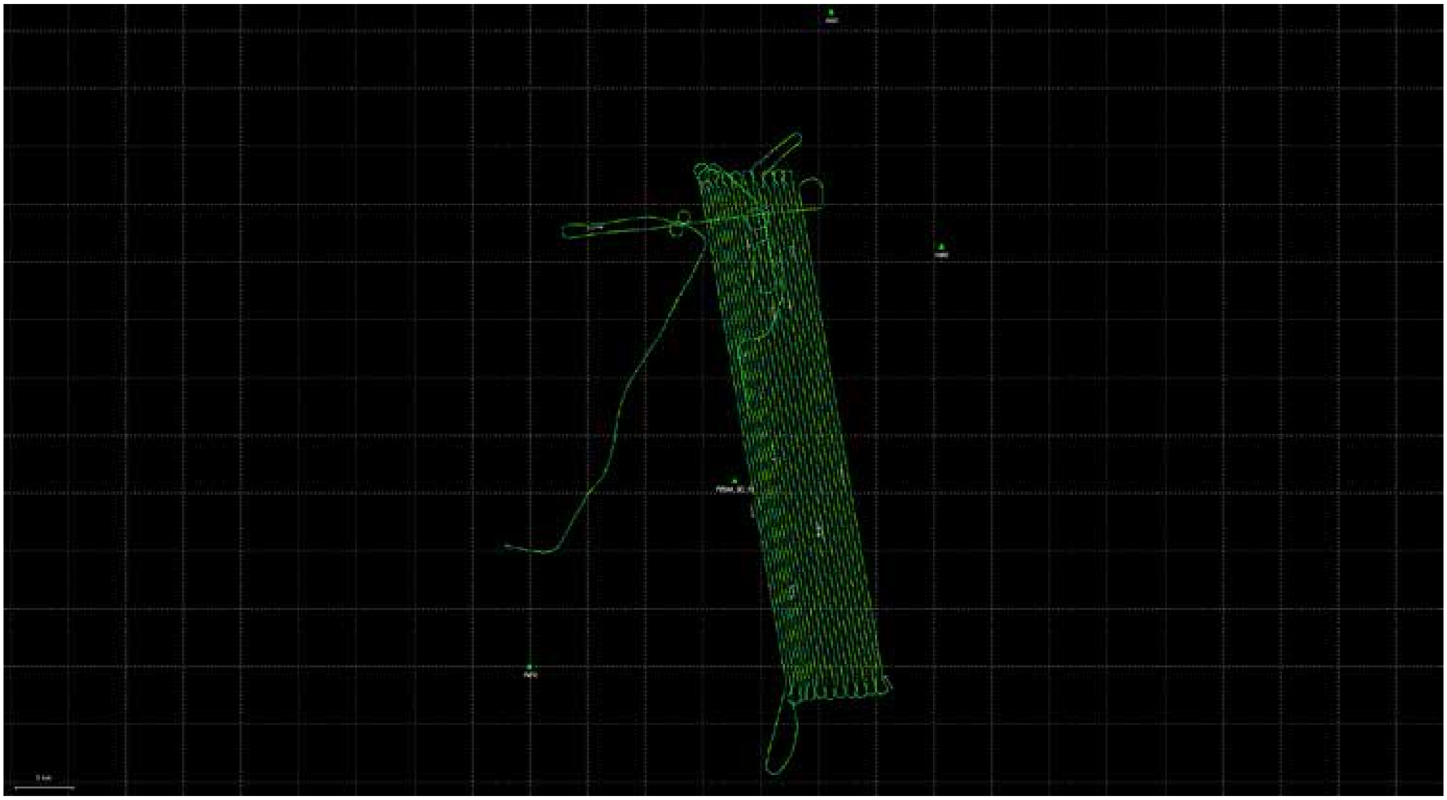
Other Acquisition Notes:

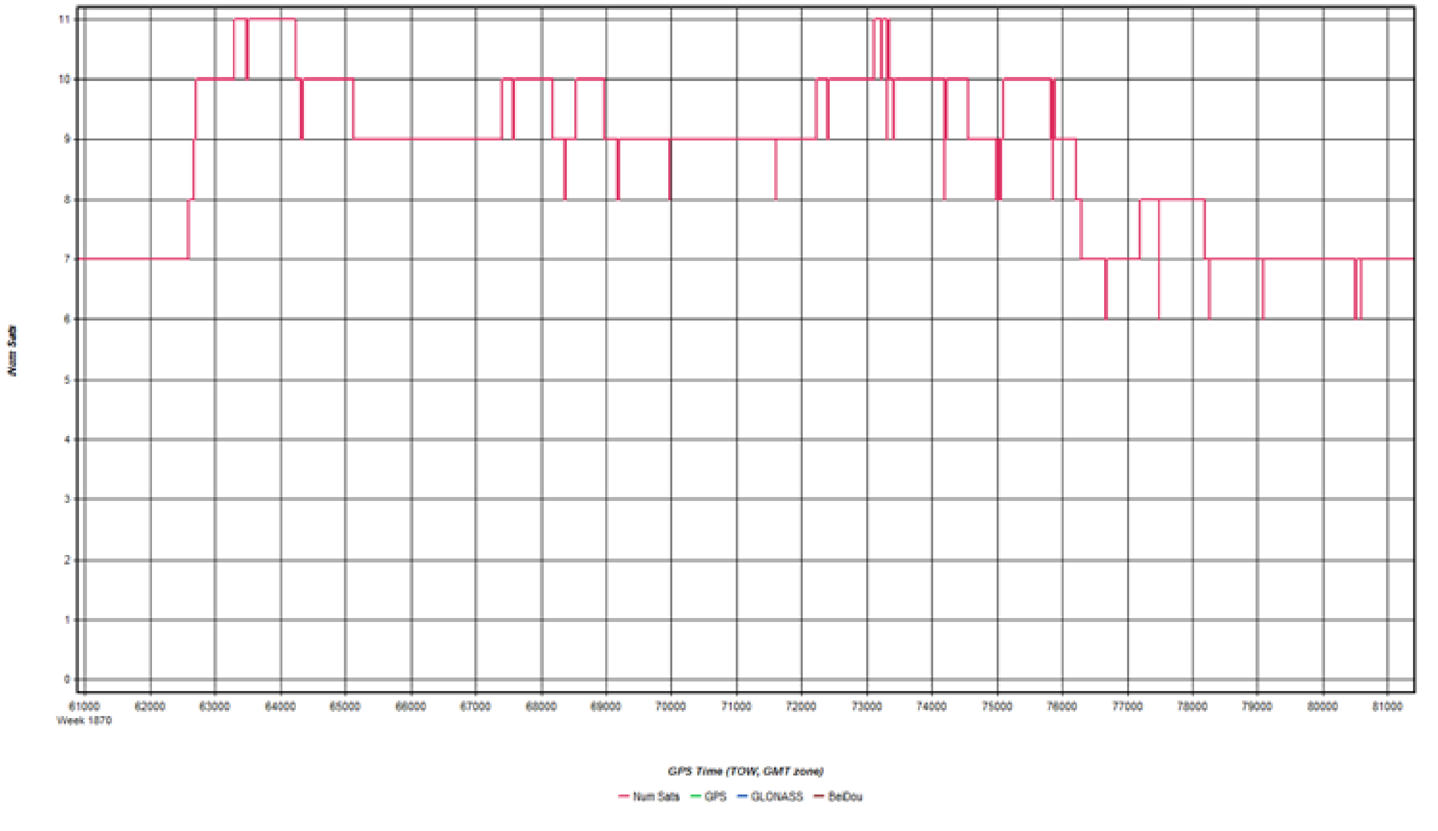
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

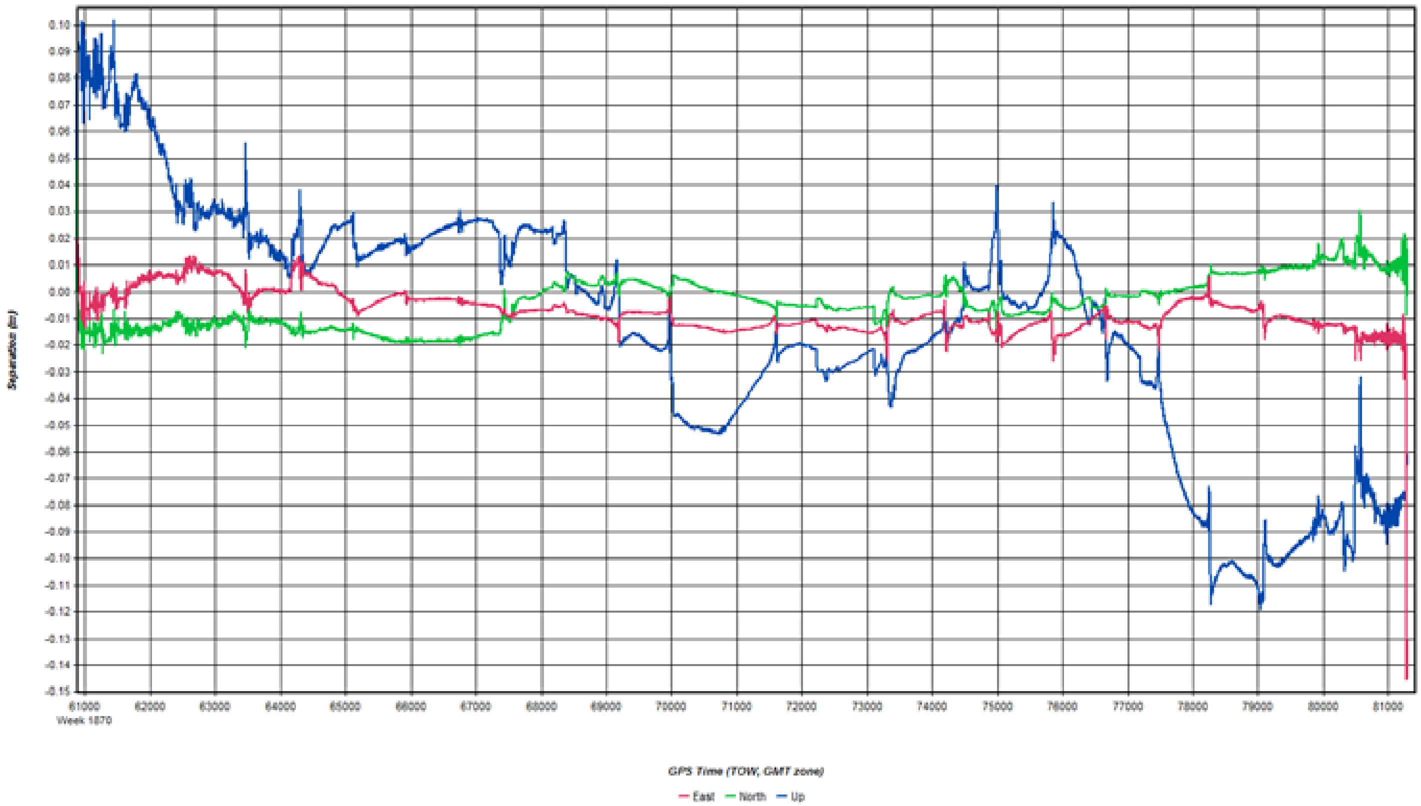
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

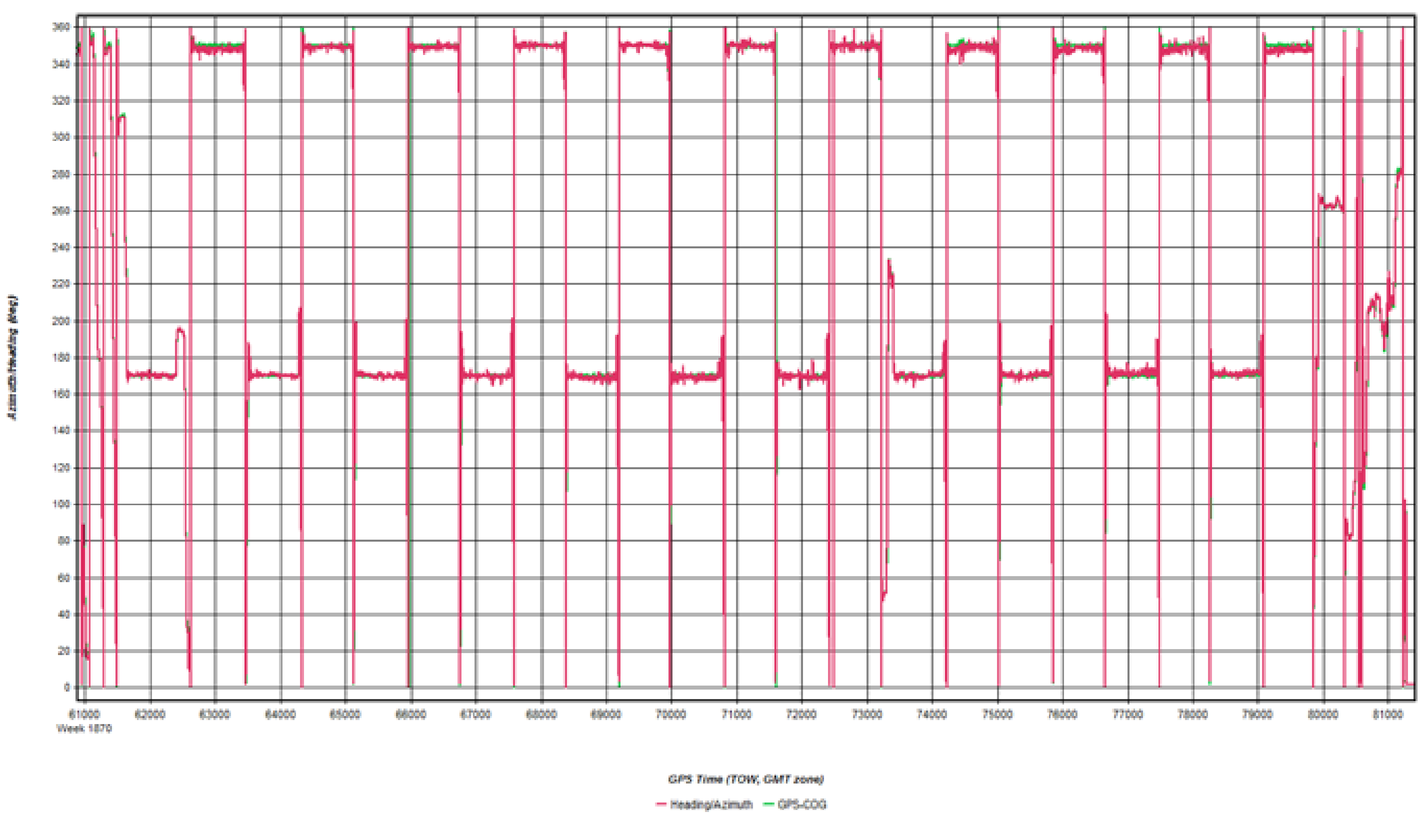
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
029	23.01	5965	163542			Start N to S
030	22.99	5971	164939			
031	22.98	5971	170356			
032	22.96	5985	171743			
033	22.95	5998	173135			
034	22.94	6014	174537			s to n
035	22.92	6034	175935			n to s
036	22.91	6037	181343			
037	22.9	6037	182741			
038	22.88	6063	184159			
039	22.87	6155	185543			
040	22.85	6155	190936			
041	22.84	6155	192318			n to s
042	22.82	6162	193647			
043	22.8	6165	195017			
044	22.79	6165	200359			CROSSLINE: 221033
045	22.77	6165	201725			
046	22.76	6145	203115			s to n
047	22.74	6145	204503			
048	22.73	6145	205838	210034		missed start point, refly
049	22.71	6145	211402			n to s
050	22.7	6165	212736			
051	22.69	6172	214109			
052	22.68	6178	215449			s to n last line

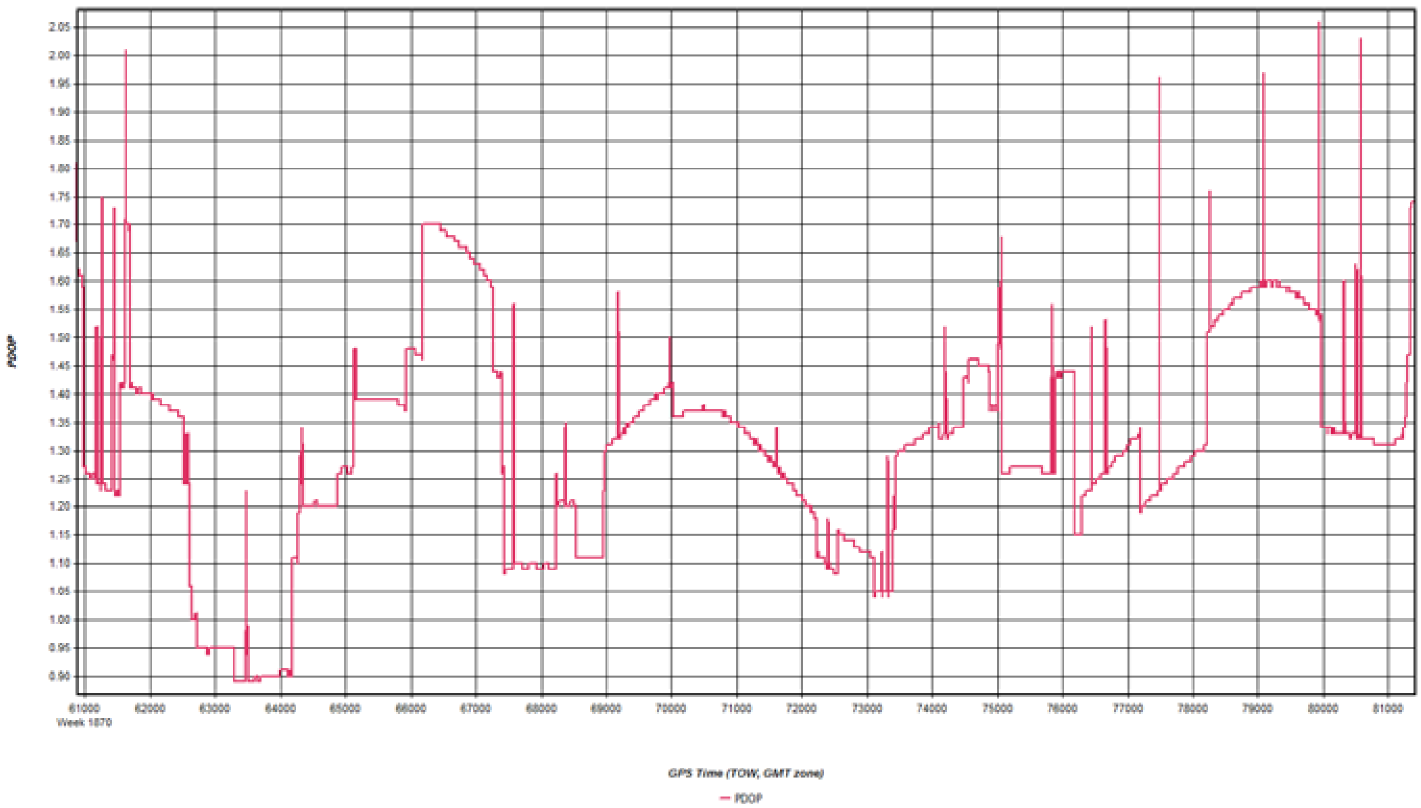
Nov 08, 2015-A

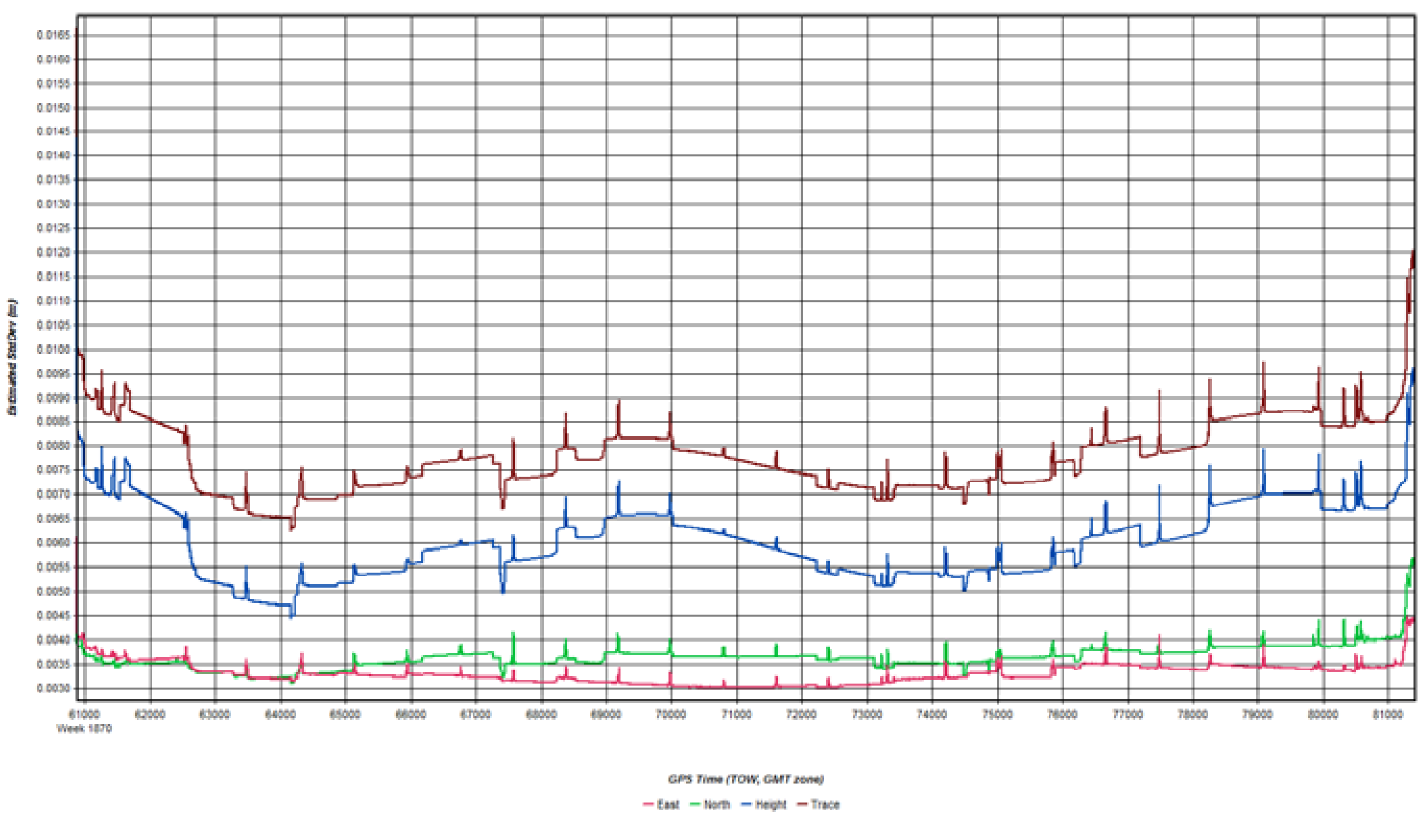


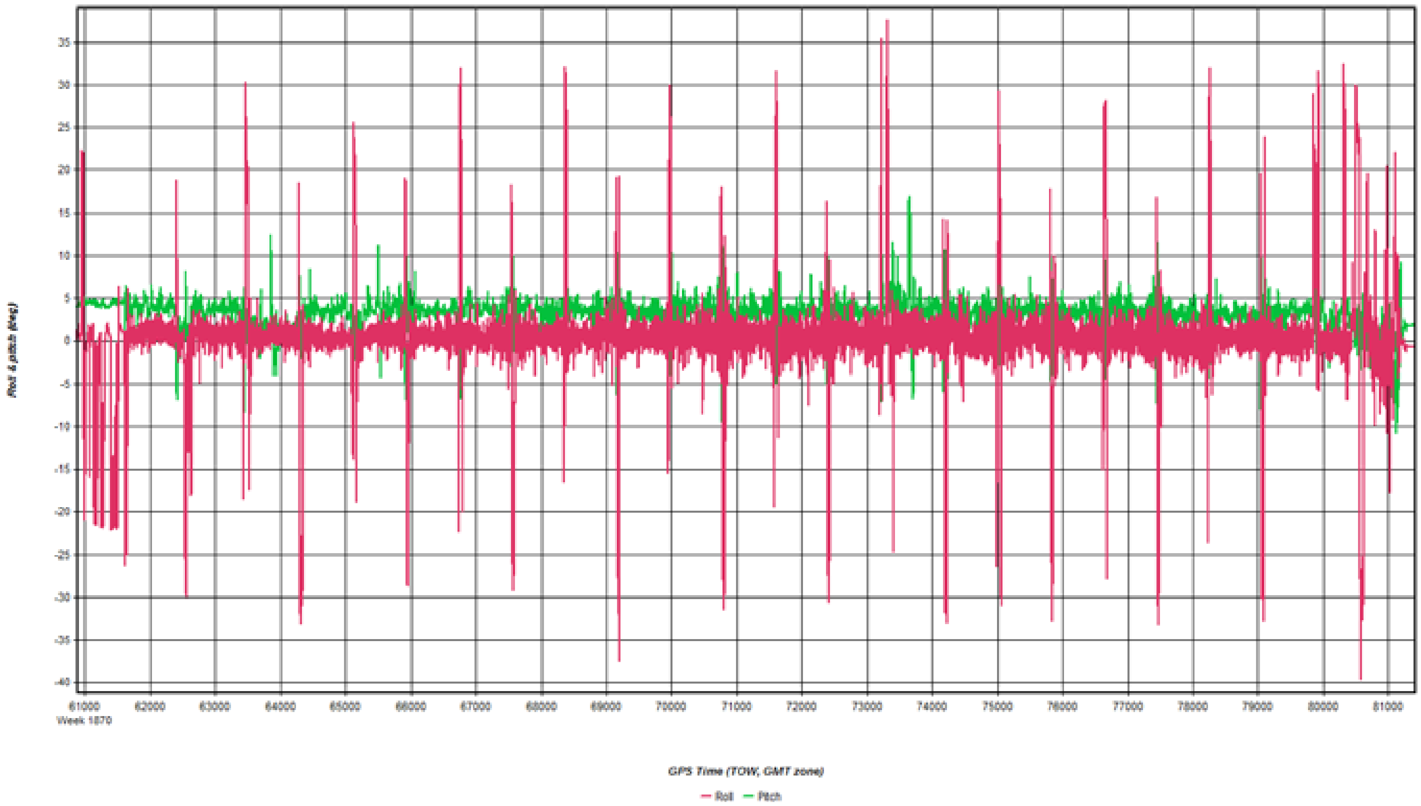

Num Sats
0
1
2
3
4
5
6
7
8
9
10
11
61000
Week 1870
62000
63000
64000
65000
66000
67000
68000
69000
70000
71000
72000
73000
74000
75000
76000
77000
78000
79000
80000
81000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

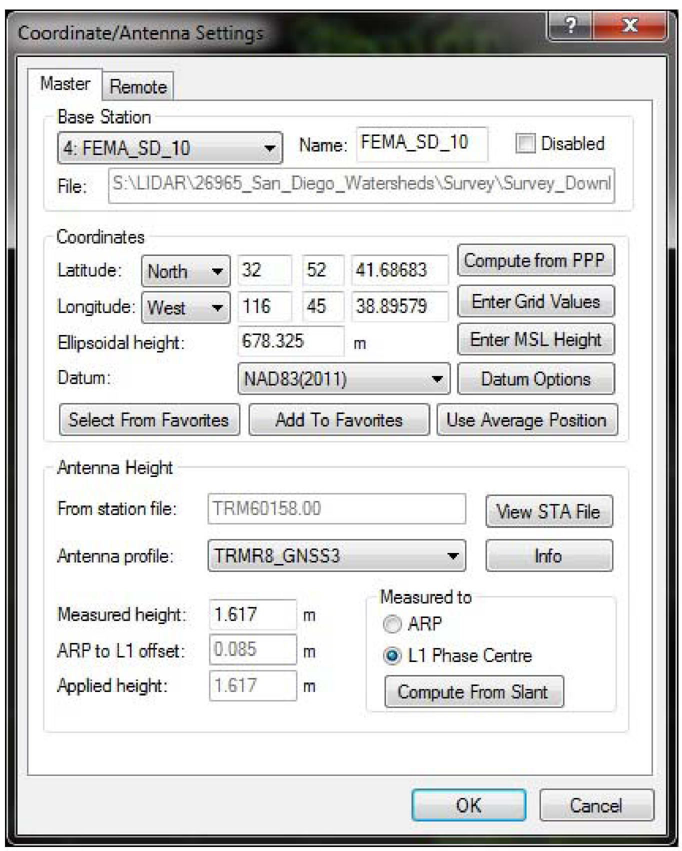

Separation (m)
Week 1870
GPS Time (TOW, GMT zone)
East
North
Up

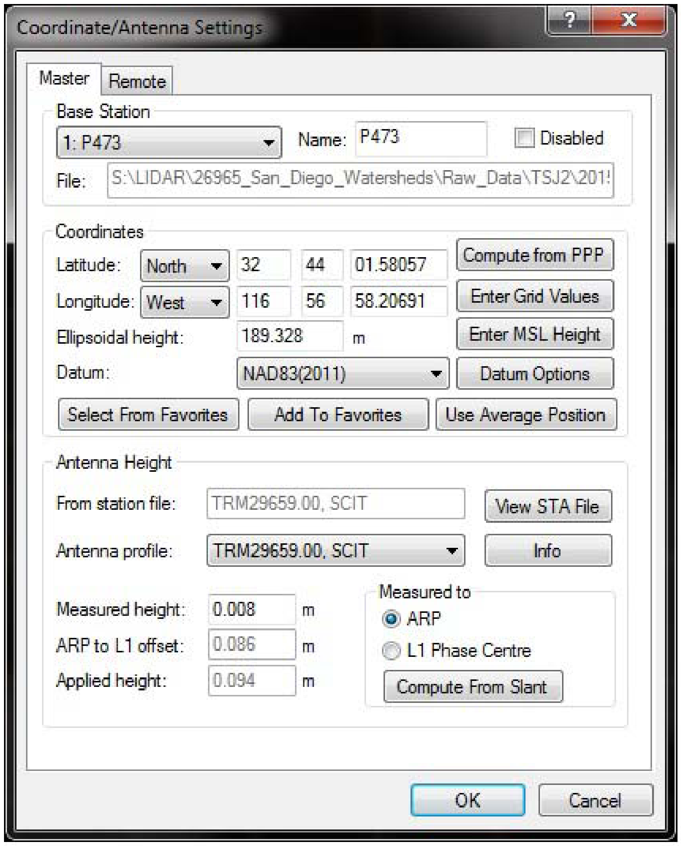

Azimuth/Heading (deg)
Week 1870
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG

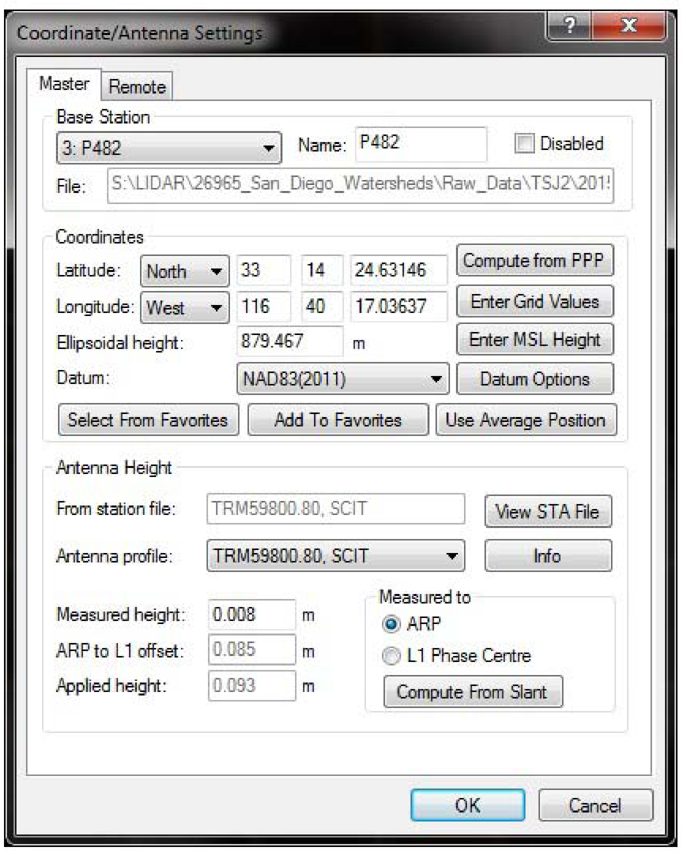

PDOP
GPS Time (TOW, GMT zone)
Week 1870
— PDOP

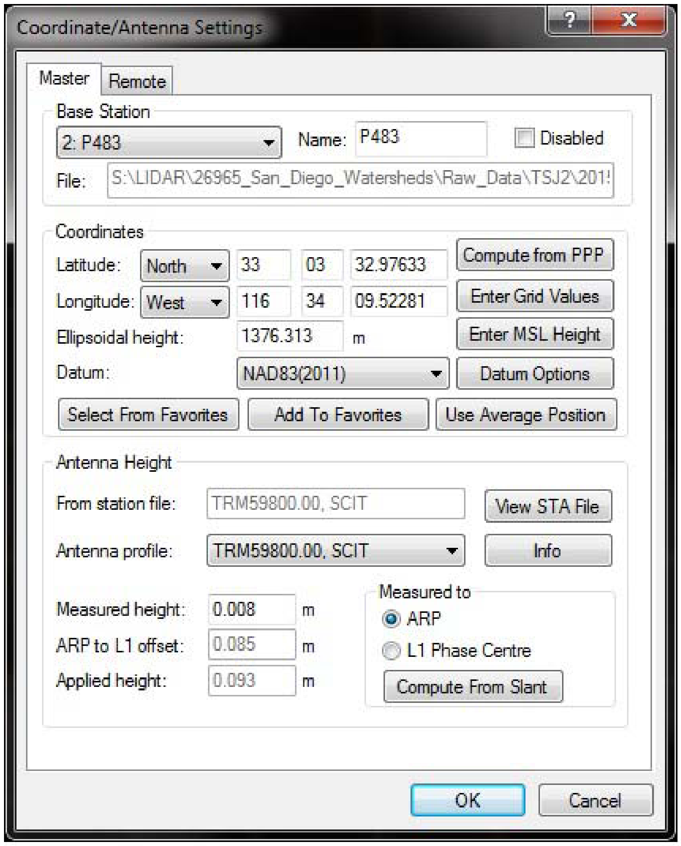

Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1870
— East — North — Height — Trace


Roll & pitch (deg)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
61000 62000 63000 64000 65000 66000 67000 68000 69000 70000 71000 72000 73000 74000 75000 76000 77000 78000 79000 80000 81000
Week 1870
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
4: FEMA_SD_10
Name: FEMA_SD_10
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 32 52 41.68683
Longitude: West 116 45 38.89579
Ellipsoidal height: 678.325 m
Datum: NAD83(2011)
Compute from PPP
Enter Grid Values
Enter MSL Height
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM60158.00
View STA File
Antenna profile: TRMR8_GNSS3
Info
Measured height: 1.617 m
ARP to L1 offset: 0.085 m
Applied height: 1.617 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: P473
Name: P473
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Raw_Data\TSJ2\201!
Coordinates
Latitude: North 32 44 01.58057
Compute from PPP
Longitude: West 116 56 58.20691
Enter Grid Values
Ellipsoidal height: 189.328 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM29659.00, SCIT
View STA File
Antenna profile: TRM29659.00, SCIT
Info
Measured height: 0.008 m
ARP to L1 offset: 0.086 m
Applied height: 0.094 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
3: P482
Name: P482
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Raw_Data\TSJ2\201!
Coordinates
Latitude: North 33 14 24.63146
Compute from PPP
Longitude: West 116 40 17.03637
Enter Grid Values
Ellipsoidal height: 879.467 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM59800.80, SCIT
View STA File
Antenna profile: TRM59800.80, SCIT
Info
Measured height: 0.008 m
ARP to L1 offset: 0.085 m
Applied height: 0.093 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: P483
Name:
P483
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Raw_Data\TSJ2\201!
Coordinates
Latitude:
North
33
03
32.97633
Compute from PPP
Longitude:
West
116
34
09.52281
Enter Grid Values
Ellipsoidal height:
1376.313
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM59800.00, SCIT
View STA File
Antenna profile:
TRM59800.00, SCIT
Info
Measured height:
0.008
m
ARP to L1 offset:
0.085
m
Applied height:
0.093
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	**Max**
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	062
Stop Line Name	133
Turn Time (min)	3
Buffer (%)	10
Acquisition Time (hrs)	19.7

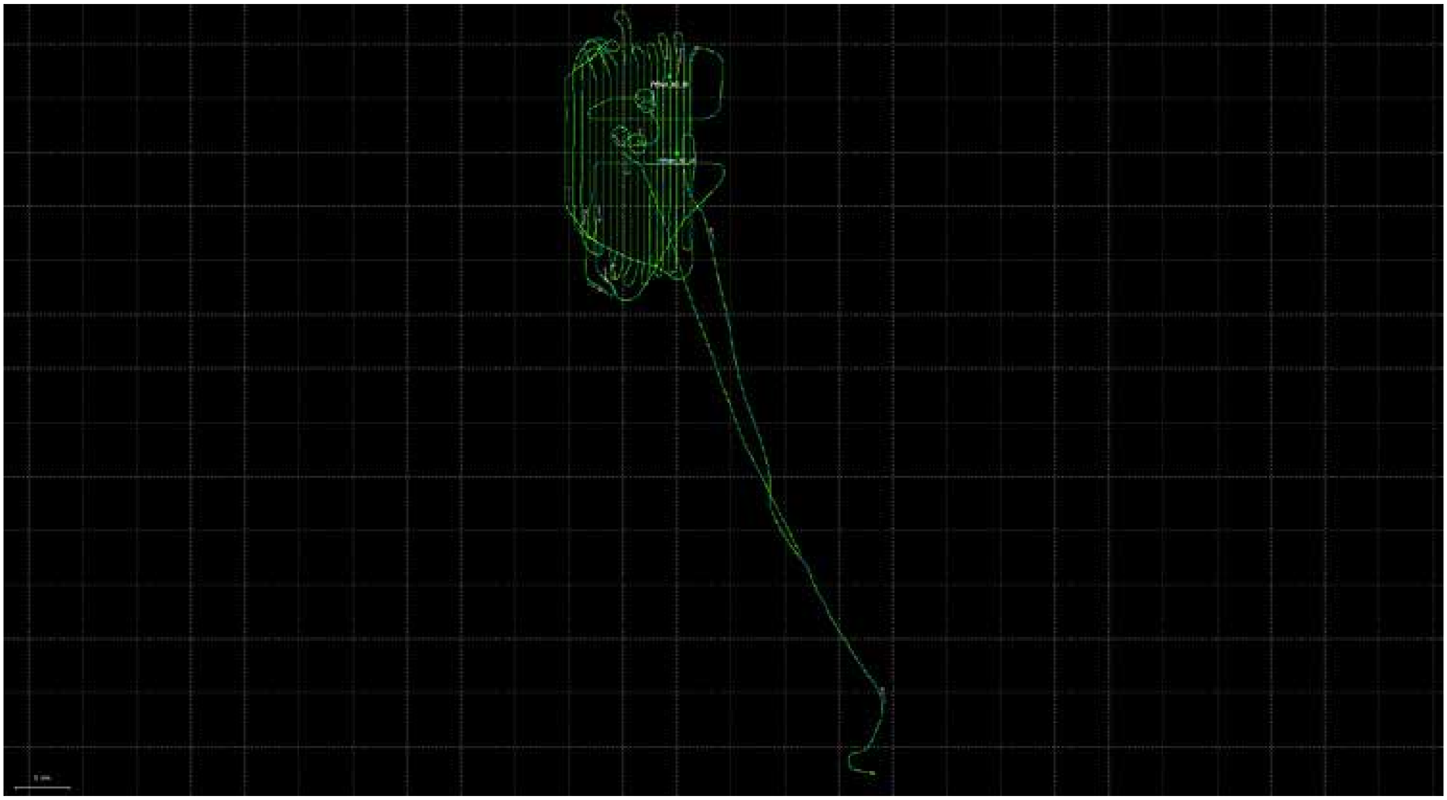
Other Acquisition Notes:

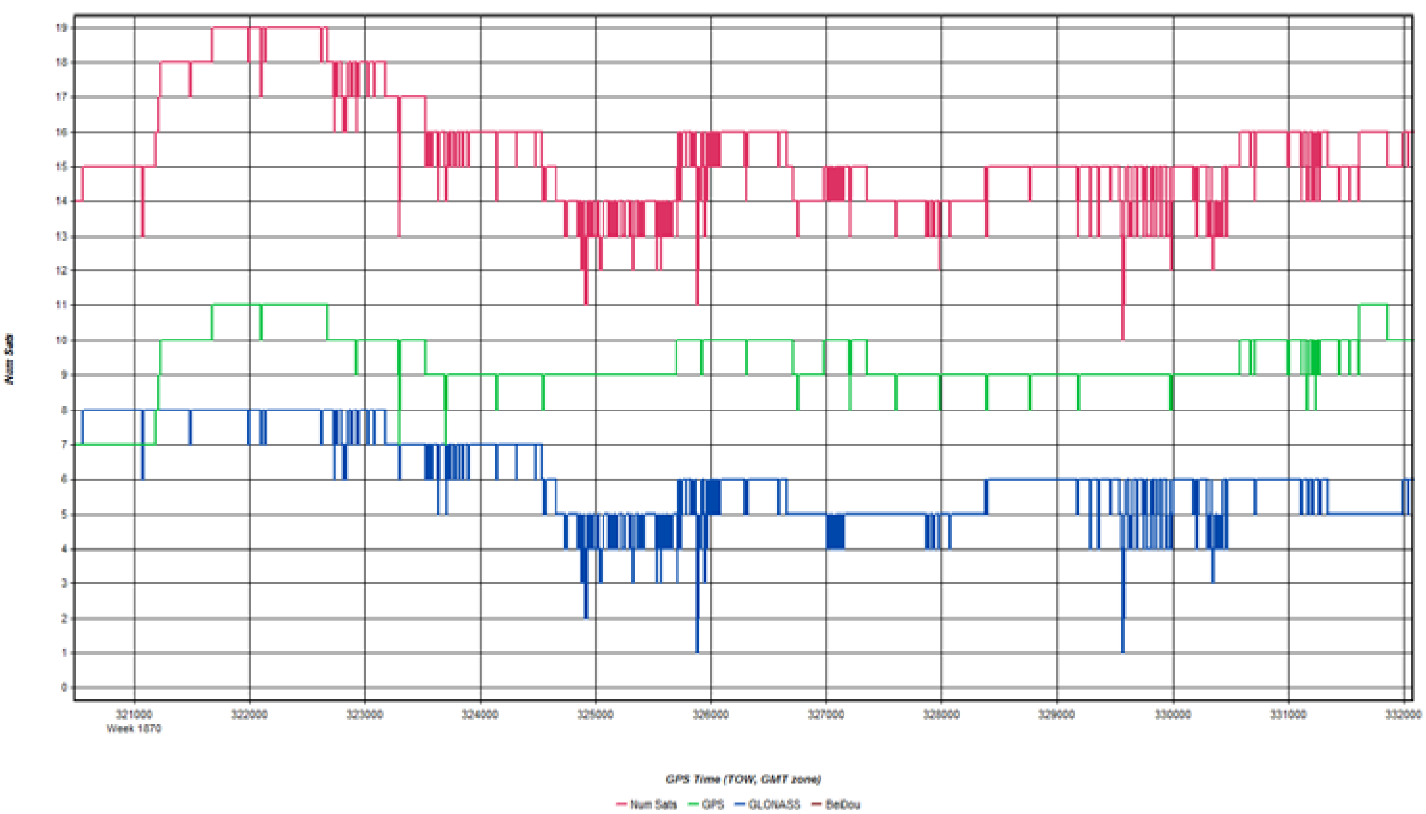
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

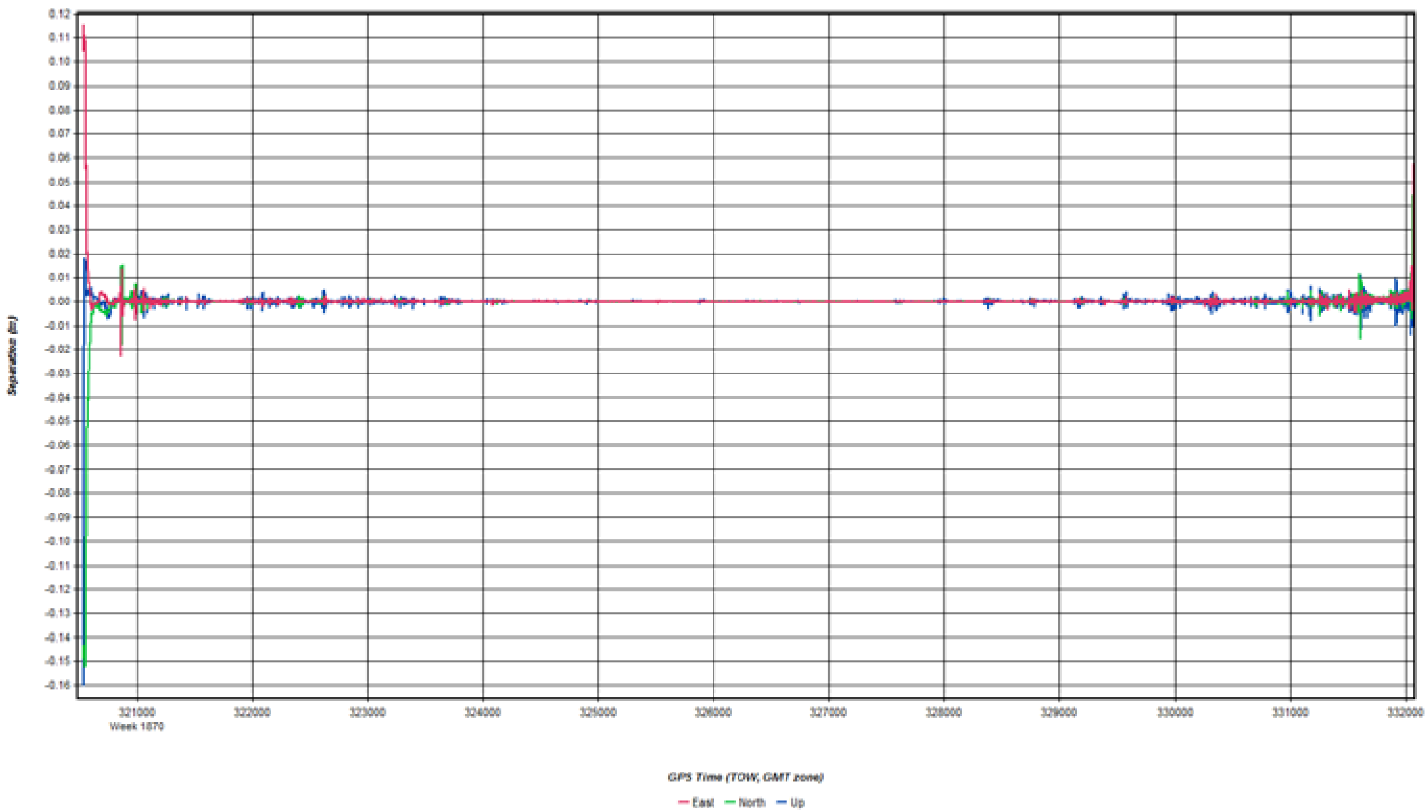
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
051	22.69	6172	214109	163349	170733	Weird data 11/7, reflown N to S; First attempt let to shutdown error; reflown again
052	22.68	6178	215449	172436		reflown s to n
053	22.66	6191	173841			n to s
054	22.65	6204	175224			
055	22.64	6227	180605			
056	22.63	6231	181934			
057	22.62	6237	183306			
058	22.6	6250	184641			
059	22.59	6273	190000			
060	22.57	6313	191324			
061	22.56	6352	192642			
062	22.54	6405	194023			
063	22.53	6493	195348			
064	22.51	6546	200714			
065	22.49	6719	202332			
066	22.48	6792	203713			
067	22.46	6828	205053			n to s
068	22.45	6861	210432			
069	22.43	6926	211755			n to s
070	22.42	6989	213139			CROSSLINE: 221159
071	22.4	7087	214448			n to s
072	22.39	7189	215816			s to n, last line

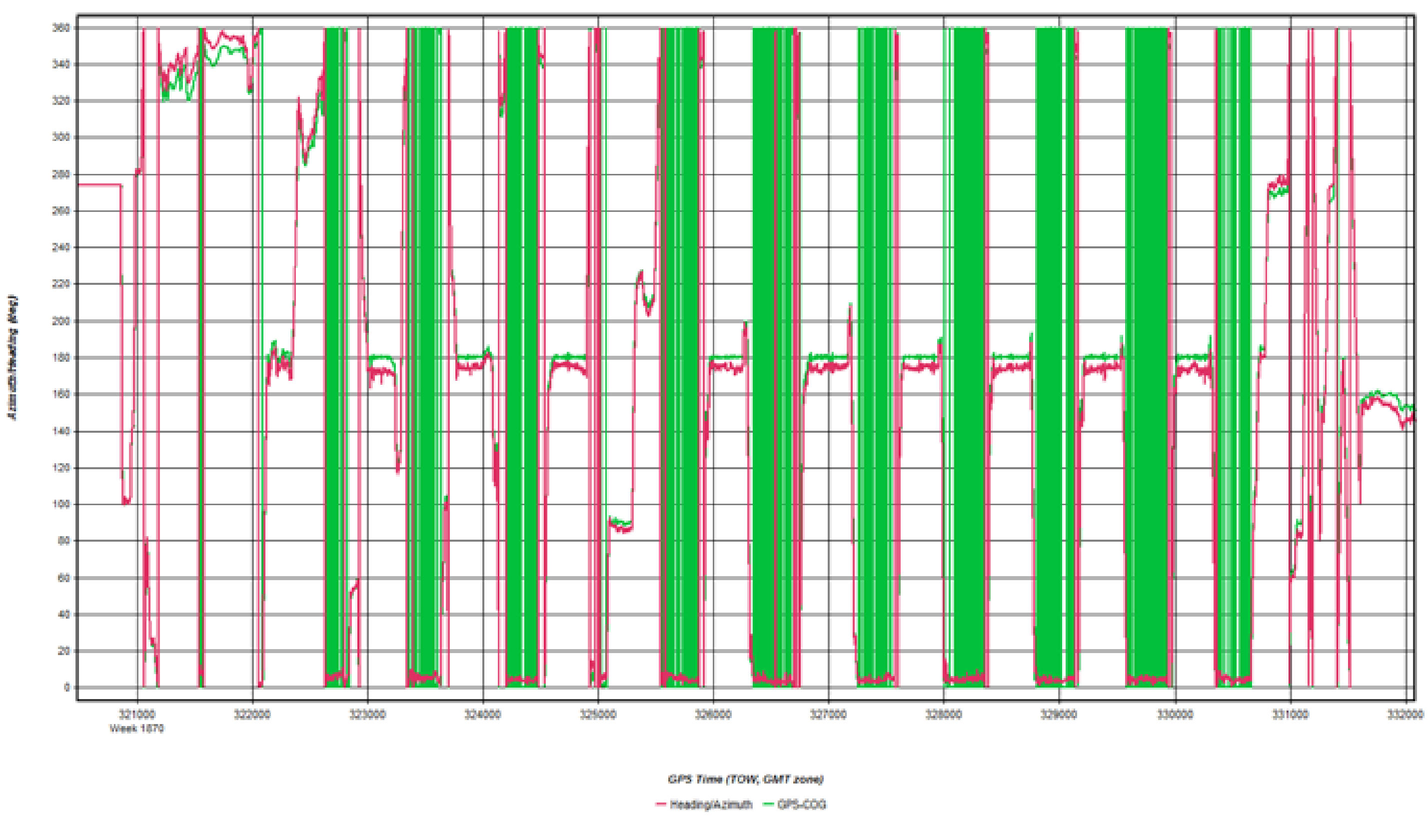
Nov 11, 2015-A



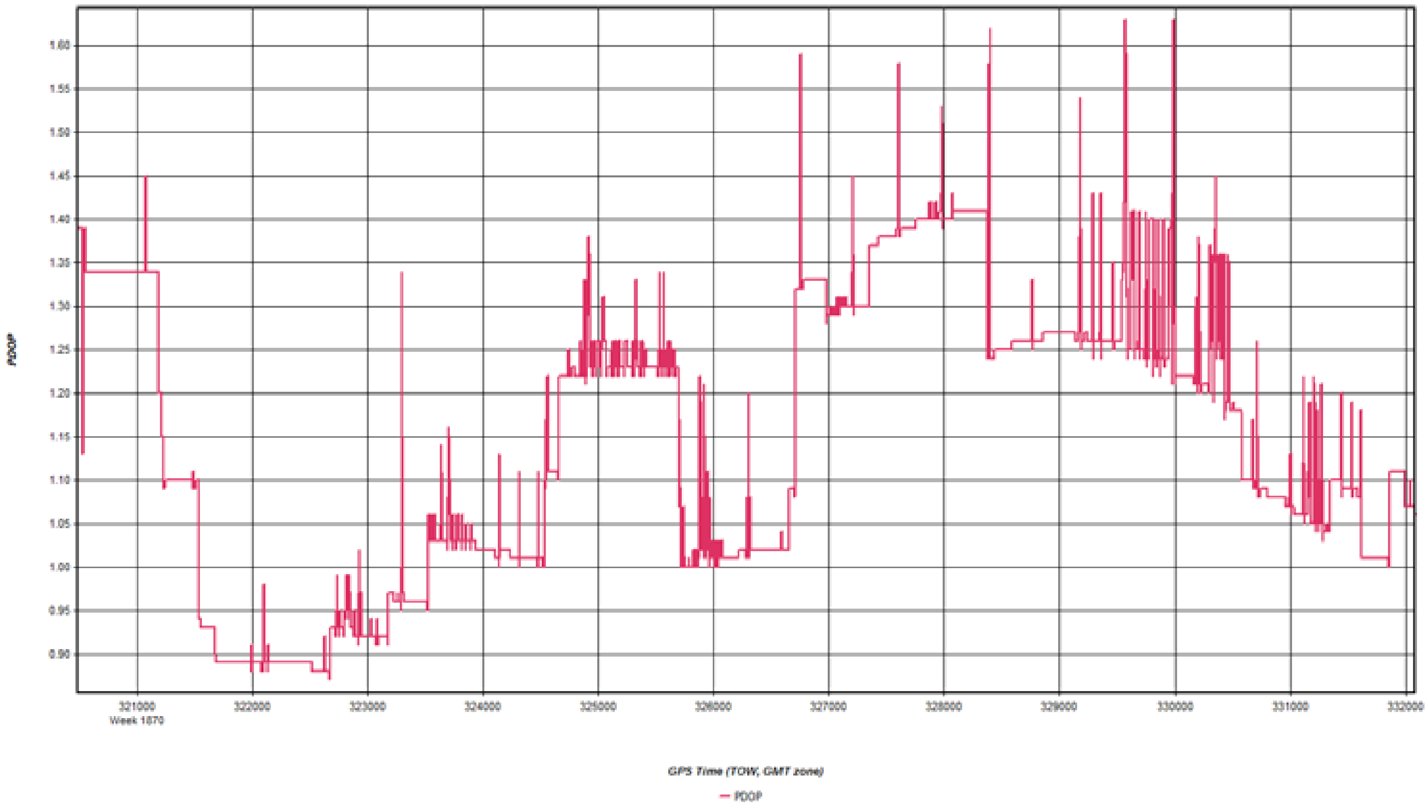

19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
321000
Week 1870
322000
323000
324000
325000
326000
327000
328000
329000
330000
331000
332000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

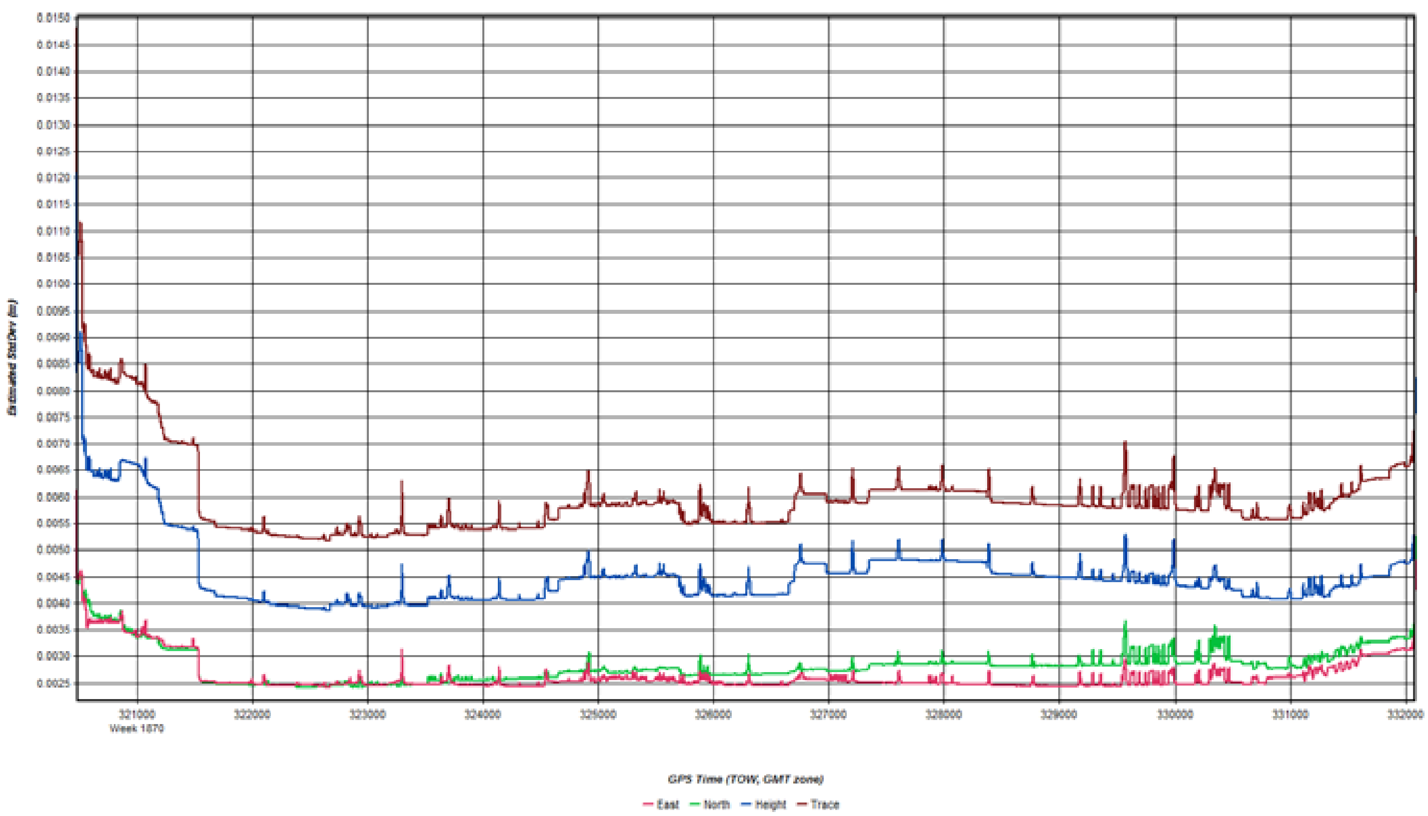


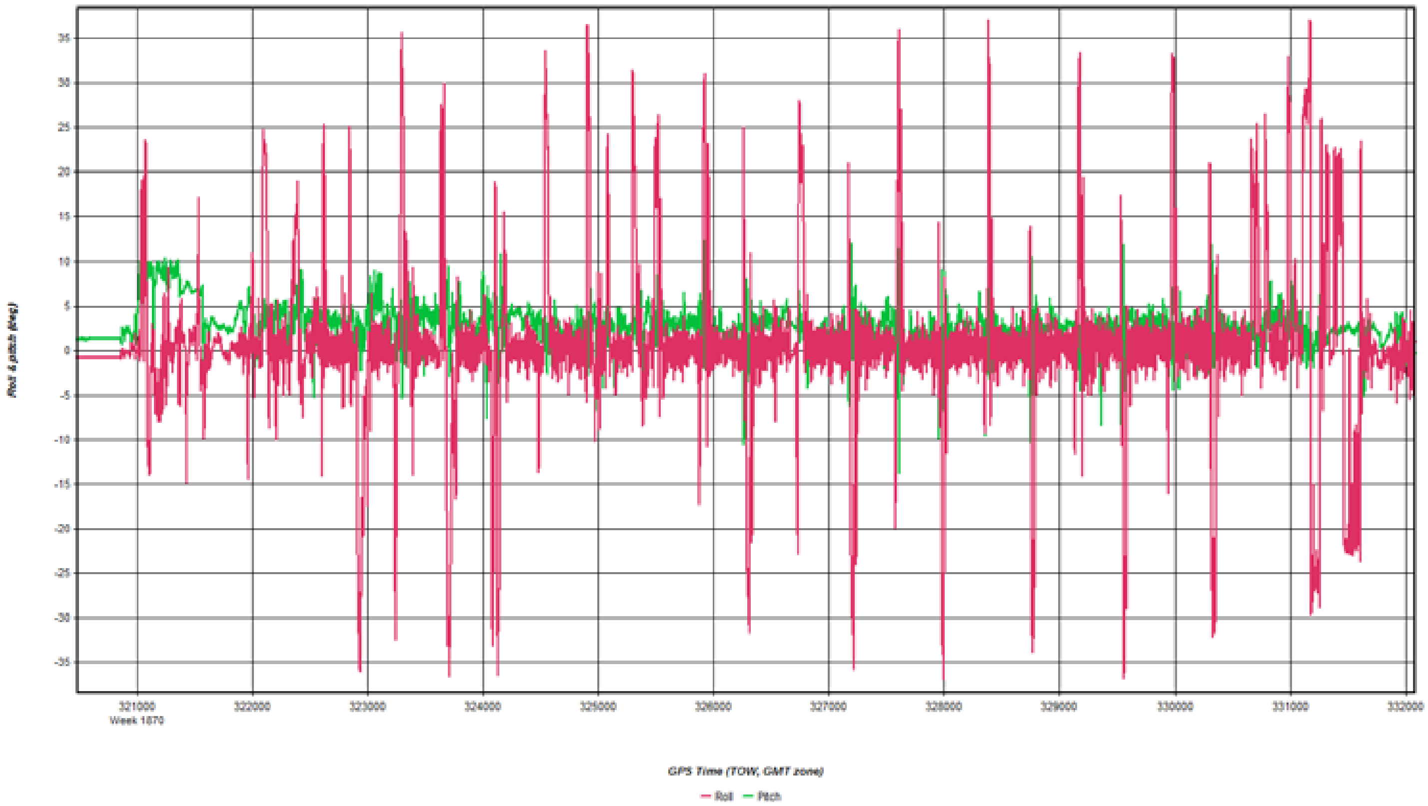
Separation (m)
GPS Time (TOW, GMT zone)
Week 1870
East
North
Up

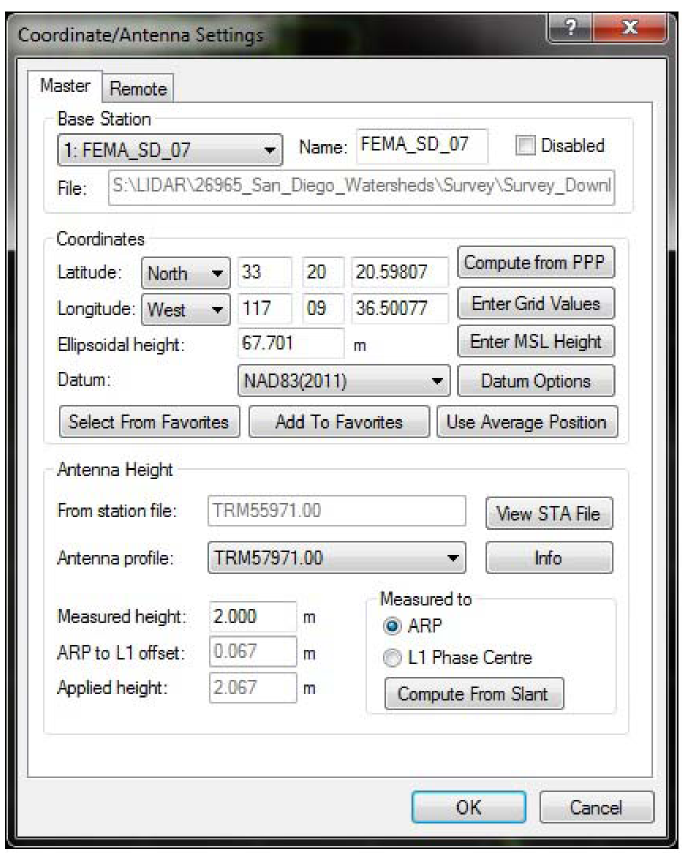


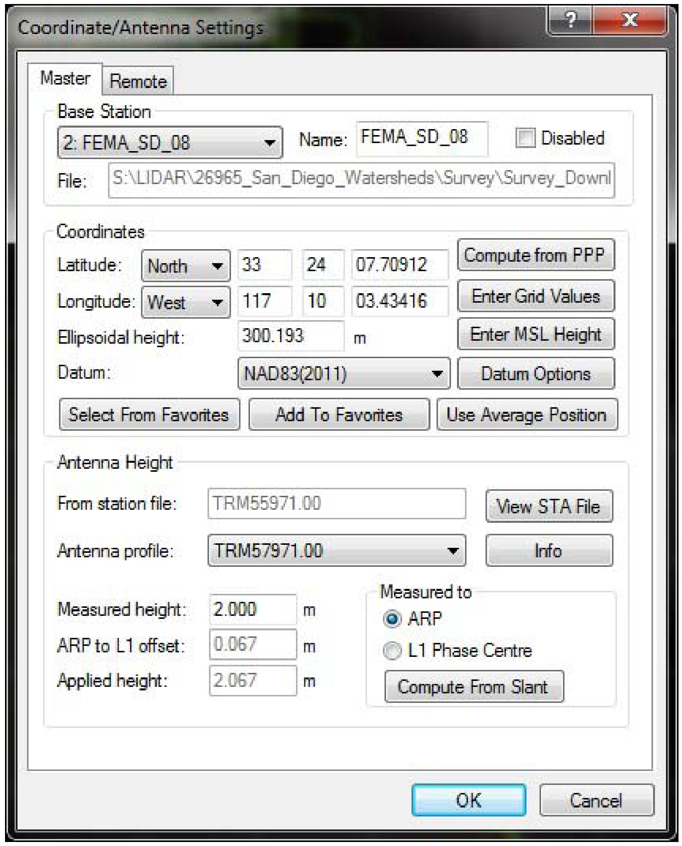
Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Week 1870
Heading/Azimuth
GPS-COG


PDOP
GPS Time (TOW, GMT zone)
Week 1870
PDOP


Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1870
East
North
Height
Trace


Roll & pitch (deg)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
321000
Week 1870
322000
323000
324000
325000
326000
327000
328000
329000
330000
331000
332000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
1: FEMA_SD_07
Name:
FEMA_SD_07
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
20
20.59807
Compute from PPP
Longitude:
West
117
09
36.50077
Enter Grid Values
Ellipsoidal height:
67.701
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
2.000
m
ARP to L1 offset:
0.067
m
Applied height:
2.067
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_08
Name: FEMA_SD_08
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 33 24 07.70912
Compute from PPP
Longitude: West 117 10 03.43416
Enter Grid Values
Ellipsoidal height: 300.193 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 2.000 m
ARP to L1 offset: 0.067 m
Applied height: 2.067 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	40	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed 255	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	464	1700
Flying Alt. MSL Range (ft)	5601	10145
Swath Width Range (m)	338	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	2238
Total Line Time (hrs, no buffer)	21.3
Total Number of Lines	182
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	9.1
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	7
Total Acquisition Time (hrs)	37.5

Mission Flight Time Estimate	
Start Line Name	375
Stop Line Name	399
Turn Time (min)	1
Buffer (%)	10
Acquisition Time (hrs)	2.8

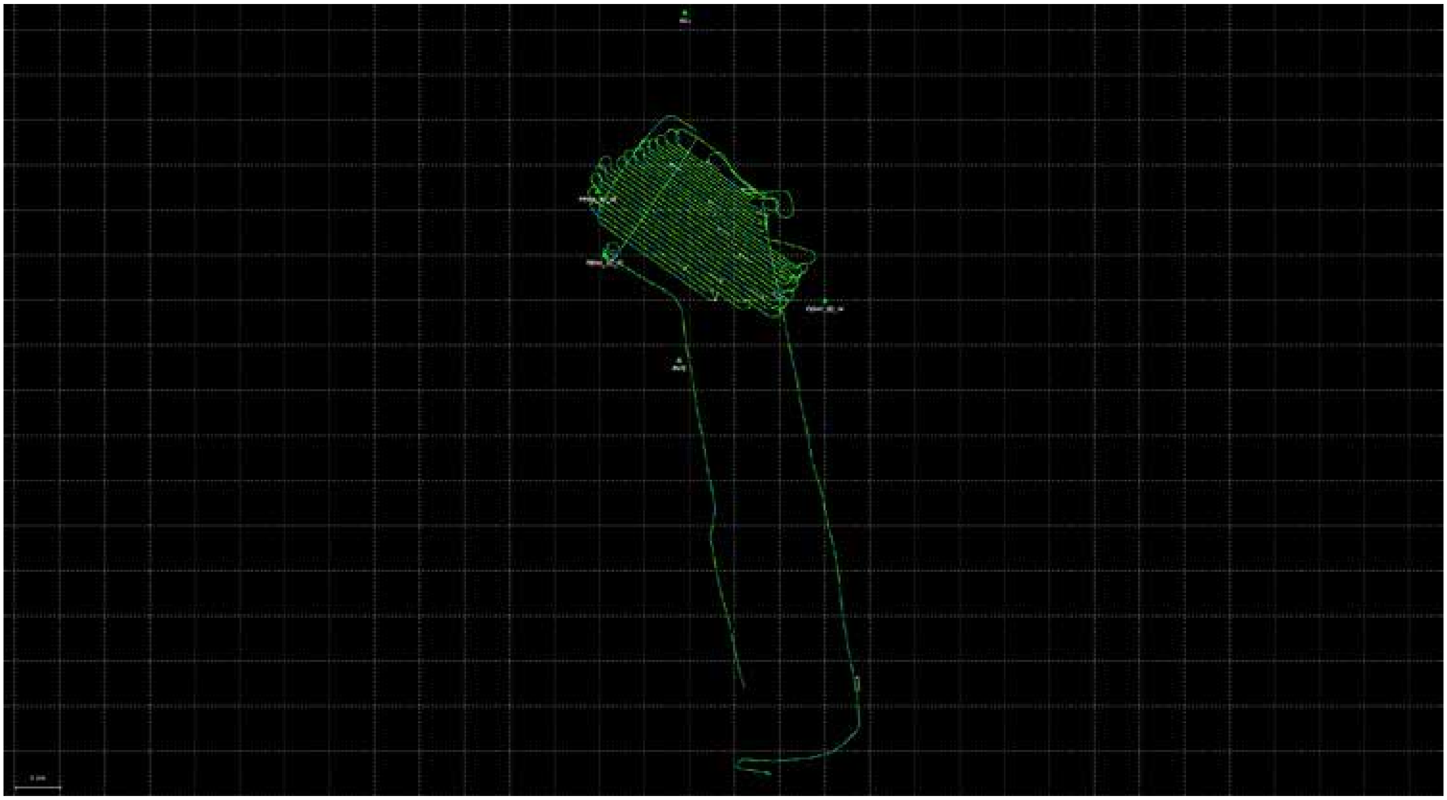
Other Acquisition Notes:

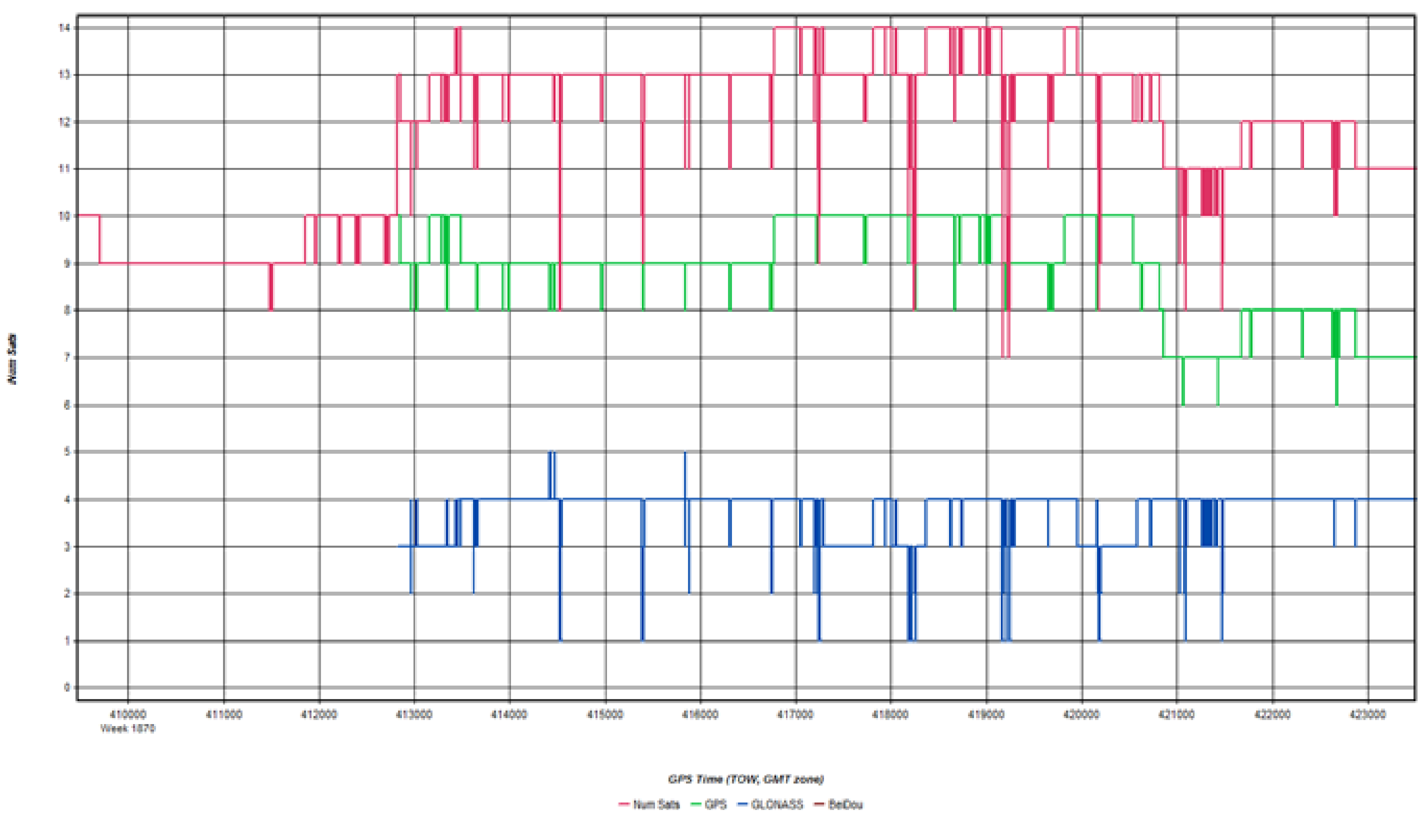
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

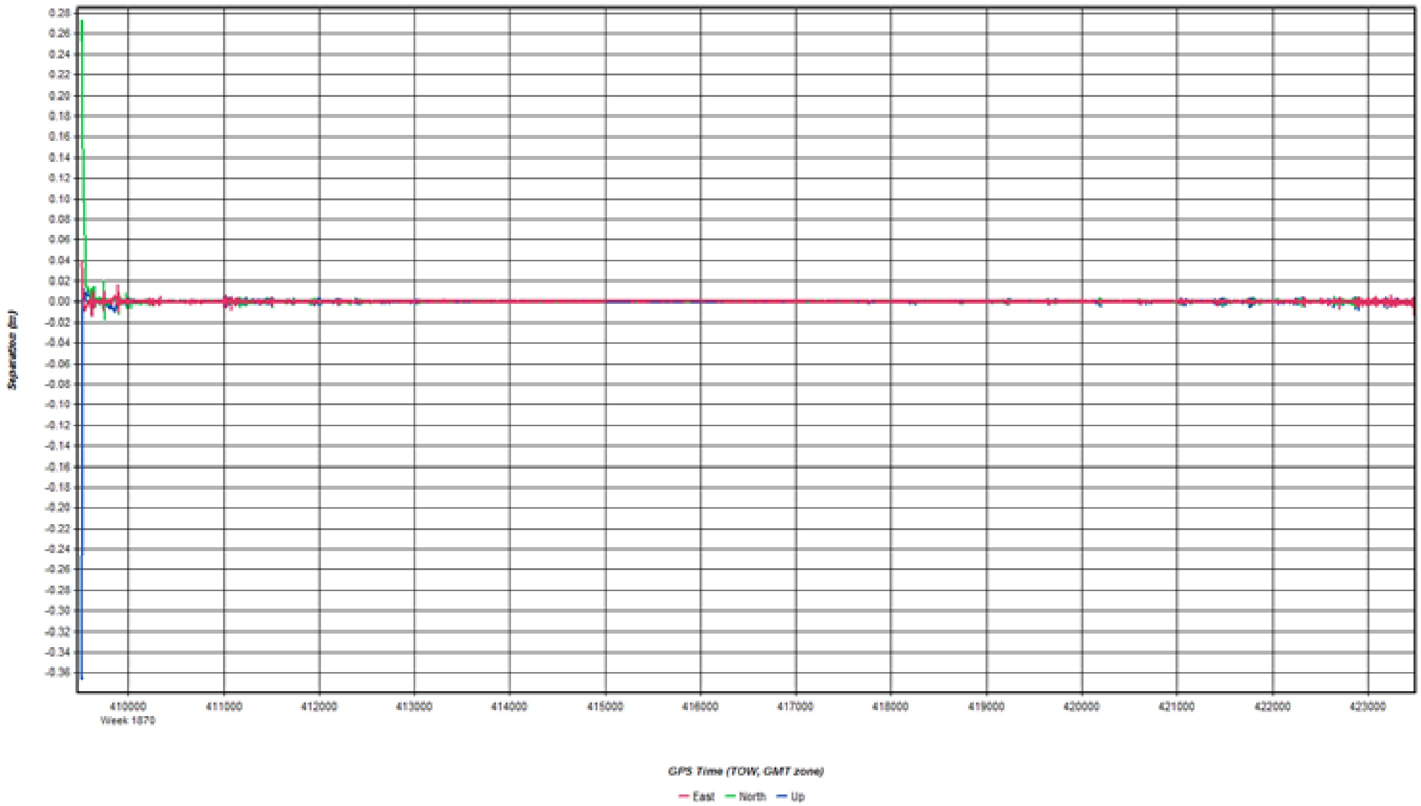
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
134	3.59	5889	173709			Start S to N
135	4.22	5958	174356			
136	4.6	5935	174954			
137	5.09	5906	175623			
138	7.64	5601	180326			s to n
139	7.75	5601	181010			n to s
140	8.18	5601	182625			
141	8.4	5604	183240			
142	8.49	5620	183859			Crossline: 181801
143	8.96	5624	184733			
144	9.35	5637	185402			Crossline2: 195315
145	9.35	5647	190029			
146	9.35	5660	190029			
147	9.35	5663	190657			
148	9.2	5663	191336			
149	9.37	5673	192003			**FLOWN 20151111**
150	9.39	5679	192642			
151	8.36	5693	193313			
152	8.12	5696	194009			n to s
237	5.28	9282	194608			S to N last line

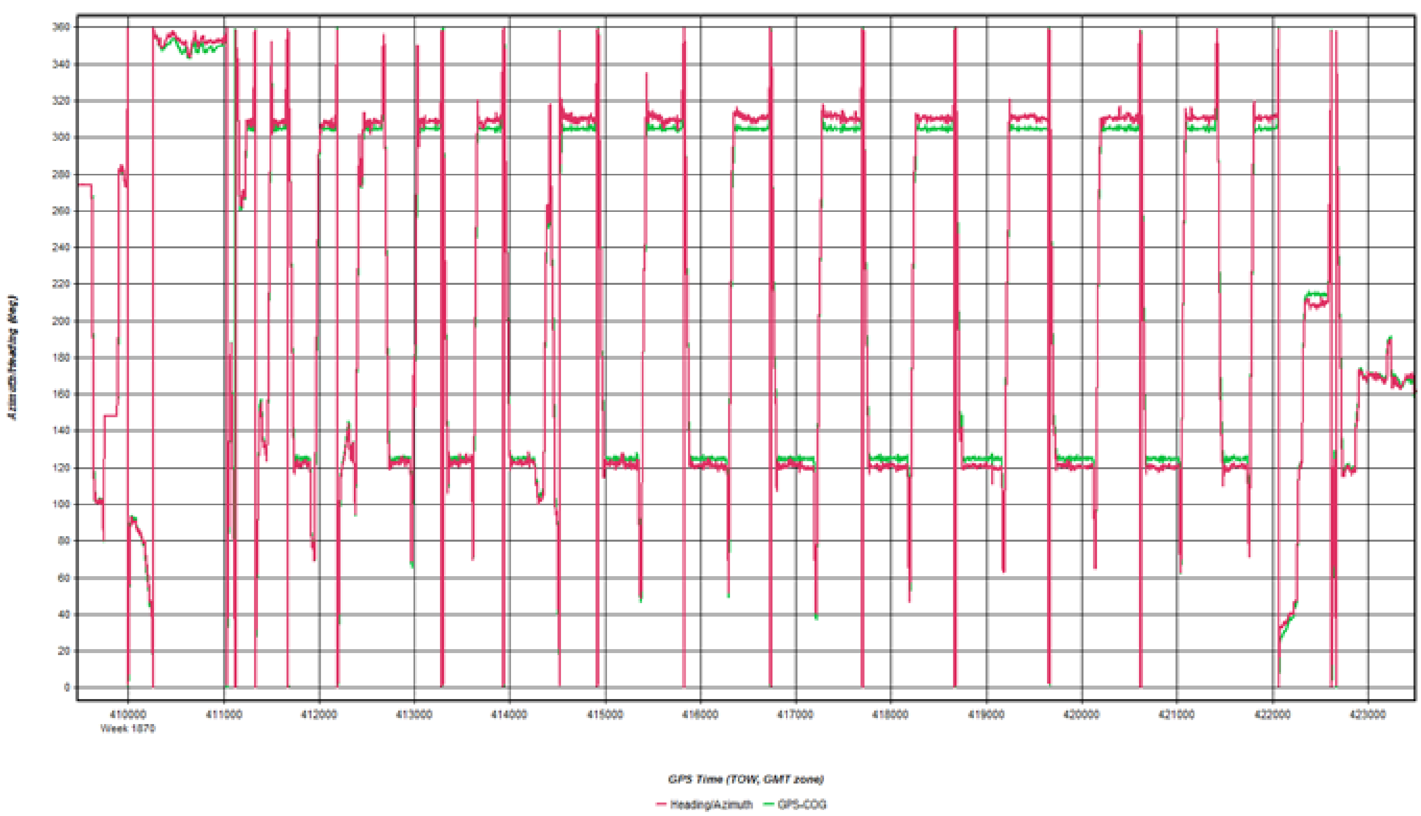
Nov 12, 2015-A

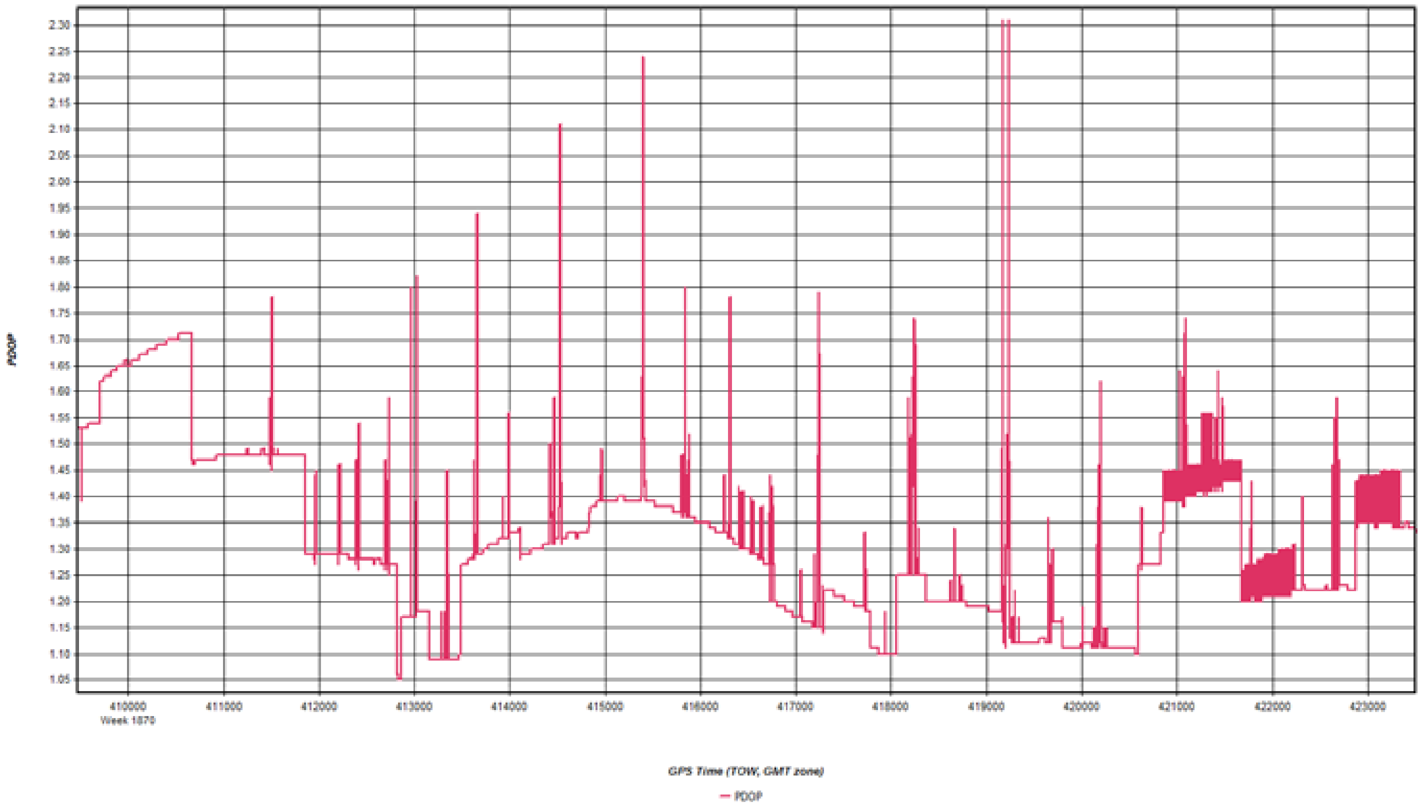


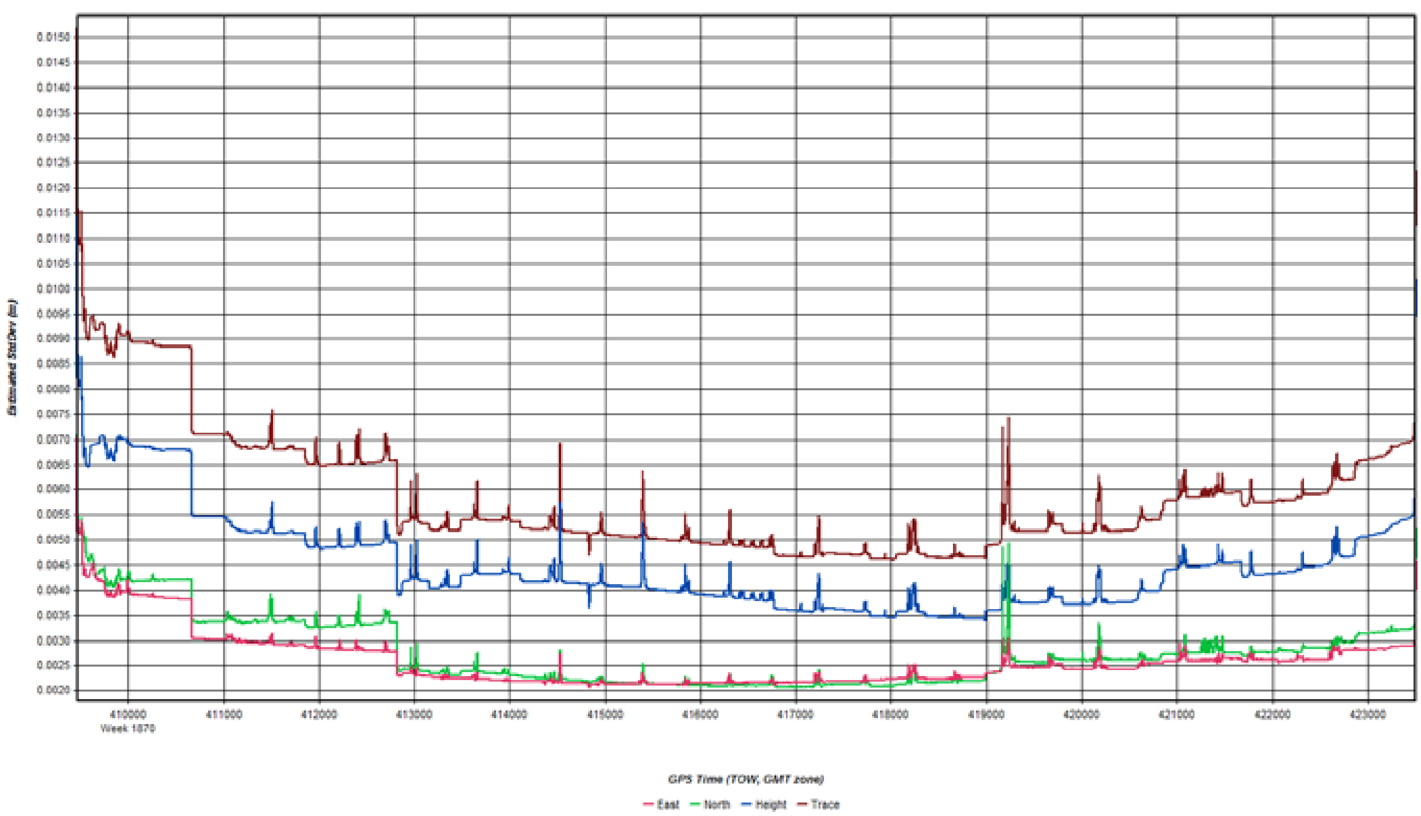


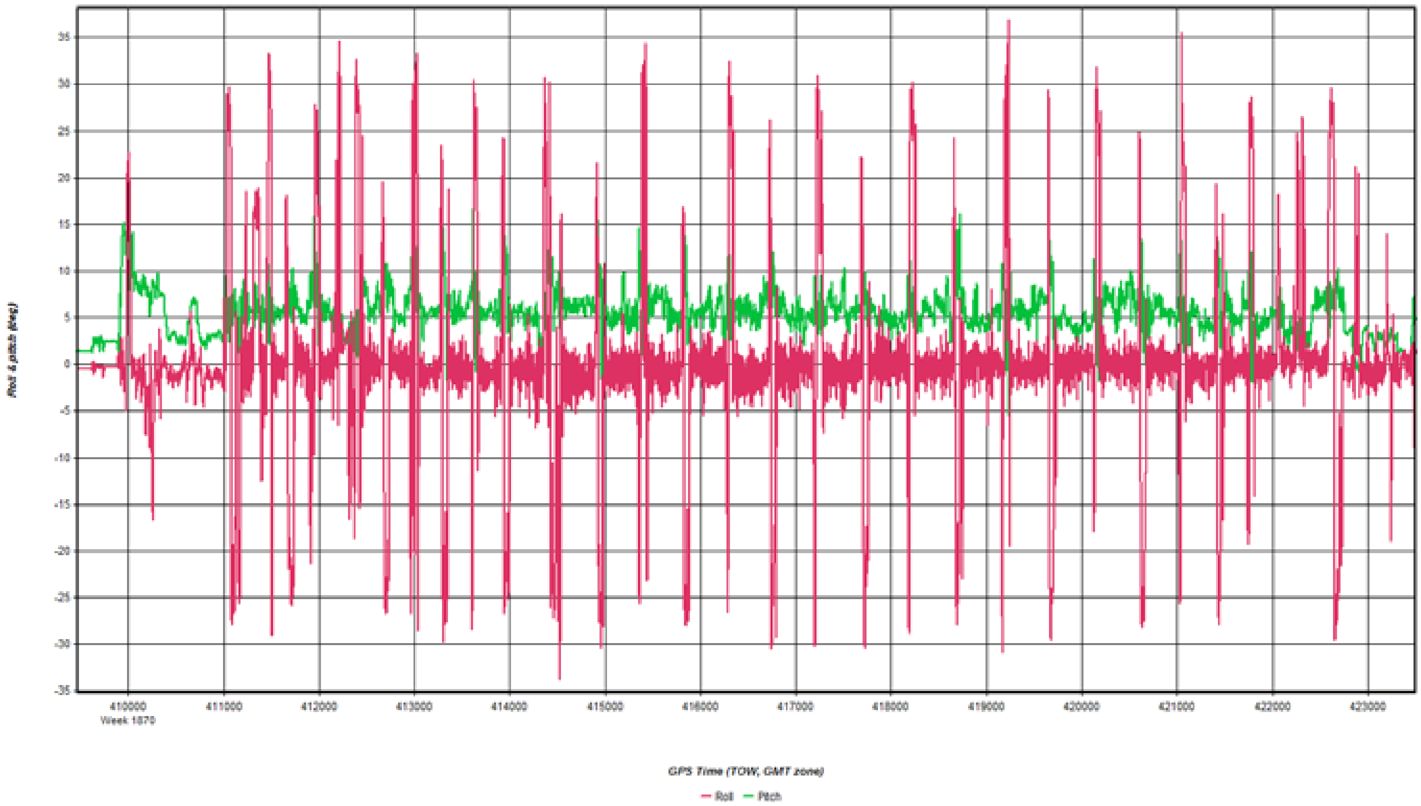
Num Sats
GPS Time (TOW, GMT zone)
Week 1870
Num Sats
GPS
GLONASS
BeiDou

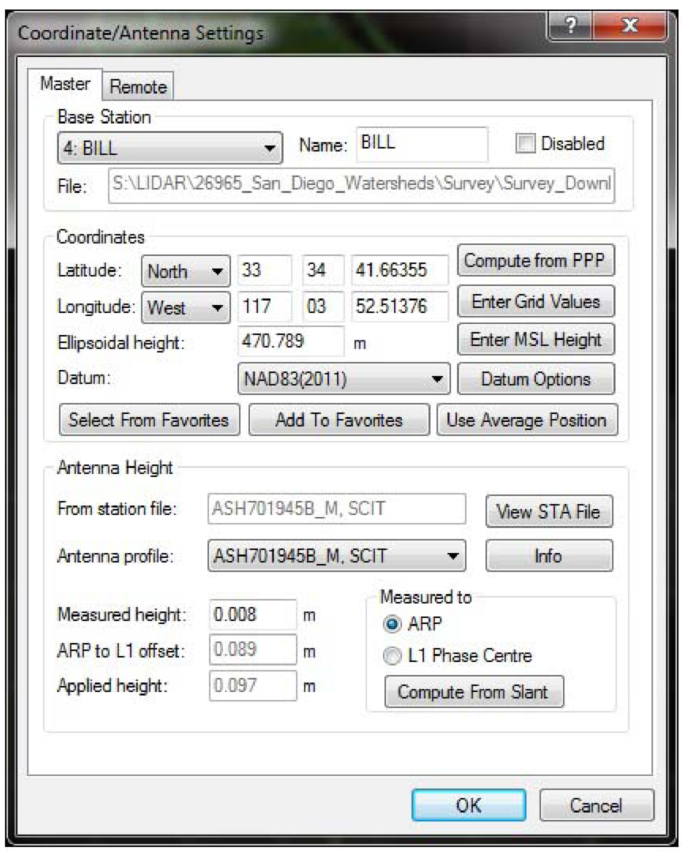

Separation (m)
GPS Time (TOW, GMT zone)
East
North
Up
Week 1870

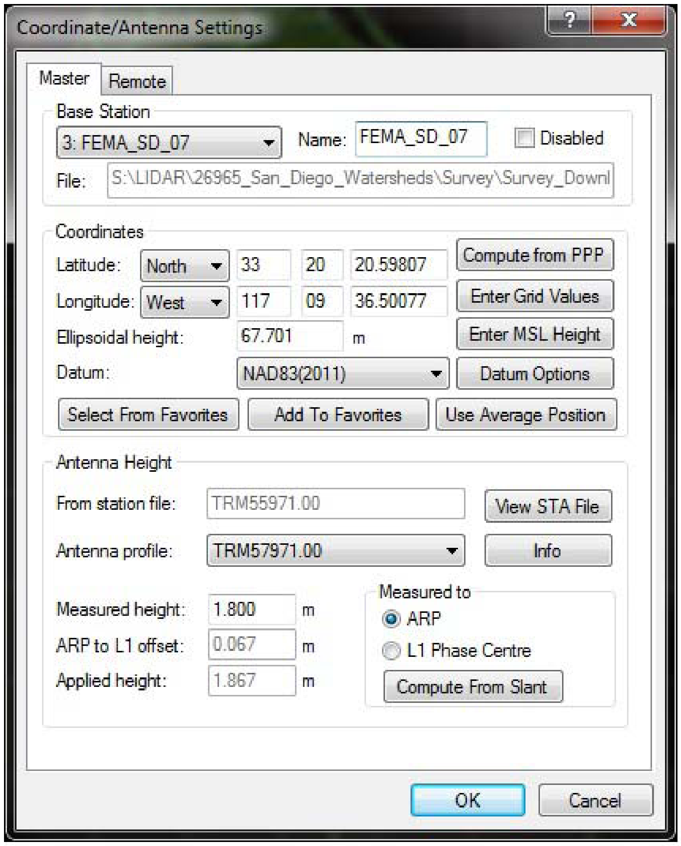

Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG
Week 1870

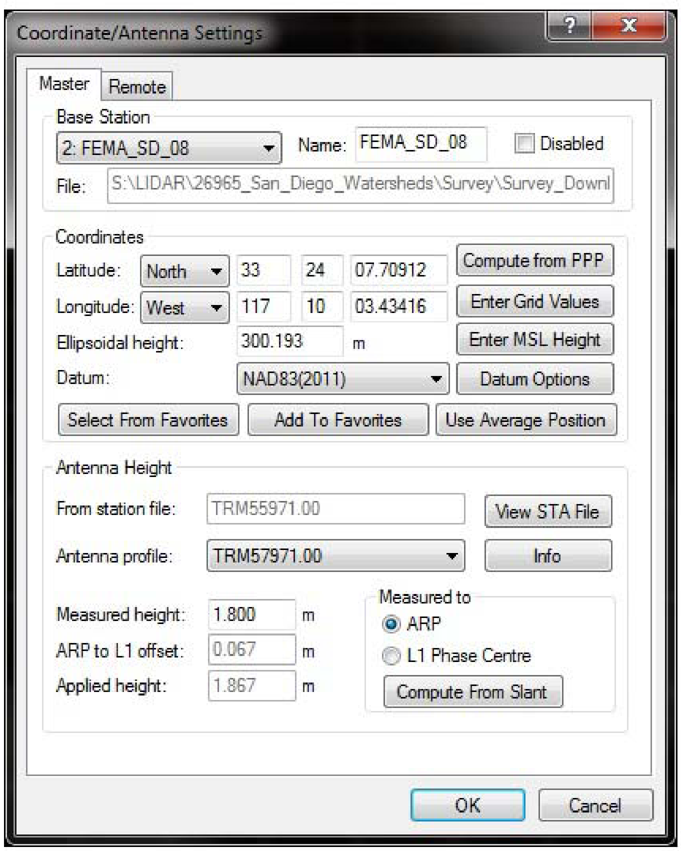

PDOP
410000
Week 1870
411000
412000
413000
414000
415000
416000
417000
418000
419000
420000
421000
422000
423000
GPS Time (TOW, GMT zone)
PDOP

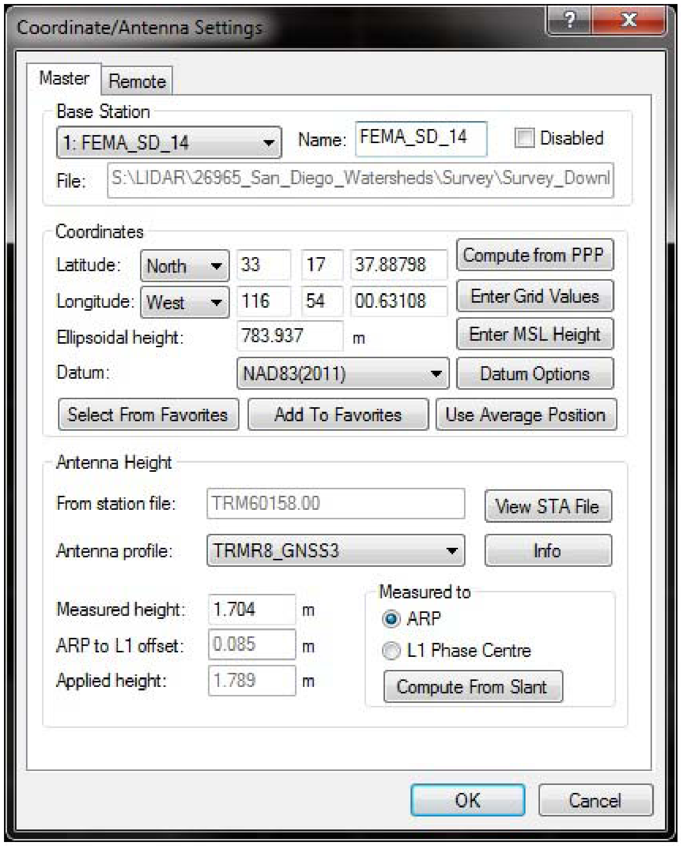

Estimated Std Dev (m)
410000
Week 1870
411000
412000
413000
414000
415000
416000
417000
418000
419000
420000
421000
422000
423000
GPS Time (TOW, GMT zone)
East
North
Height
Trace

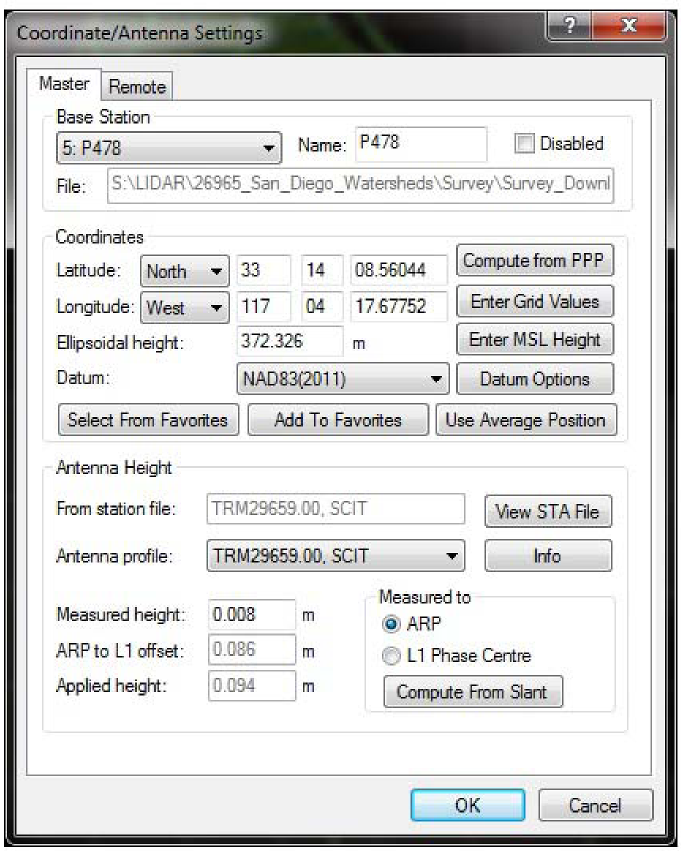

Roll & pitch (deg)
GPS Time (TOW, GMT zone)
Week 1870
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
4: BILL
Name:
BILL
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
34
41.66355
Compute from PPP
Longitude:
West
117
03
52.51376
Enter Grid Values
Ellipsoidal height:
470.789
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
ASH701945B_M, SCIT
View STA File
Antenna profile:
ASH701945B_M, SCIT
Info
Measured height:
0.008
m
ARP to L1 offset:
0.089
m
Applied height:
0.097
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
3: FEMA_SD_07
Name:
FEMA_SD_07
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
20
20.59807
Compute from PPP
Longitude:
West
117
09
36.50077
Enter Grid Values
Ellipsoidal height:
67.701
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.800
m
ARP to L1 offset:
0.067
m
Applied height:
1.867
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_08
Name:
FEMA_SD_08
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
24
07.70912
Compute from PPP
Longitude:
West
117
10
03.43416
Enter Grid Values
Ellipsoidal height:
300.193
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.800
m
ARP to L1 offset:
0.067
m
Applied height:
1.867
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: FEMA_SD_14
Name:
FEMA_SD_14
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
17
37.88798
Compute from PPP
Longitude:
West
116
54
00.63108
Enter Grid Values
Ellipsoidal height:
783.937
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM60158.00
View STA File
Antenna profile:
TRMR8_GNSS3
Info
Measured height:
1.704
m
ARP to L1 offset:
0.085
m
Applied height:
1.789
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
5: P478
Name:
P478
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
14
08.56044
Compute from PPP
Longitude:
West
117
04
17.67752
Enter Grid Values
Ellipsoidal height:
372.326
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM29659.00, SCIT
View STA File
Antenna profile:
TRM29659.00, SCIT
Info
Measured height:
0.008
m
ARP to L1 offset:
0.086
m
Applied height:
0.094
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning		
Target Speed (kts)		
Max Bank Angle in Turns (°)		
Minimum Line Overlap (%)		
Pulses in Air Mode		
Scan Pattern		
Gain Up		
Gain Down		
FOV (°)		
Scan Rate (Hz)		
Autoscan		
Laser Power (%)		
	Min.	Max
AGL Range (m)		
Flying Alt. MSL Range (ft)		
Swath Width Range (m)		
Pulse Rate Range (Hz)		

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	
Total Line Time (hrs, no buffer)	
Total Number of Lines	
Turn Time (min)	
Total Turn Time (hrs, no buffer)	
Buffer (%)	
MOB Dist. Round Trip (nmi)	
Number of MOBs	
Total Acquisition Time (hrs)	

Mission Flight Time Estimate	
Start Line Name	
Stop Line Name	
Turn Time (min)	
Buffer (%)	
Acquisition Time (hrs)	

Other Acquisition Notes:

Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
375	3.32	6818	181834	182713		181404 - BAD, BINO SHUTOFF, 181834-Sensor not recording, error
376	4.19	6782	182226			
377	5.1	6716	183417			
378	5.91	6690	183858			
379	6.75	6660	184353			
380	6.96	6503	184902			
381	7.04	6418	185415			
382	7.13	6237	190003			
383	10.17	6188	190851			
384	10.37	6178	191620			
385	10.58	6149	192350			crossline: 211902
386	10.74	6096	193124			
387	10.75	6011	193858			
388	11.16	5912	194629			
389	11.73	5870	195434			N840JA
390	11.74	5847	200244			TC, CB, SW, EMP
391	11.75	5824	201053			
392	11.75	5811	201858			
393	11.64	5798	202721			
394	11.43	5788	203523			
395	11.22	5765	204314			
396	9.45	5765	205121			
397	7.74	5765	205849			
398	7.01	5765	210441			
399	6.25	5765	211019			

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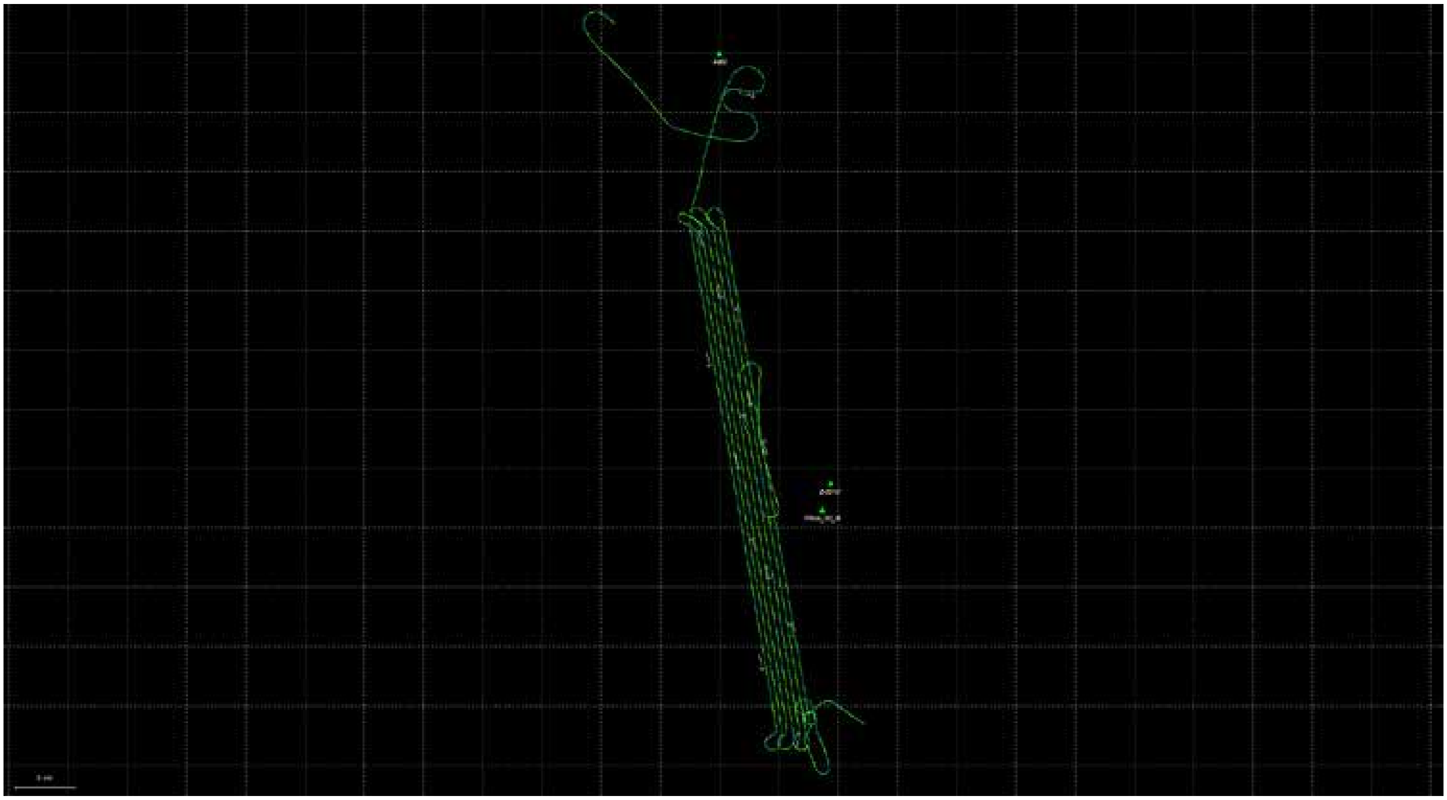
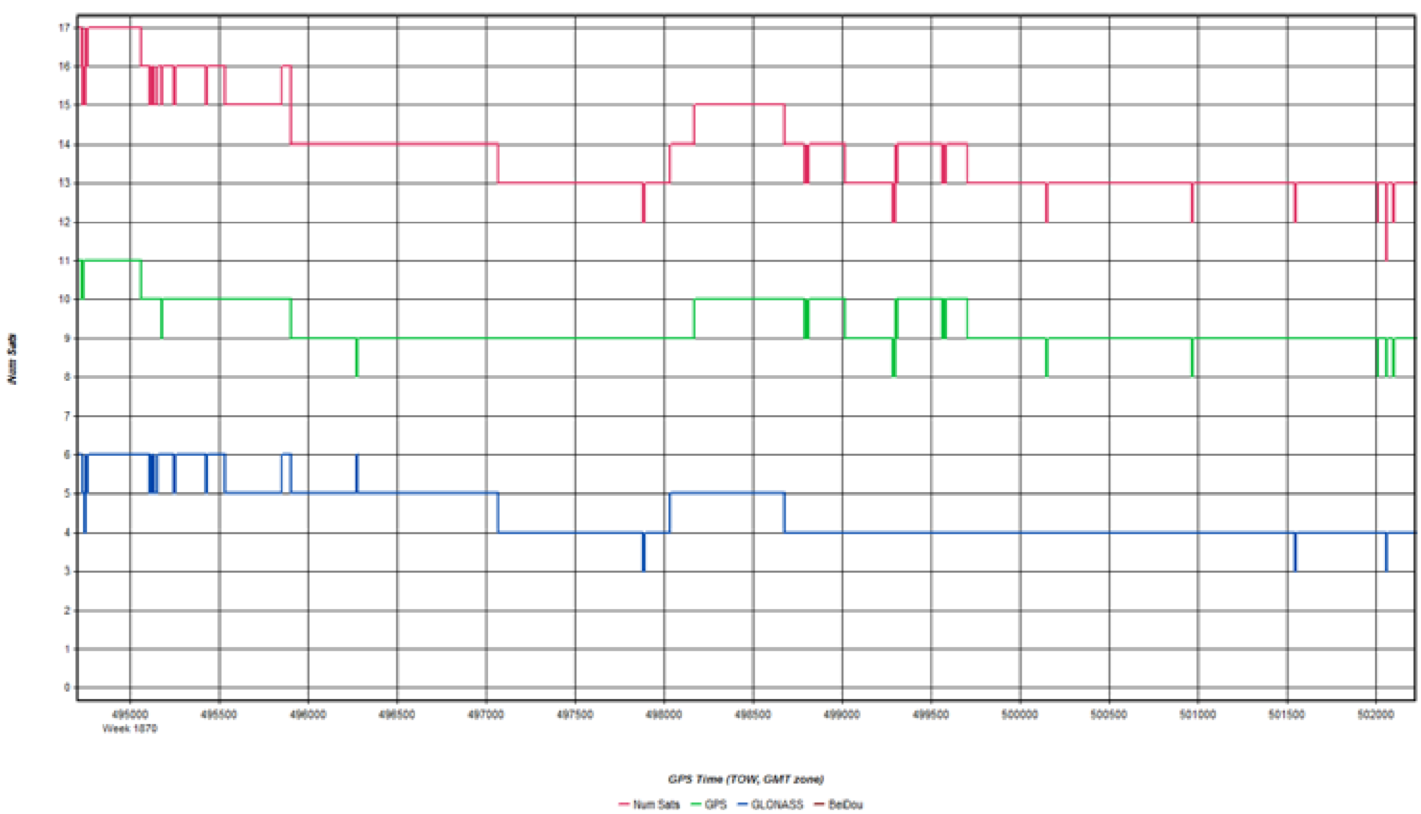
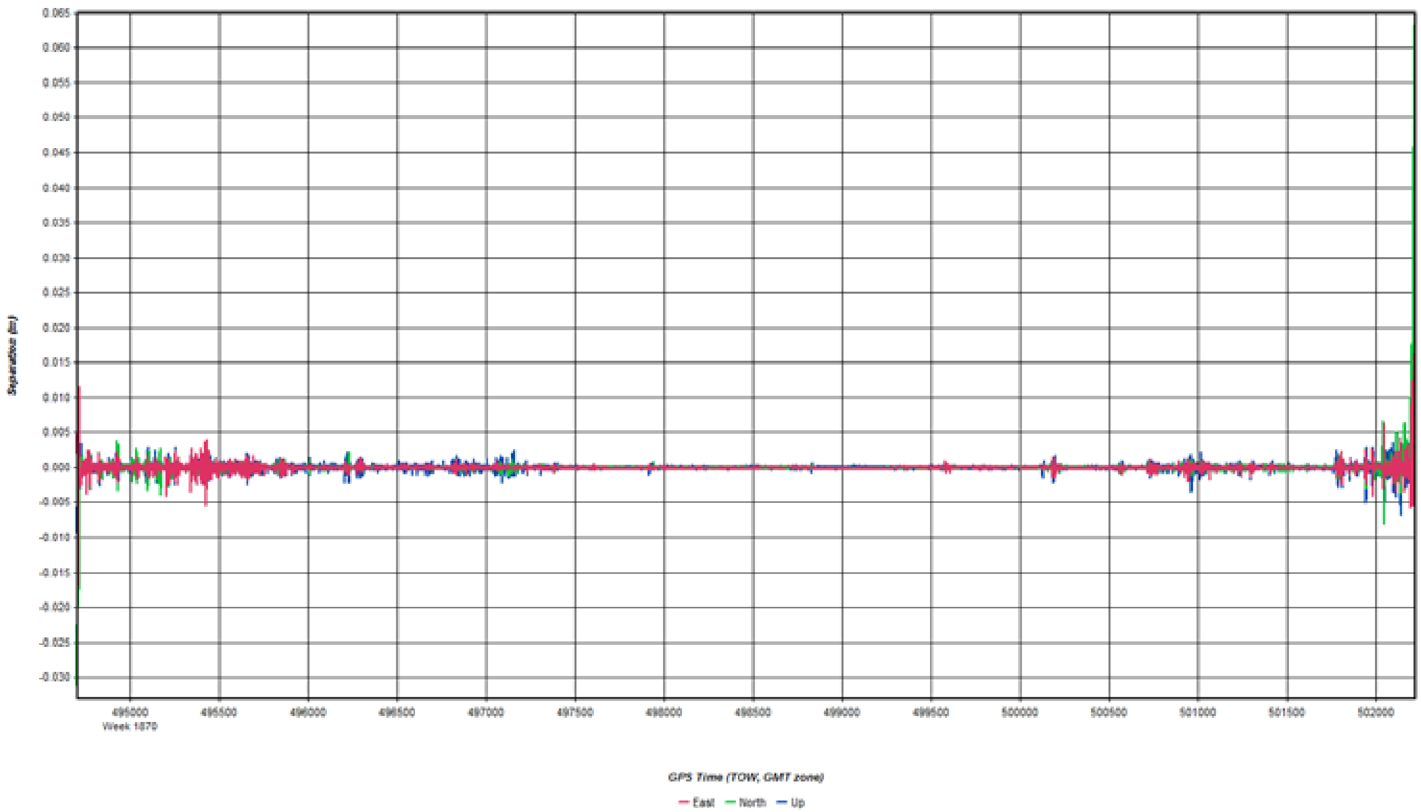
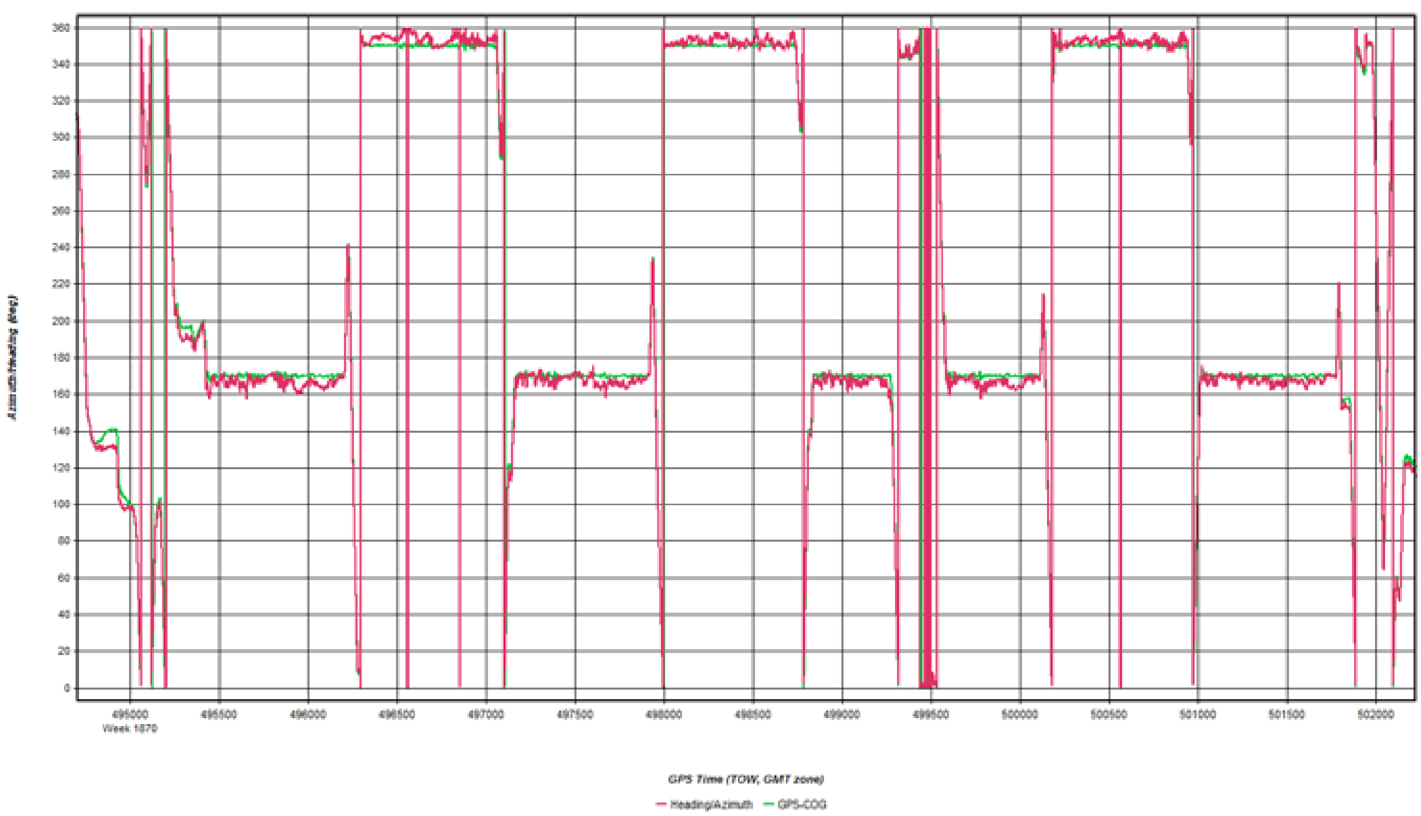
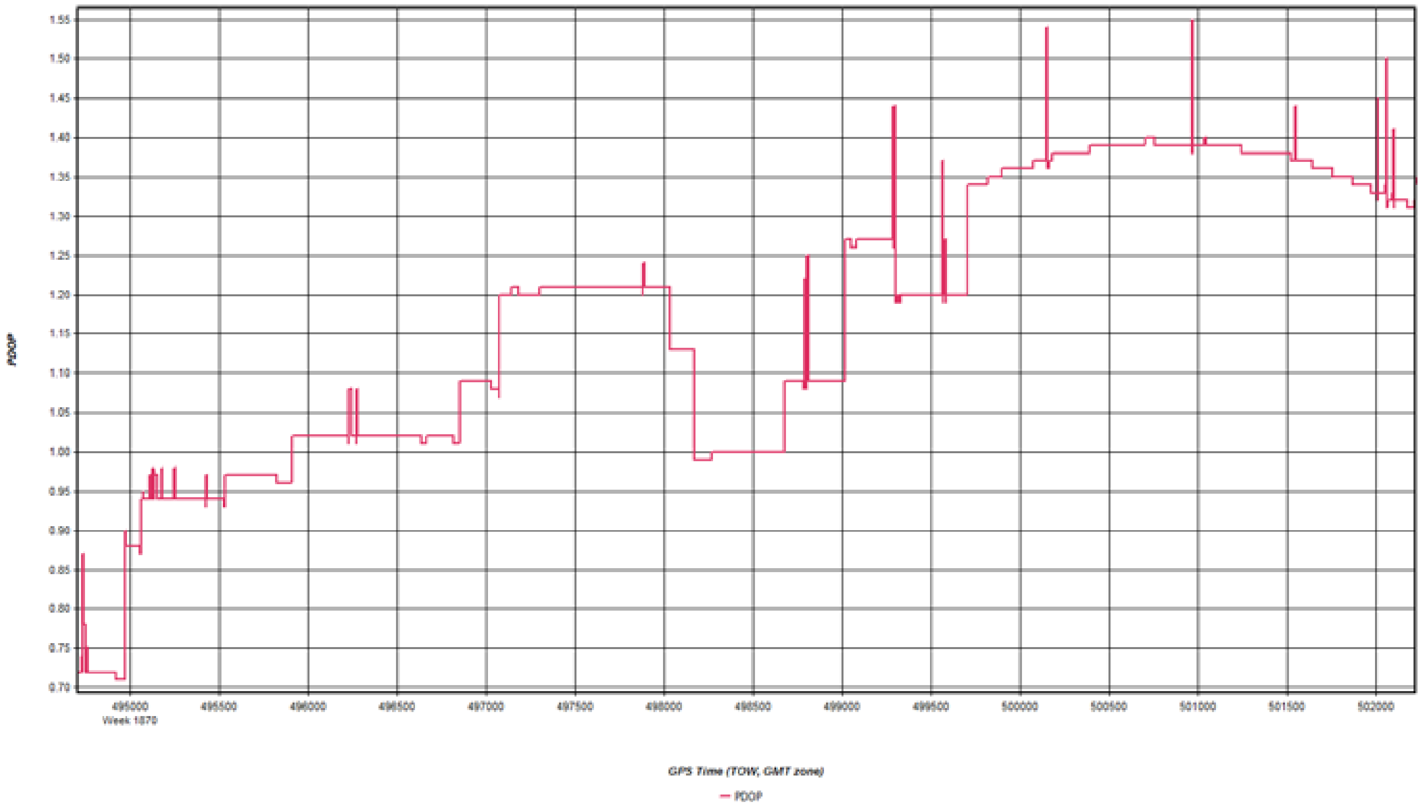


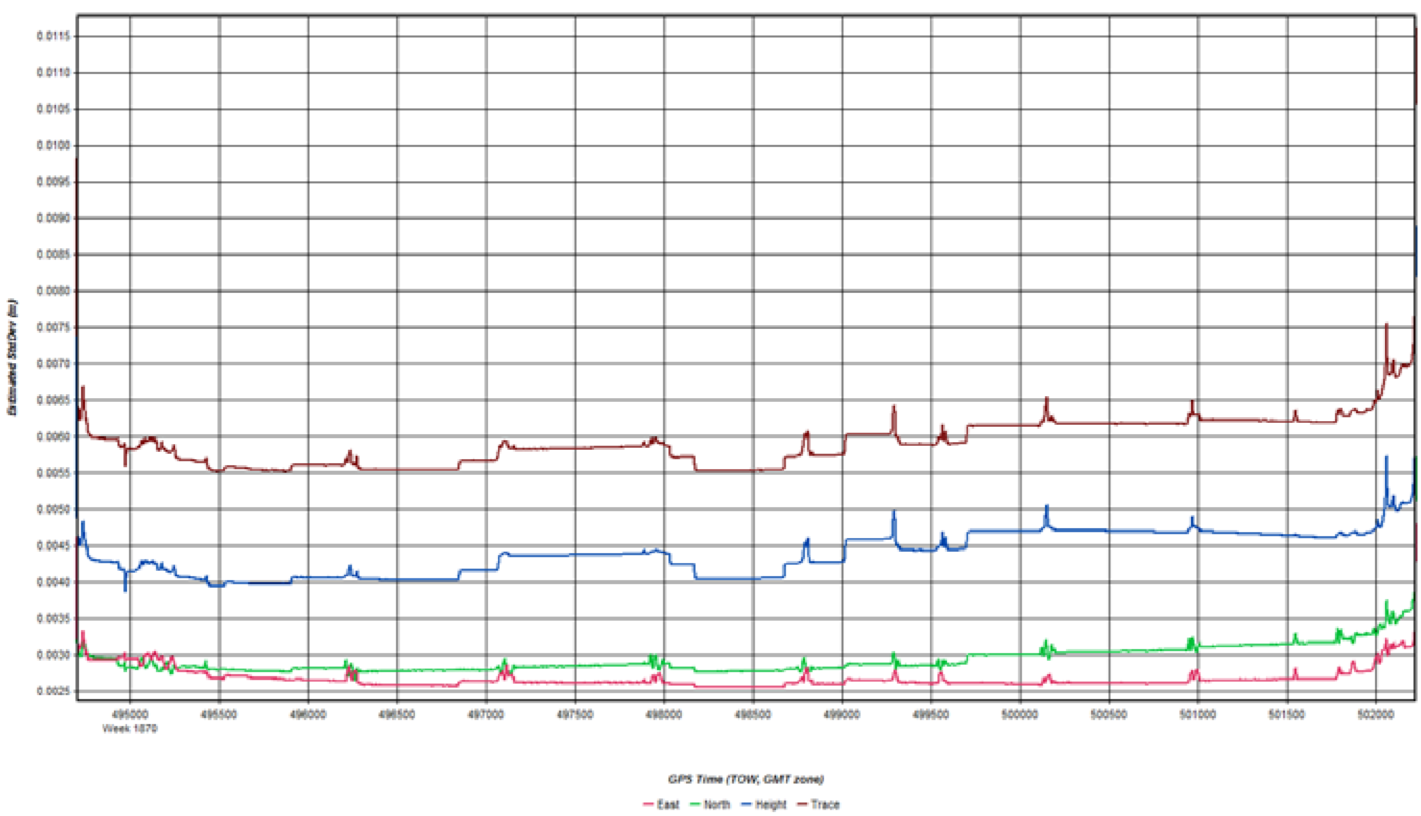


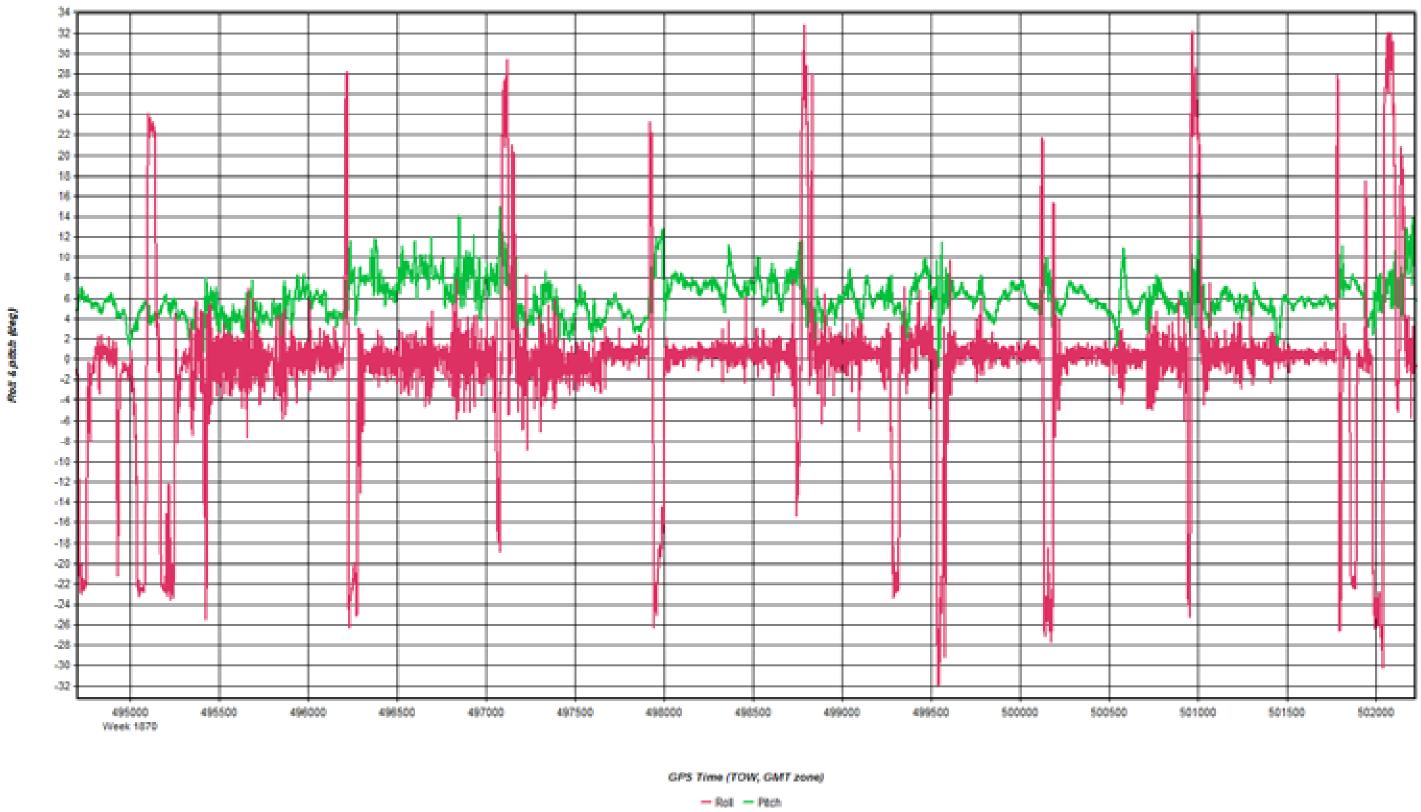
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
495000
Week 1870
495500
496000
496500
497000
497500
498000
498500
499000
499500
500000
500500
501000
501500
502000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

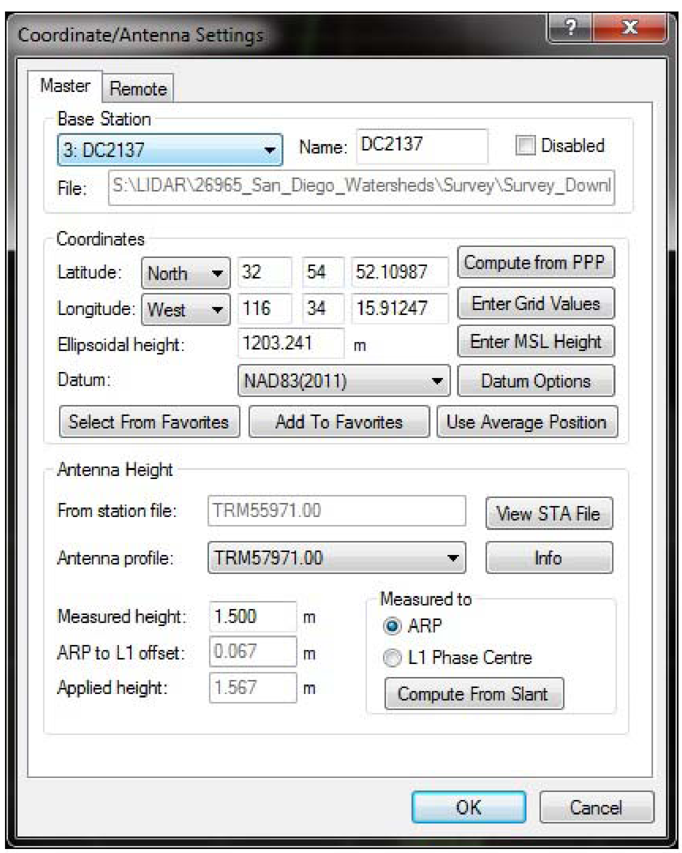

Separation (m)
0.065
0.060
0.055
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-0.005
-0.010
-0.015
-0.020
-0.025
-0.030
495000
Week 1870
495500
496000
496500
497000
497500
498000
498500
499000
499500
500000
500500
501000
501500
502000
GPS Time (TOW, GMT zone)
East
North
Up

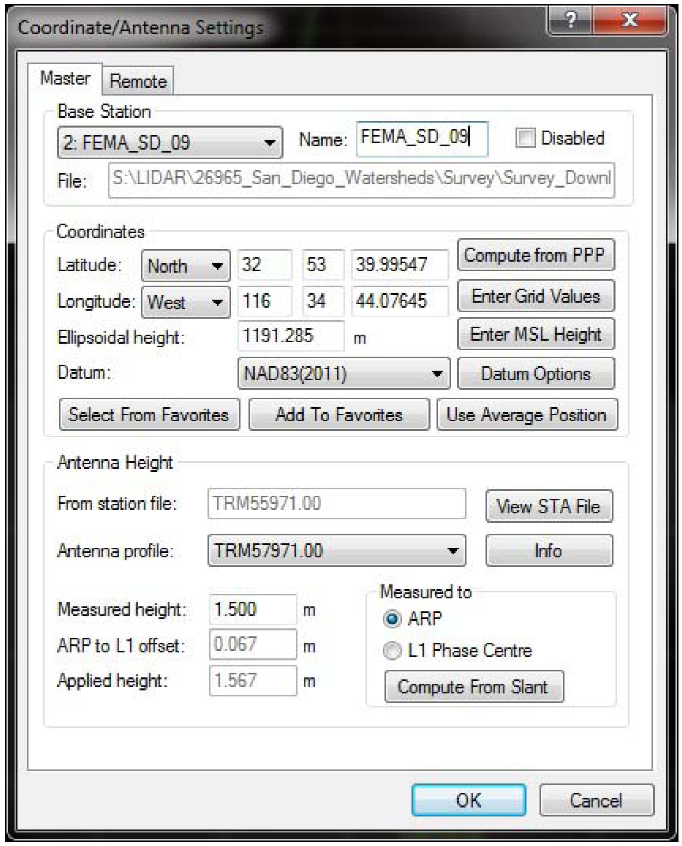

Azimuth/Heading (deg)
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
495000
Week 1870
495500
496000
496500
497000
497500
498000
498500
499000
499500
500000
500500
501000
501500
502000
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG

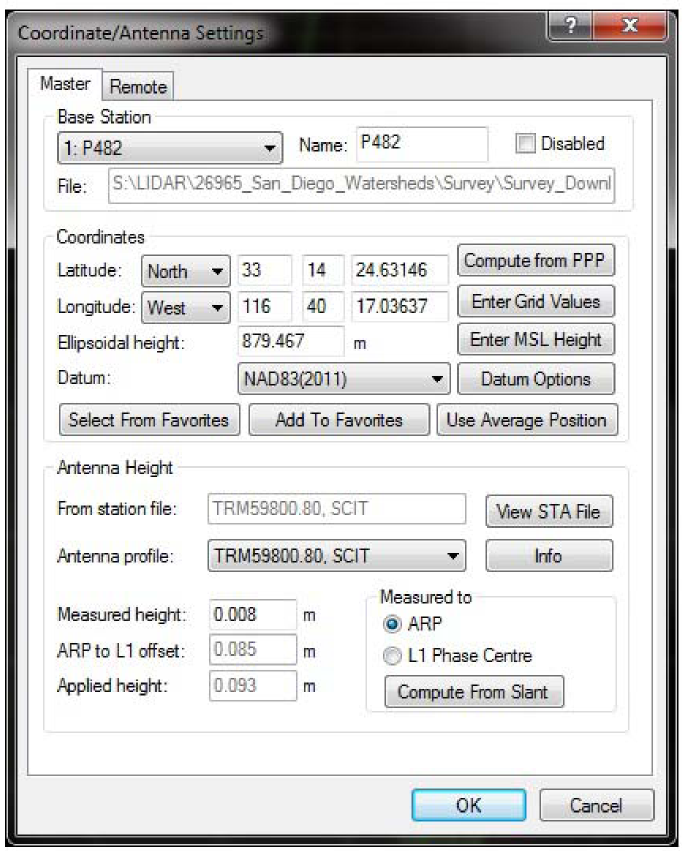

PDOP
GPS Time (TOW, GMT zone)
Week 1870
— PDOP


Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1870
— East — North — Height — Trace


Roll & pitch (deg)
GPS Time (TOW, GMT zone)
Week 1870
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
3: DC2137
Name: DC2137
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 32 54 52.10987
Longitude: West 116 34 15.91247
Ellipsoidal height: 1203.241 m
Datum: NAD83(2011)
Compute from PPP
Enter Grid Values
Enter MSL Height
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.500 m
ARP to L1 offset: 0.067 m
Applied height: 1.567 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_09
Name: FEMA_SD_09
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 32 53 39.99547
Compute from PPP
Longitude: West 116 34 44.07645
Enter Grid Values
Ellipsoidal height: 1191.285 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.500 m
ARP to L1 offset: 0.067 m
Applied height: 1.567 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: P482
Name: P482
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 33 14 24.63146
Compute from PPP
Longitude: West 116 40 17.03637
Enter Grid Values
Ellipsoidal height: 879.467 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM59800.80, SCIT
View STA File
Antenna profile: TRM59800.80, SCIT
Info
Measured height: 0.008 m
ARP to L1 offset: 0.085 m
Applied height: 0.093 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	096
Stop Line Name	133
Turn Time (min)	2
Buffer (%)	0
Acquisition Time (hrs)	5.7

Other Acquisition Notes:

Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
073	22.37	7215	173714			start n to s, 7 degree roll due to turbulence
074	22.35	7300	175129			8 degree roll due to turbulence
075	22.34	7507	180558			
076	22.32	7641	182001			
077	22.3	7737	183354	184627		183354 - Ranges stopped halfway, 184627 - partial refly
078	22.28	7799	185631			
079	22.26	8006	191022			After the line end, got an ALS config error

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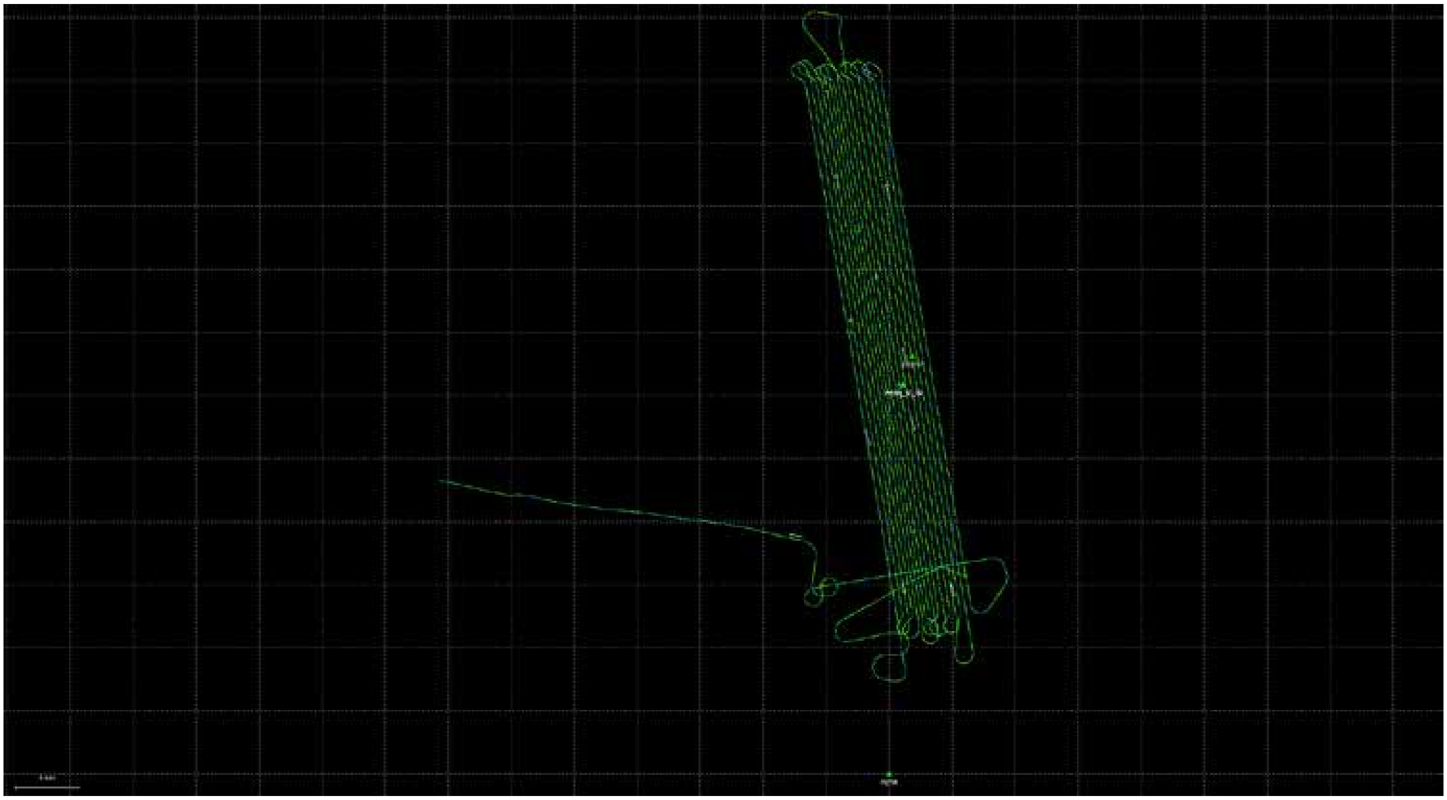
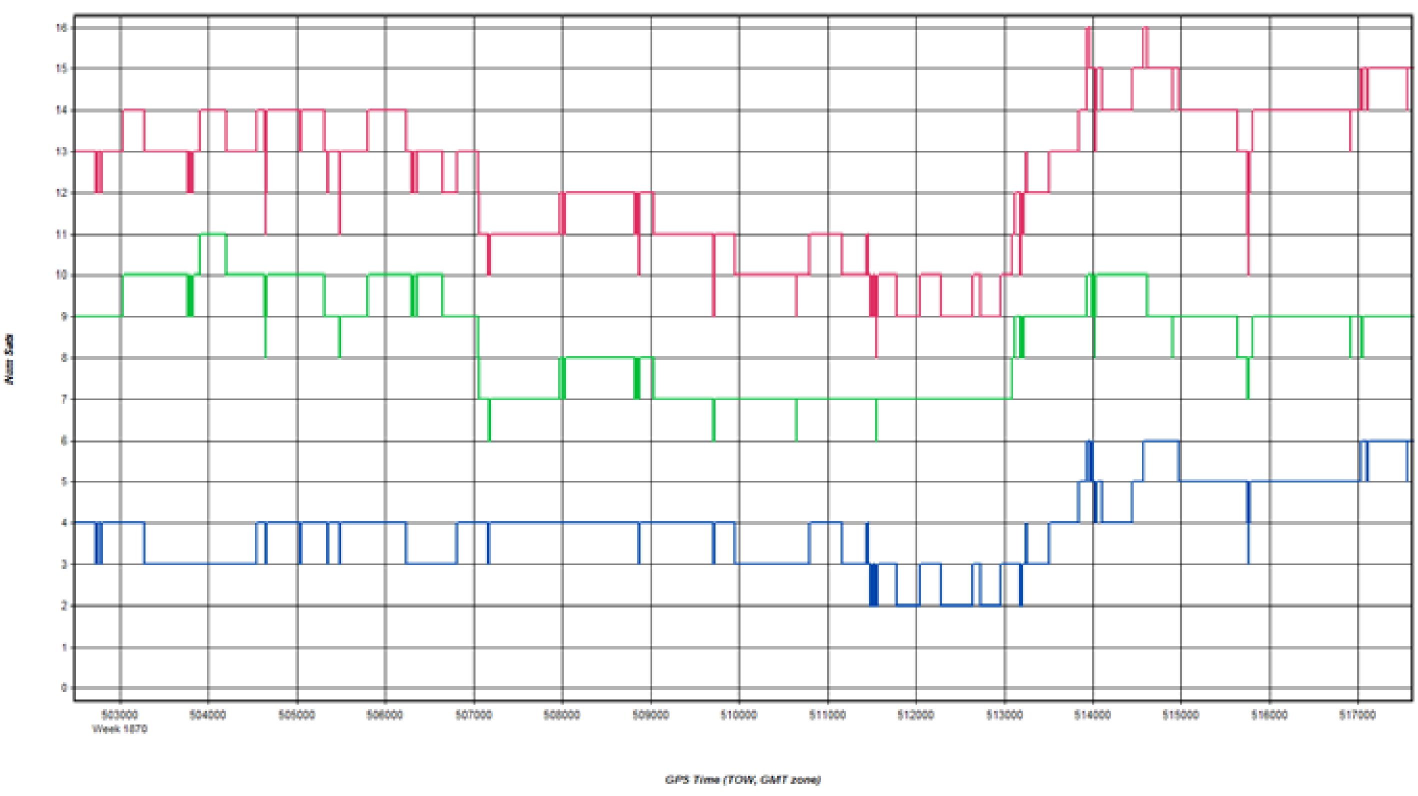
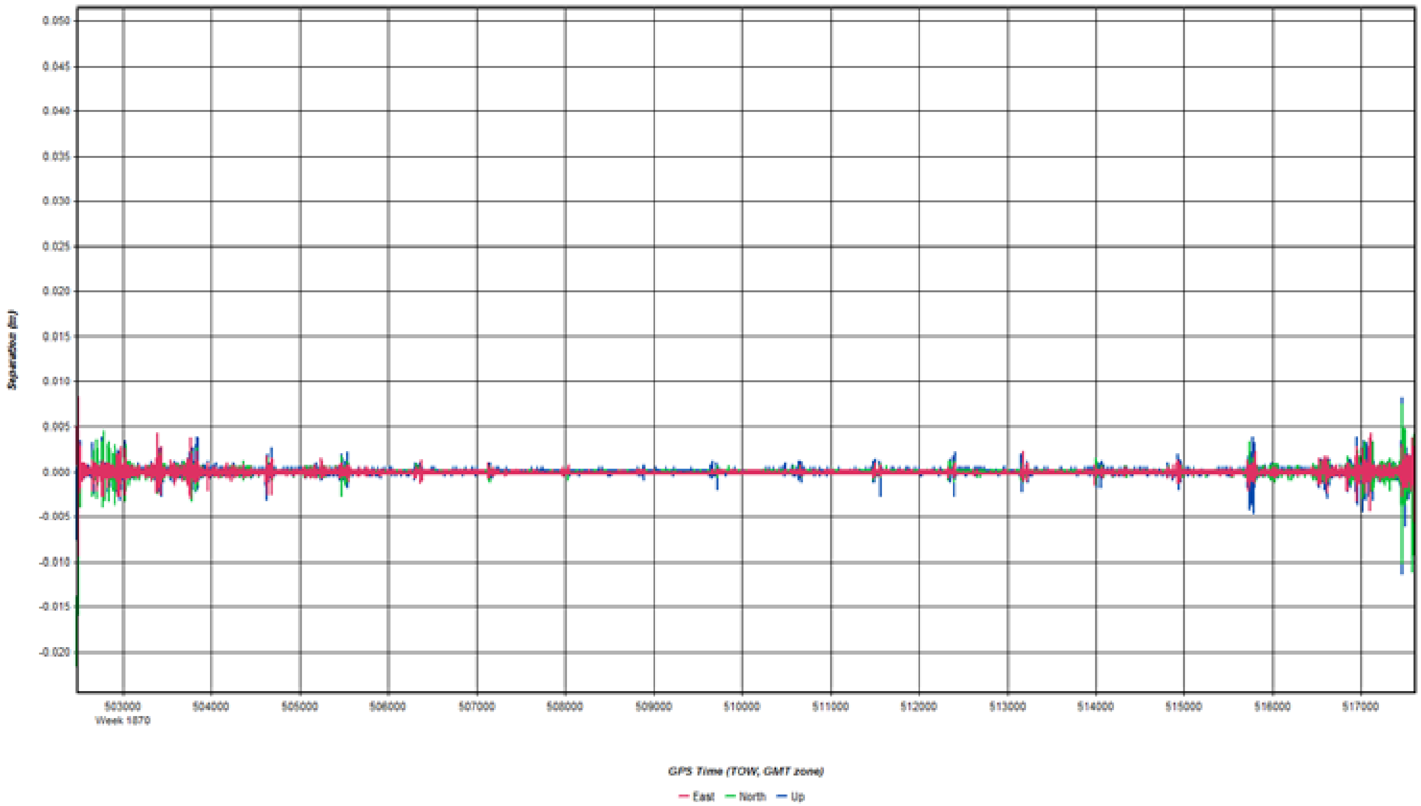
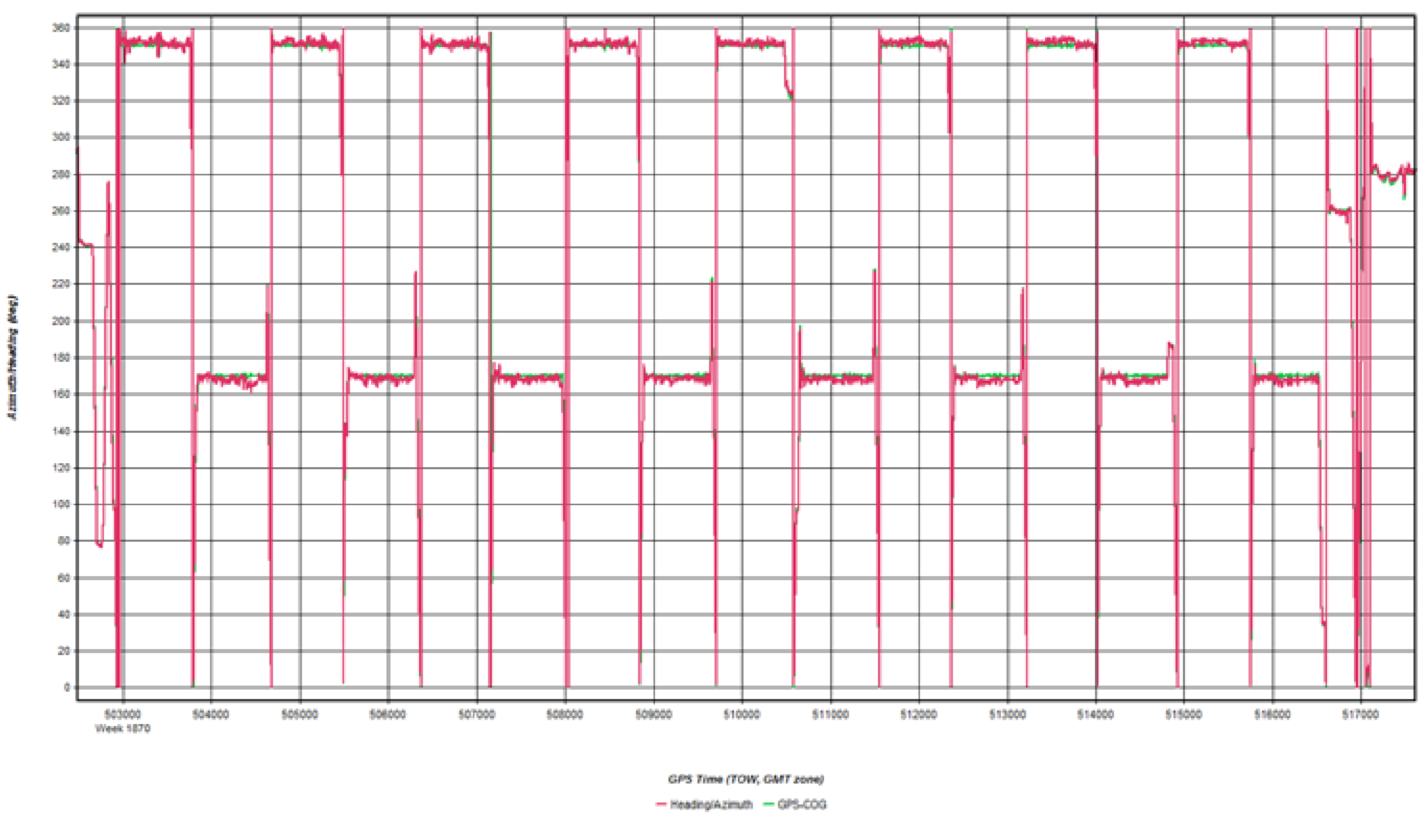



Num Sats
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
503000
Week 1870
504000
505000
506000
507000
508000
509000
510000
511000
512000
513000
514000
515000
516000
517000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

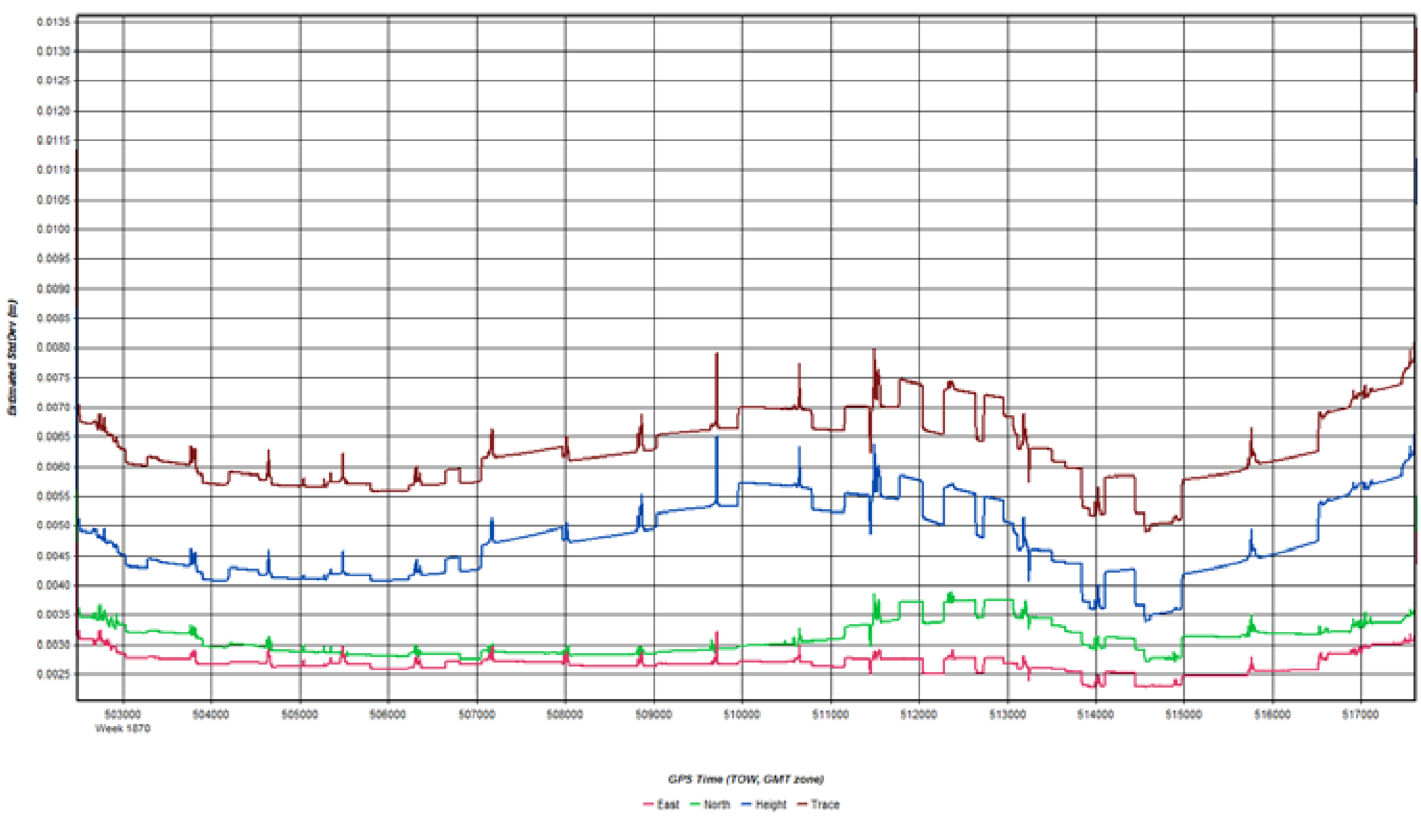


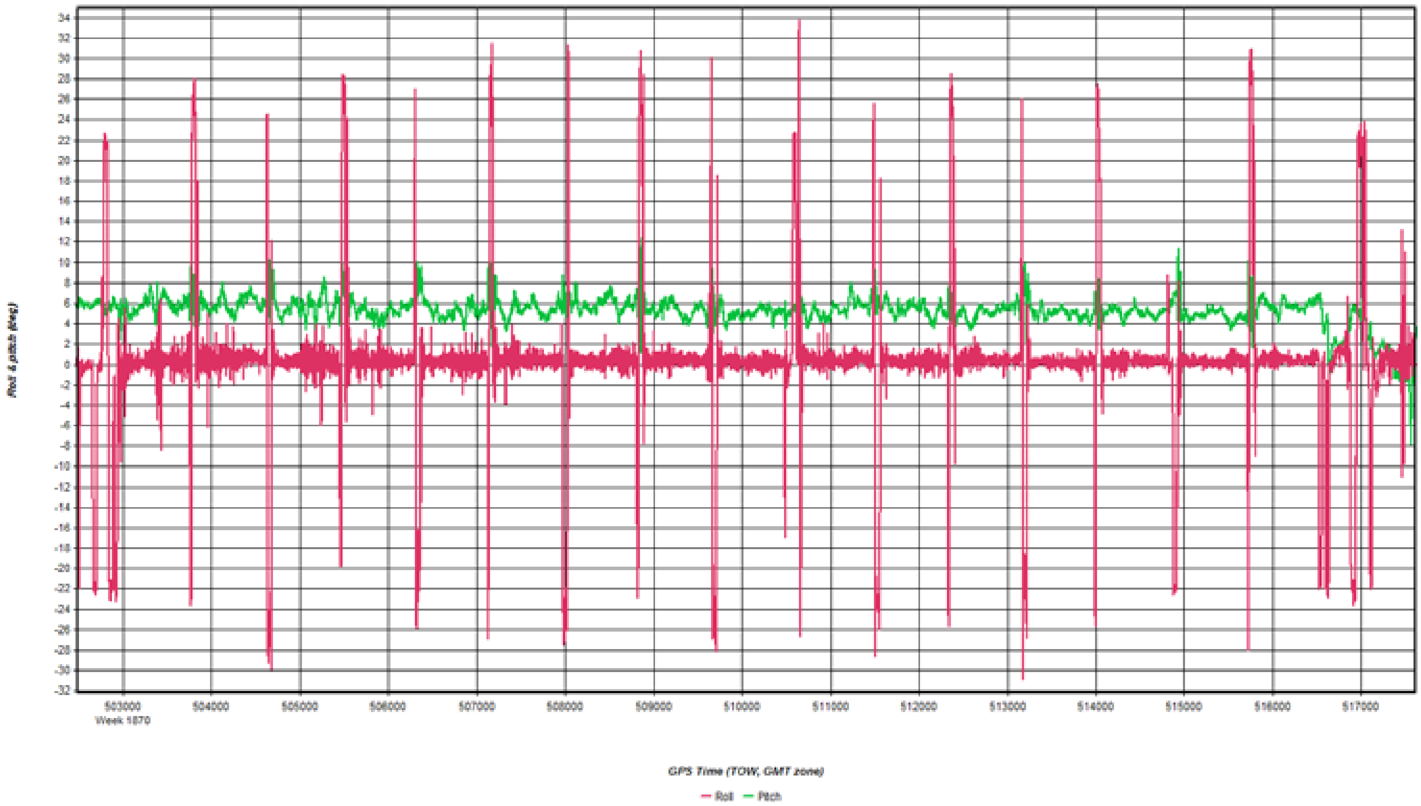
Separation (m)
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-0.005
-0.010
-0.015
-0.020
503000
Week 1870
504000
505000
506000
507000
508000
509000
510000
511000
512000
513000
514000
515000
516000
517000
GPS Time (TOW, GMT zone)
East
North
Up

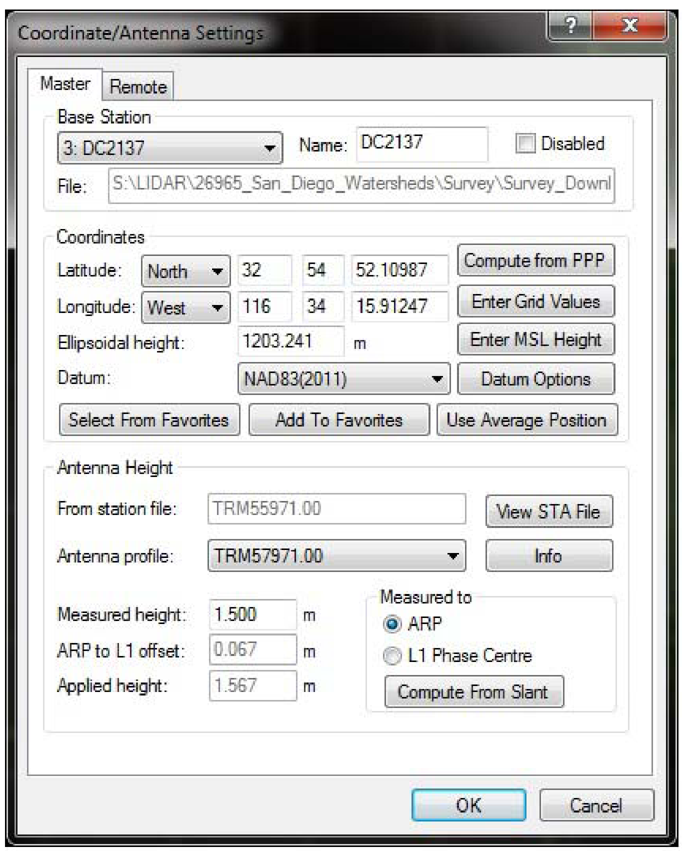


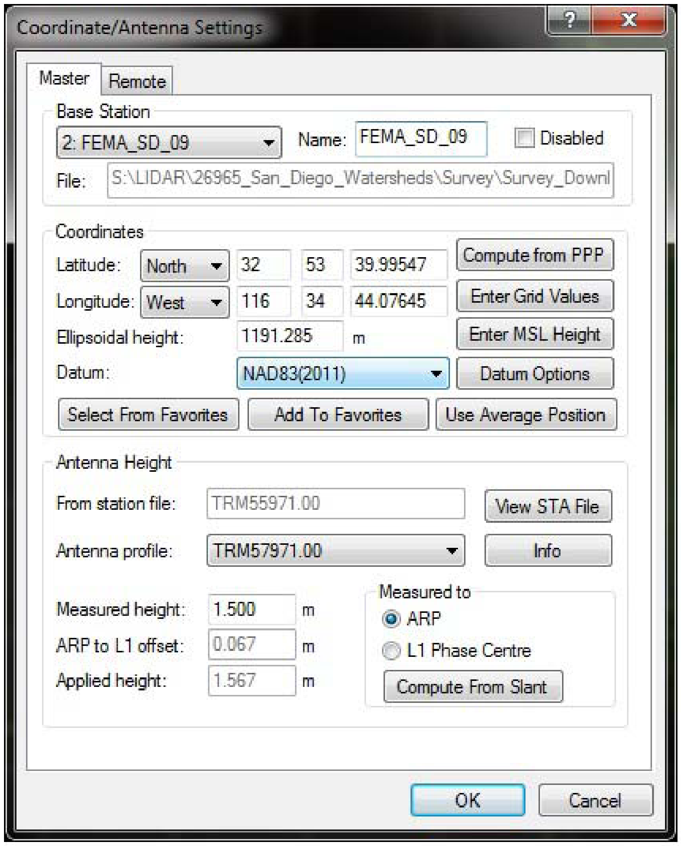
Azimuth/Heading (deg)
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
503000
Week 1870
504000
505000
506000
507000
508000
509000
510000
511000
512000
513000
514000
515000
516000
517000
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG

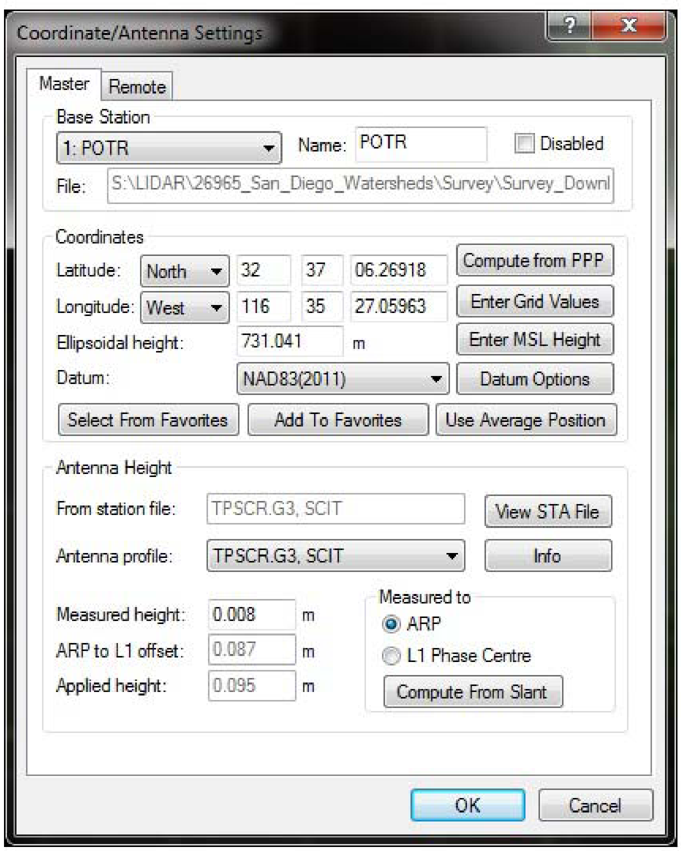

PDOP
GPS Time (TOW, GMT zone)
Week 1870
PDOP


Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1870
East
North
Height
Trace


Roll & pitch (deg)
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
503000
Week 1870
504000
505000
506000
507000
508000
509000
510000
511000
512000
513000
514000
515000
516000
517000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
3: DC2137
Name: DC2137
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 32 54 52.10987
Compute from PPP
Longitude: West 116 34 15.91247
Enter Grid Values
Ellipsoidal height: 1203.241 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.500 m
ARP to L1 offset: 0.067 m
Applied height: 1.567 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_09
Name:
FEMA_SD_09
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
53
39.99547
Compute from PPP
Longitude:
West
116
34
44.07645
Enter Grid Values
Ellipsoidal height:
1191.285
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.500
m
ARP to L1 offset:
0.067
m
Applied height:
1.567
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: POTR
Name:
POTR
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
37
06.26918
Compute from PPP
Longitude:
West
116
35
27.05963
Enter Grid Values
Ellipsoidal height:
731.041
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TPSCR.G3, SCIT
View STA File
Antenna profile:
TPSCR.G3, SCIT
Info
Measured height:
0.008
m
ARP to L1 offset:
0.087
m
Applied height:
0.095
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	096
Stop Line Name	133
Turn Time (min)	2
Buffer (%)	0
Acquisition Time (hrs)	5.7

Other Acquisition Notes:

Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
080	22.25	8104	194318			
081	22.23	8173	195719			
082	22.22	8265	201128			
083	22.2	8367	202540			
084	22.19	8504	203942			
085	22.18	8517	205312			
086	22.17	8550	210713			CROSSLINE:233052
087	22.15	8600	212127			
088	22.14	8701	213532			
089	22.13	8773	215202			
090	22.11	8800	220607			Saw return drop out temperarily
091	22.09	8800	222005			
092	22.08	8832	223354			
093	22.06	8980	224746			N to S
094	22.05	9023	230256			
095	22.03	9056	231629			N to S

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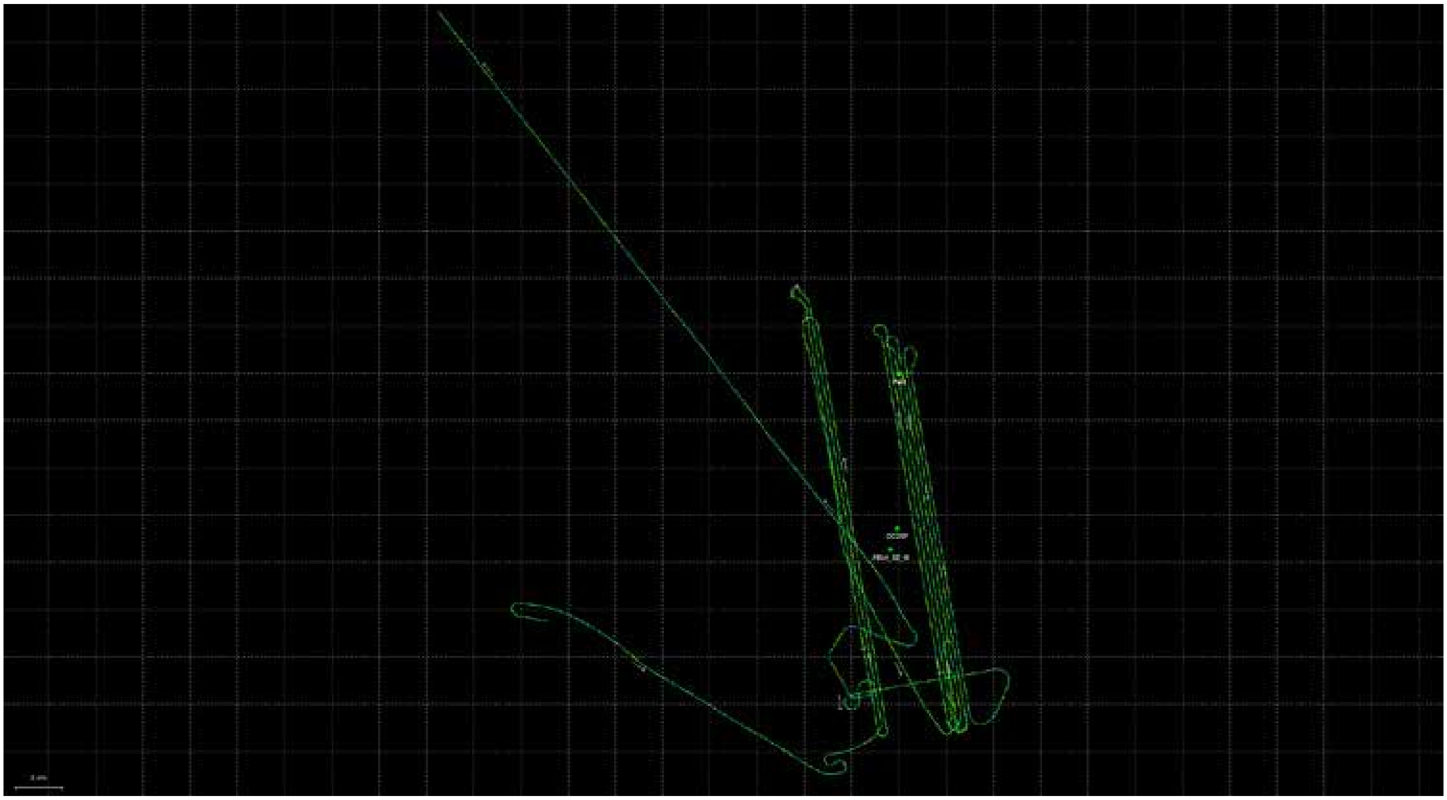
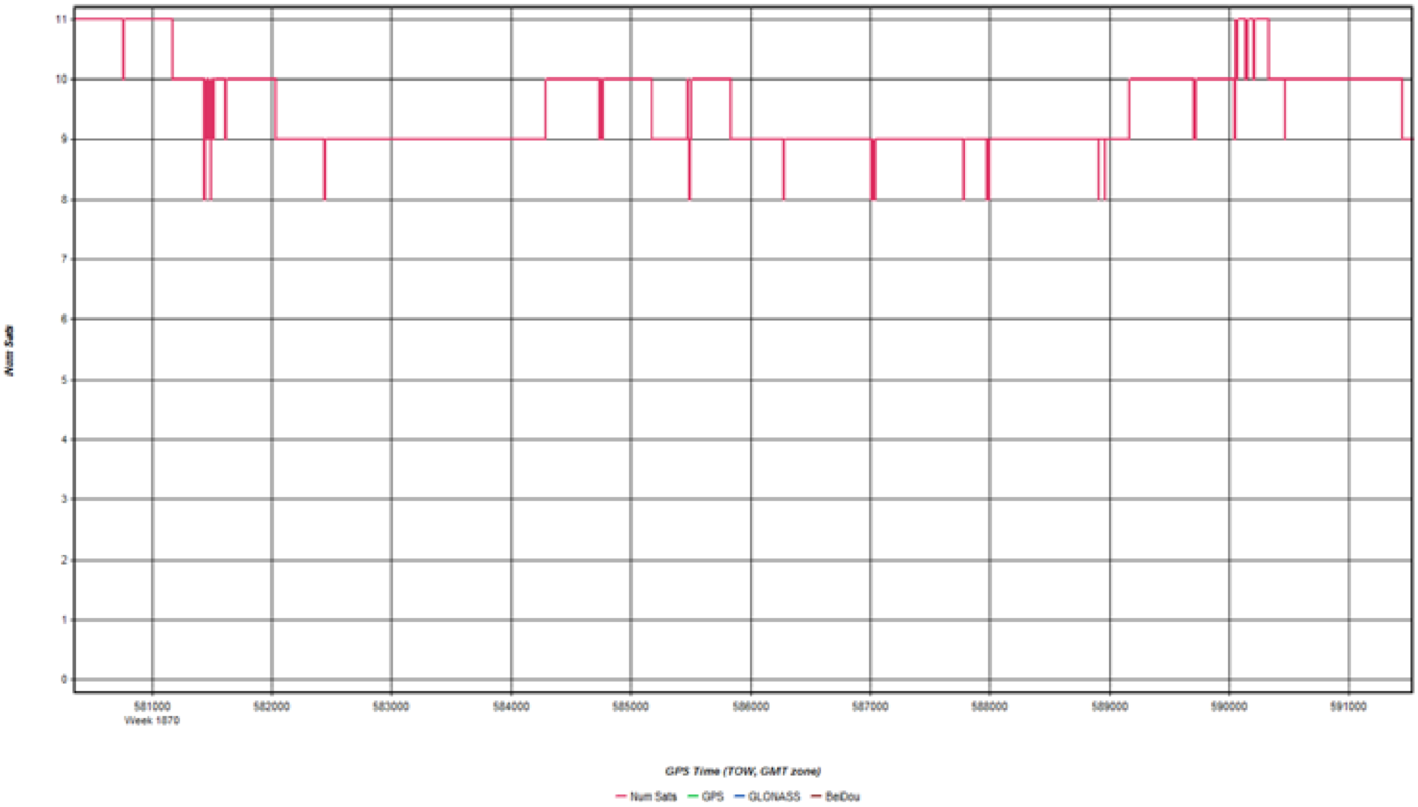
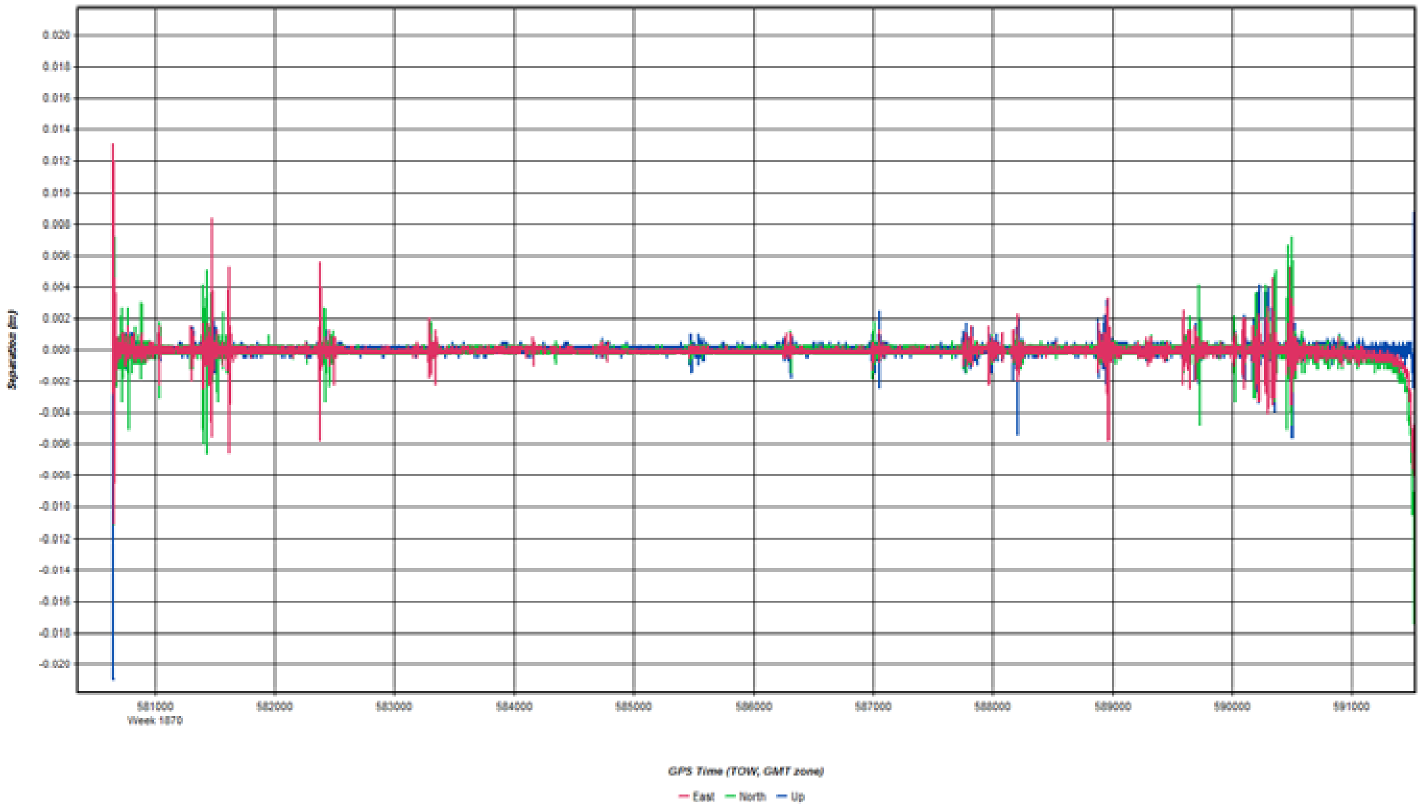
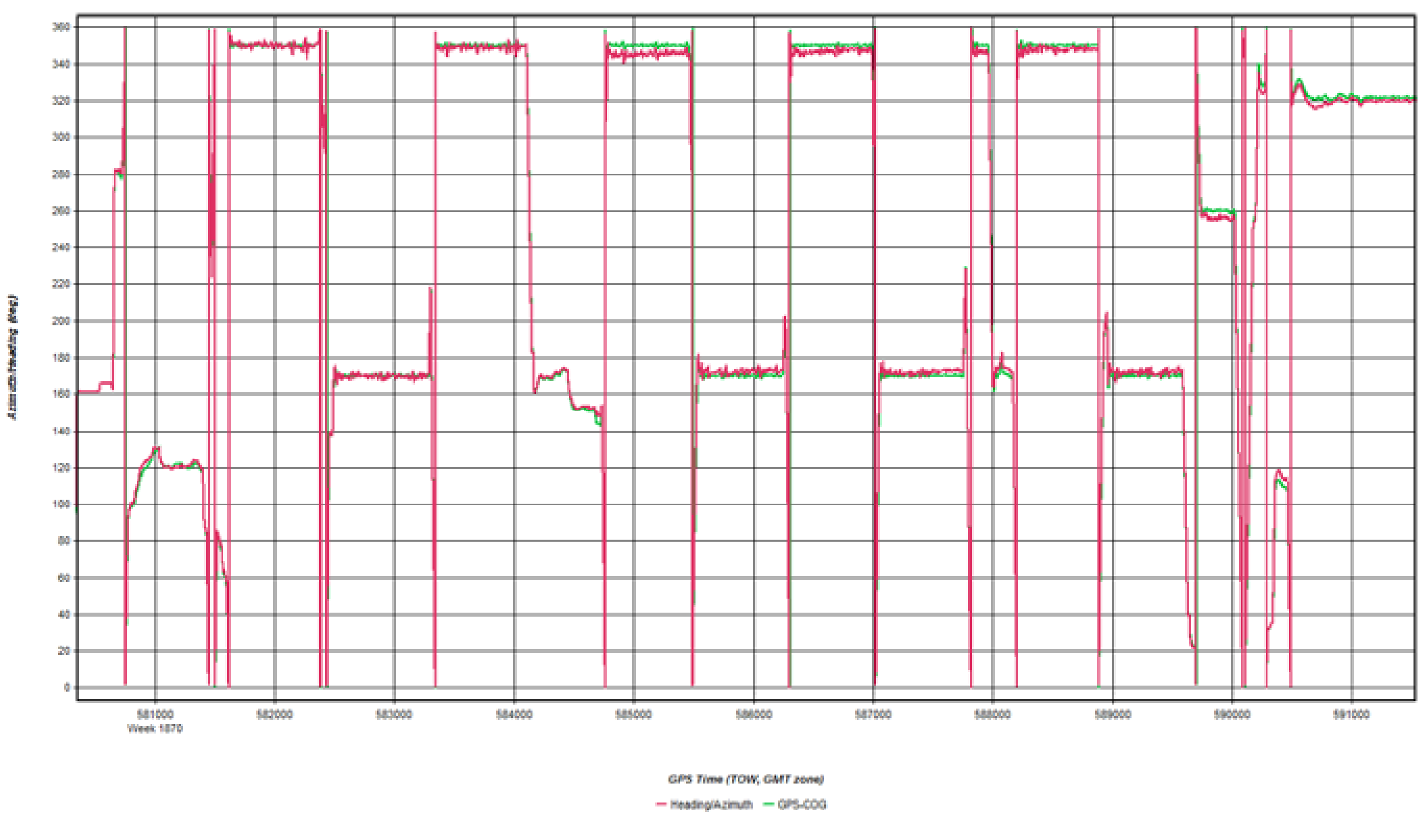
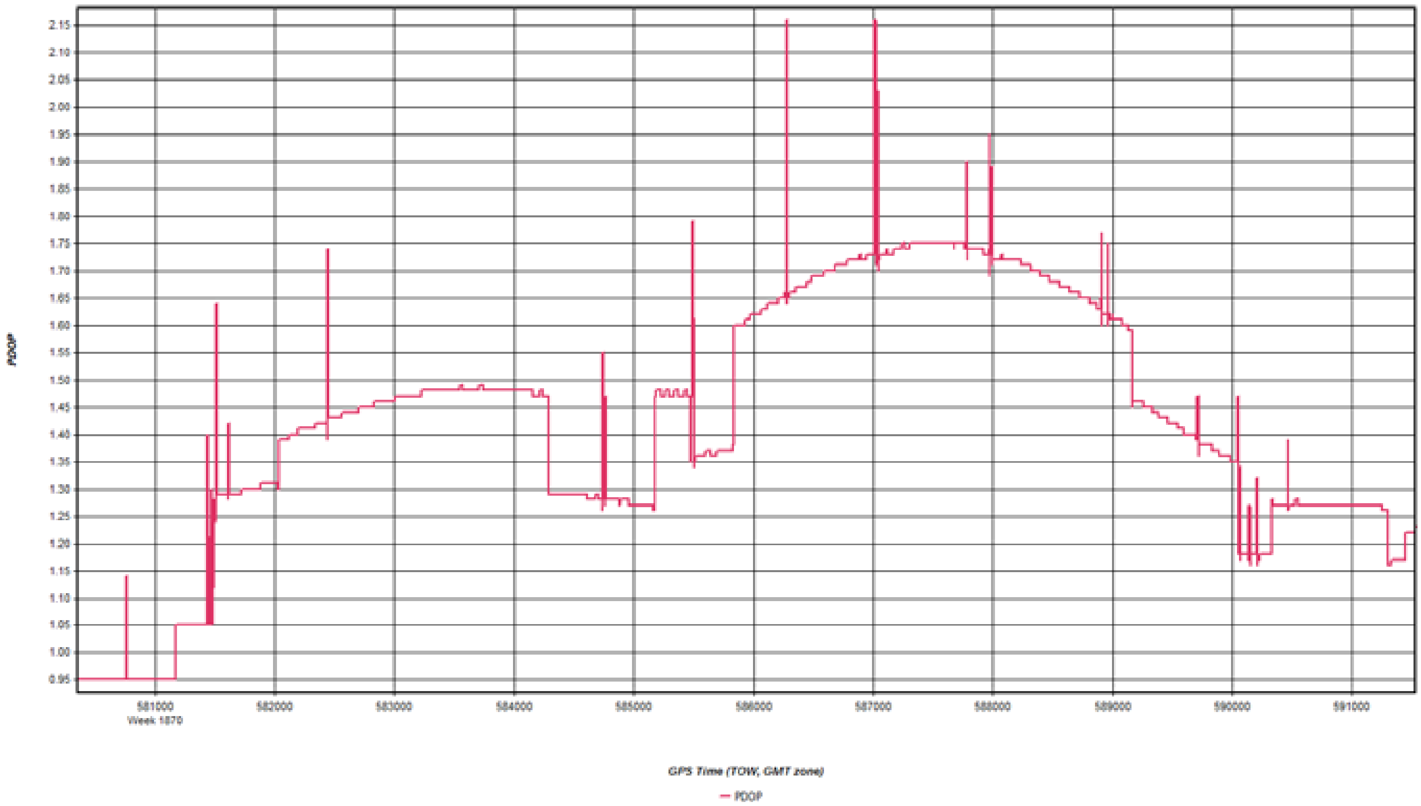
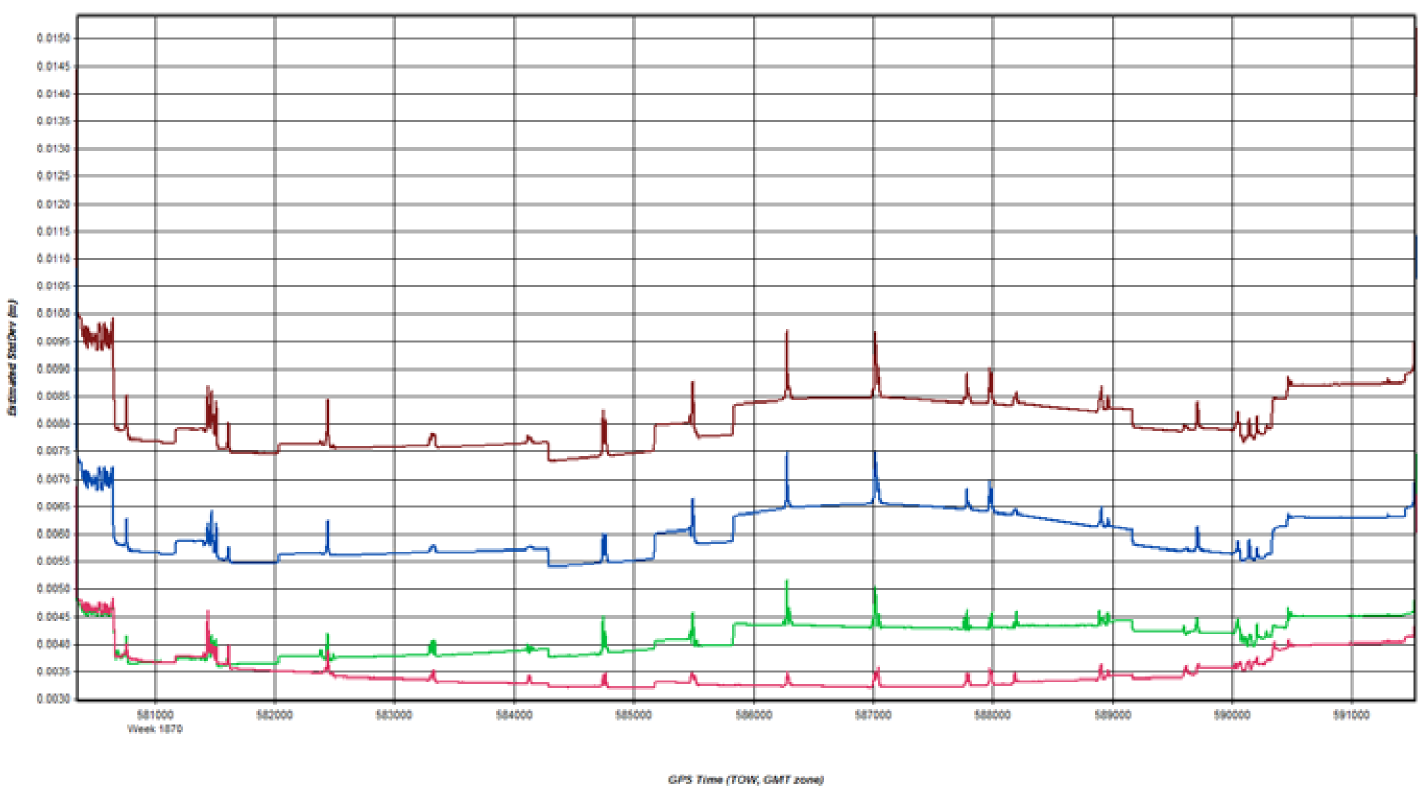


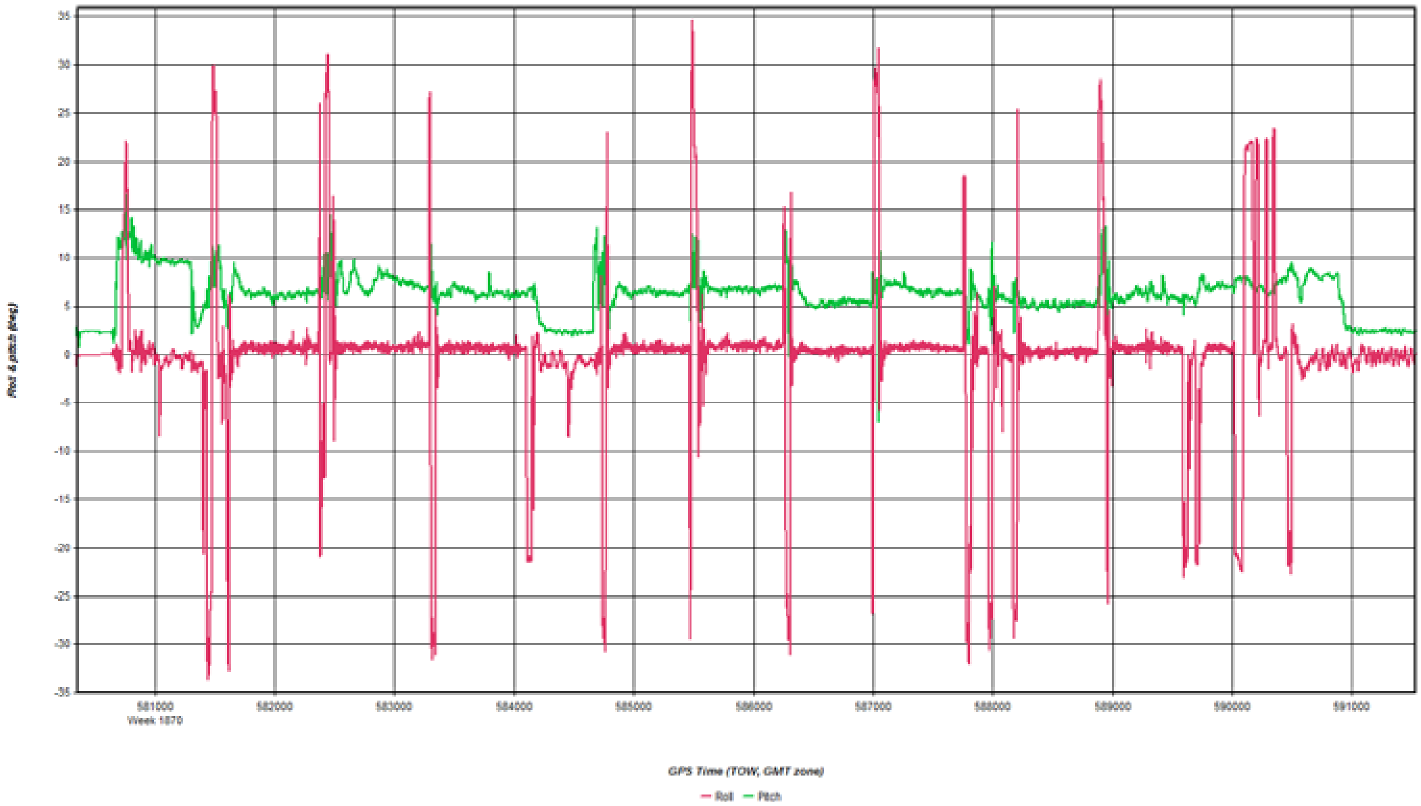

Num Sats
GPS Time (TOW, GMT zone)
Week 1870
Num Sats
GPS
GLONASS
BeiDou

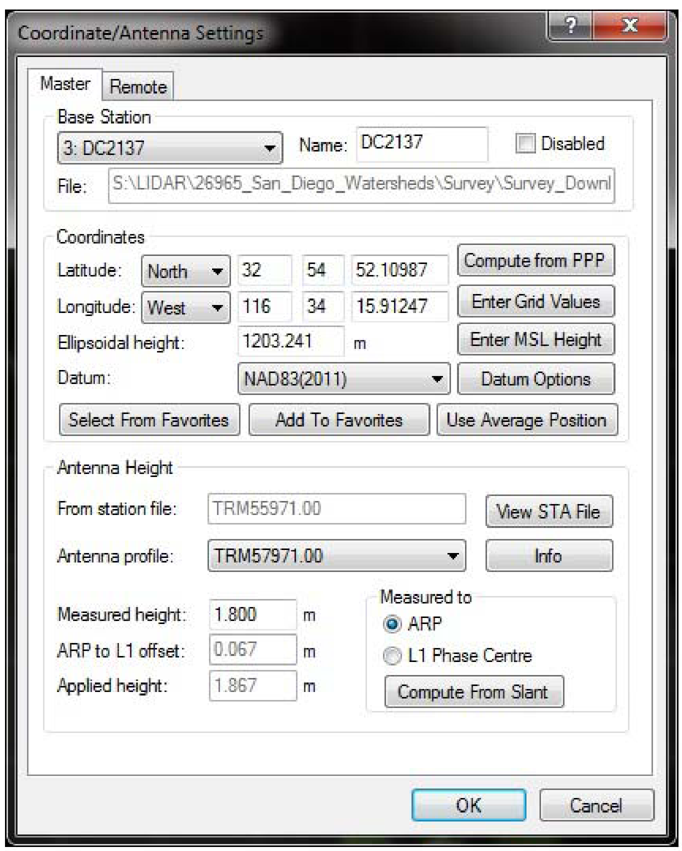

0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
-0.002
-0.004
-0.006
-0.008
-0.010
-0.012
-0.014
-0.016
-0.018
-0.020
Separation (m)
581000
Week 1870
582000
583000
584000
585000
586000
587000
588000
589000
590000
591000
GPS Time (TOW, GMT zone)
East
North
Up

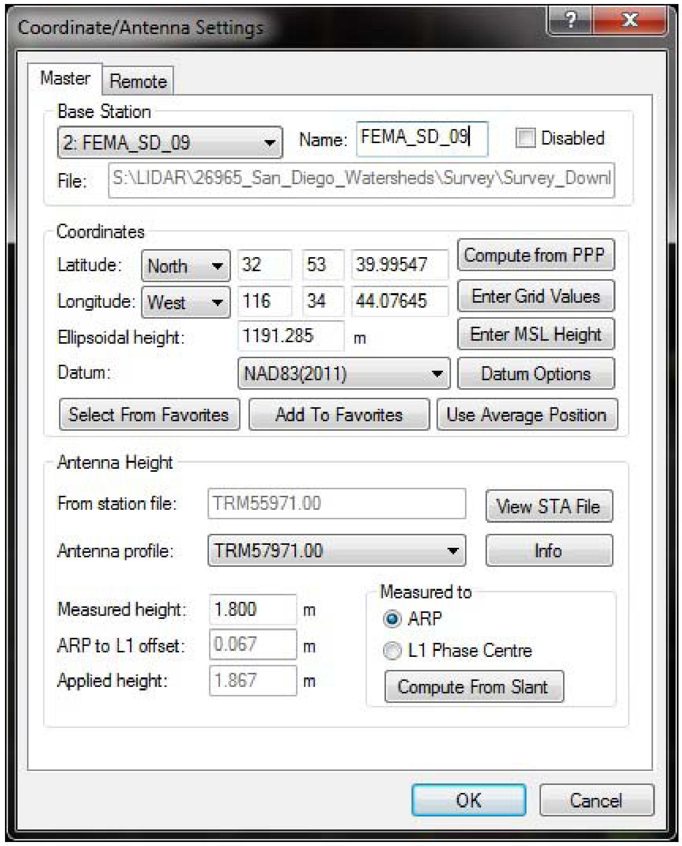

360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
Azimuth/Heading (deg)
581000
Week 1870
582000
583000
584000
585000
586000
587000
588000
589000
590000
591000
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG

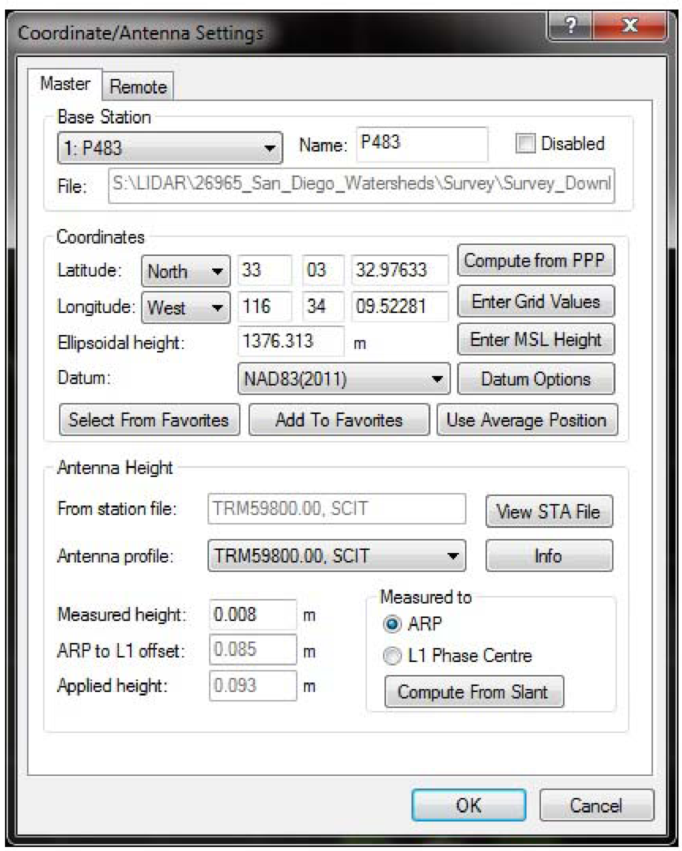

PDOP
Week 1870
GPS Time (TOW, GMT zone)
PDOP


Estimated Std Dev (m)
Week 1870
GPS Time (TOW, GMT zone)
East
North
Height
Trace


35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
Roll & pitch (deg)
581000
Week 1870
582000
583000
584000
585000
586000
587000
588000
589000
590000
591000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
3: DC2137
Name: DC2137
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 32 54 52.10987
Compute from PPP
Longitude: West 116 34 15.91247
Enter Grid Values
Ellipsoidal height: 1203.241 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.800 m
ARP to L1 offset: 0.067 m
Applied height: 1.867 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_09
Name: FEMA_SD_09
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 32 53 39.99547
Compute from PPP
Longitude: West 116 34 44.07645
Enter Grid Values
Ellipsoidal height: 1191.285 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.800 m
ARP to L1 offset: 0.067 m
Applied height: 1.867 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: P483
Name: P483
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 33 03 32.97633
Compute from PPP
Longitude: West 116 34 09.52281
Enter Grid Values
Ellipsoidal height: 1376.313 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM59800.00, SCIT
View STA File
Antenna profile: TRM59800.00, SCIT
Info
Measured height: 0.008 m
ARP to L1 offset: 0.085 m
Applied height: 0.093 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	102
Stop Line Name	133
Turn Time (min)	2
Buffer (%)	0
Acquisition Time (hrs)	4.3

Other Acquisition Notes:

Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
078	22.28	7799	173330			s to n
079	22.26	8006	174837			
080	22.25	8104	180223			s to n
096	20.87	9056	182615			s to n
097	20.48	8967	183909			
098	20.3	8757	185140			CROSSLINE: 194842
099	20.15	8672	190418			
100	20.02	8363	191705	192325		191705: bad, range went to zero
101	18.73	8636	193553			n to s

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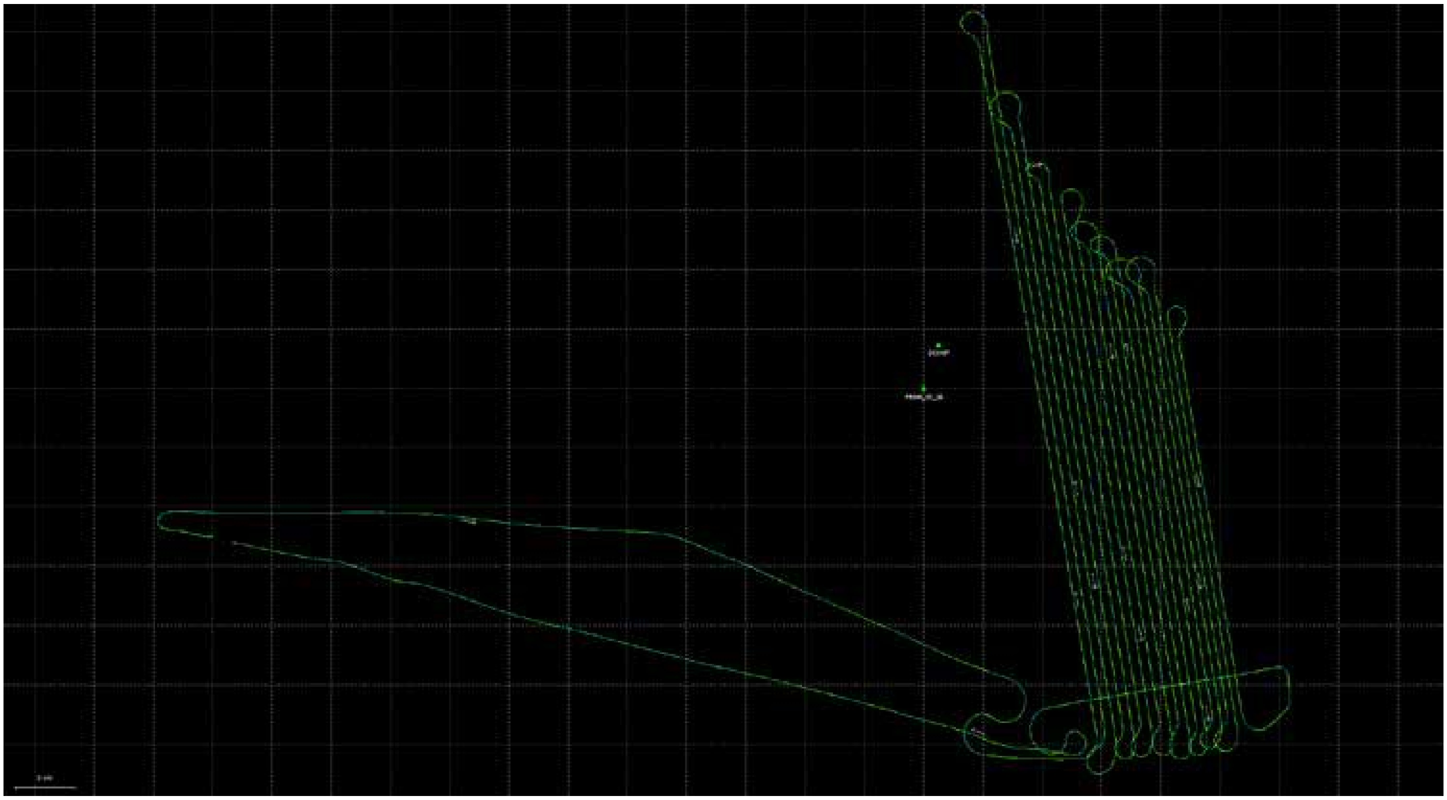
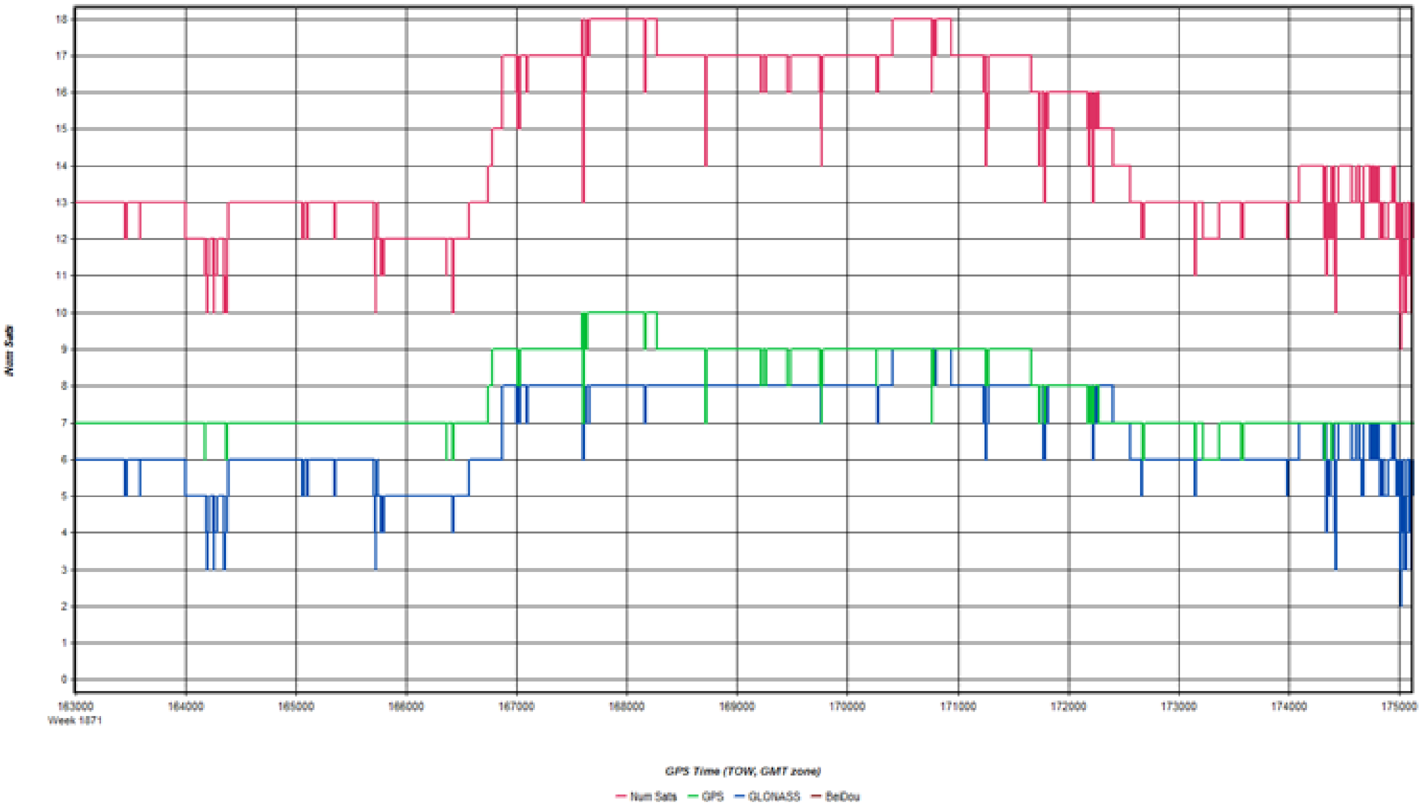
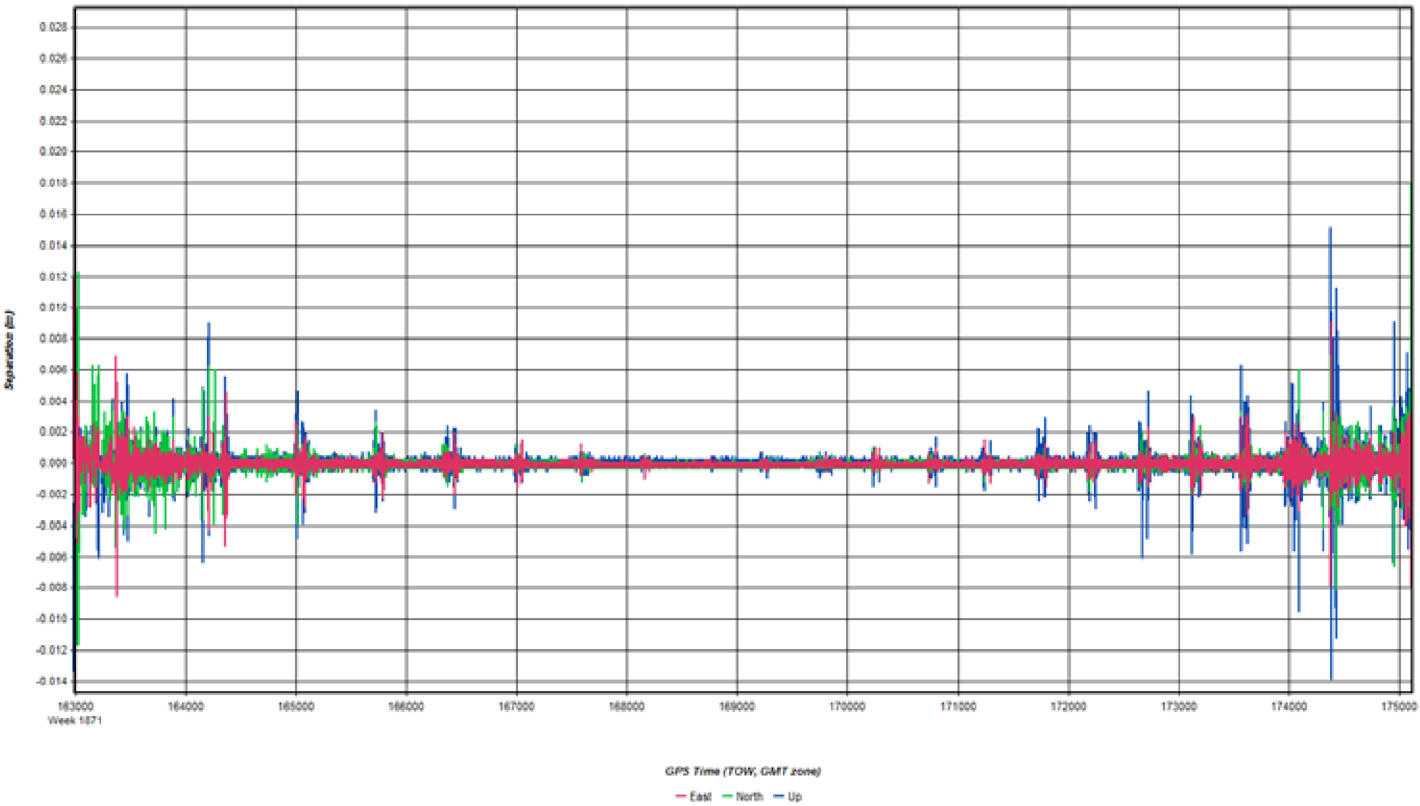
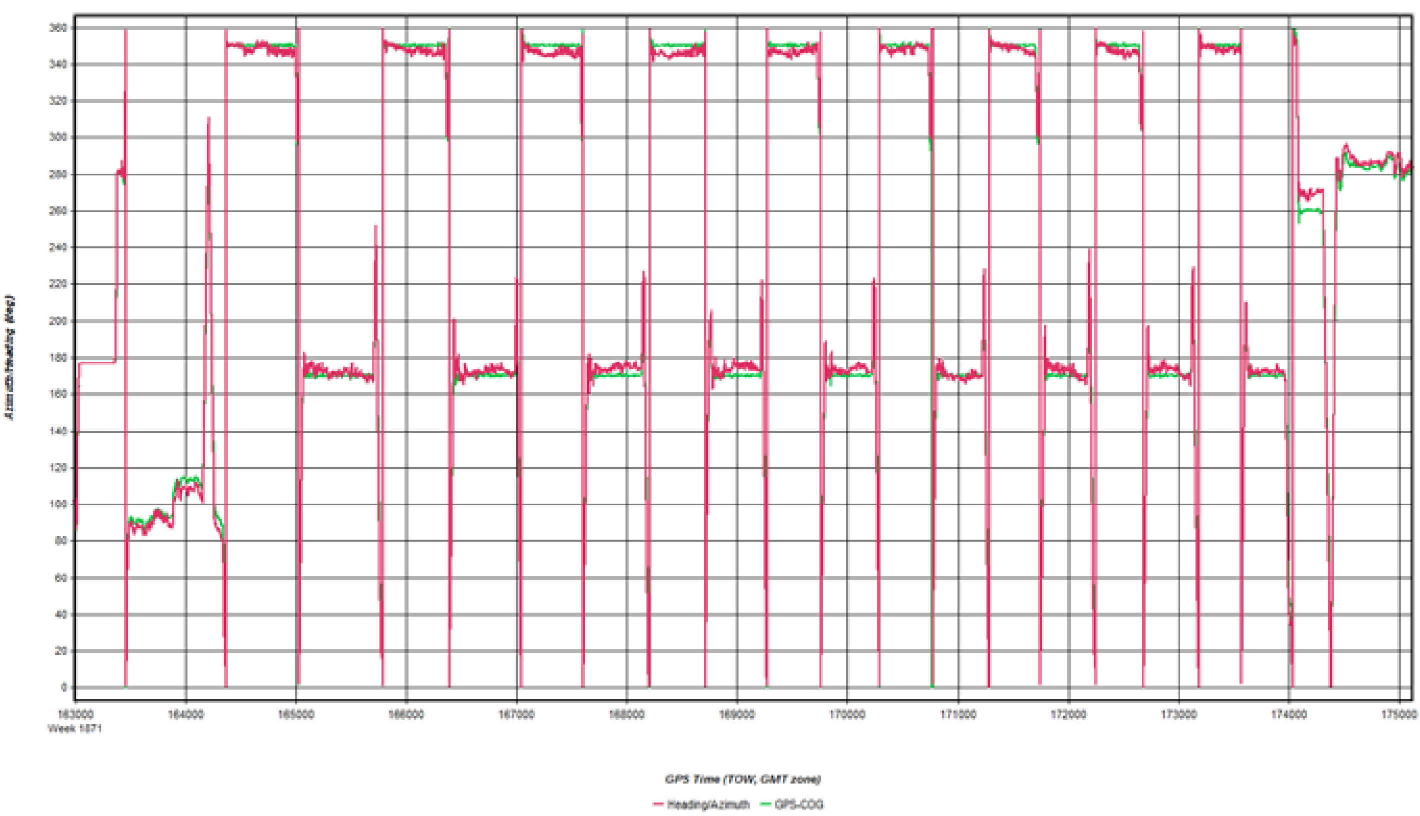
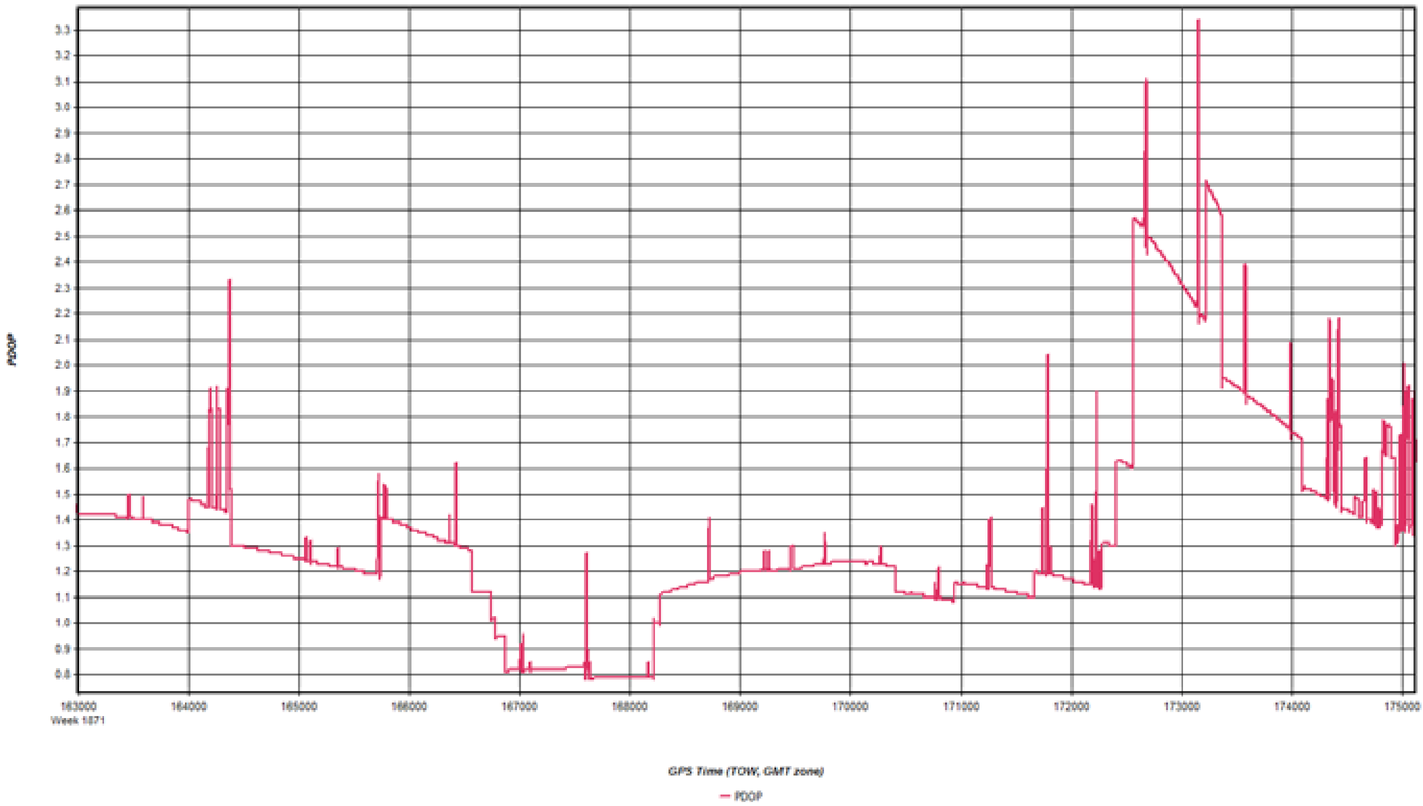
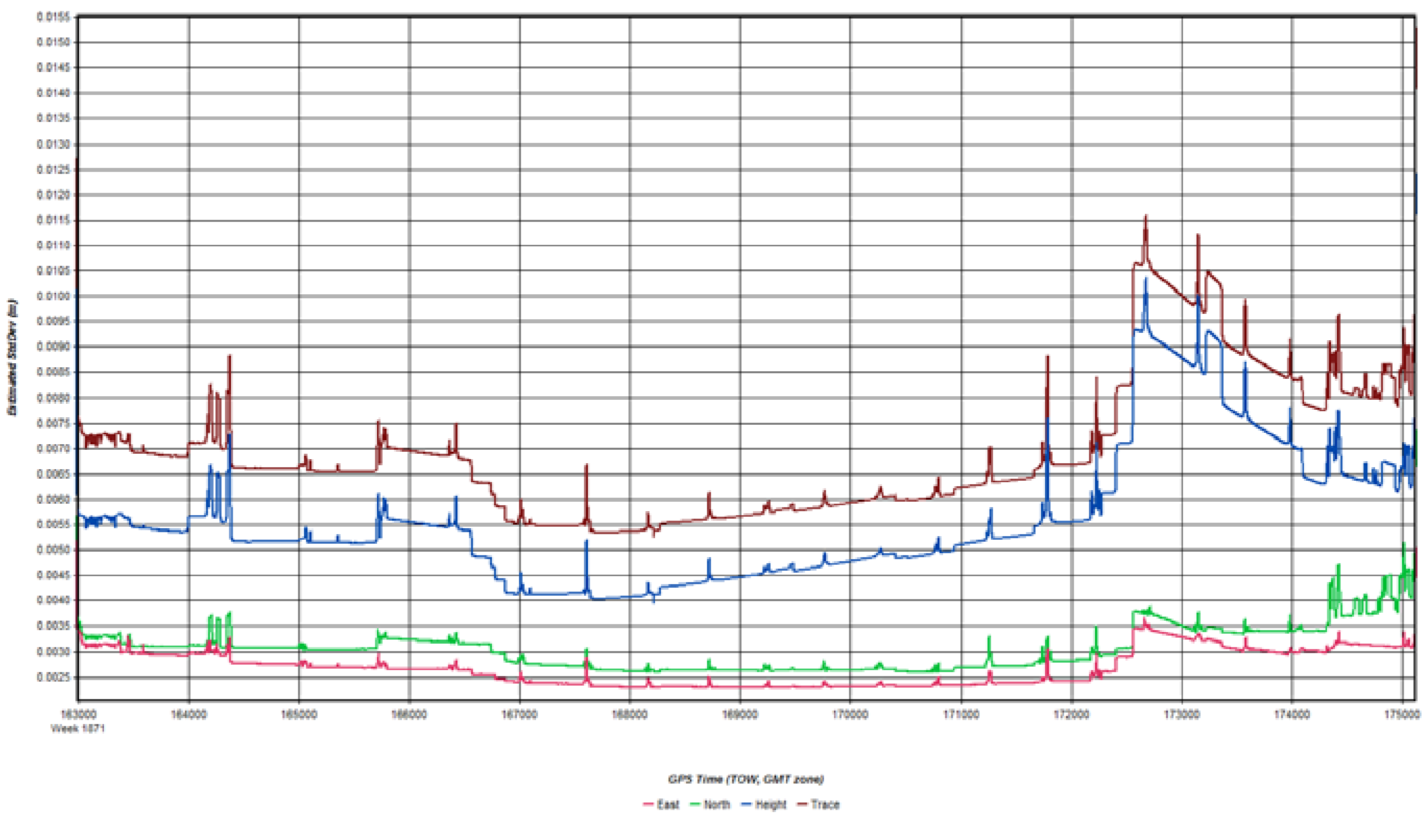


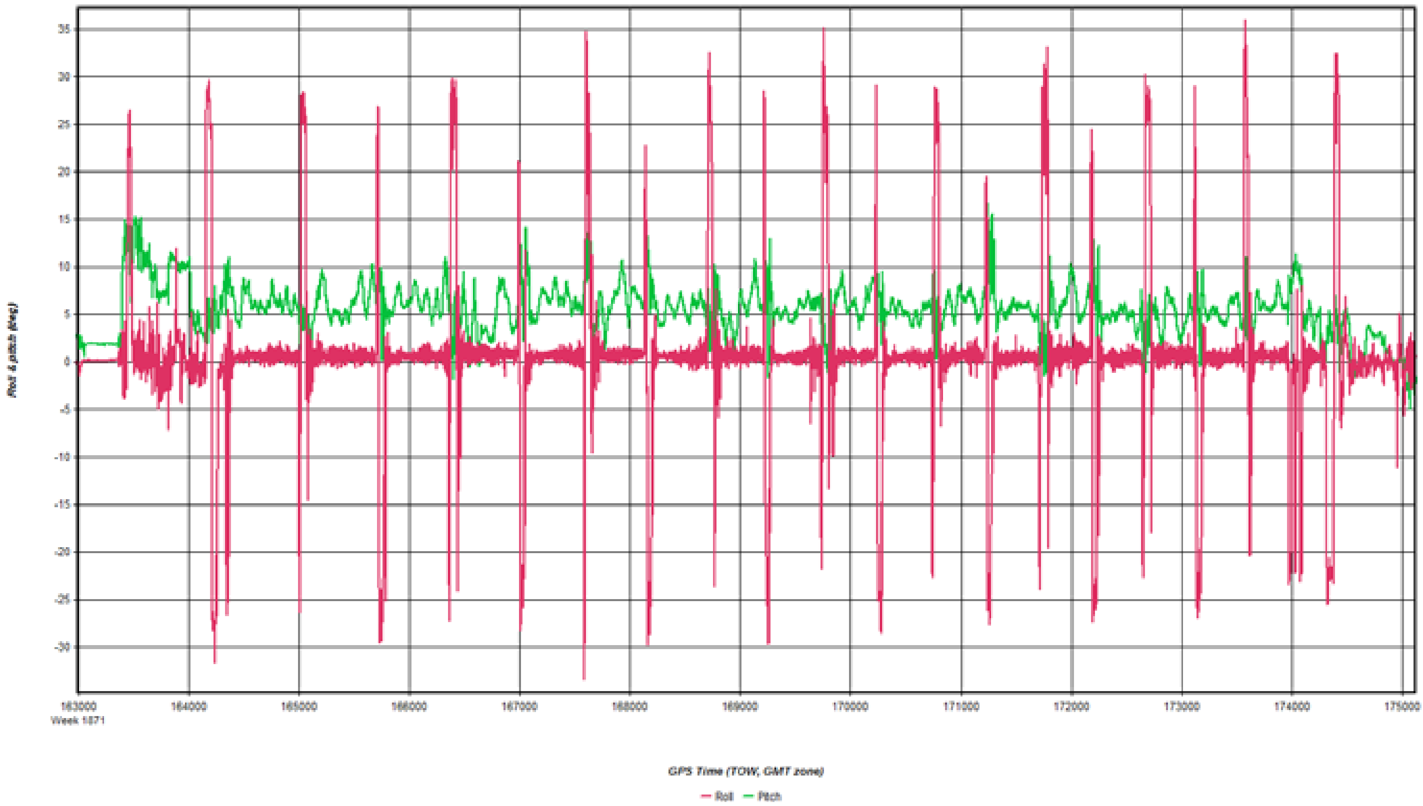

18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
163000
Week 1871
164000
165000
166000
167000
168000
169000
170000
171000
172000
173000
174000
175000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

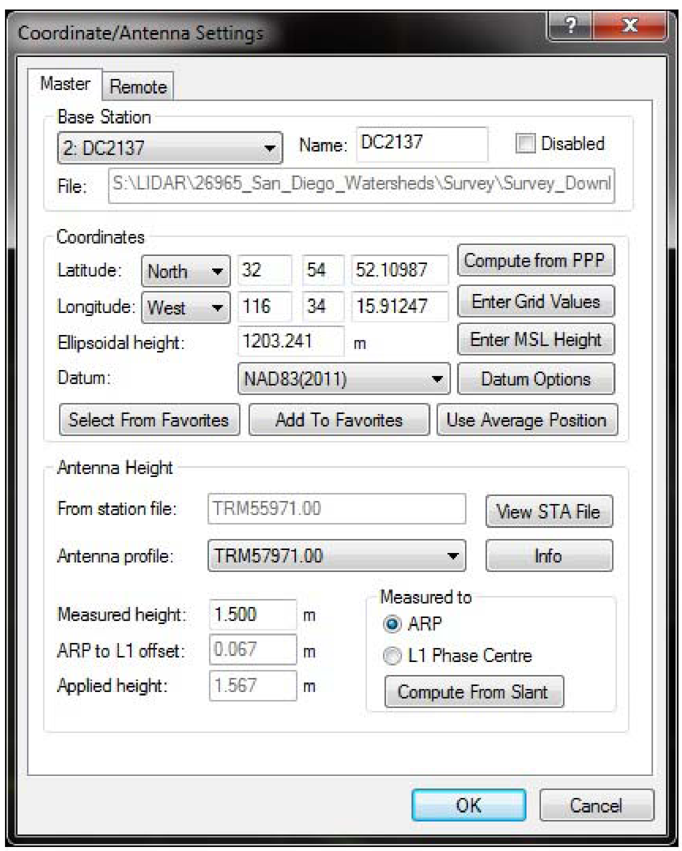

Separation (m)
0.028
0.026
0.024
0.022
0.020
0.018
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
-0.002
-0.004
-0.006
-0.008
-0.010
-0.012
-0.014
163000
Week 1871
164000
165000
166000
167000
168000
169000
170000
171000
172000
173000
174000
175000
GPS Time (TOW, GMT zone)
East
North
Up

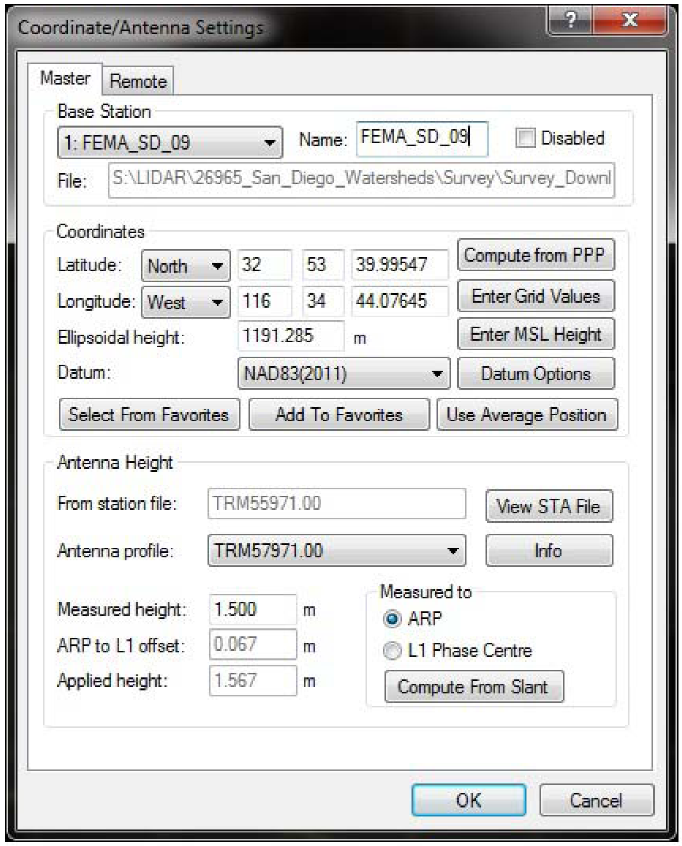

Azimuth/Heading (deg)
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
163000
Week 1871
164000
165000
166000
167000
168000
169000
170000
171000
172000
173000
174000
175000
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG


PDOP
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
2.4
2.3
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
163000
Week 1871
164000
165000
166000
167000
168000
169000
170000
171000
172000
173000
174000
175000
GPS Time (TOW, GMT zone)
PDOP


Estimated Std Dev (m)
0.0155
0.0150
0.0145
0.0140
0.0135
0.0130
0.0125
0.0120
0.0115
0.0110
0.0105
0.0100
0.0095
0.0090
0.0085
0.0080
0.0075
0.0070
0.0065
0.0060
0.0055
0.0050
0.0045
0.0040
0.0035
0.0030
0.0025
163000
Week 1871
164000
165000
166000
167000
168000
169000
170000
171000
172000
173000
174000
175000
GPS Time (TOW, GMT zone)
East
North
Height
Trace


35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
Roll & pitch (deg)
163000
Week 1871
164000
165000
166000
167000
168000
169000
170000
171000
172000
173000
174000
175000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
2: DC2137
Name:
DC2137
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
54
52.10987
Compute from PPP
Longitude:
West
116
34
15.91247
Enter Grid Values
Ellipsoidal height:
1203.241
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.500
m
ARP to L1 offset:
0.067
m
Applied height:
1.567
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: FEMA_SD_09
Name:
FEMA_SD_09
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
53
39.99547
Compute from PPP
Longitude:
West
116
34
44.07645
Enter Grid Values
Ellipsoidal height:
1191.285
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.500
m
ARP to L1 offset:
0.067
m
Applied height:
1.567
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	120
Stop Line Name	133
Turn Time (min)	2
Buffer (%)	0
Acquisition Time (hrs)	1.5

Other Acquisition Notes:

Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
102	18.43	8636	213930			Start s to n
103	17.48	8632	215136			
104	15.93	8645	220315			Mountain wave created speed fluctuations on north side of field area.
105	15.92	8704	221400			Speed got up129 kts due to high winds on north side
106	14.5	8832	222419			
107	14.19	9170	223408			n to s
108	13.98	9187	224328			
109	12.57	9239	225255			
110	12.47	9305	230121			s to n
111	12.31	8960	231000			Mountain wave speed fluctions north side
112	12.18	8783	231824			s to n
113	11.1	9128	232710			
114	11.12	9226	233500			CROSSLINE:002132
115	11.14	9170	234312			
116	11.15	9069	235050			s to n
117	11.08	8826	235849			
118	10.5	8770	000630			s to n
119	9.13	9010	001354			

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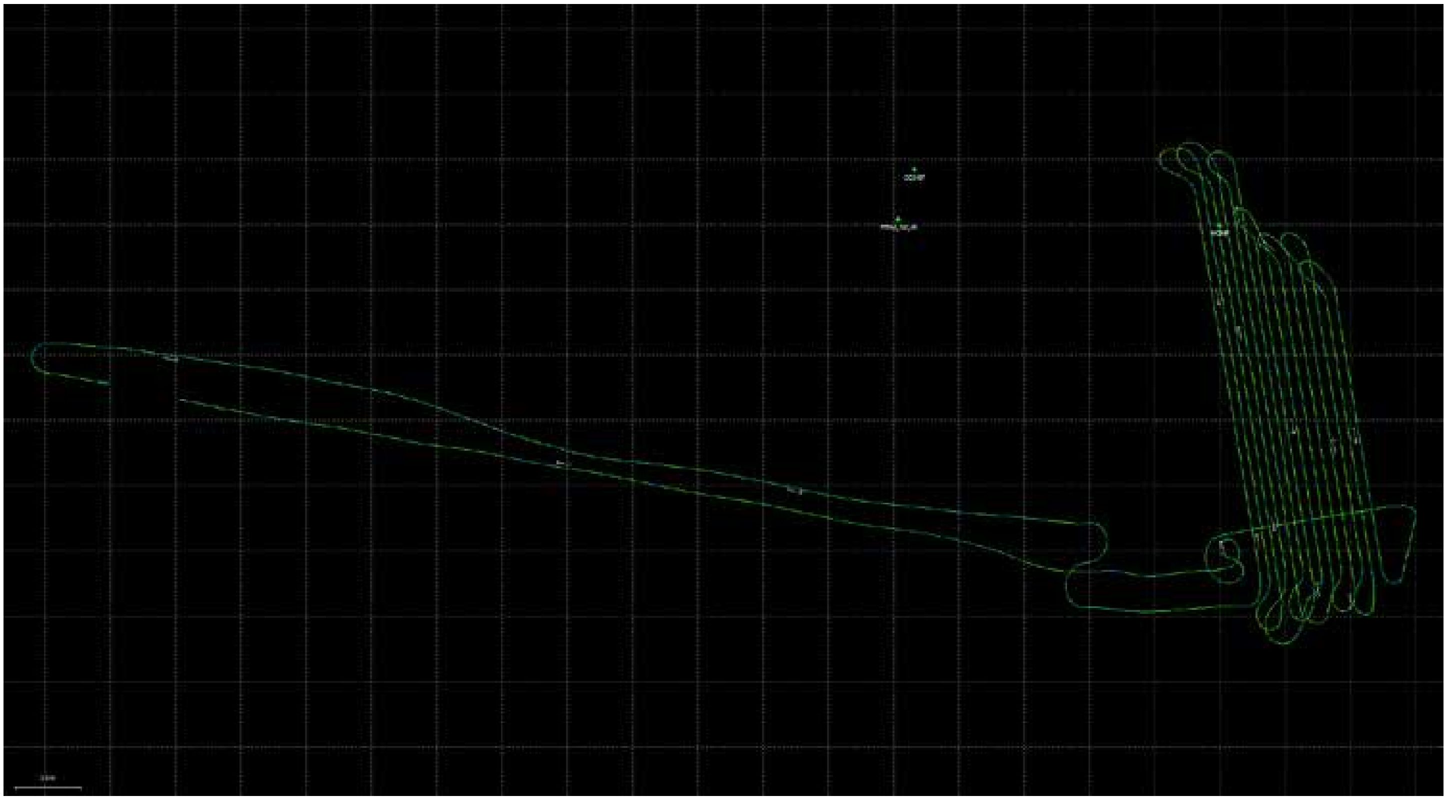
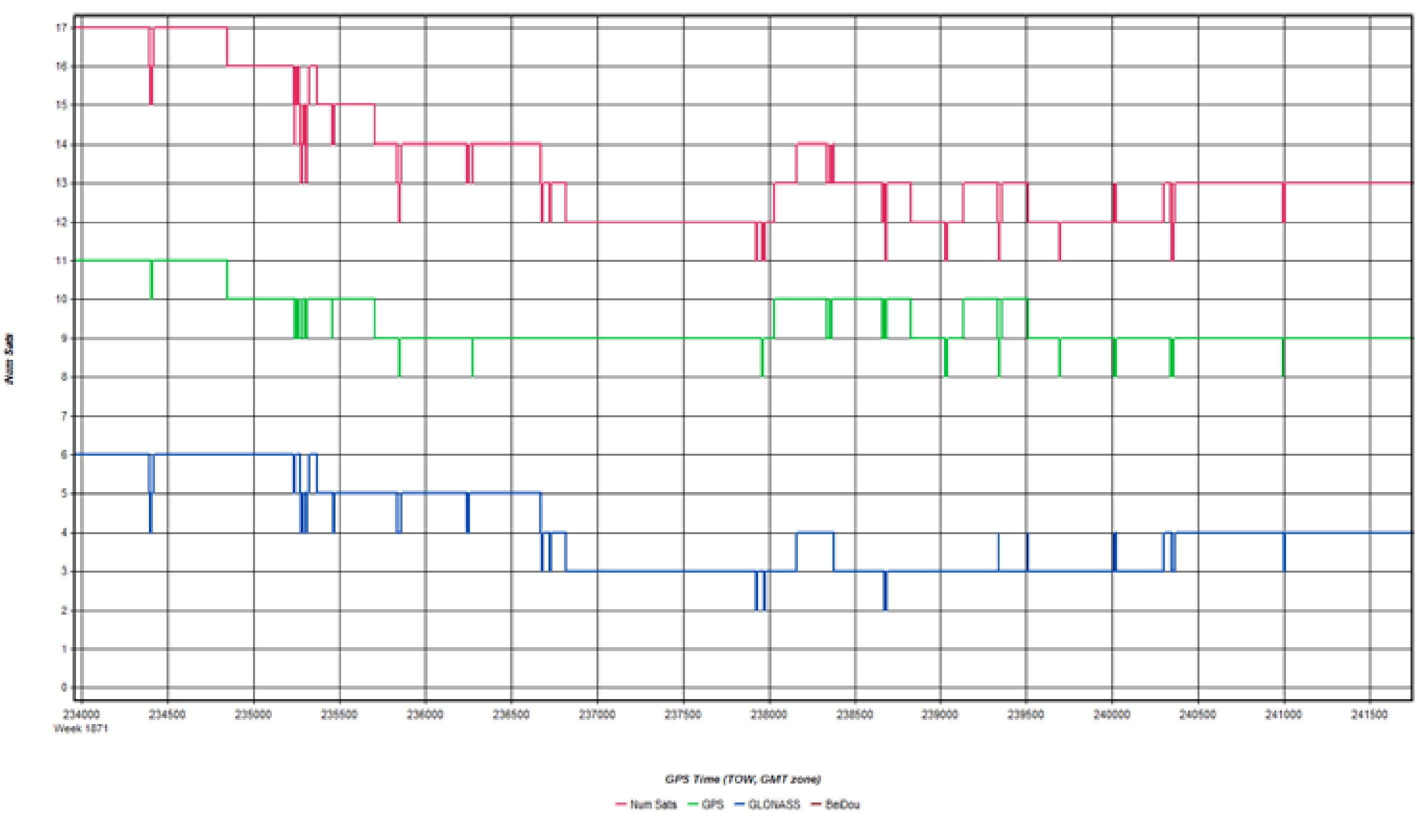
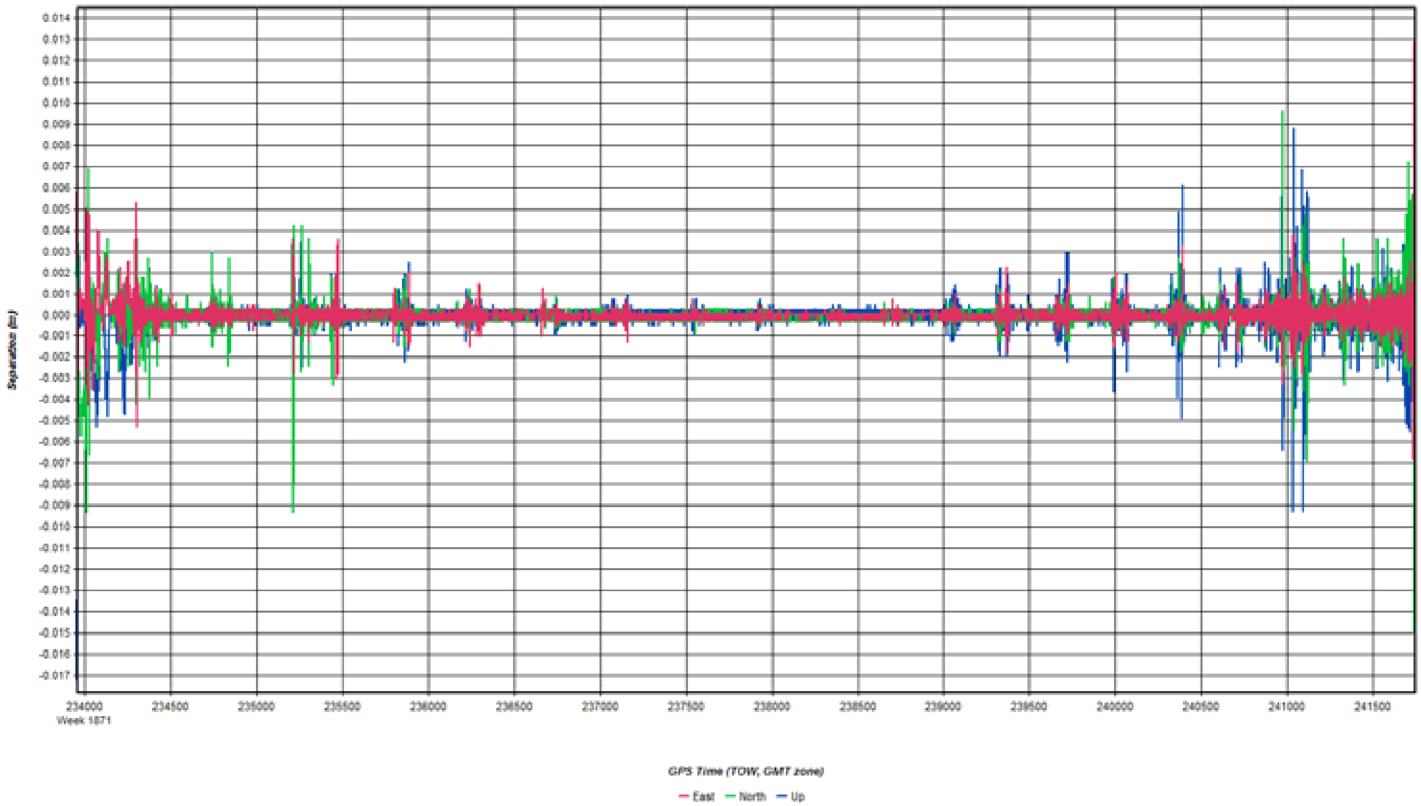
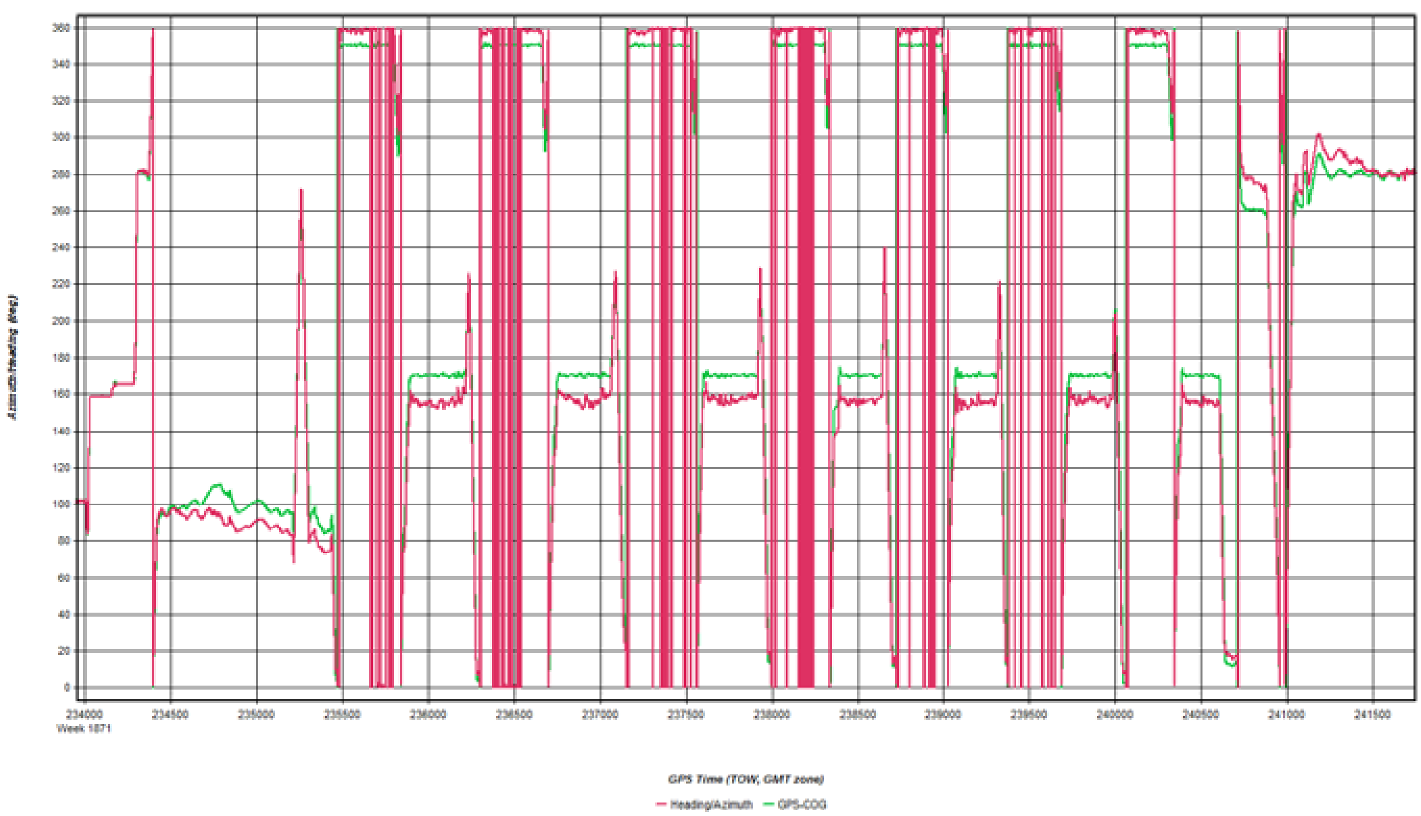
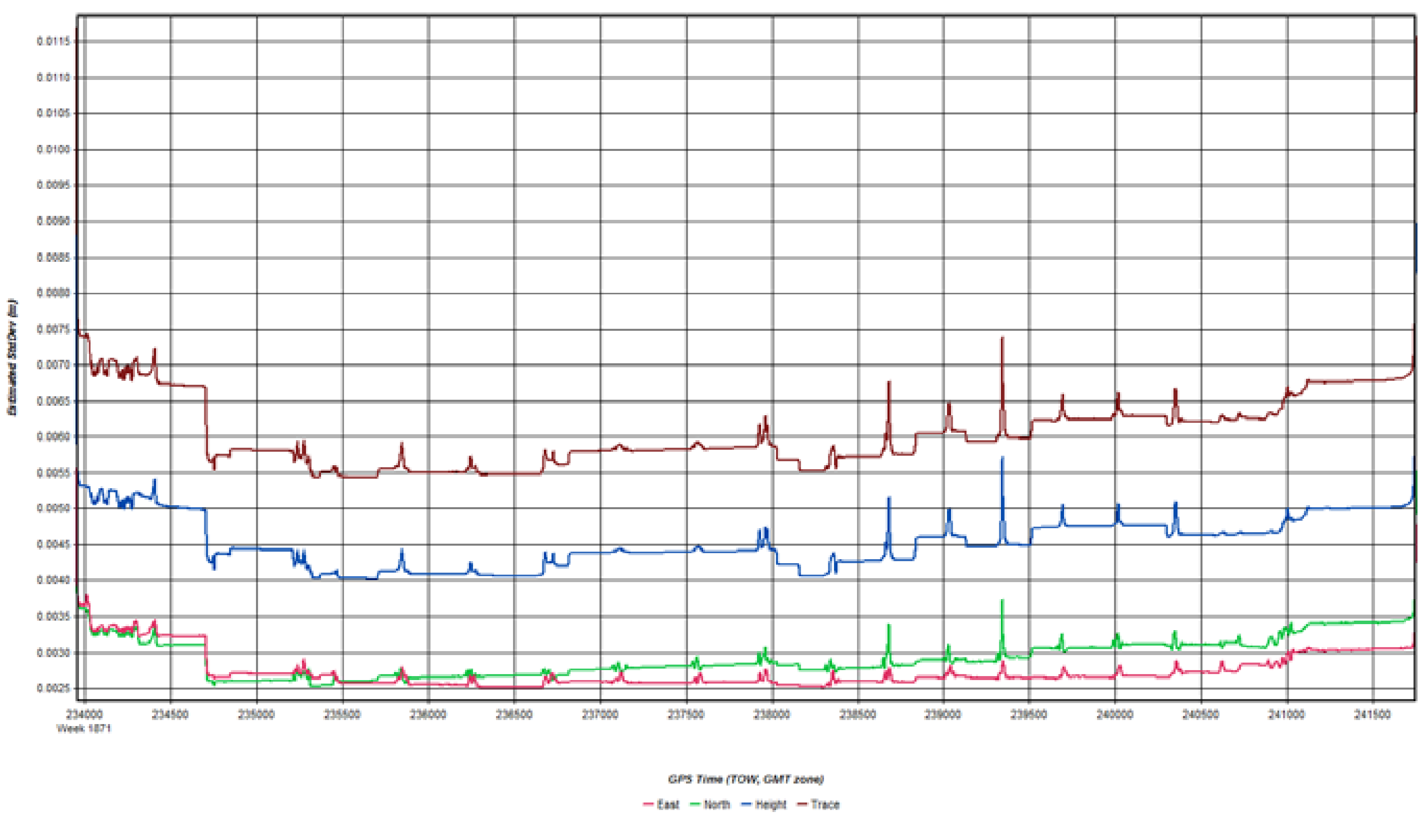


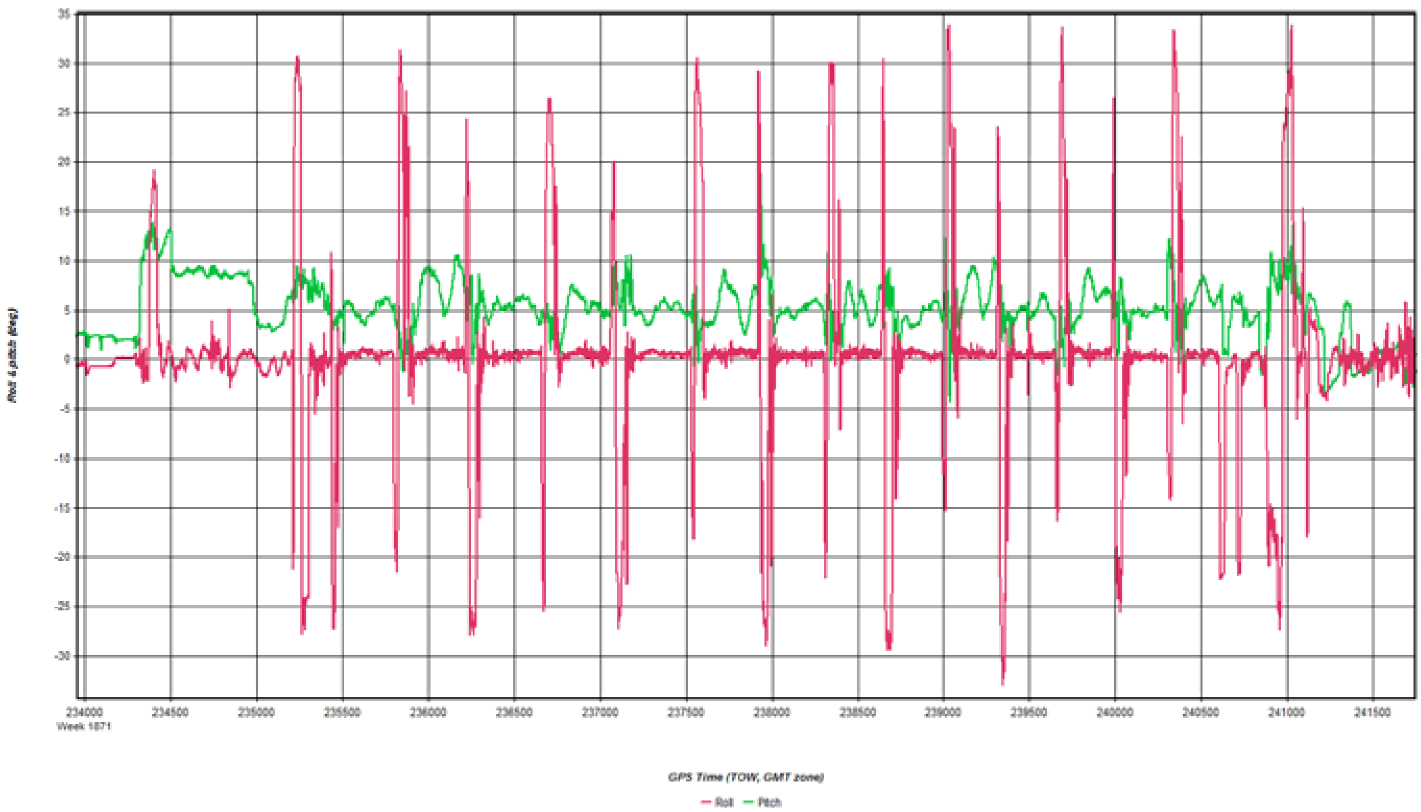

17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
234000
Week 1871
234500
235000
235500
236000
236500
237000
237500
238000
238500
239000
239500
240000
240500
241000
241500
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

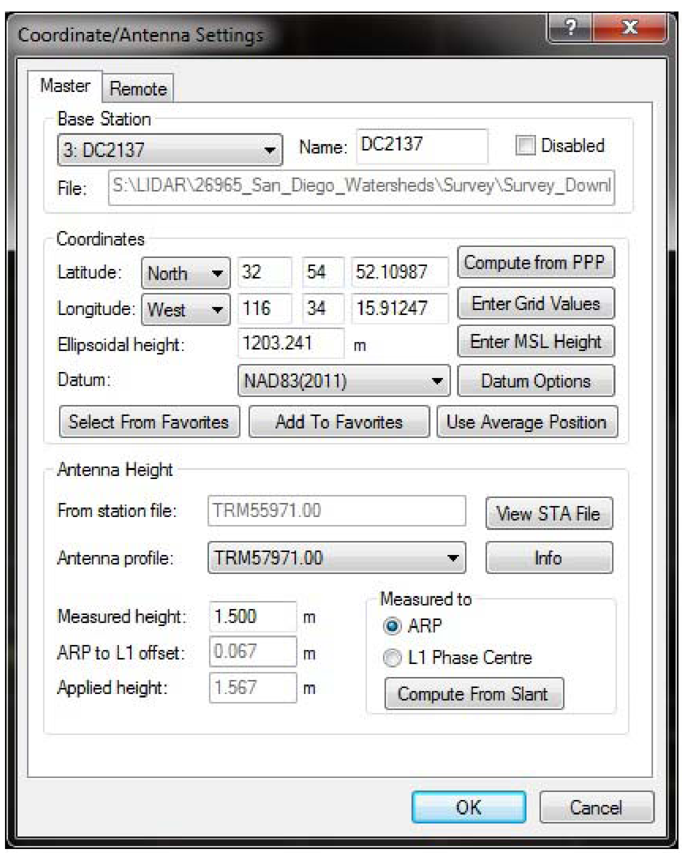

Separation (m)
Week 1871
GPS Time (TOW, GMT zone)
East
North
Up

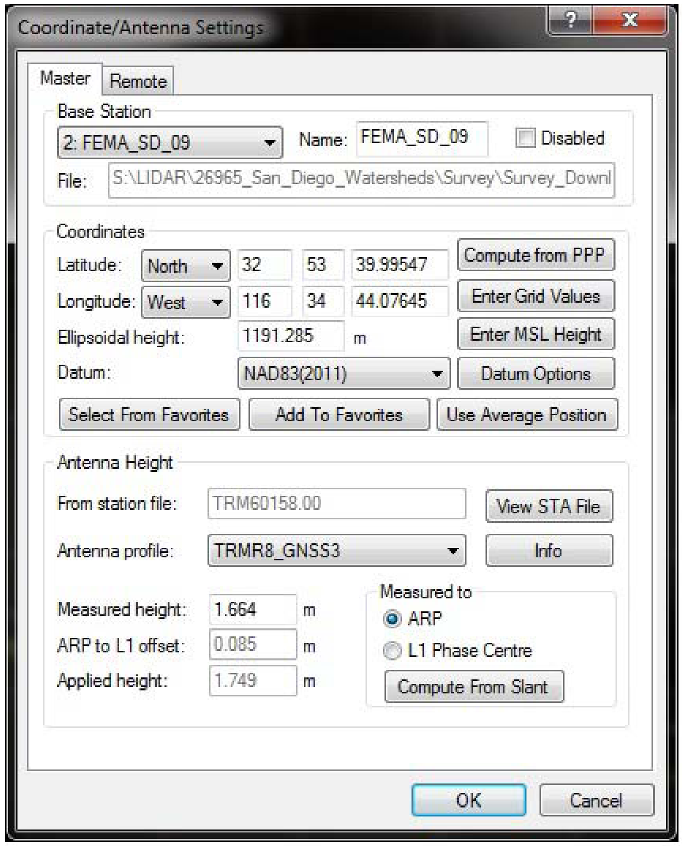

Azimuth/Heading (deg)
Week 1871
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG

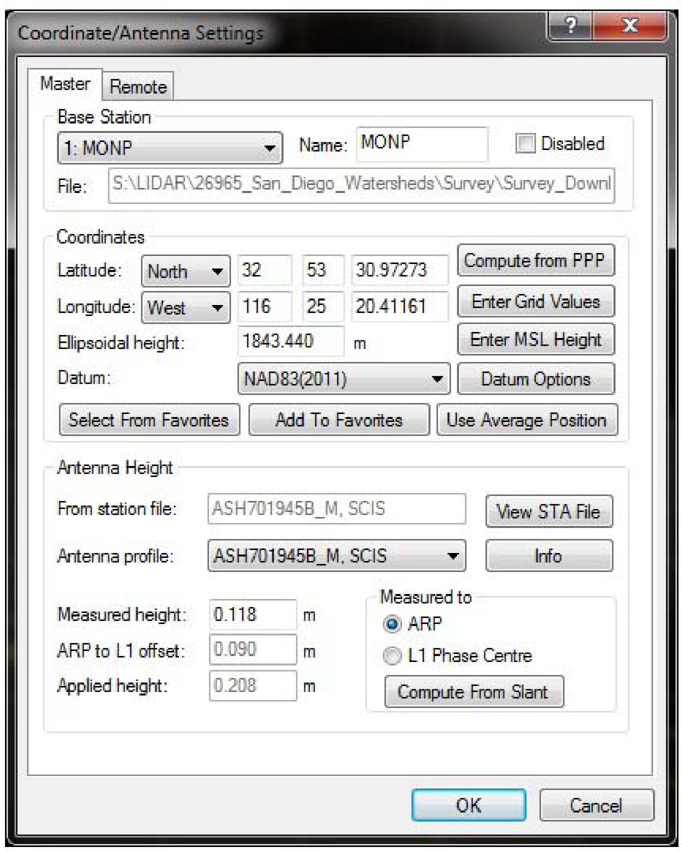

PDOP
GPS Time (TOW, GMT zone)
Week 1871
PDOP


Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1871
East
North
Height
Trace


Roll & pitch (deg)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
234000
Week 1871
234500
235000
235500
236000
236500
237000
237500
238000
238500
239000
239500
240000
240500
241000
241500
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
3: DC2137
Name:
DC2137
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
54
52.10987
Compute from PPP
Longitude:
West
116
34
15.91247
Enter Grid Values
Ellipsoidal height:
1203.241
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.500
m
ARP to L1 offset:
0.067
m
Applied height:
1.567
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_09
Name:
FEMA_SD_09
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
53
39.99547
Compute from PPP
Longitude:
West
116
34
44.07645
Enter Grid Values
Ellipsoidal height:
1191.285
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM60158.00
View STA File
Antenna profile:
TRMR8_GNSS3
Info
Measured height:
1.664
m
ARP to L1 offset:
0.085
m
Applied height:
1.749
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: MONP
Name:
MONP
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
53
30.97273
Compute from PPP
Longitude:
West
116
25
20.41161
Enter Grid Values
Ellipsoidal height:
1843.440
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
ASH701945B_M, SCIS
View STA File
Antenna profile:
ASH701945B_M, SCIS
Info
Measured height:
0.118
m
ARP to L1 offset:
0.090
m
Applied height:
0.208
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	127
Stop Line Name	133
Turn Time (min)	2
Buffer (%)	0
Acquisition Time (hrs)	0.7

Other Acquisition Notes:

Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
120	9.14	9006	172418			start s to n
121	9.16	9010	173129			
122	9.17	9016	173827			s to n
123	9.19	9033	174547			28 kts north northeast wind, 125 kts start speed
124	9.09	9098	175305			
125	8.86	8983	180010			
126	7.85	9243	180642			s to n
127	7.09	9416	181310			31 kts north northeast wind
128	7.05	9433	181846			
129	7.06	9692	182418			35 kts north northeast wind
130	6.99	9558	182941			s to n
131	6.91	8941	183527			CROSSLINE: 185211
132	6.16	8790	184104			
133	5.7	9407	184631			end n to s

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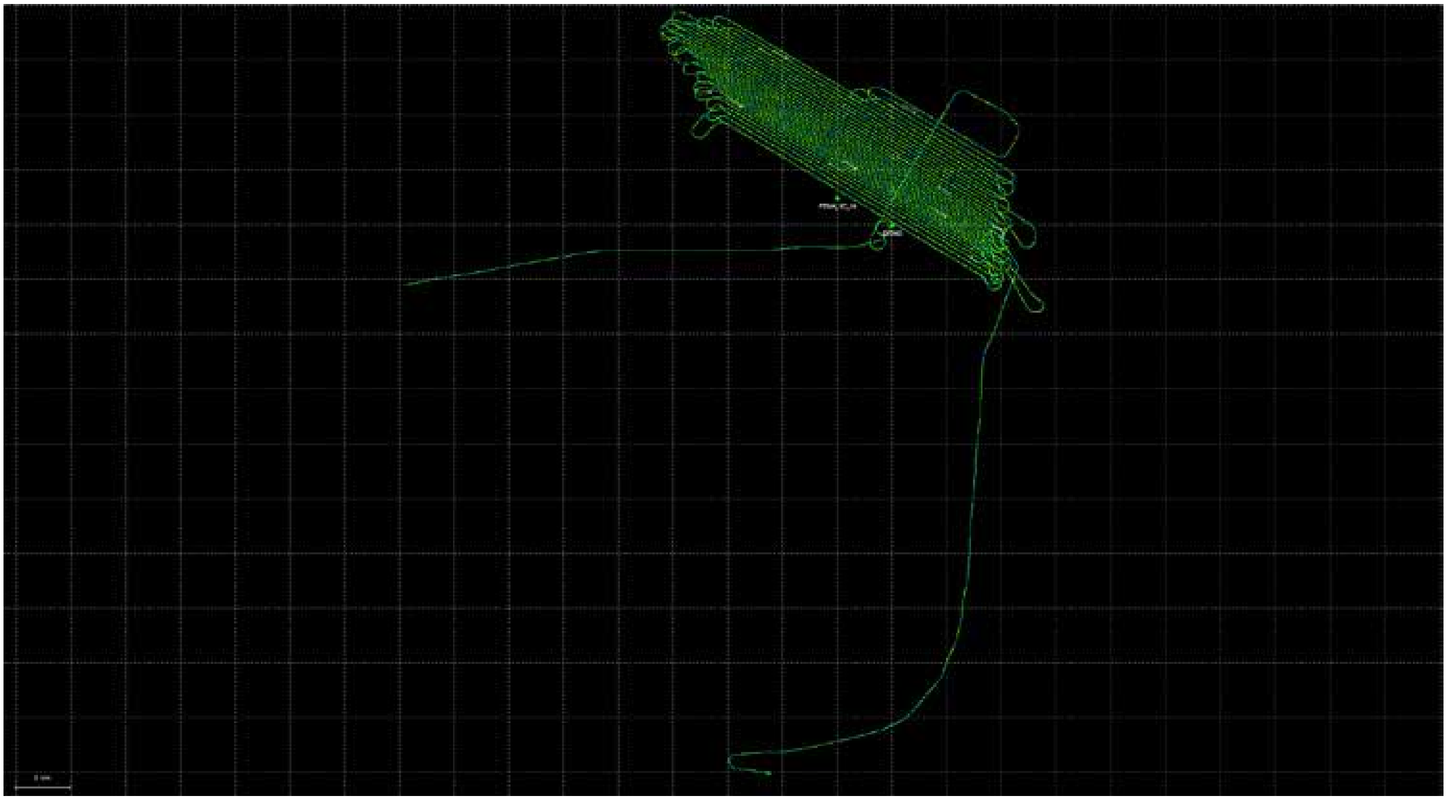
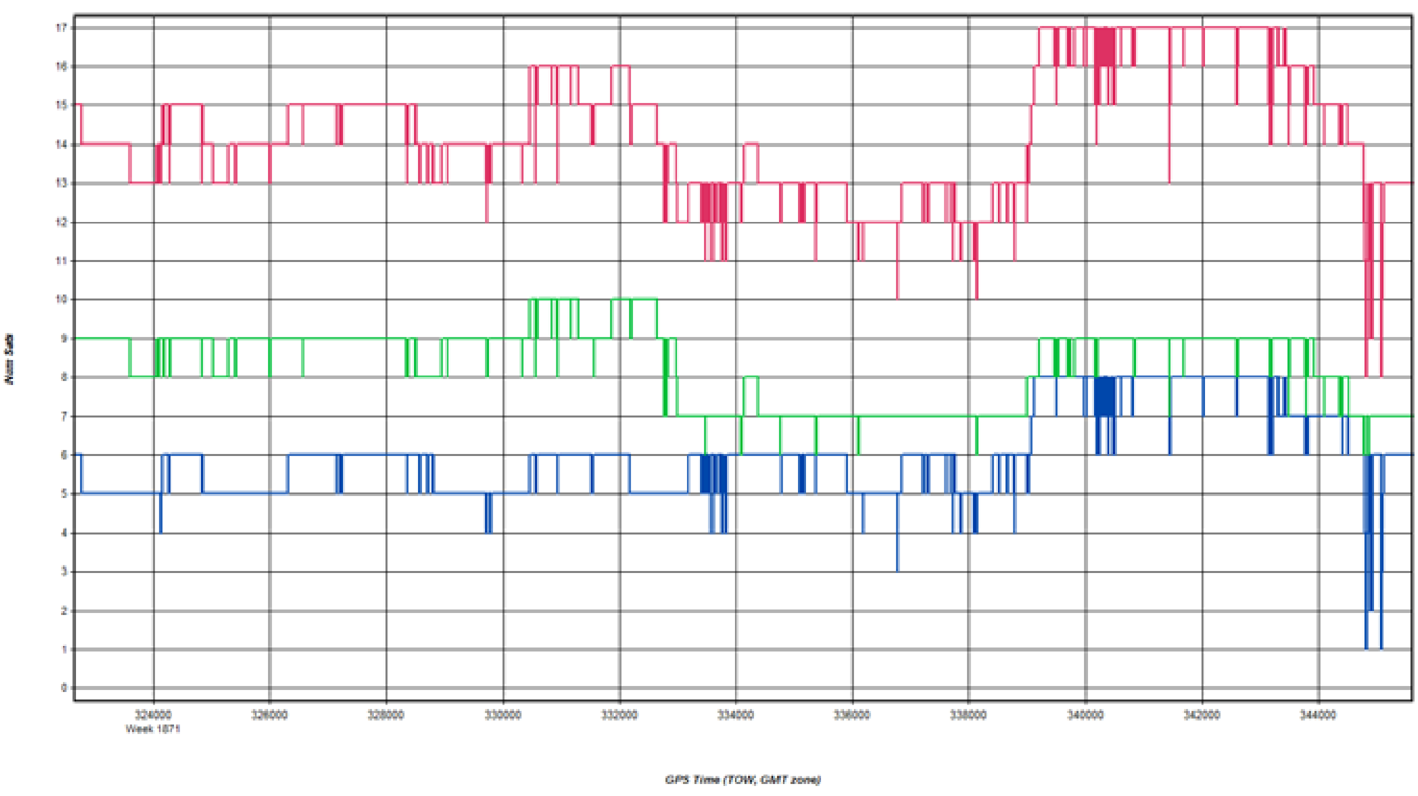
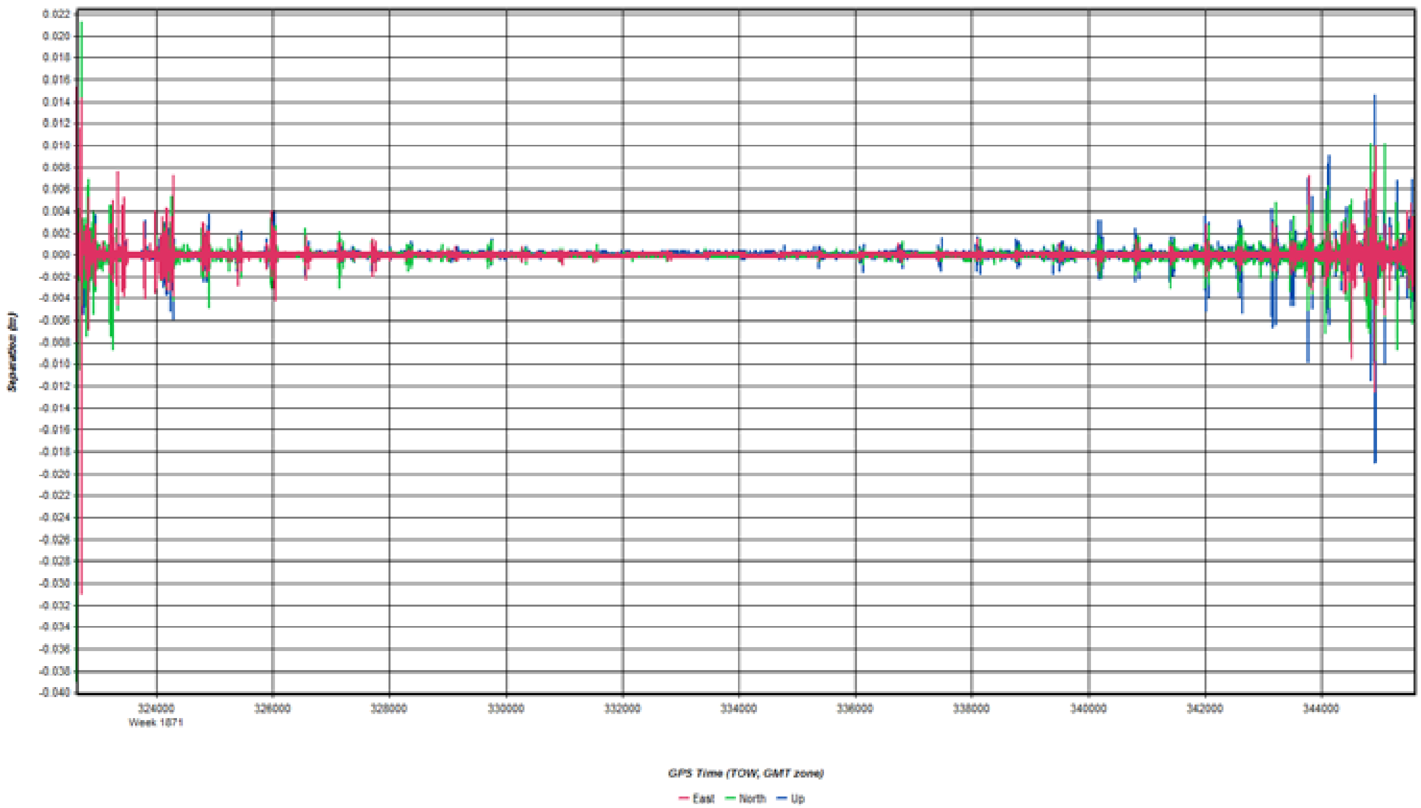
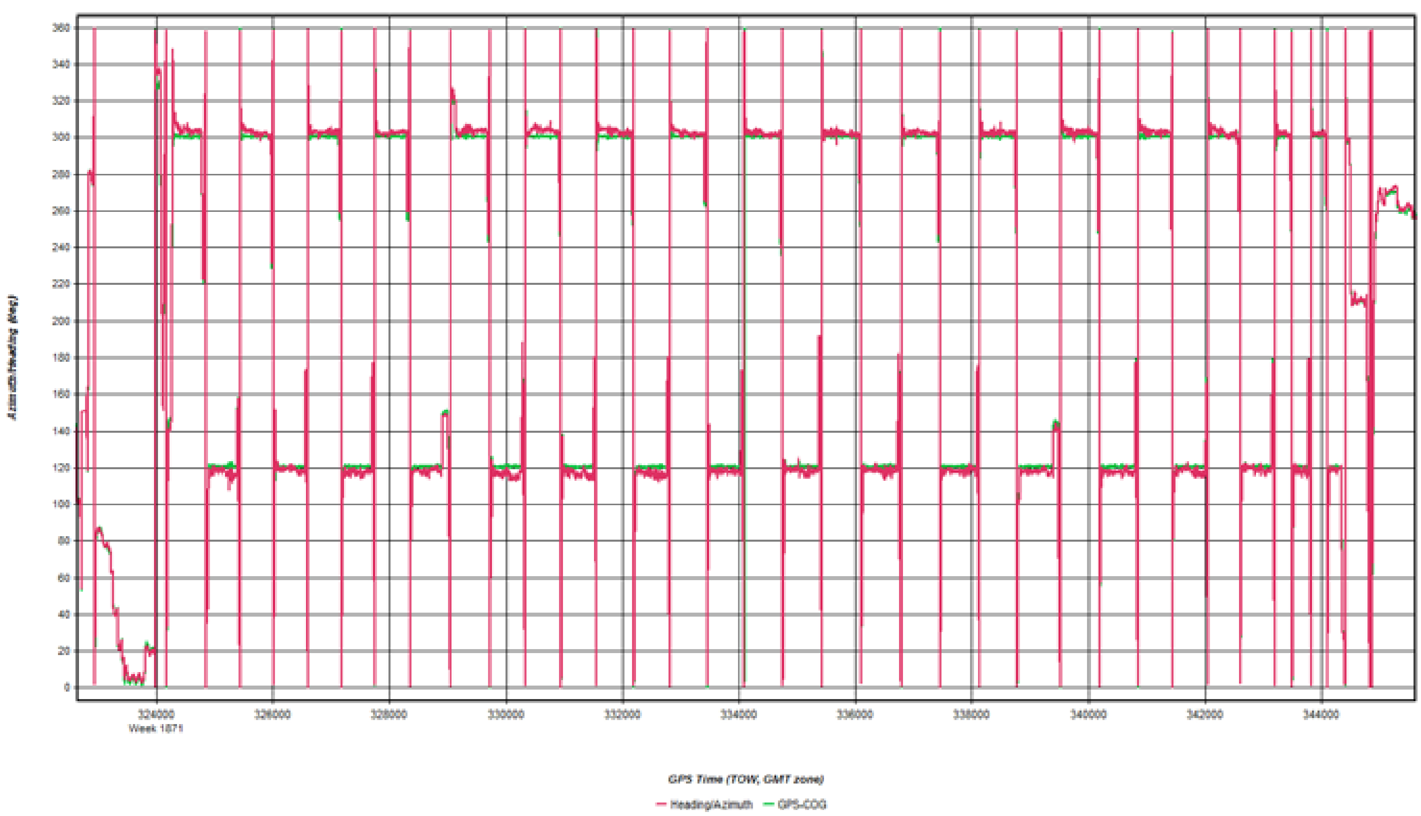
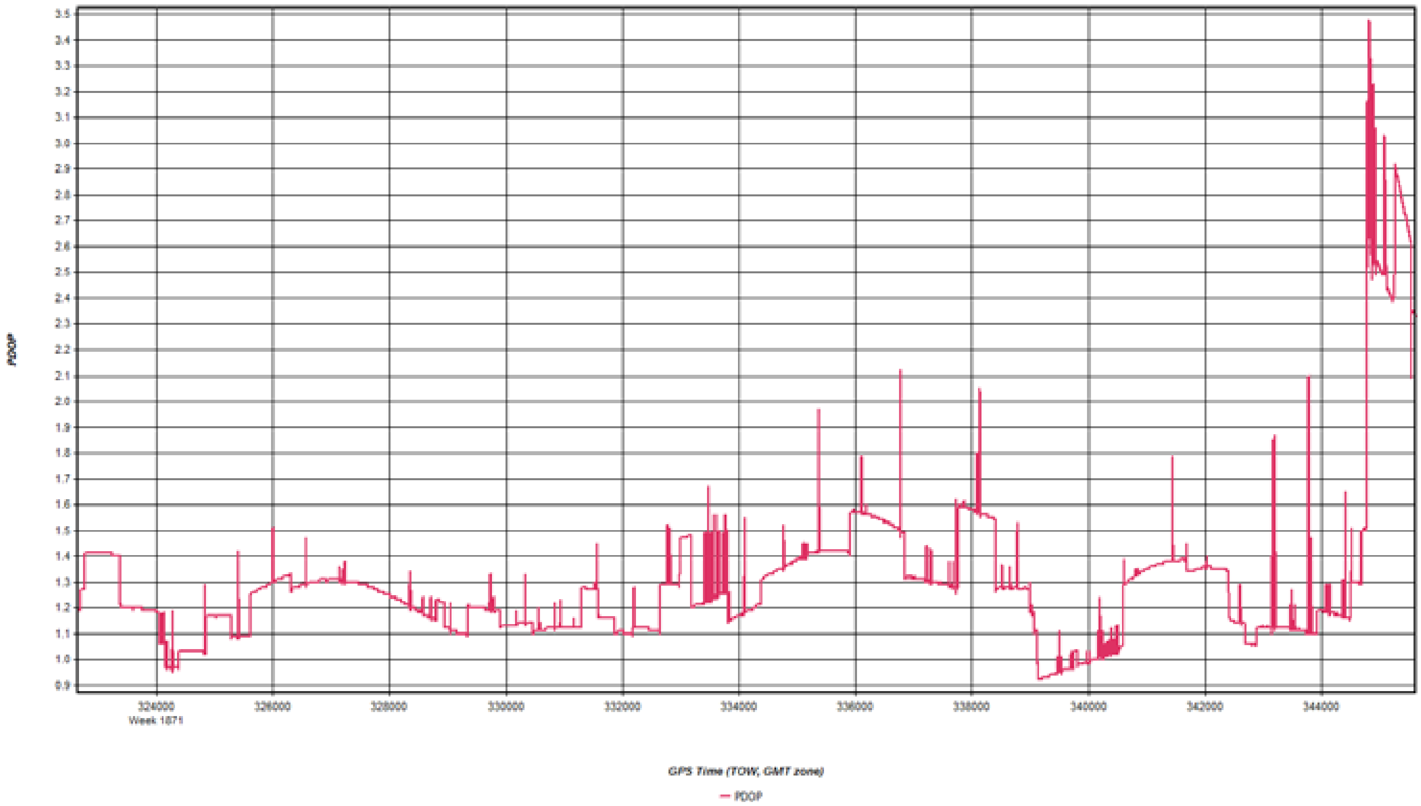
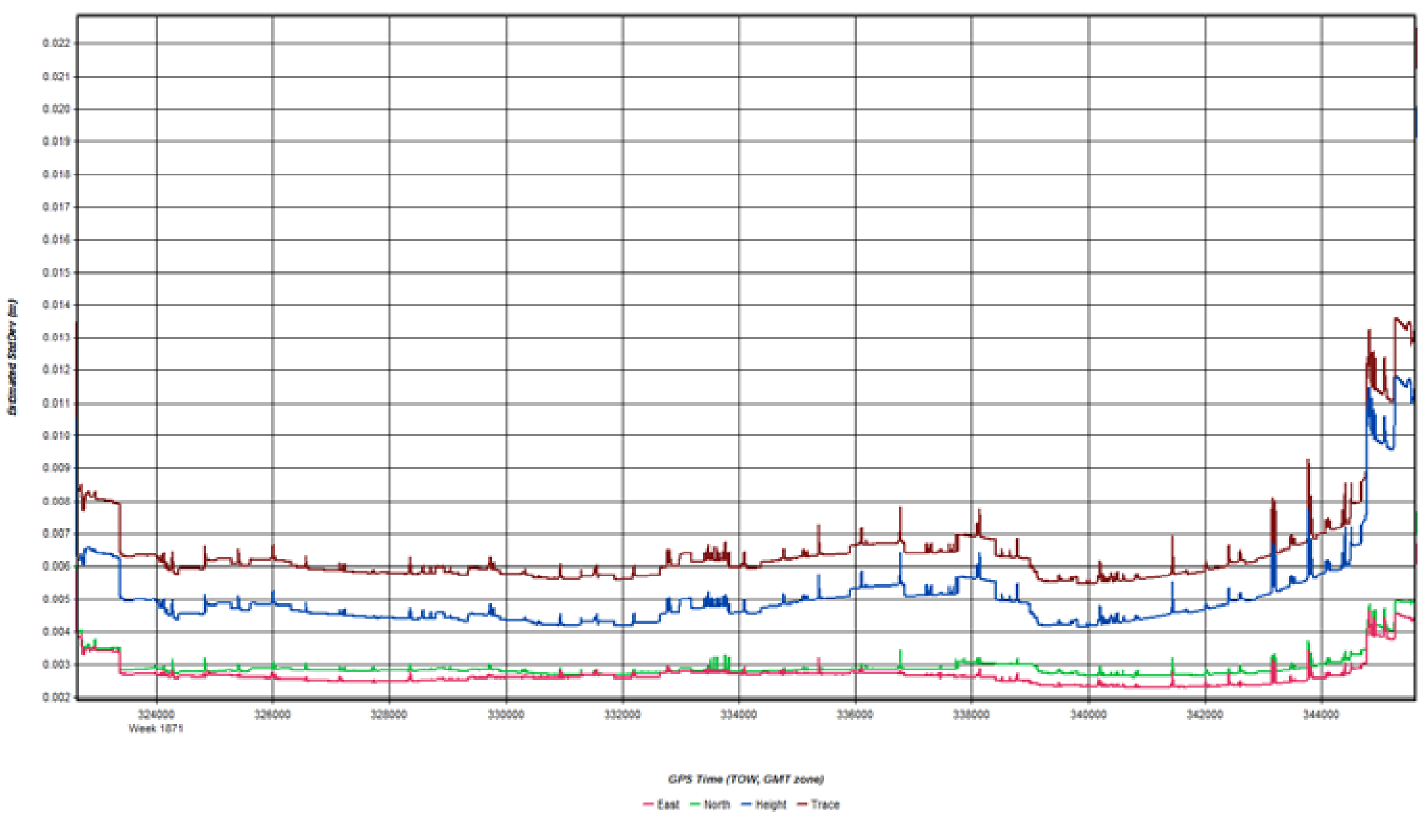


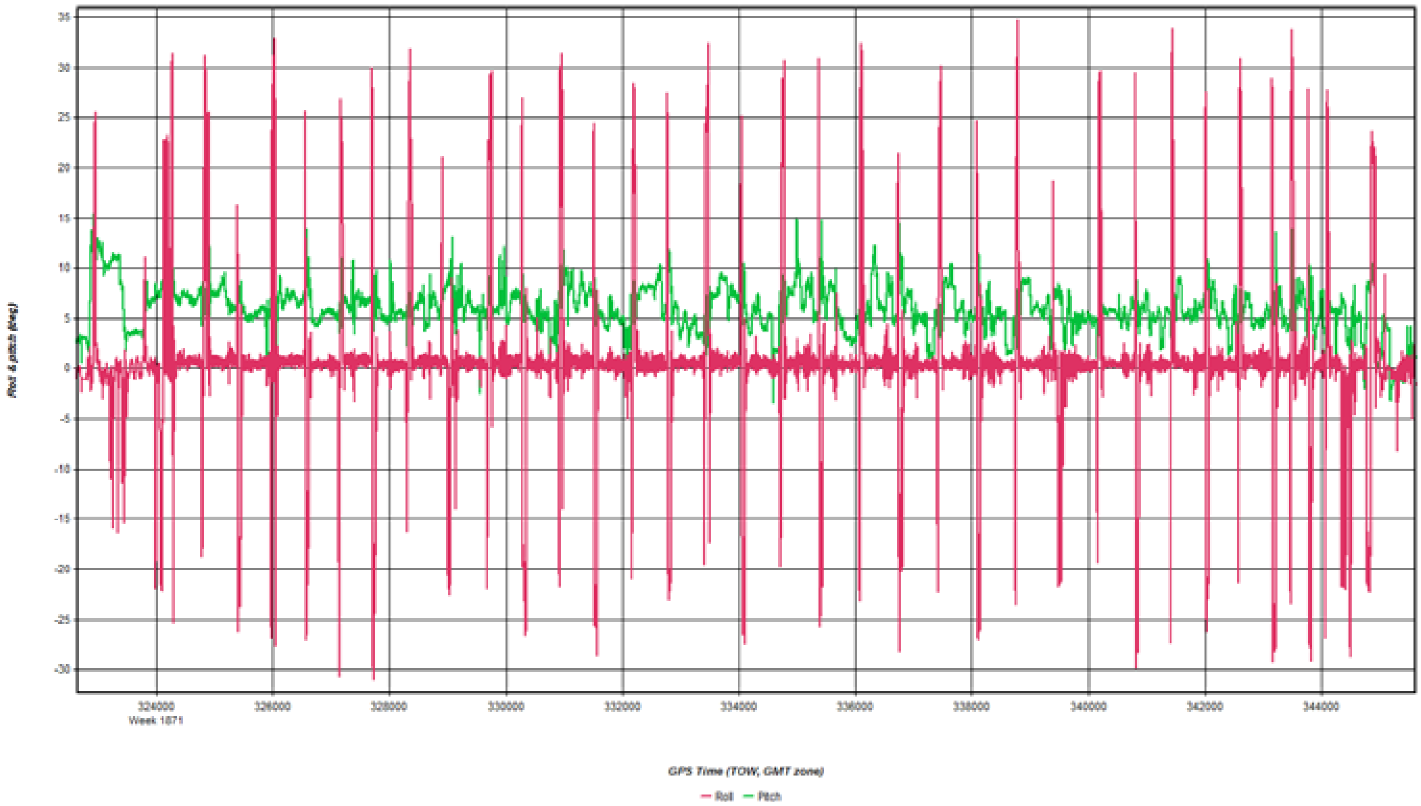

Num Sats
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
324000
Week 1871
326000
328000
330000
332000
334000
336000
338000
340000
342000
344000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

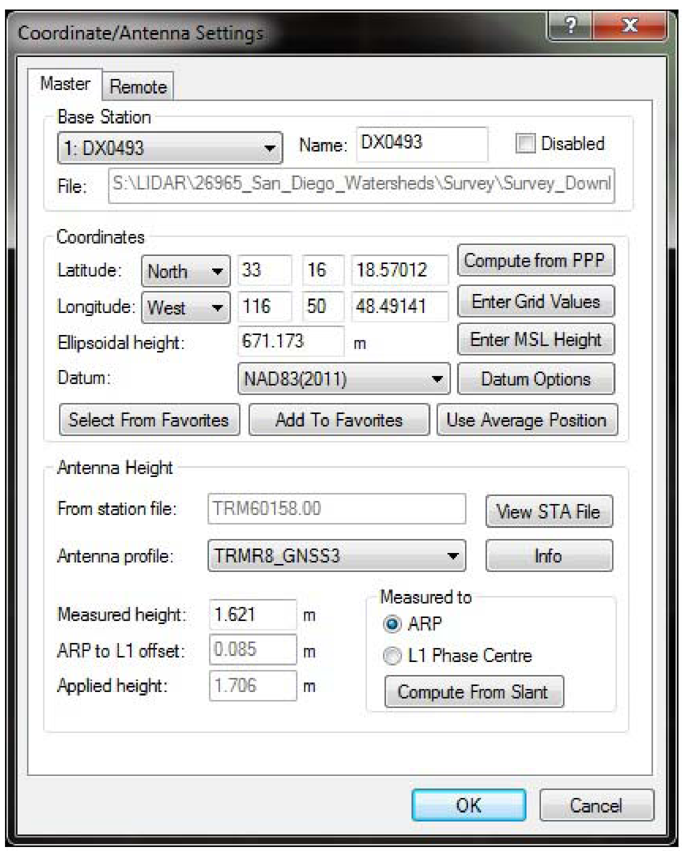

Separation (m)
324000
Week 1871
326000
328000
330000
332000
334000
336000
338000
340000
342000
344000
GPS Time (TOW, GMT zone)
East
North
Up

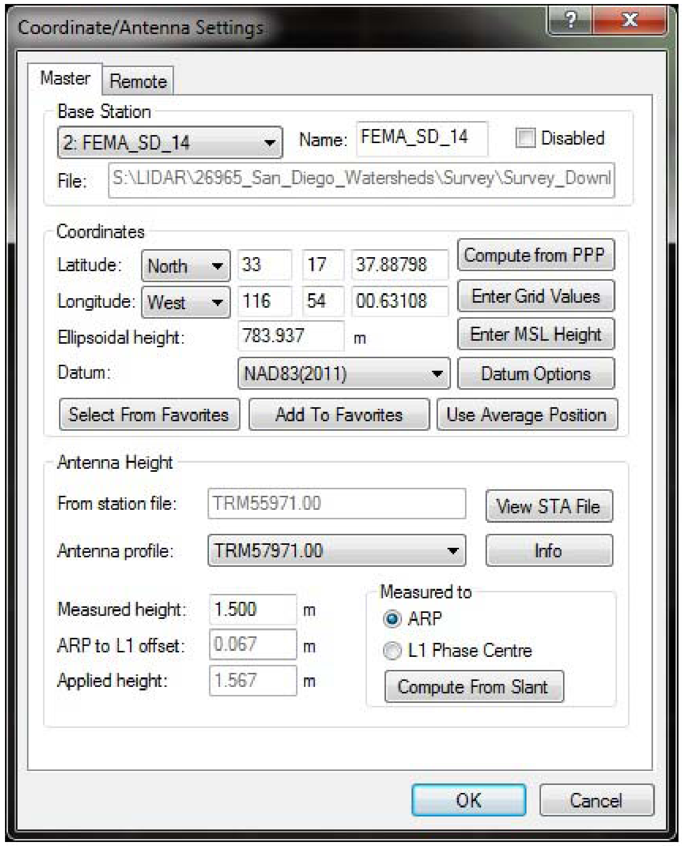

Azimuth/Heading (deg)
324000
Week 1871
326000
328000
330000
332000
334000
336000
338000
340000
342000
344000
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG


PDOP
3.5
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
2.4
2.3
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
324000
Week 1871
326000
328000
330000
332000
334000
336000
338000
340000
342000
344000
GPS Time (TOW, GMT zone)
PDOP


Estimated Std Dev (m)
0.022
0.021
0.020
0.019
0.018
0.017
0.016
0.015
0.014
0.013
0.012
0.011
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
324000
Week 1871
326000
328000
330000
332000
334000
336000
338000
340000
342000
344000
GPS Time (TOW, GMT zone)
East
North
Height
Trace


Roll & pitch (deg)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
324000
Week 1871
326000
328000
330000
332000
334000
336000
338000
340000
342000
344000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
1: DX0493
Name:
DX0493
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
16
18.57012
Compute from PPP
Longitude:
West
116
50
48.49141
Enter Grid Values
Ellipsoidal height:
671.173
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM60158.00
View STA File
Antenna profile:
TRMR8_GNSS3
Info
Measured to
Measured height:
1.621
m
ARP
ARP to L1 offset:
0.085
m
L1 Phase Centre
Applied height:
1.706
m
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_14
Name: FEMA_SD_14
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 33 17 37.88798
Compute from PPP
Longitude: West 116 54 00.63108
Enter Grid Values
Ellipsoidal height: 783.937 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.500 m
ARP to L1 offset: 0.067 m
Applied height: 1.567 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	40	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed 255	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	**Max**
AGL Range (m)	464	1700
Flying Alt. MSL Range (ft)	5601	10145
Swath Width Range (m)	338	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	2238
Total Line Time (hrs, no buffer)	21.3
Total Number of Lines	182
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	9.1
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	7
Total Acquisition Time (hrs)	37.5

Mission Flight Time Estimate	
Start Line Name	269
Stop Line Name	374
Turn Time (min)	2
Buffer (%)	10
Acquisition Time (hrs)	18.7

Other Acquisition Notes:

Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
237	5.28	9282	233545			finish e to w
238	5.64	9449	233050			
239	6.22	9328	232541			e to w
240	6.52	9029	232027			
241	13.99	8242	231053			CROSSLINE: 234154
242	14.31	8409	230115			
243	14.42	8278	225136			
244	15.25	8262	224114			e to w
245	16.08	7897	223038			
246	16.32	7963	221955			
247	16.42	8124	220659			
248	16.5	8219	215559			e to w
249	16.64	7943	214450			
250	16.66	7687	213337			
251	16.74	7566	212221			
252	16.8	7346	211052			e to w
253	16.68	7369	205938			got a low range temperarily
254	16.45	7356	204844			
255	16.22	7372	203800			
256	16	7372	202723			e to w
257	15.78	7320	201706			
258	15.56	7261	200632			e to w
259	15.35	7120	195607			
260	15.14	7048	194614			e to w
261	14.94	6923	193556			
262	14.73	6995	191301	192557		w to e, refly ranges too low on the midpoint of the line, refly e to w
263	14.49	6910	190259			
264	14.22	7116	185328			
265	14.1	7051	184351			
266	14.07	6910	183404			
267	14.01	6805	182426			e to w

268	13.94	6805	180446	181503		start e to w, west end had low R1 value (80) for the last 2 miles of the line and higher then our max AGL range

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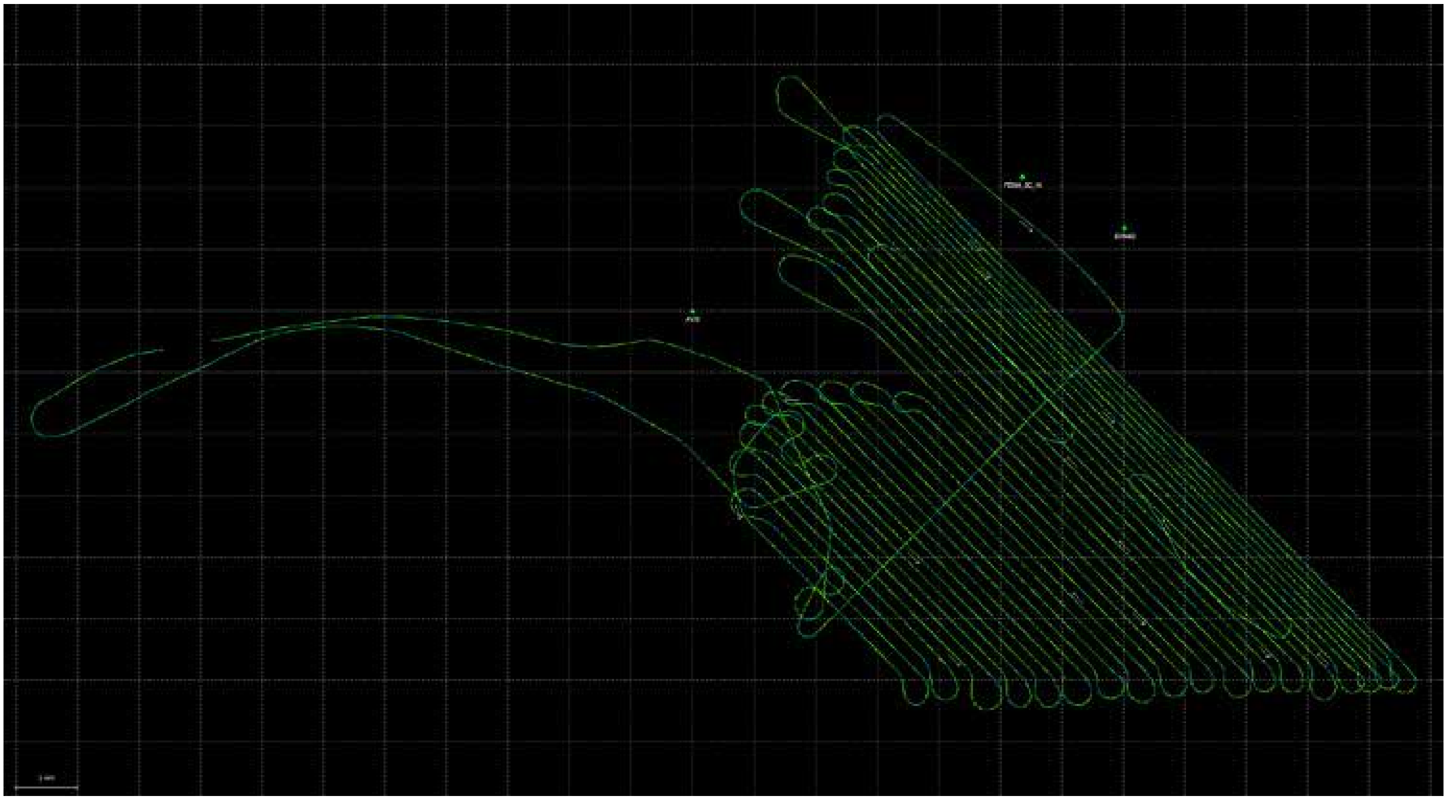
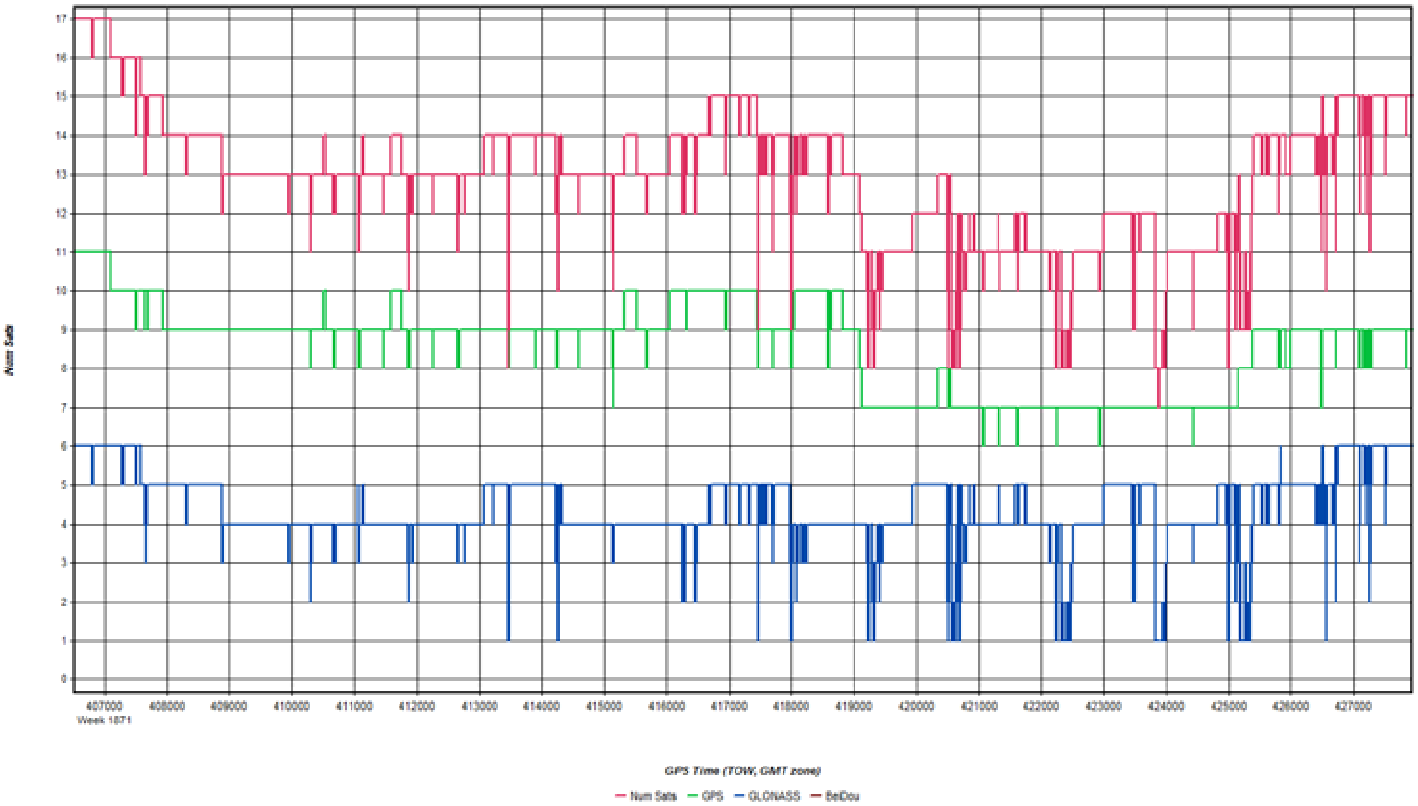
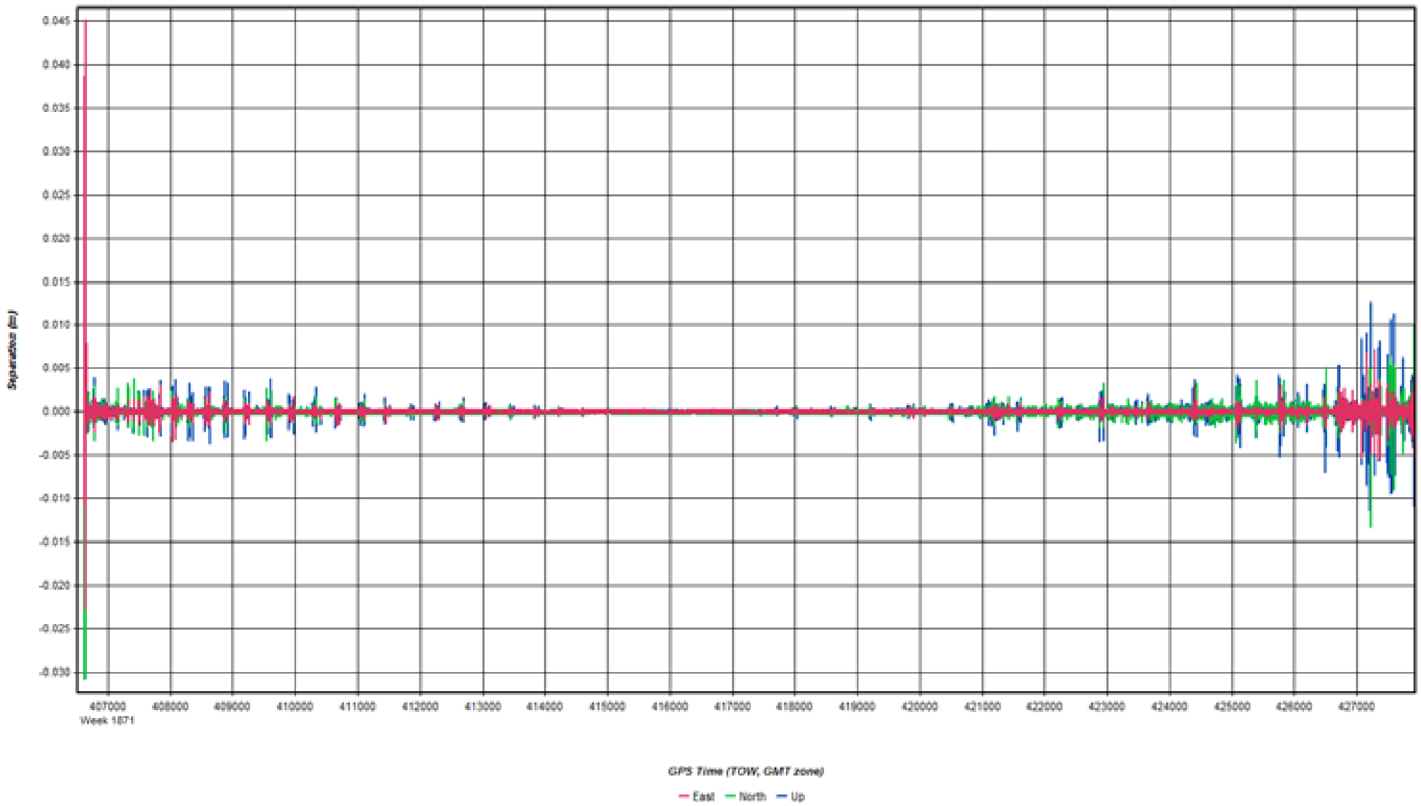
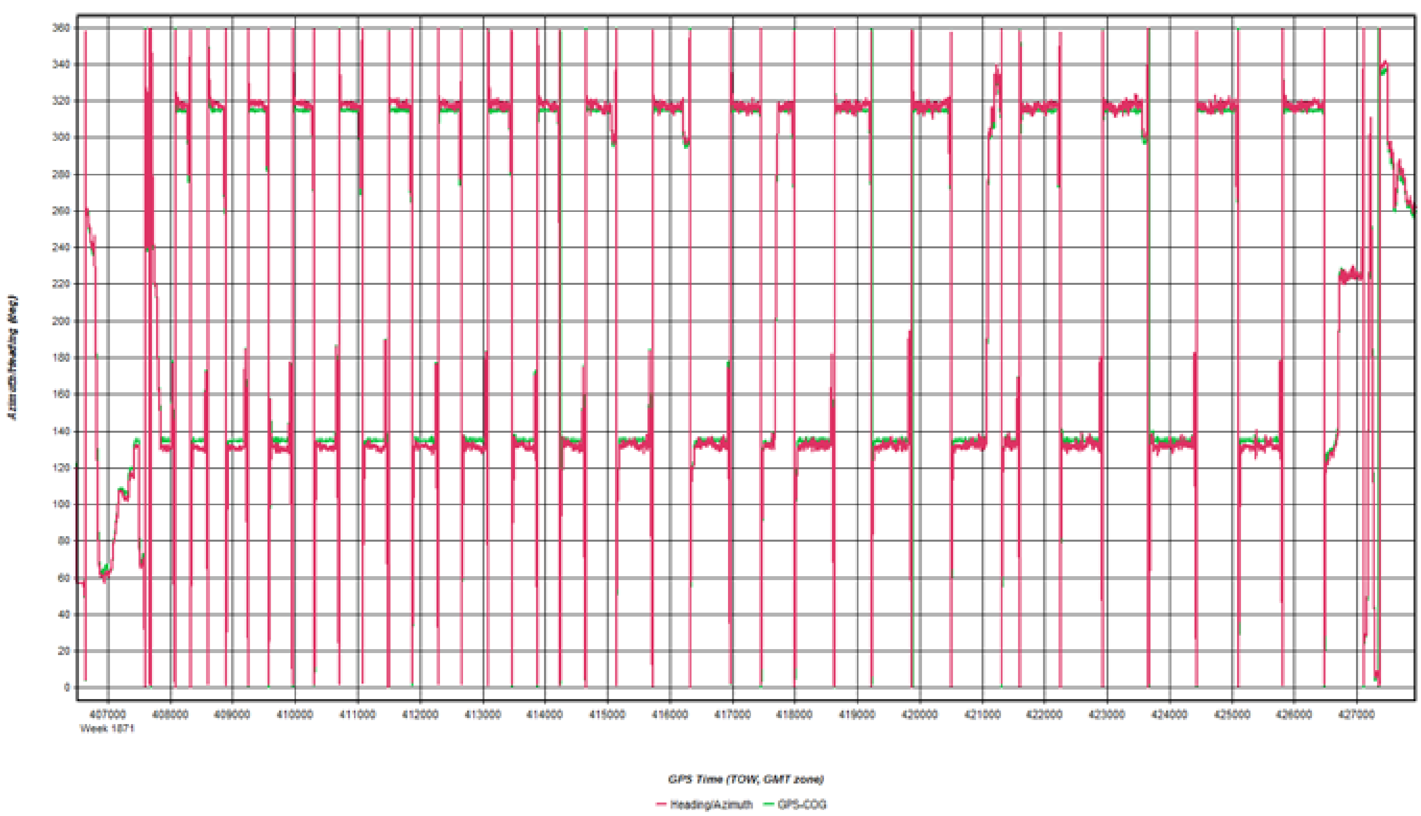
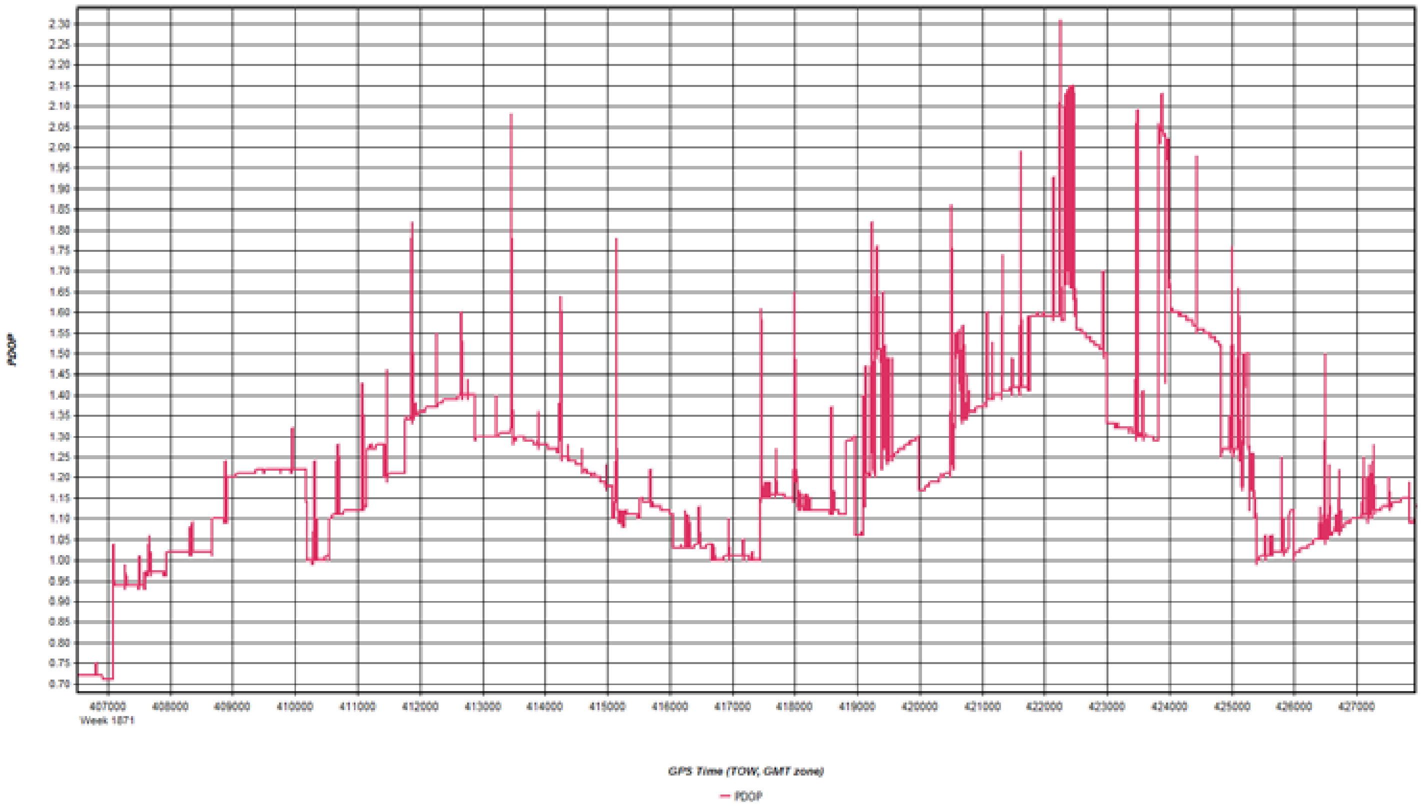
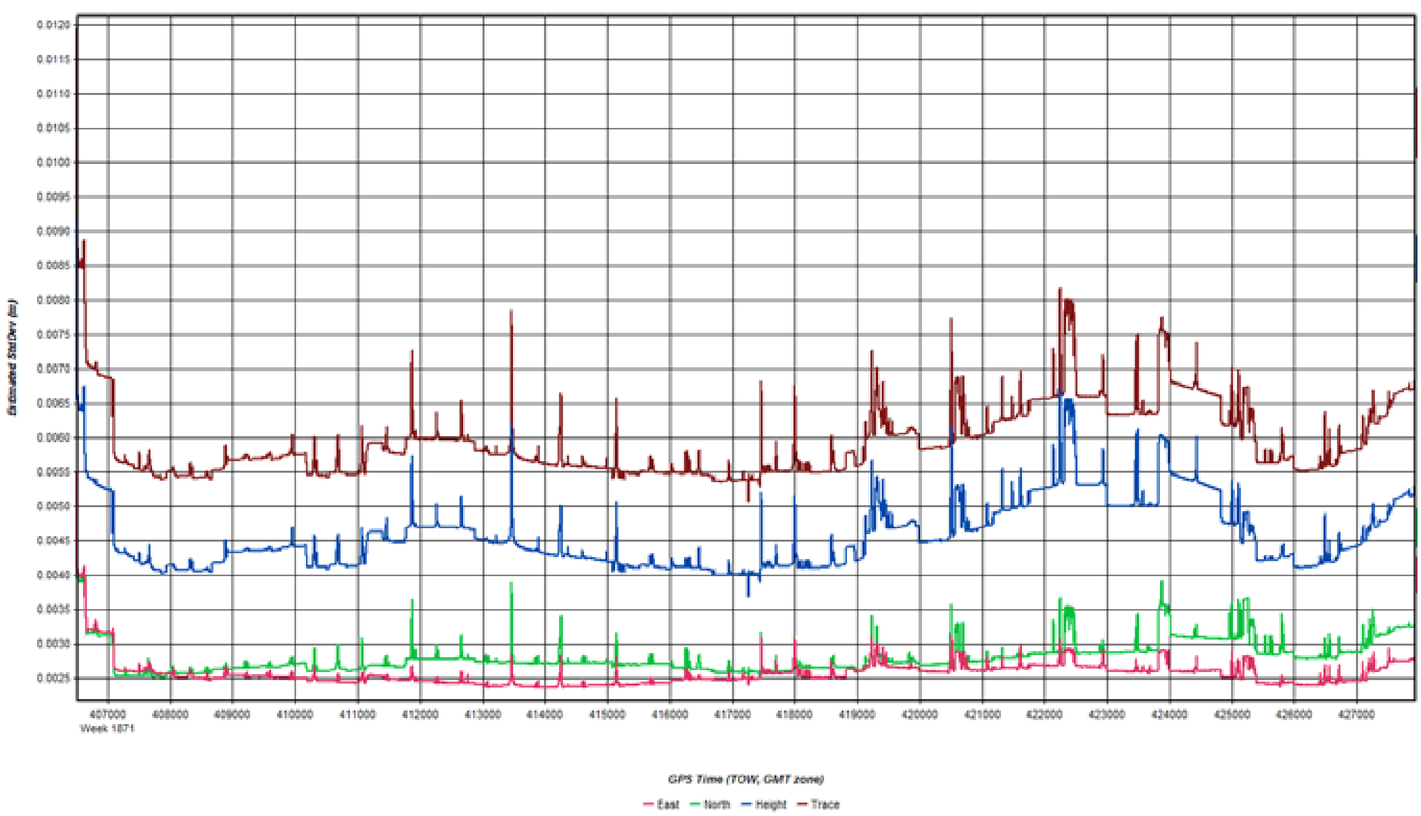


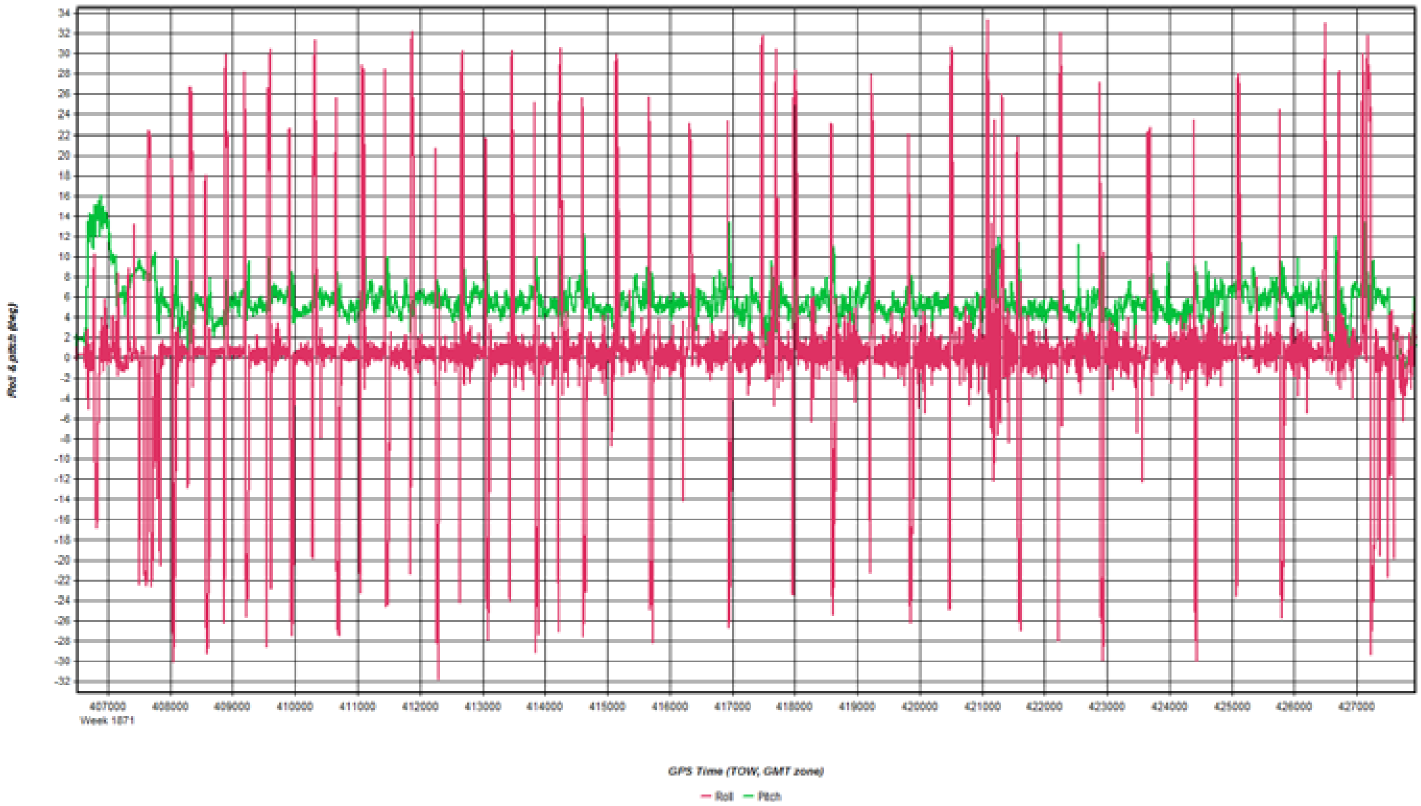

Num Sats
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
407000
Week 1871
408000
409000
410000
411000
412000
413000
414000
415000
416000
417000
418000
419000
420000
421000
422000
423000
424000
425000
426000
427000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

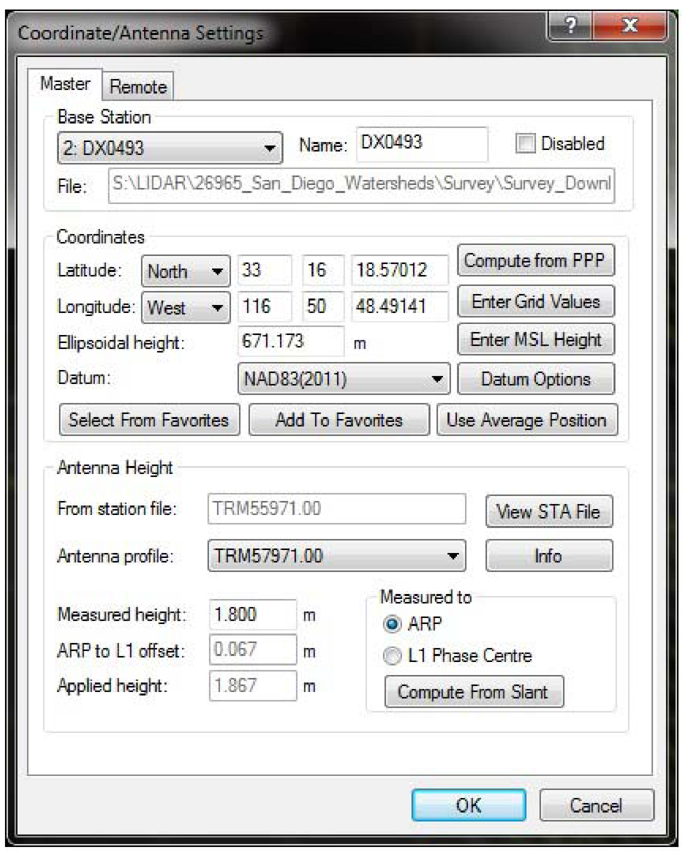

Separation (m)
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-0.005
-0.010
-0.015
-0.020
-0.025
-0.030
407000
Week 1871
408000
409000
410000
411000
412000
413000
414000
415000
416000
417000
418000
419000
420000
421000
422000
423000
424000
425000
426000
427000
GPS Time (TOW, GMT zone)
East
North
Up

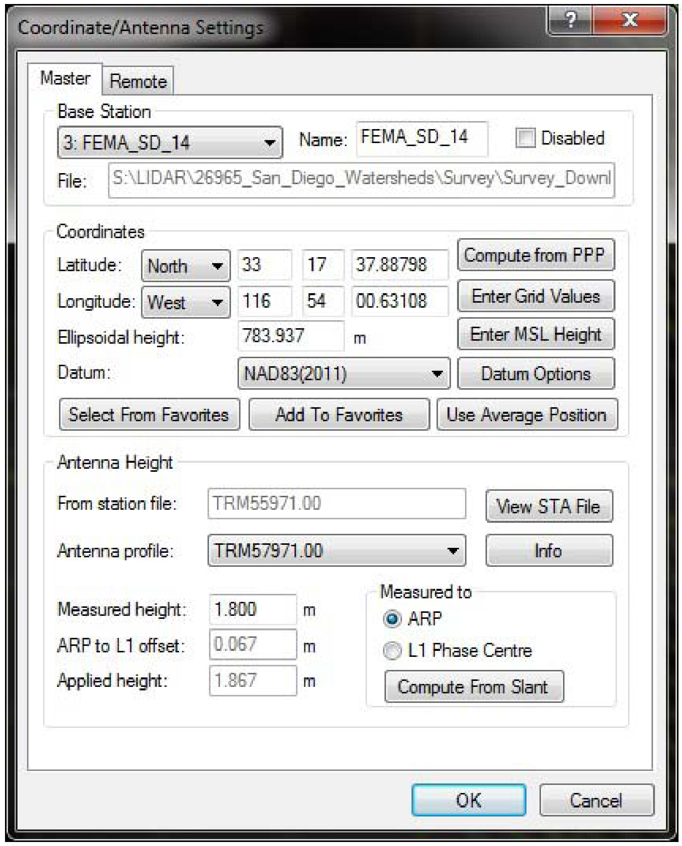

Azimuth/Heading (deg)
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
407000
Week 1871
408000
409000
410000
411000
412000
413000
414000
415000
416000
417000
418000
419000
420000
421000
422000
423000
424000
425000
426000
427000
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG

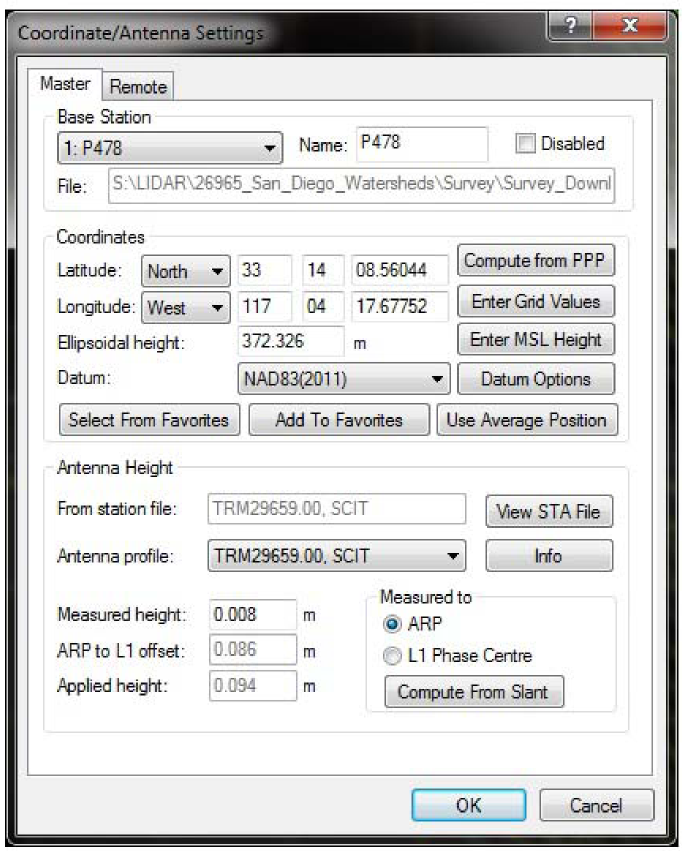

PDOP
Week 1871
GPS Time (TOW, GMT zone)
PDOP


Estimated Std Dev (m)
Week 1871
GPS Time (TOW, GMT zone)
East
North
Height
Trace


Roll & pitch (deg)
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
407000
Week 1871
408000
409000
410000
411000
412000
413000
414000
415000
416000
417000
418000
419000
420000
421000
422000
423000
424000
425000
426000
427000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
?
X
Master
Remote
Base Station
2: DX0493
Name:
DX0493
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
16
18.57012
Compute from PPP
Longitude:
West
116
50
48.49141
Enter Grid Values
Ellipsoidal height:
671.173
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.800
m
ARP to L1 offset:
0.067
m
Applied height:
1.867
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
3: FEMA_SD_14
Name: FEMA_SD_14
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 33 17 37.88798
Compute from PPP
Longitude: West 116 54 00.63108
Enter Grid Values
Ellipsoidal height: 783.937 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.800 m
ARP to L1 offset: 0.067 m
Applied height: 1.867 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: P478
Name: P478
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 33 14 08.56044
Compute from PPP
Longitude: West 117 04 17.67752
Enter Grid Values
Ellipsoidal height: 372.326 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM29659.00, SCIT
View STA File
Antenna profile: TRM29659.00, SCIT
Info
Measured height: 0.008 m
ARP to L1 offset: 0.086 m
Applied height: 0.094 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	40	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed 255	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	464	1700
Flying Alt. MSL Range (ft)	5601	10145
Swath Width Range (m)	338	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	2238
Total Line Time (hrs, no buffer)	21.3
Total Number of Lines	182
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	9.1
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	7
Total Acquisition Time (hrs)	37.5

Mission Flight Time Estimate	
Start Line Name	336
Stop Line Name	341
Turn Time (min)	2
Buffer (%)	0
Acquisition Time (hrs)	1.3

Other Acquisition Notes:

Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
357	8.73	6359	185816			light turbulence
358	9.06	6339	185151			light turbulence, nw to se
359	9.09	6316	184507			light to moderate turbulence
360	9.12	6293	183829			light turbulence
361	9.14	6283	183142			light turbulence
362	9.15	6250	182519			nw to se
363	9.1	6227	181826			CROSSLINE: 223154
364	9.06	6201	181148			
365	8.78	6122	180519			
366	8.51	6011	175905			short air bubble turbulance caused 6 degree roll
367	8.26	5925	175252			
368	8	5919	174650			nw to se
369	7.57	5893	174102			
370	6.99	5886	173530			nw to se
371	6.31	5873	173022			
372	5.35	5866	172549			nw to se
373	4.67	5866	172135			
374	4.24	5866	171736			start nw to se

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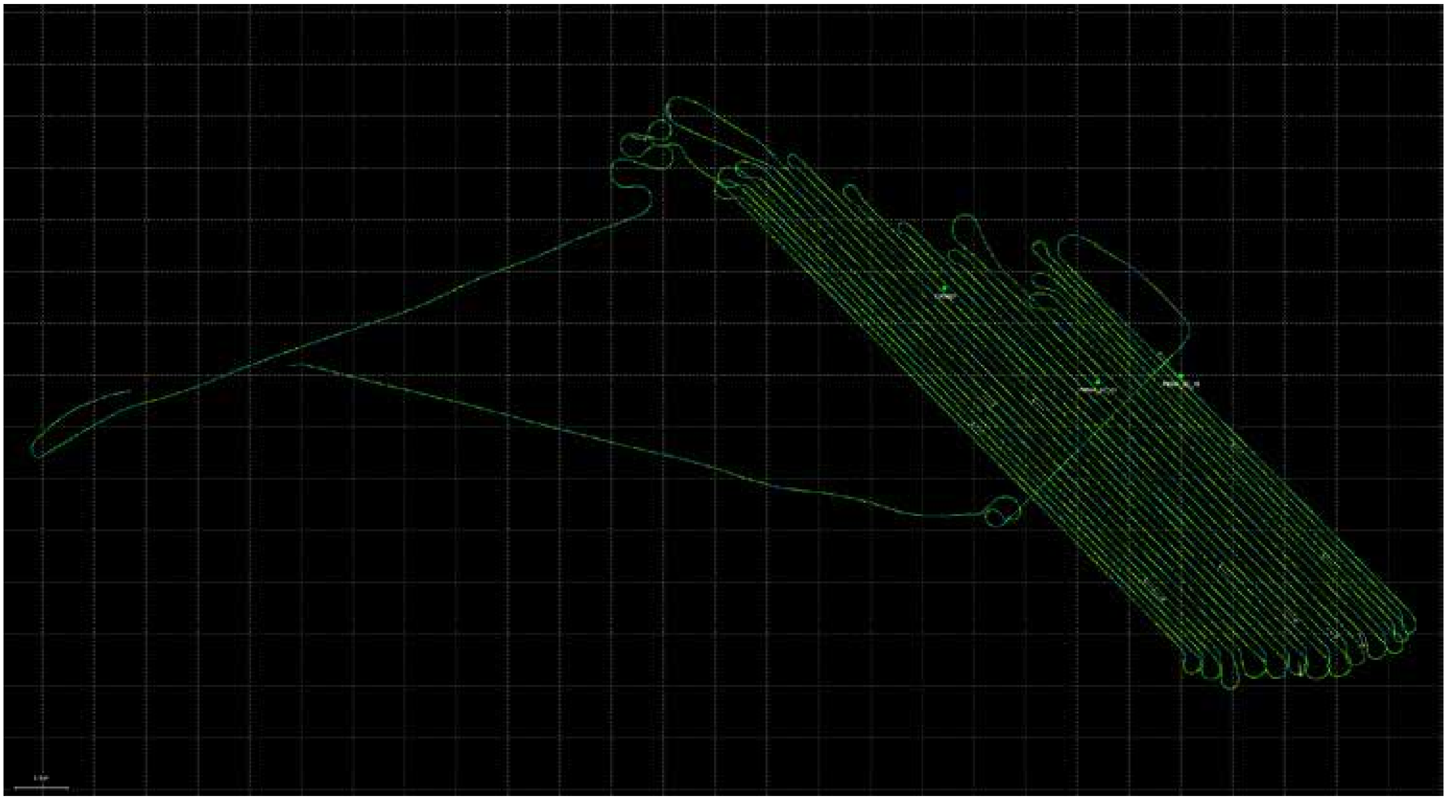
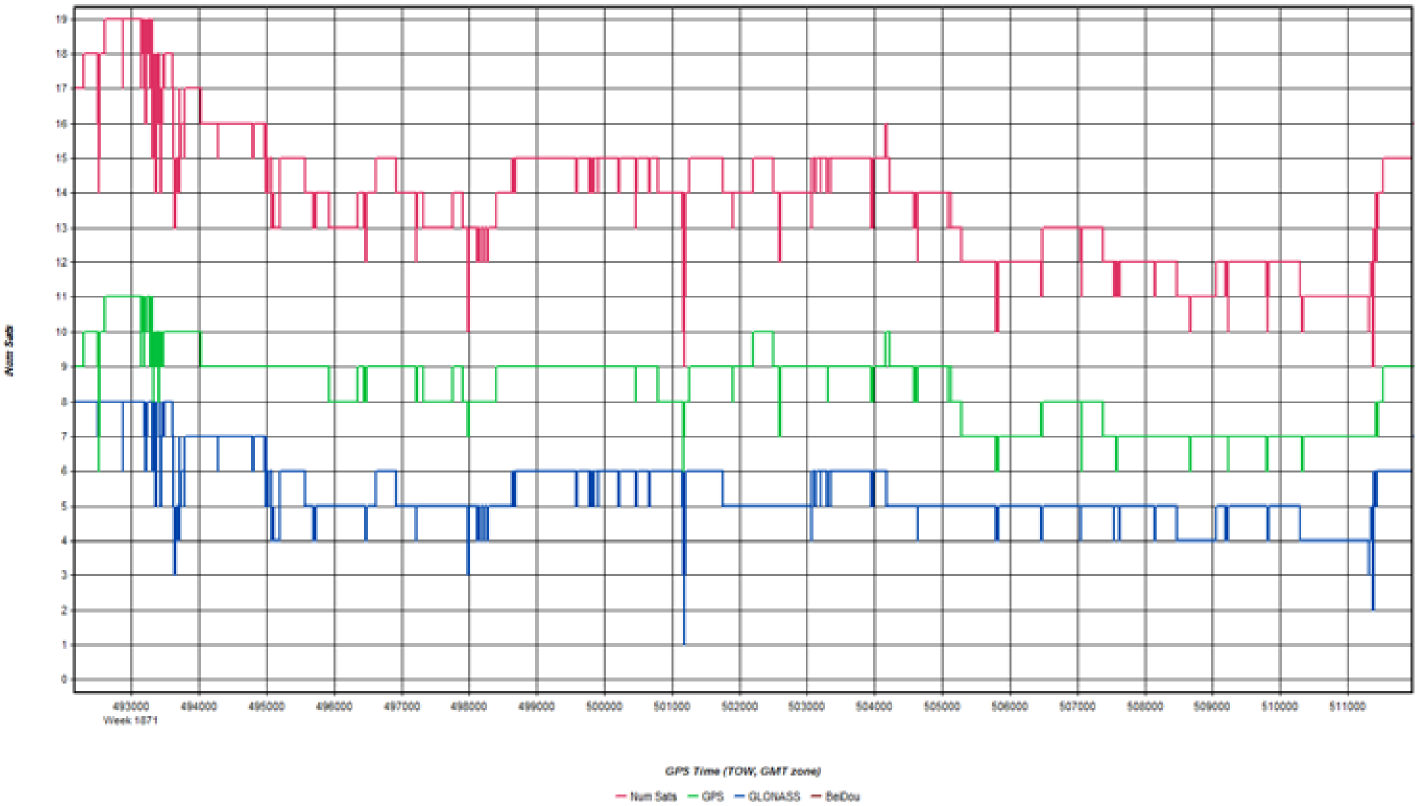
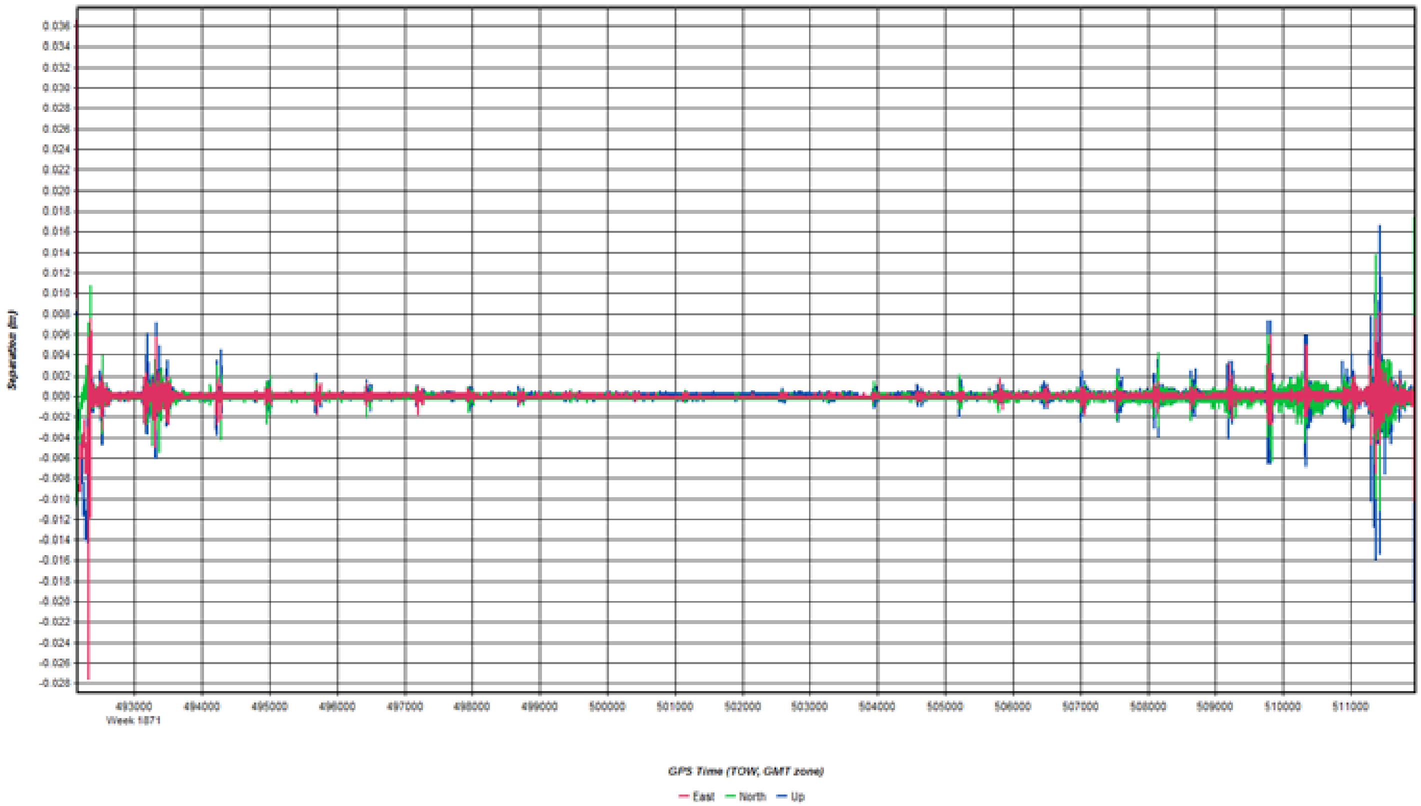
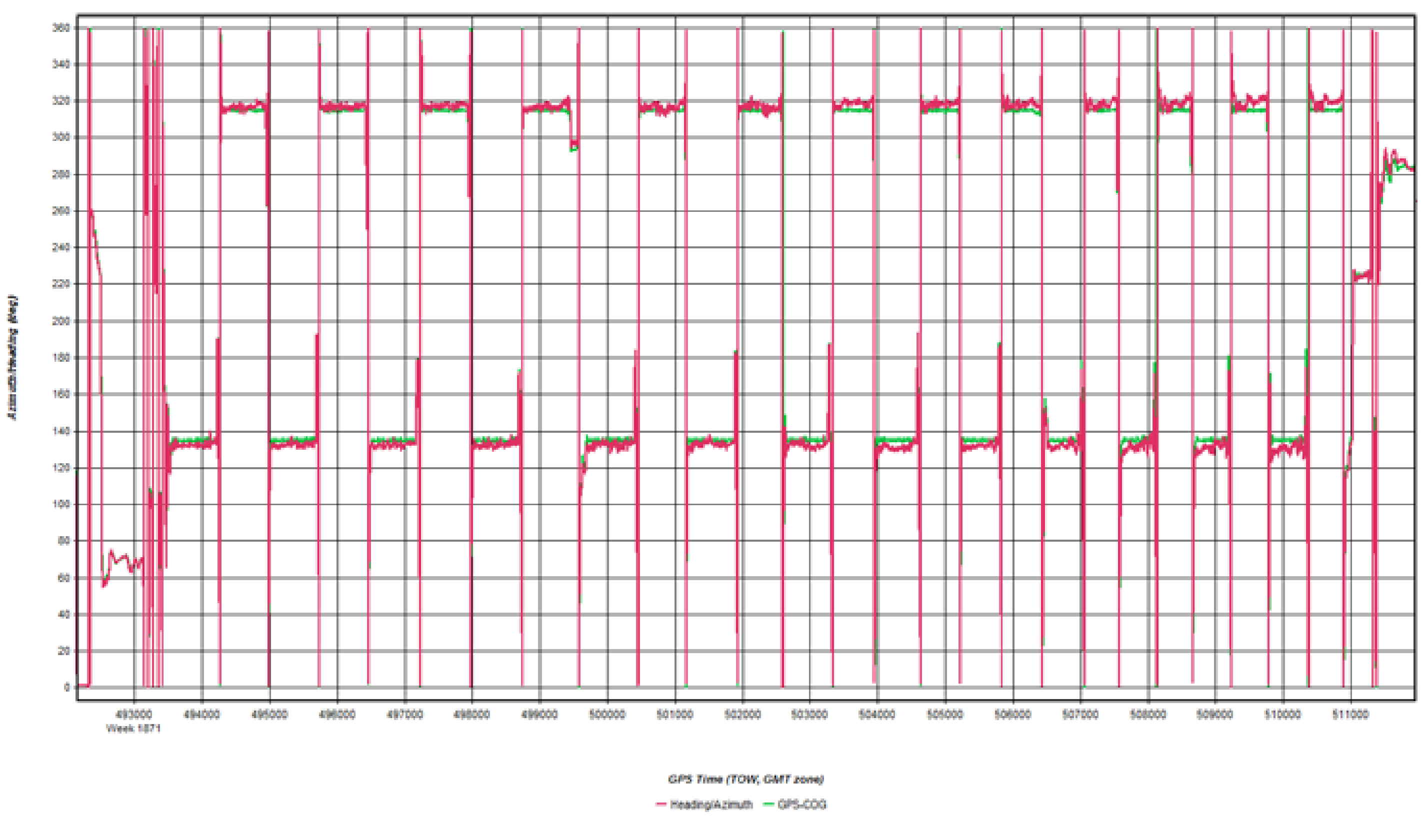
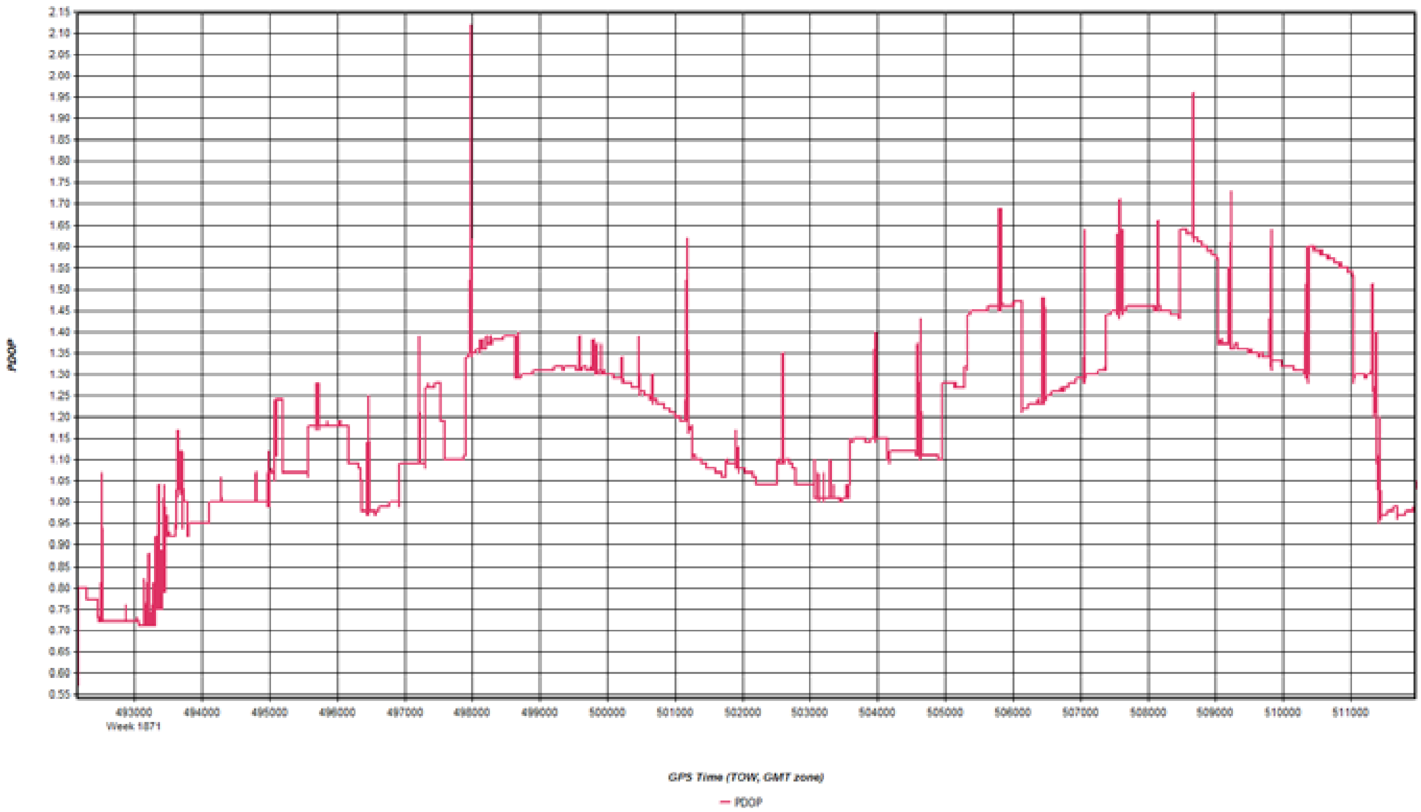
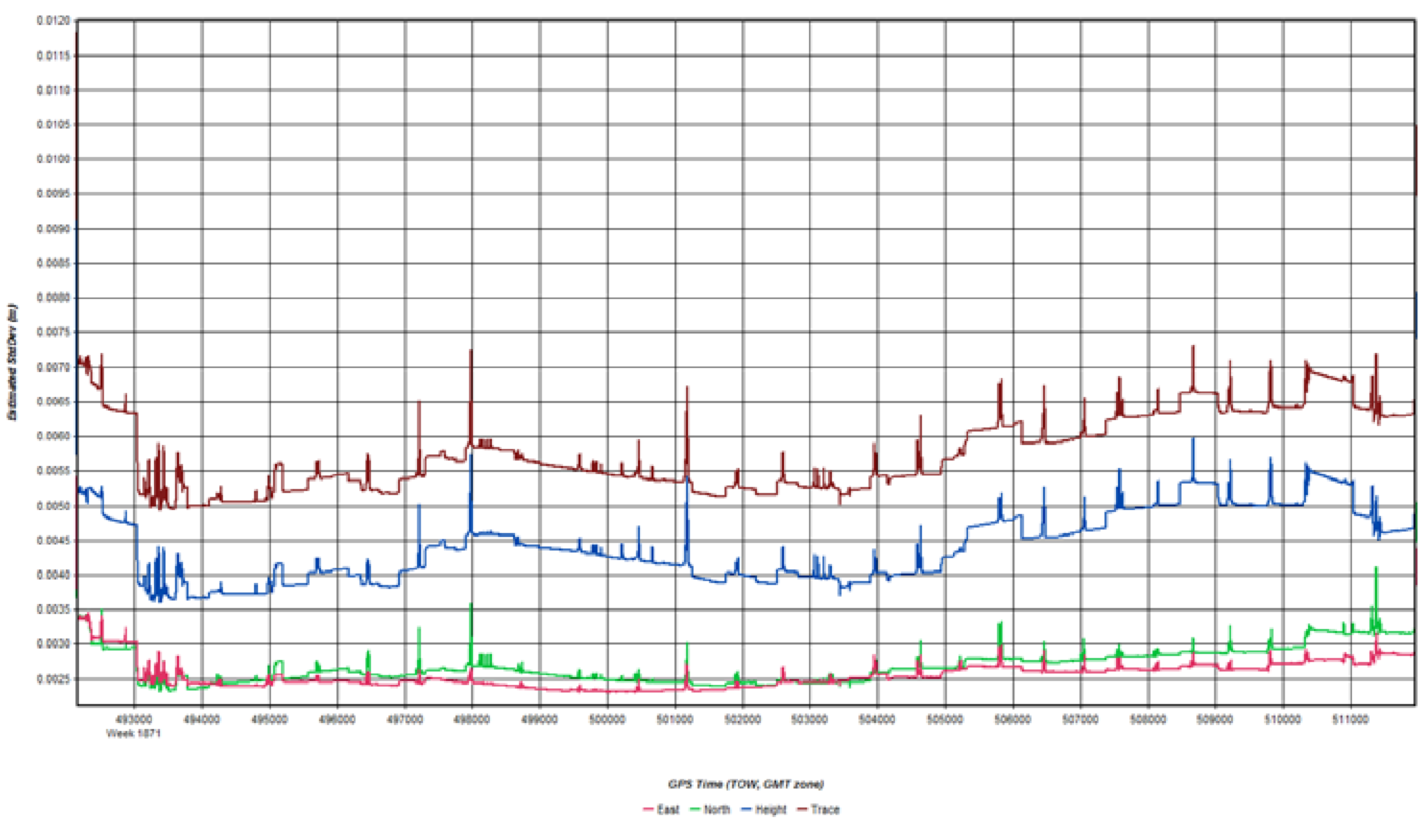


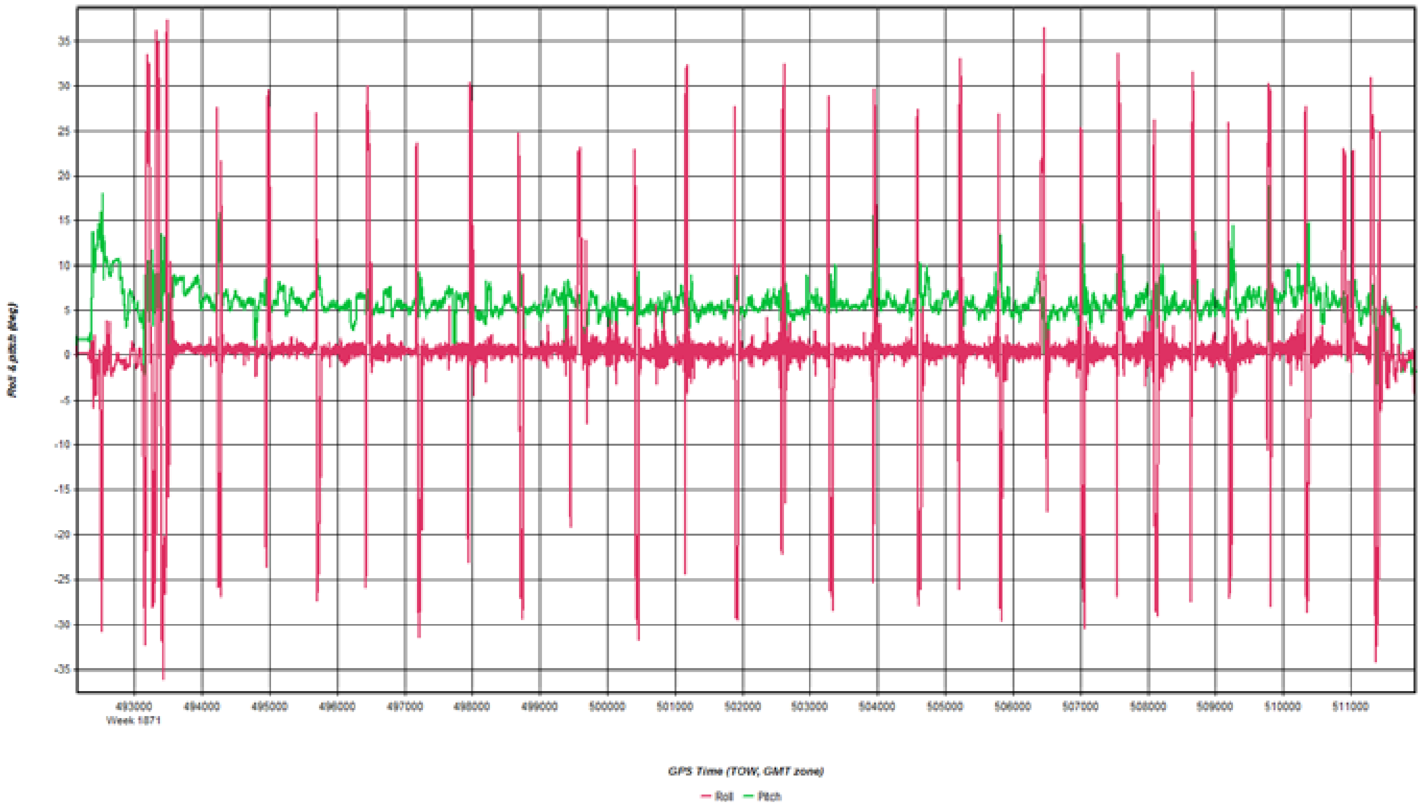

19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
493000
Week 1871
494000
495000
496000
497000
498000
499000
500000
501000
502000
503000
504000
505000
506000
507000
508000
509000
510000
511000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

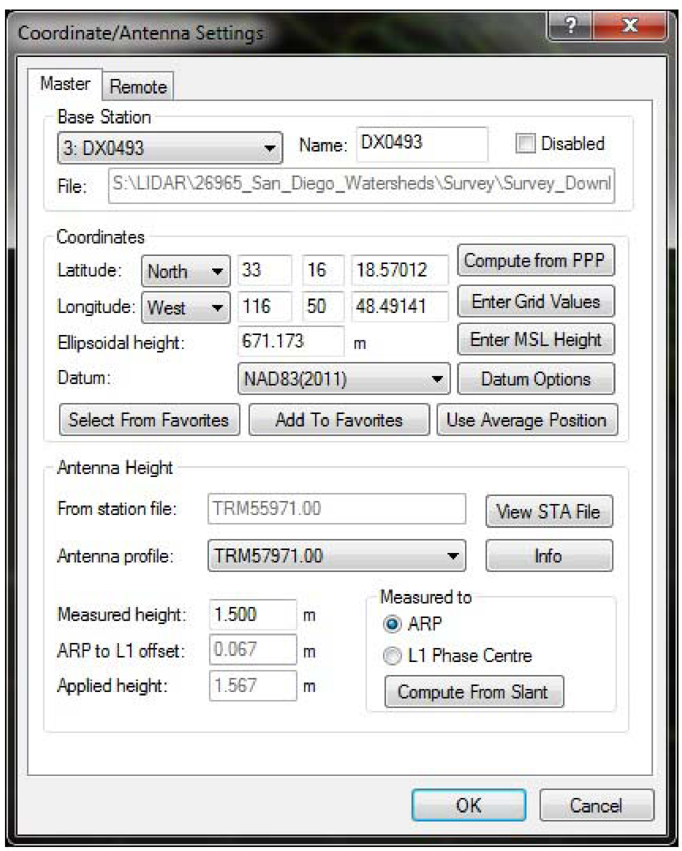

Separation (m)
GPS Time (TOW, GMT zone)
Week 1871
East
North
Up

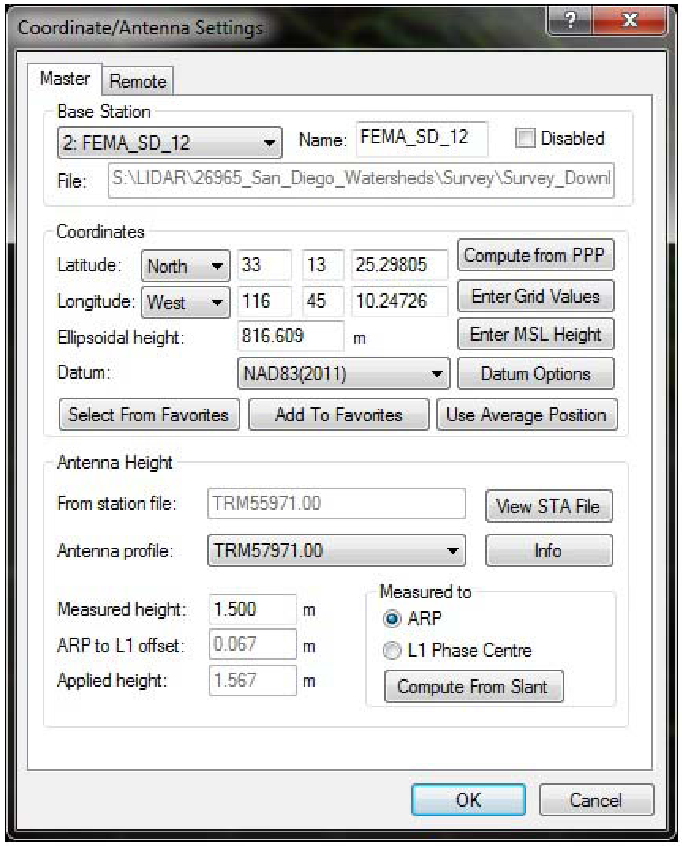

Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Week 1871
Heading/Azimuth
GPS-COG

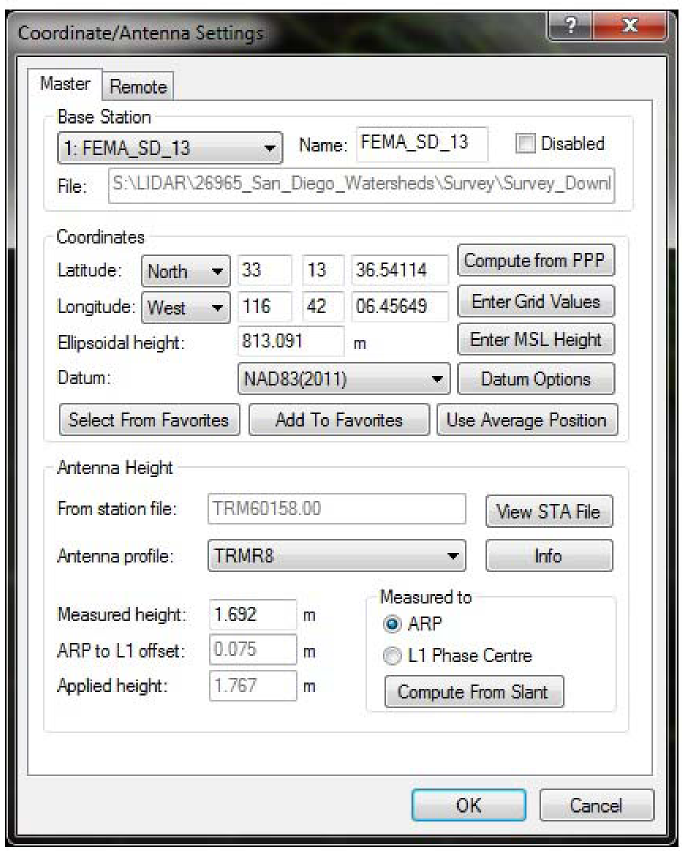

PDOP
GPS Time (TOW, GMT zone)
Week 1871
PDOP


Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1871
East
North
Height
Trace


Roll & pitch (deg)
GPS Time (TOW, GMT zone)
Week 1871
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
3: DX0493
Name:
DX0493
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
16
18.57012
Compute from PPP
Longitude:
West
116
50
48.49141
Enter Grid Values
Ellipsoidal height:
671.173
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.500
m
ARP to L1 offset:
0.067
m
Applied height:
1.567
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_12
Name:
FEMA_SD_12
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
13
25.29805
Compute from PPP
Longitude:
West
116
45
10.24726
Enter Grid Values
Ellipsoidal height:
816.609
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.500
m
ARP to L1 offset:
0.067
m
Applied height:
1.567
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: FEMA_SD_13
Name:
FEMA_SD_13
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
13
36.54114
Compute from PPP
Longitude:
West
116
42
06.45649
Enter Grid Values
Ellipsoidal height:
813.091
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM60158.00
View STA File
Antenna profile:
TRMR8
Info
Measured height:
1.692
m
ARP to L1 offset:
0.075
m
Applied height:
1.767
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	40	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed 255	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	464	1700
Flying Alt. MSL Range (ft)	5601	10145
Swath Width Range (m)	338	1237
Pulse Rate Range (Hz)	158000	158000
*Shading = Auto-calculated		

Project Flight Time Estimate	
Total Line Length (nmi)	2238
Total Line Time (hrs, no buffer)	21.3
Total Number of Lines	182
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	9.1
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	7
Total Acquisition Time (hrs)	37.5

Mission Flight Time Estimate	
Start Line Name	269
Stop Line Name	314
Turn Time (min)	2
Buffer (%)	10
Acquisition Time (hrs)	7.6

Other Acquisition Notes:

Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
313	14.57	8124	214630			light turbulence, hybrid AGL, CROSSLINE: 215717
314	14.54	8117	213703			light turbulence, hybrid AGL
315	14.39	8117	212721			light turbulence, short lake dropout, hybrid AGL
316	14.22	8117	211813			light, turbulence, lake dropout, MSL
317	14.05	8117	210907			light turbulence, hybrid AGL, lake dropout
318	13.88	8117	205958			lake dropout, MSL
319	13.68	8107	205103			line start had low return then quickly went to 100, light turbulence, MSL, lake dropout
320	13.25	8098	204237			lake dropout, MSL, nw to se
321	13.96	7989	203049			lake dropout, MSL
322	15.03	7937	202110			some light turbulence, MSL, nw to se
323	16.02	7805	201045			MSL
324	16.8	7750	195959			some light turbulence, MSL
325	17.54	7714	194903			some light turbulence, MSL
326	18.23	7668	193727			light turbulence, MSL
327	18.94	7648	192536			light turbulence, MSL
328	19.67	7612	191328			light turbulence, MSL, nw to se
329	20.39	7543	190105			light turbulence, hybrid AGL
330	20.69	7428	184813			light turbulence, hybrid AGL
331	20.45	7402	183232			hybrid AGL
332	20.21	7261	182009			hybrid AGL, nw to se
333	19.97	7107	180735			hybrid AGL
334	19.74	6969	175501			hybrid AGL
335	19.5	6854	174231			hybrid AGL
336	19.28	6772	173021			hybrid AGL
337	19.06	6539	171759			hybrid AGL
338	18.85	6414	170607			start ne to sw, hybrid AGL

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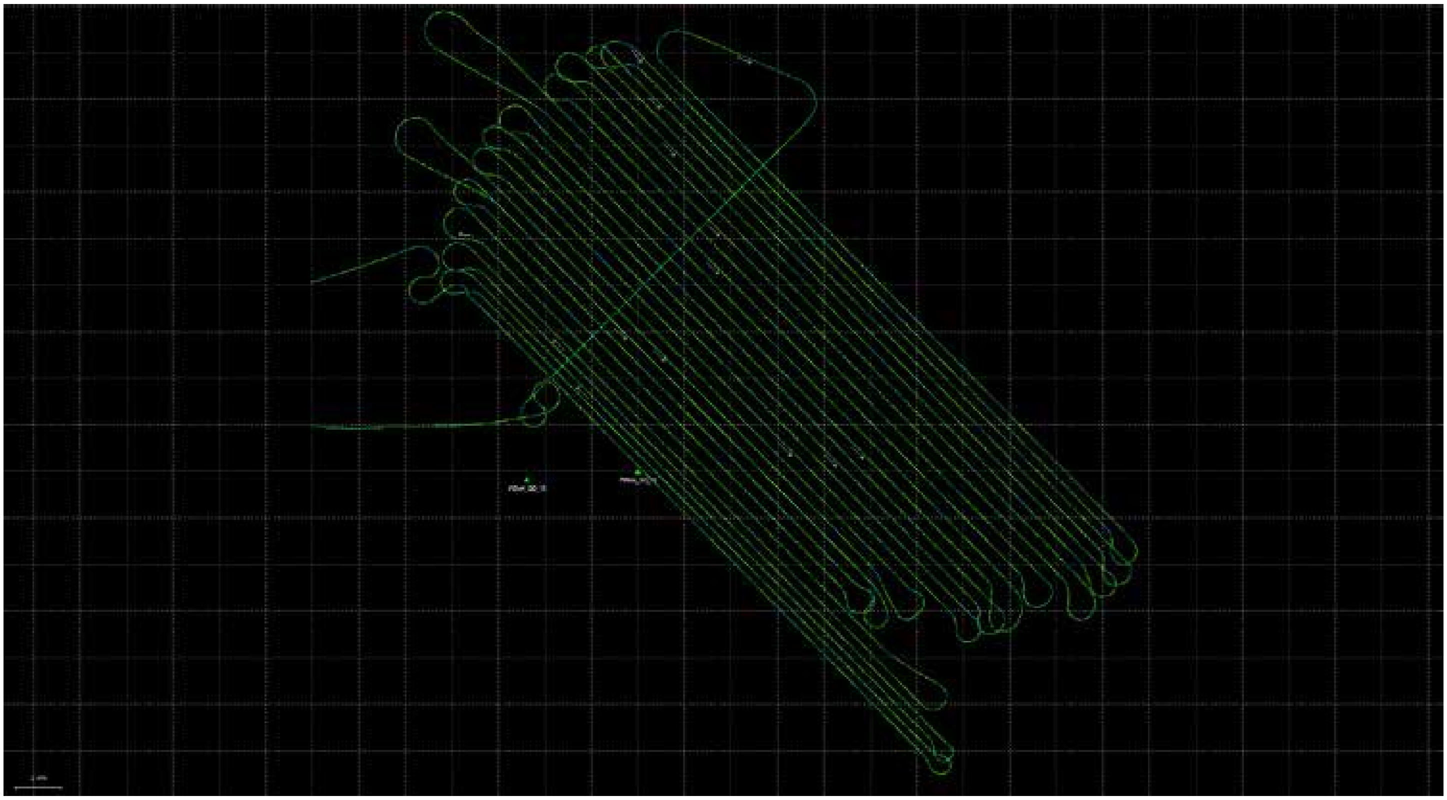
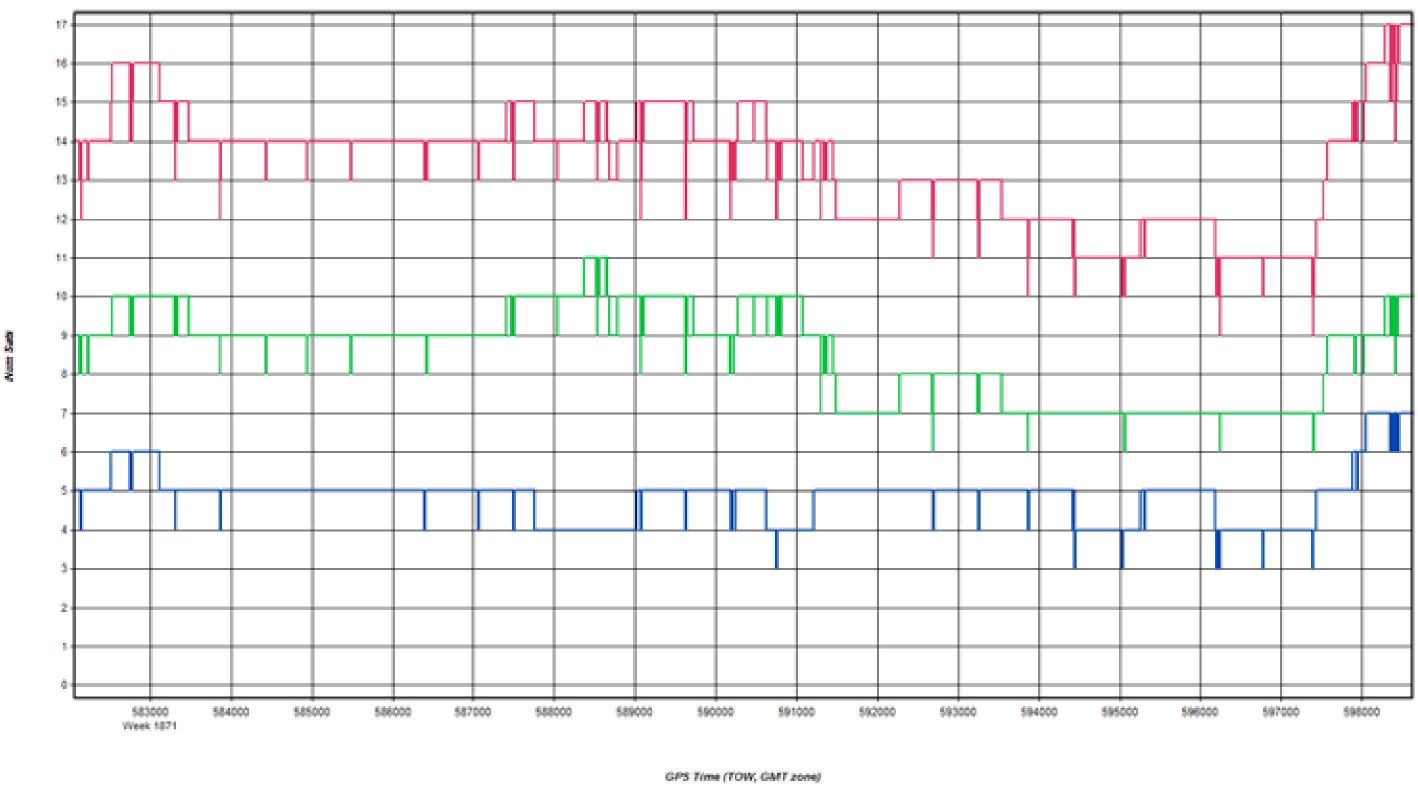
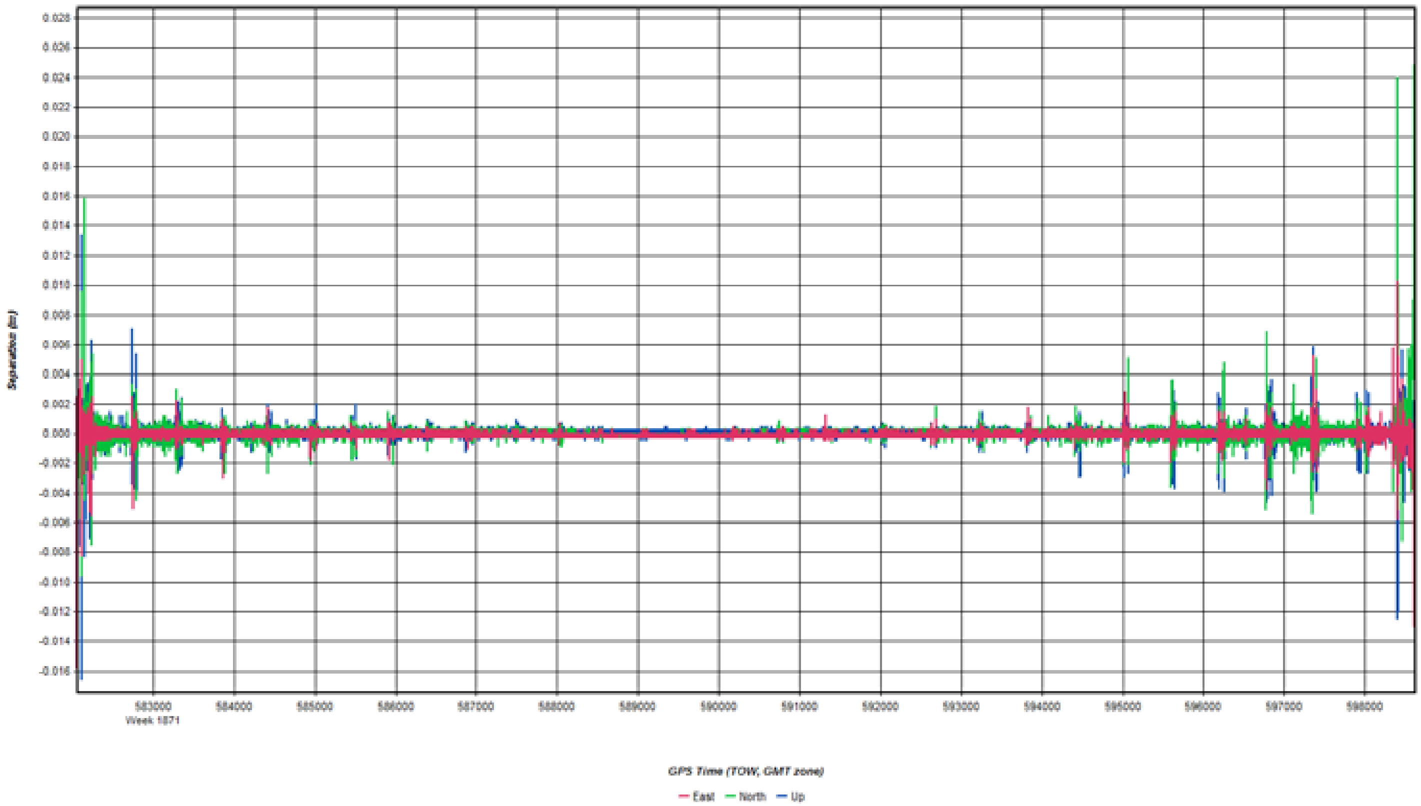
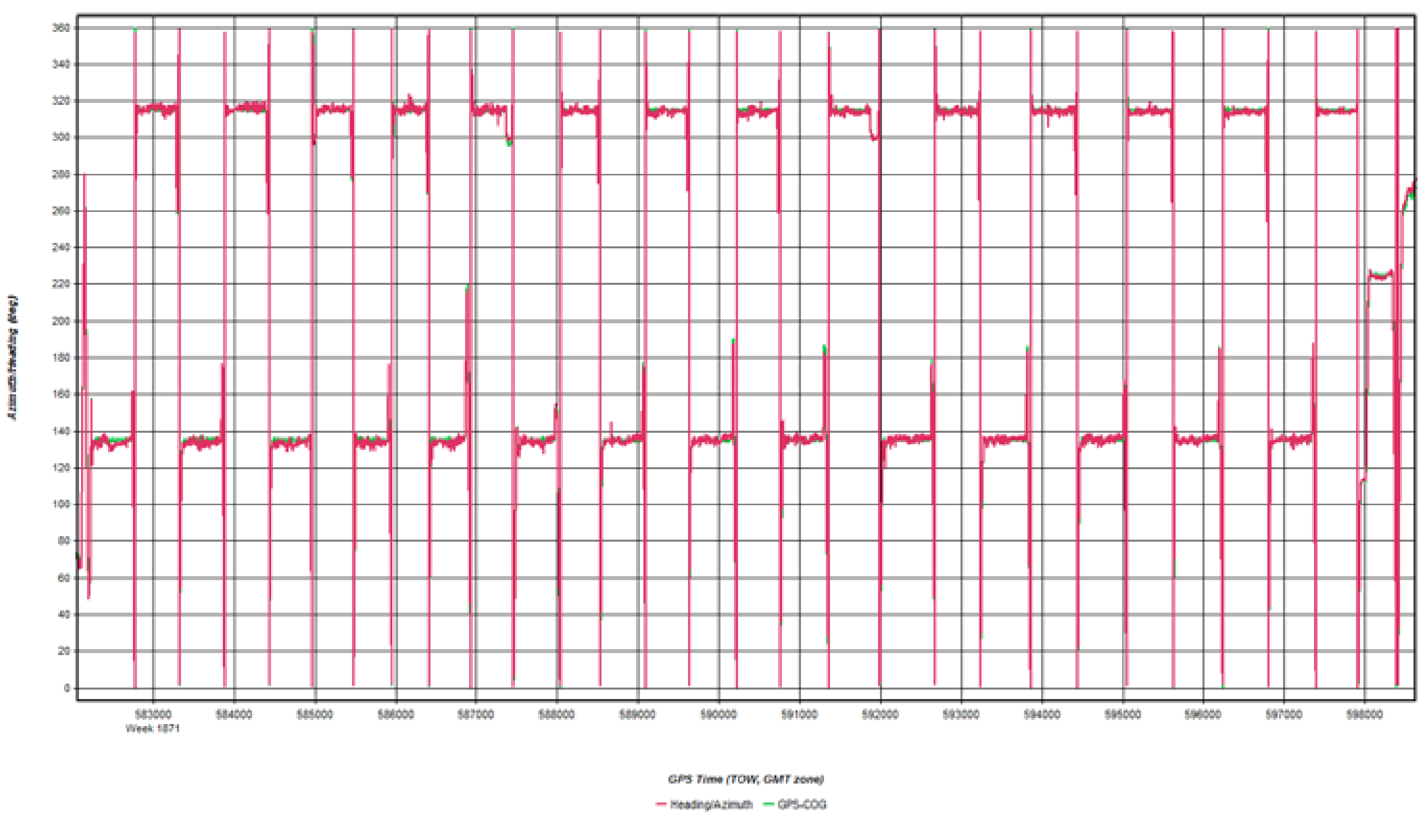
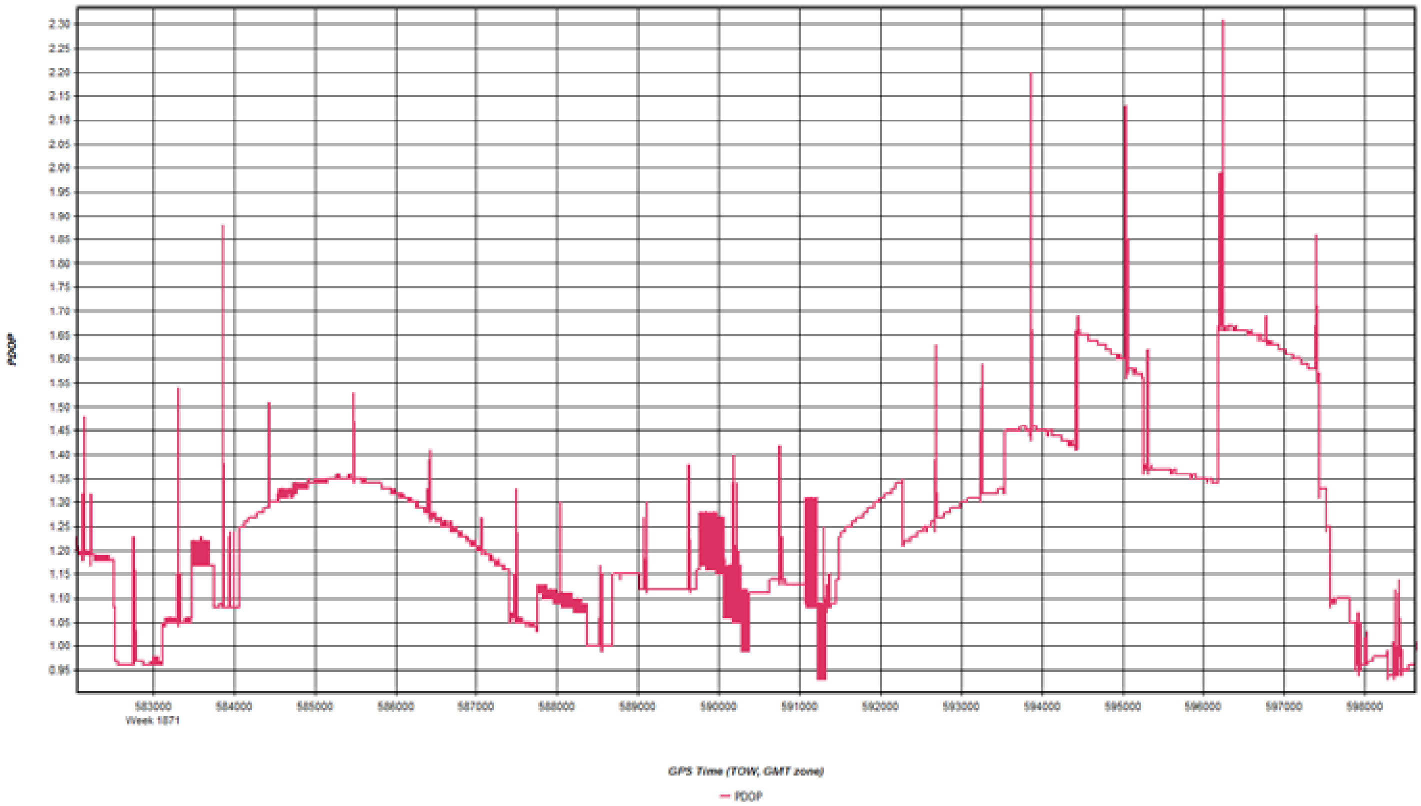
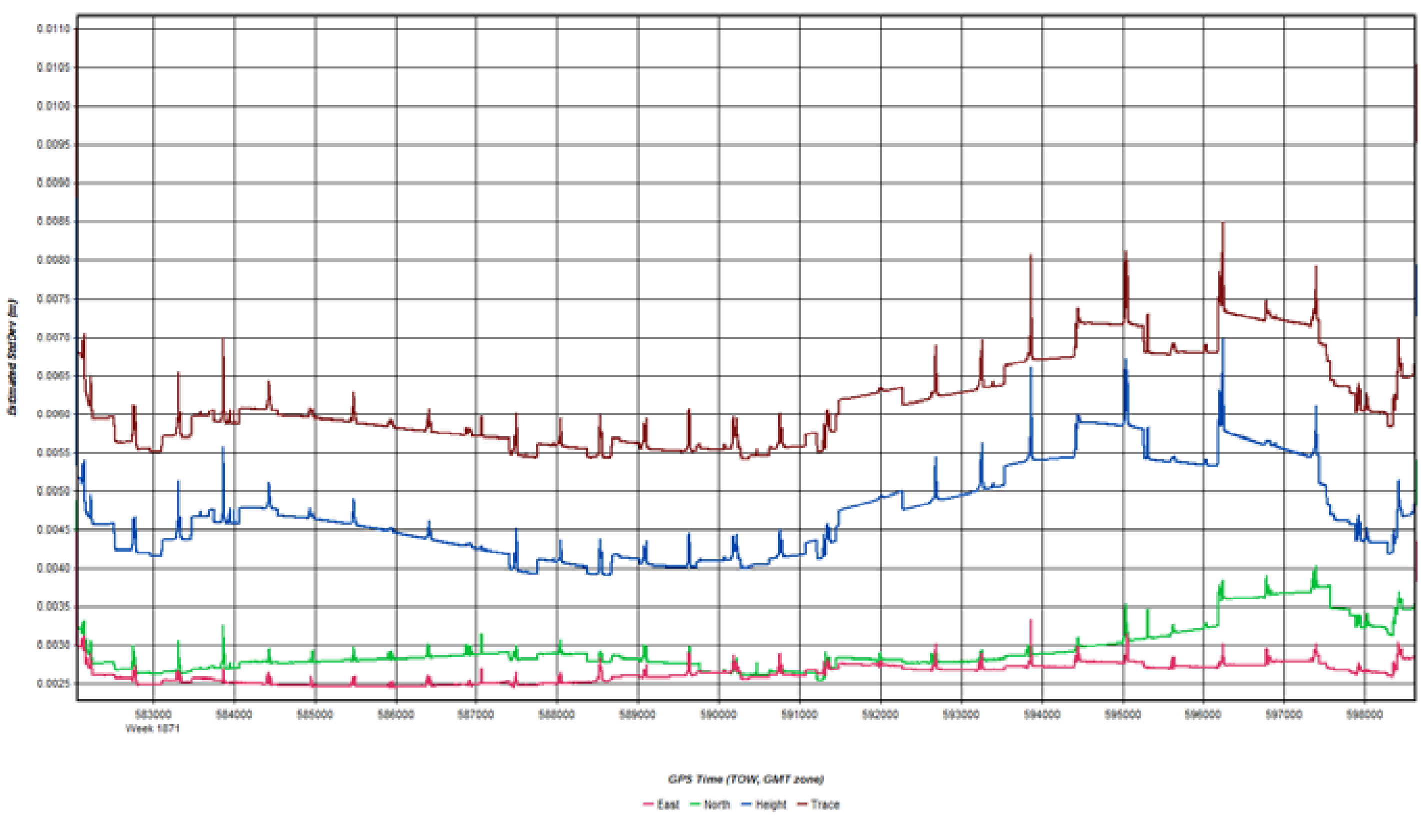


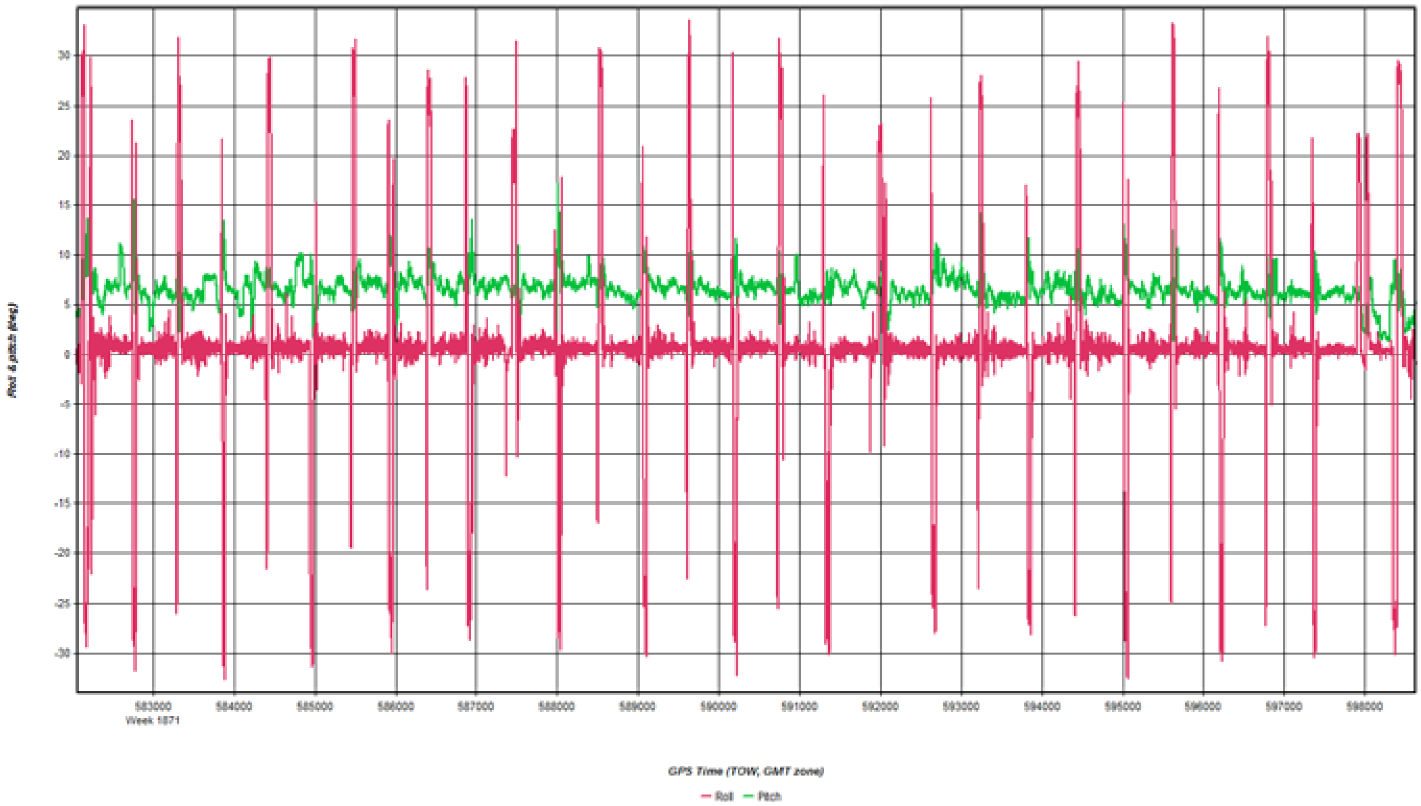

17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Num Sats
583000
Week 1871
584000
585000
586000
587000
588000
589000
590000
591000
592000
593000
594000
595000
596000
597000
598000
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

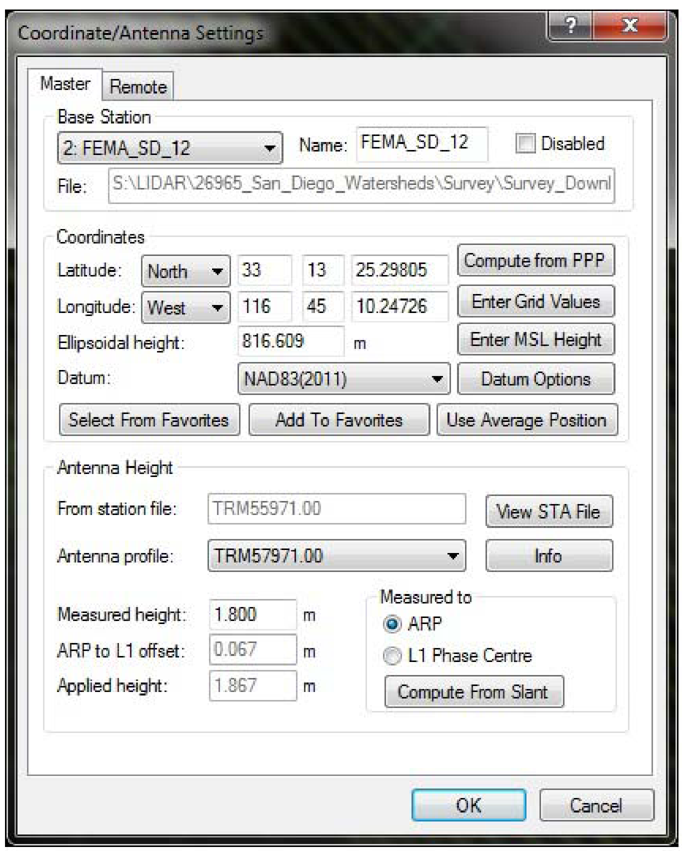

Separation (m)
Week 1871
GPS Time (TOW, GMT zone)
East
North
Up

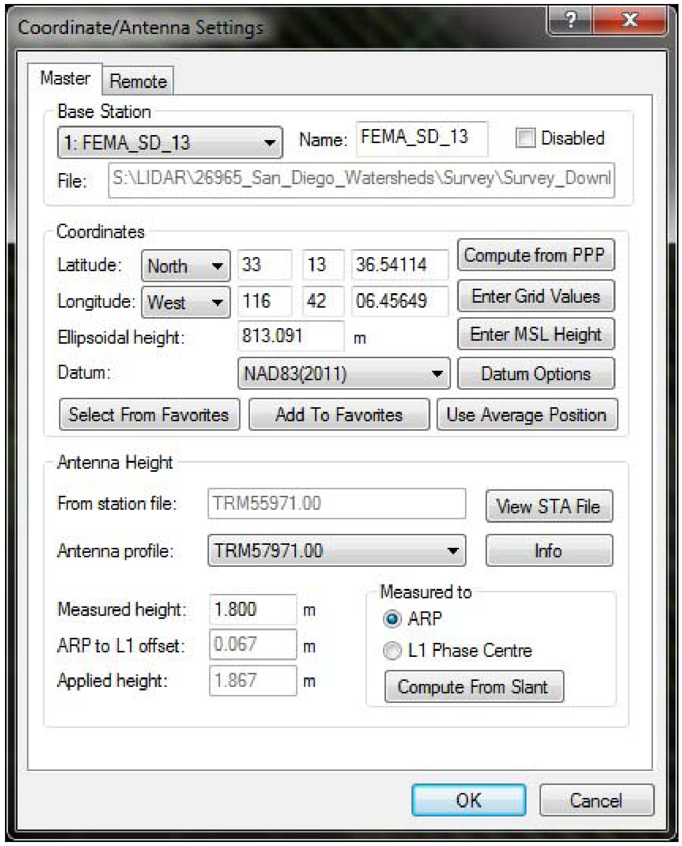

Azimuth/Heading (deg)
Week 1871
GPS Time (TOW, GMT zone)
Heading/Azimuth
GPS-COG


PDOP
GPS Time (TOW, GMT zone)
Week 1871
PDOP


Estimated Std Dev (m)
GPS Time (TOW, GMT zone)
Week 1871
East
North
Height
Trace


Roll & pitch (deg)
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
583000
Week 1871
584000
585000
586000
587000
588000
589000
590000
591000
592000
593000
594000
595000
596000
597000
598000
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_12
Name: FEMA_SD_12
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 33 13 25.29805
Compute from PPP
Longitude: West 116 45 10.24726
Enter Grid Values
Ellipsoidal height: 816.609 m
Enter MSL Height
Datum: NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.800 m
ARP to L1 offset: 0.067 m
Applied height: 1.867 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: FEMA_SD_13
Name:
FEMA_SD_13
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
13
36.54114
Compute from PPP
Longitude:
West
116
42
06.45649
Enter Grid Values
Ellipsoidal height:
813.091
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.800
m
ARP to L1 offset:
0.067
m
Applied height:
1.867
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	40	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed 255	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	**Max**
AGL Range (m)	464	1700
Flying Alt. MSL Range (ft)	5601	10145
Swath Width Range (m)	338	1237
Pulse Rate Range (Hz)	158000	158000
*Shading = Auto-calculated		

Project Flight Time Estimate	
Total Line Length (nmi)	2238
Total Line Time (hrs, no buffer)	21.3
Total Number of Lines	182
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	9.1
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	7
Total Acquisition Time (hrs)	37.5

Mission Flight Time Estimate	
Start Line Name	269
Stop Line Name	285
Turn Time (min)	2
Buffer (%)	10
Acquisition Time (hrs)	2.1

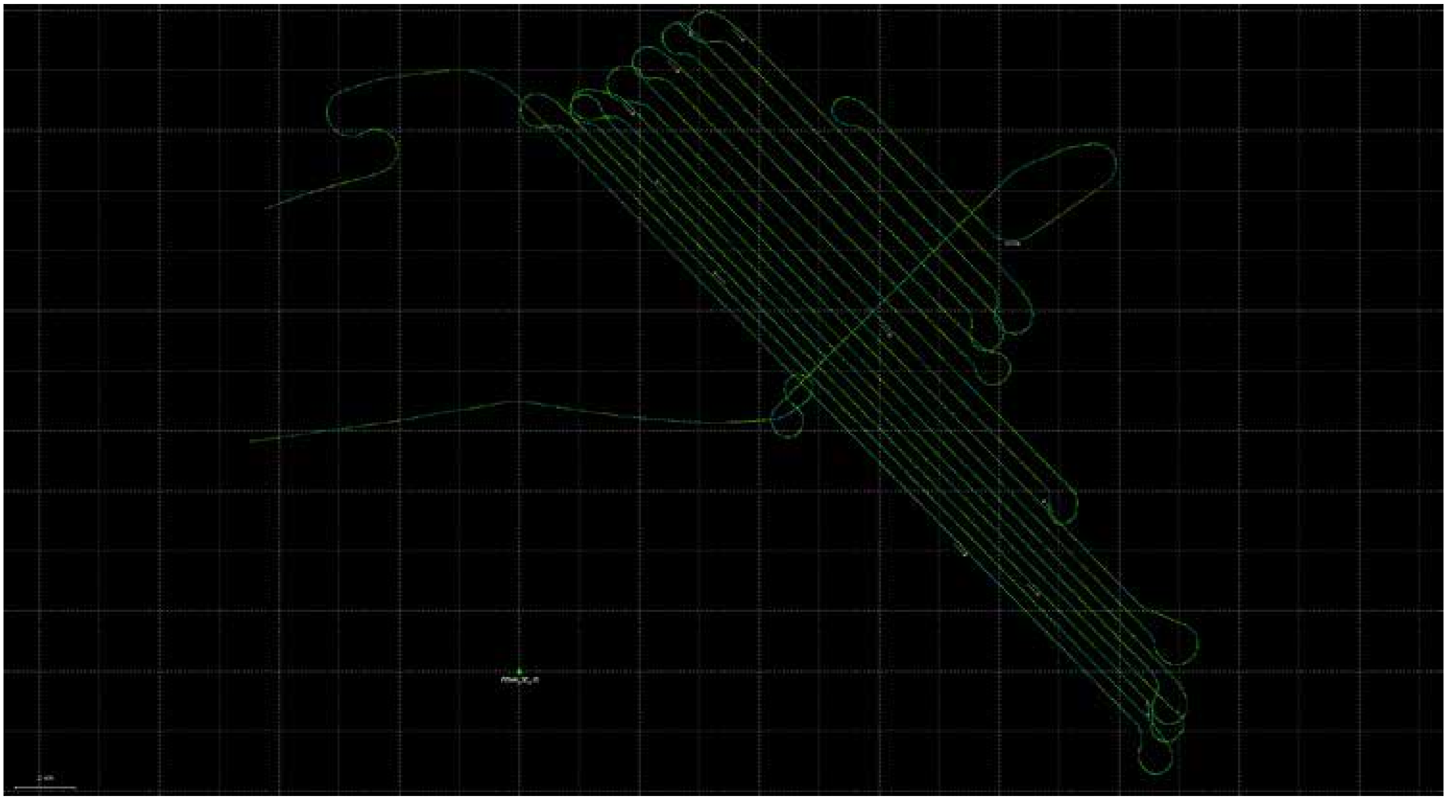
Other Acquisition Notes:

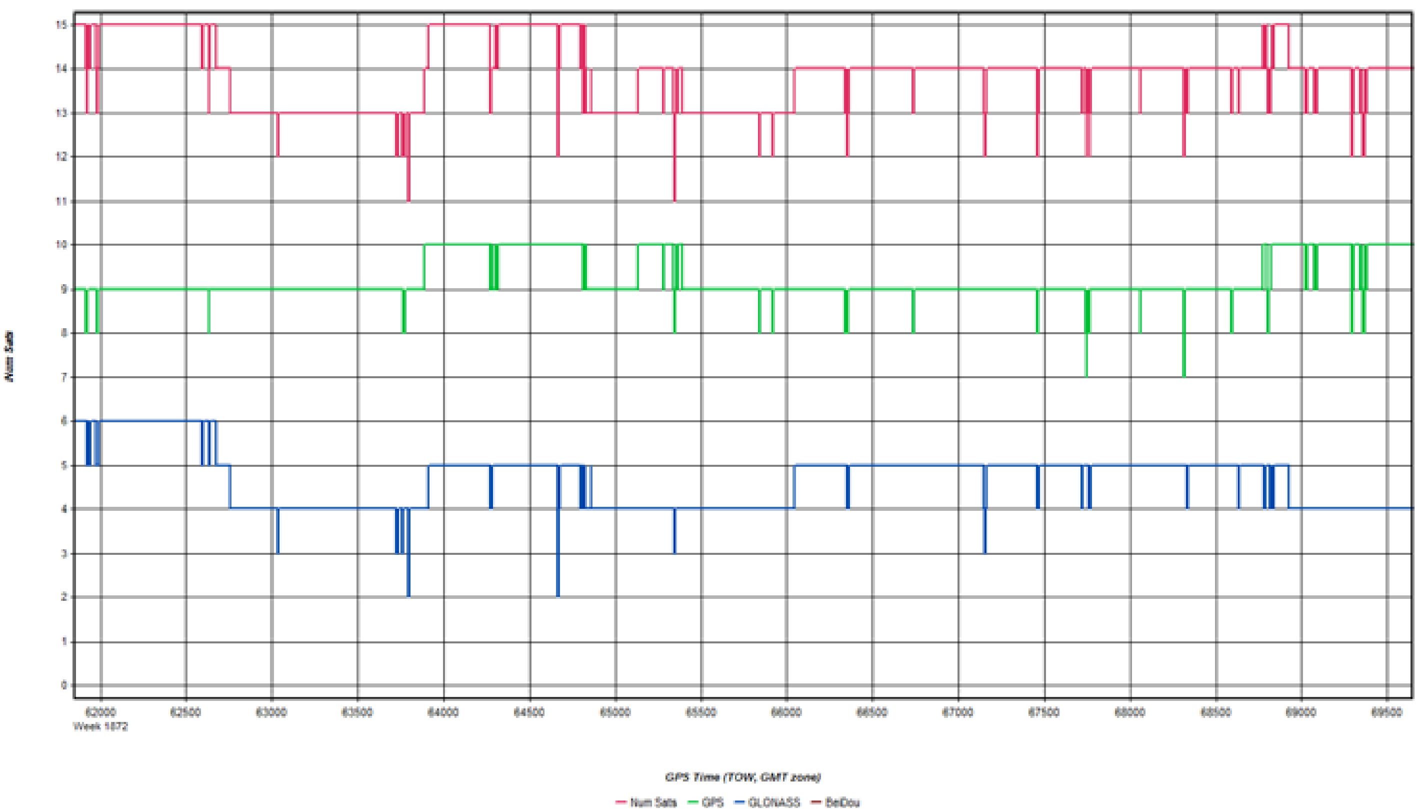
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

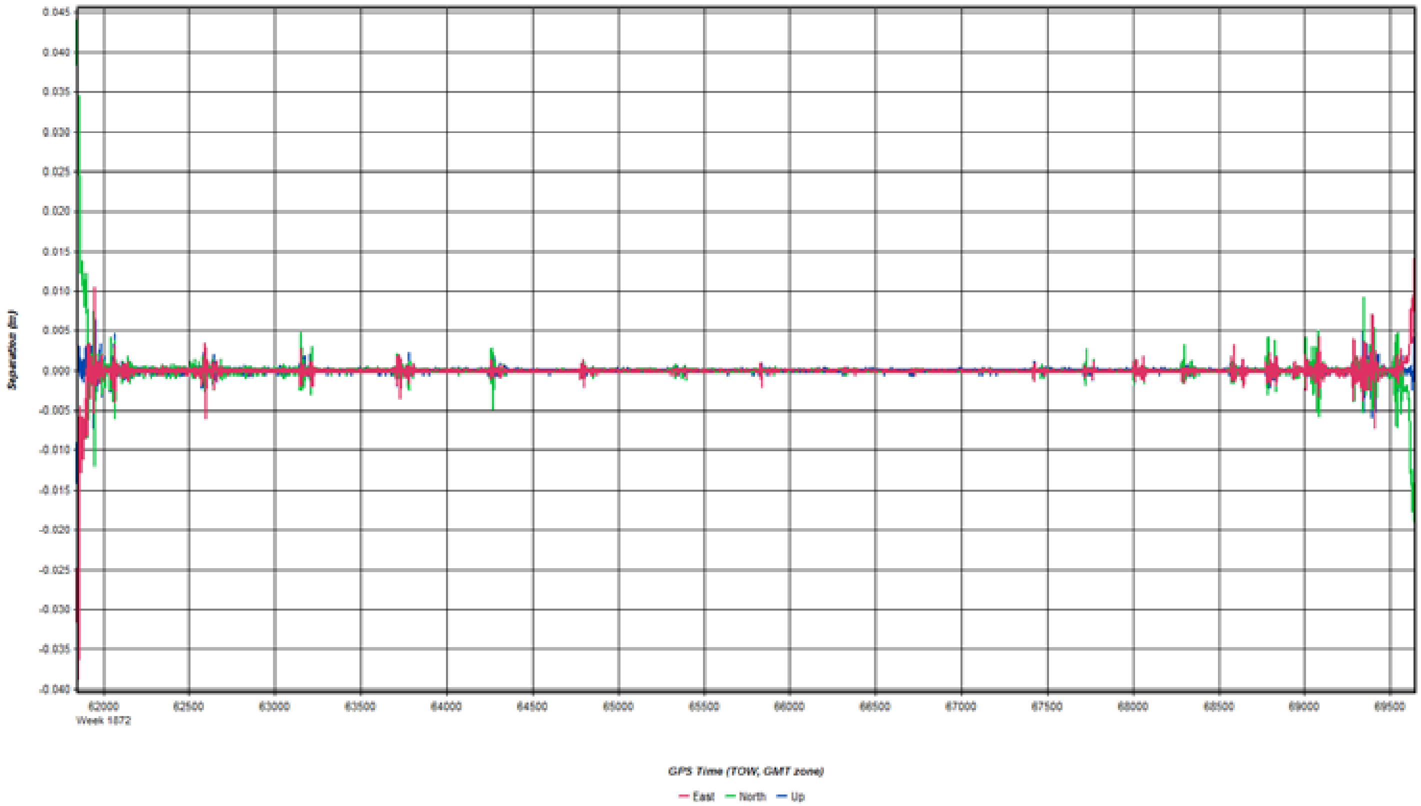
Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

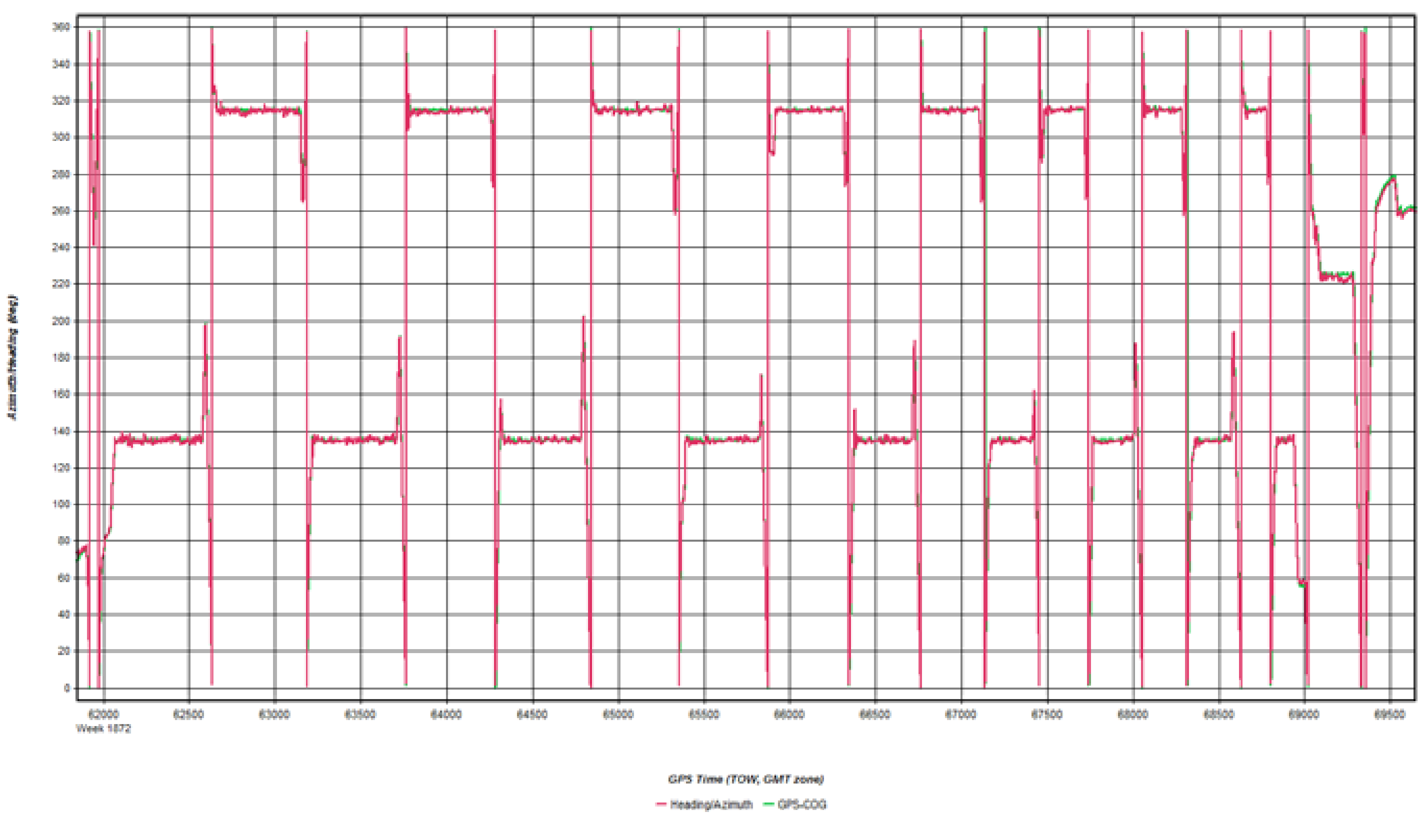
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
286	14.5	8898	215646			MSL
287	14.54	8806	214724			light turbulence, MSL
288	14.79	8734	213738			light turbulence, MSL
289	15.08	8701	212738			light turbulence, MSL
290	15.27	8642	211752			light turbulence, MSL
291	15.32	8567	210800			light turbulence, MSL
292	15.32	8498	205755			light turbulelnce, MSL
293	15.27	8429	204755			MSL, nw to se
294	14.8	8412	203805			MSL
295	14.55	8393	202835			MSL, CROSSLINE: 220724
296	14.47	8367	201612			MSL
297	14.3	8314	200633			MSL
298	14.29	8298	195713			MSL
299	14.29	8268	194742			nw to se, MSL
300	14.21	8255	193829			MSL
301	14.15	8242	192916			MSL
302	13.07	8229	192037			slight roll deviation at start se side, MSL
303	11.88	8216	191227			nw, to se, MSL
304	11.23	8206	185404	190250		refly (se to nw) due to strap going through slot in sensor
305	10.98	8189	184626			hybrid AGL
306	11.26	8173	183829			nw to se, hybrid AGL
307	11.39	8163	183048			hybrid AGL
308	14.18	8153	182104			hybrid AGL
309	14.28	8150	181142			hybid AGL
310	14.4	8147	180230			hybrid AGL
311	14.27	8143	175308			hybrid AGL
312	14.28	8137	174357			start nw to se, hybrid AGL

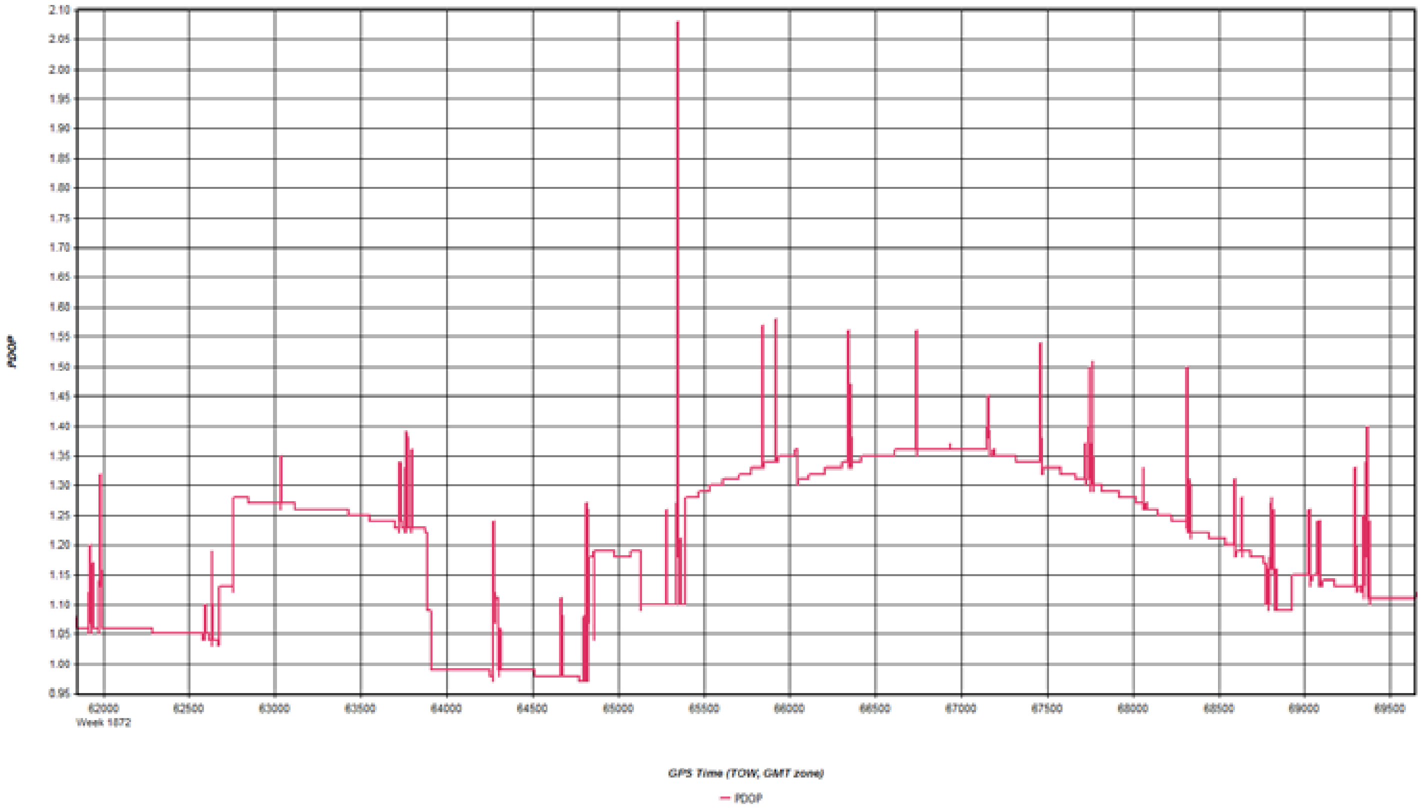
Nov 22, 2015-A

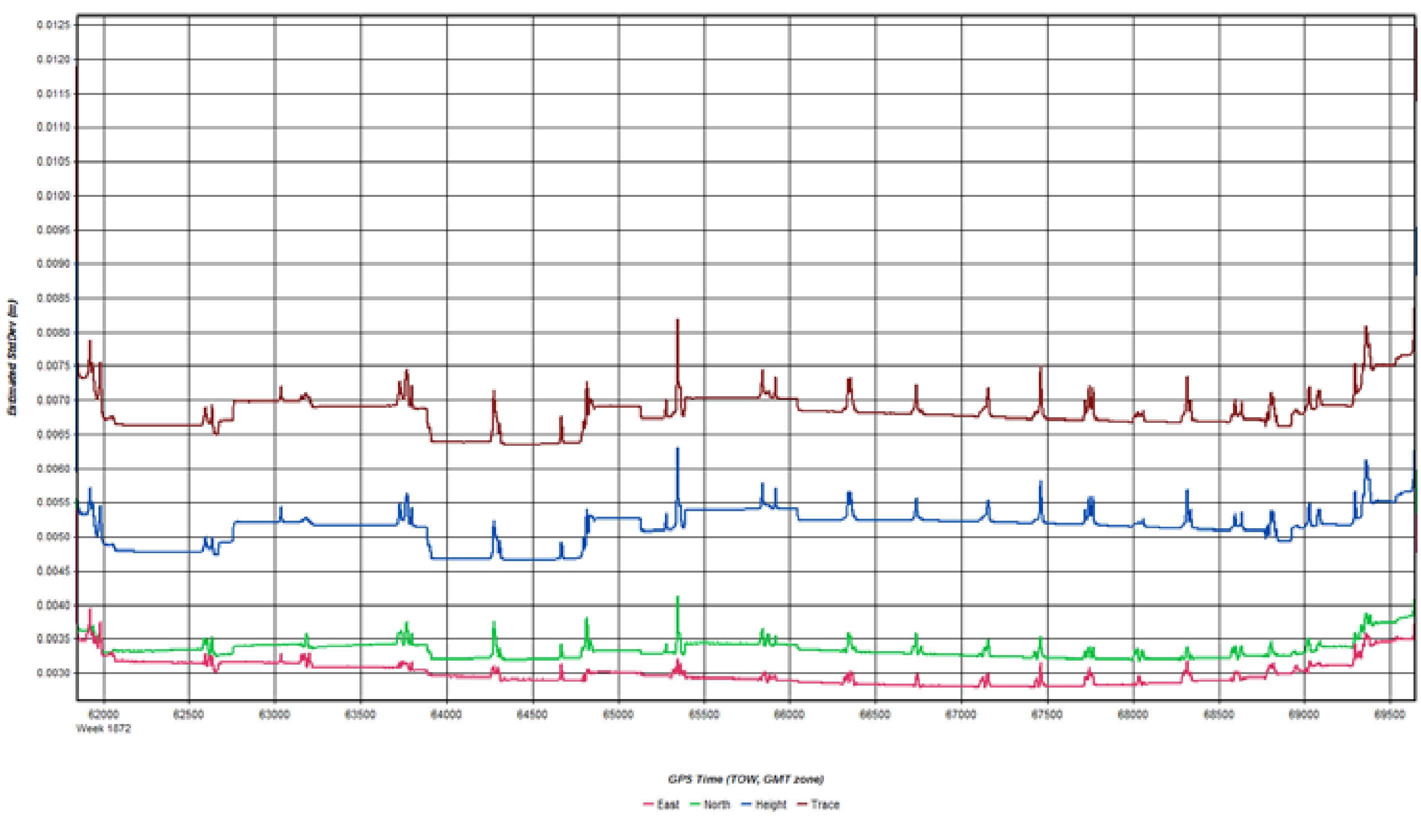


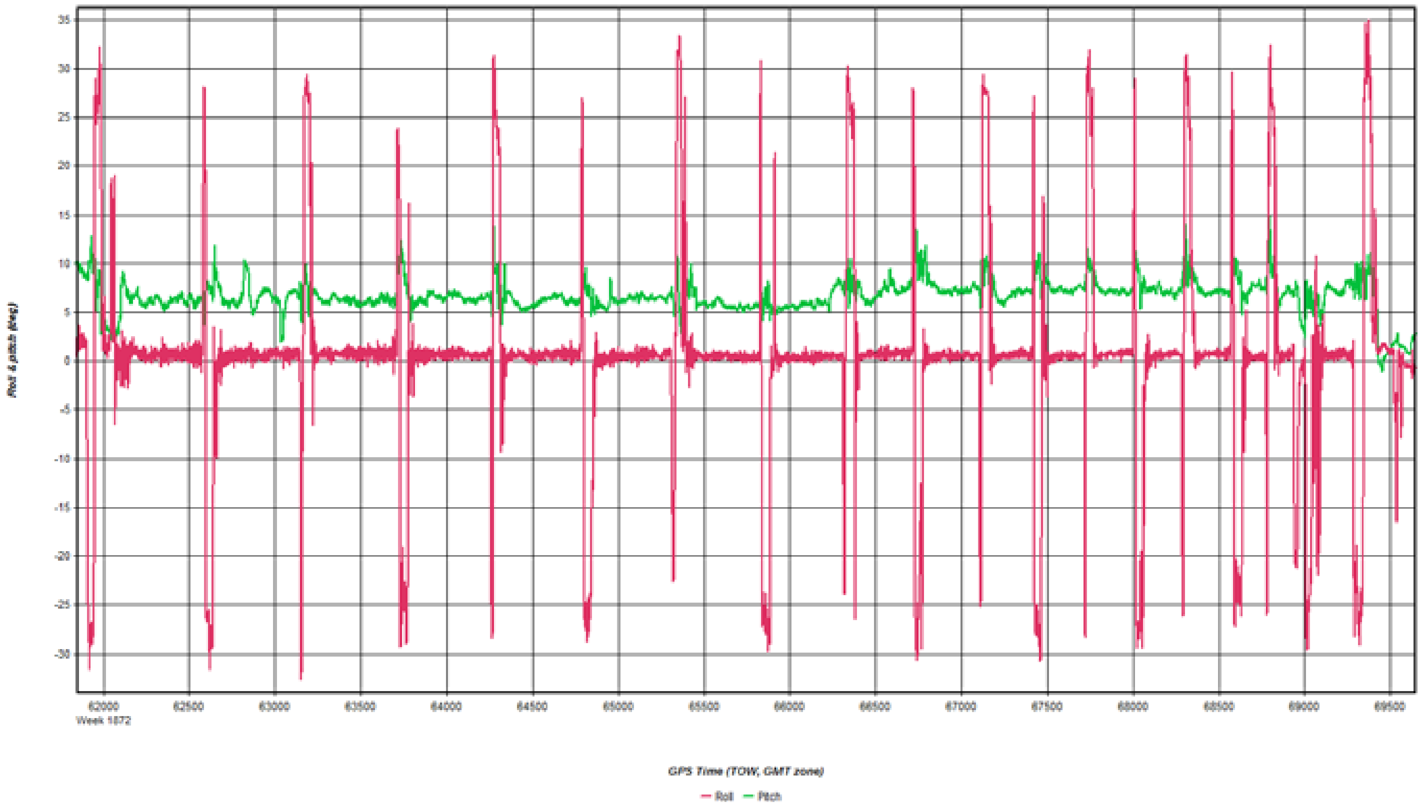

Num Sats
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
62000
Week 1872
62500
63000
63500
64000
64500
65000
65500
66000
66500
67000
67500
68000
68500
69000
69500
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou


Separation (m)
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
-0.005
-0.010
-0.015
-0.020
-0.025
-0.030
-0.035
-0.040
62000 62500 63000 63500 64000 64500 65000 65500 66000 66500 67000 67500 68000 68500 69000 69500
Week 1872
GPS Time (TOW, GMT zone)
East North Up

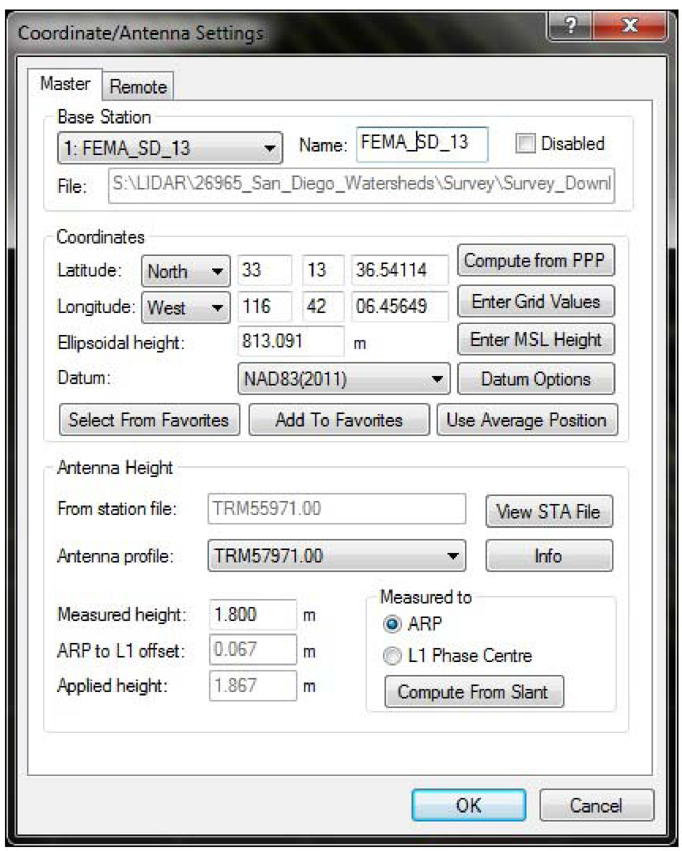

Azimuth/Heading (deg)
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
62000 62500 63000 63500 64000 64500 65000 65500 66000 66500 67000 67500 68000 68500 69000 69500
Week 1872
GPS Time (TOW, GMT zone)
Heading/Azimuth GPS-COG


2.10
2.05
2.00
1.95
1.90
1.85
1.80
1.75
1.70
1.65
1.60
1.55
1.50
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
PDOP
62000
Week 1872
62500
63000
63500
64000
64500
65000
65500
66000
66500
67000
67500
68000
68500
69000
69500
GPS Time (TOW, GMT zone)
PDOP


0.0125
0.0120
0.0115
0.0110
0.0105
0.0100
0.0095
0.0090
0.0085
0.0080
0.0075
0.0070
0.0065
0.0060
0.0055
0.0050
0.0045
0.0040
0.0035
0.0030
Estimated Std Dev (m)
62000
Week 1872
62500
63000
63500
64000
64500
65000
65500
66000
66500
67000
67500
68000
68500
69000
69500
GPS Time (TOW, GMT zone)
East
North
Height
Trace



Roll & pitch (deg)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
62000
Week 1872
62500
63000
63500
64000
64500
65000
65500
66000
66500
67000
67500
68000
68500
69000
69500
GPS Time (TOW, GMT zone)
Roll
Pitch



Coordinate/Antenna Settings
Master
Remote
Base Station
1: FEMA_SD_13
Name:
FEMA_SD_13
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
33
13
36.54114
Compute from PPP
Longitude:
West
116
42
06.45649
Enter Grid Values
Ellipsoidal height:
813.091
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.800
m
ARP to L1 offset:
0.067
m
Applied height:
1.867
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	40	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed 255	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	464	1700
Flying Alt. MSL Range (ft)	5601	10145
Swath Width Range (m)	338	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	2238
Total Line Time (hrs, no buffer)	21.3
Total Number of Lines	182
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	9.1
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	7
Total Acquisition Time (hrs)	37.5

Mission Flight Time Estimate	
Start Line Name	269
Stop Line Name	274
Turn Time (min)	2
Buffer (%)	0
Acquisition Time (hrs)	0.5

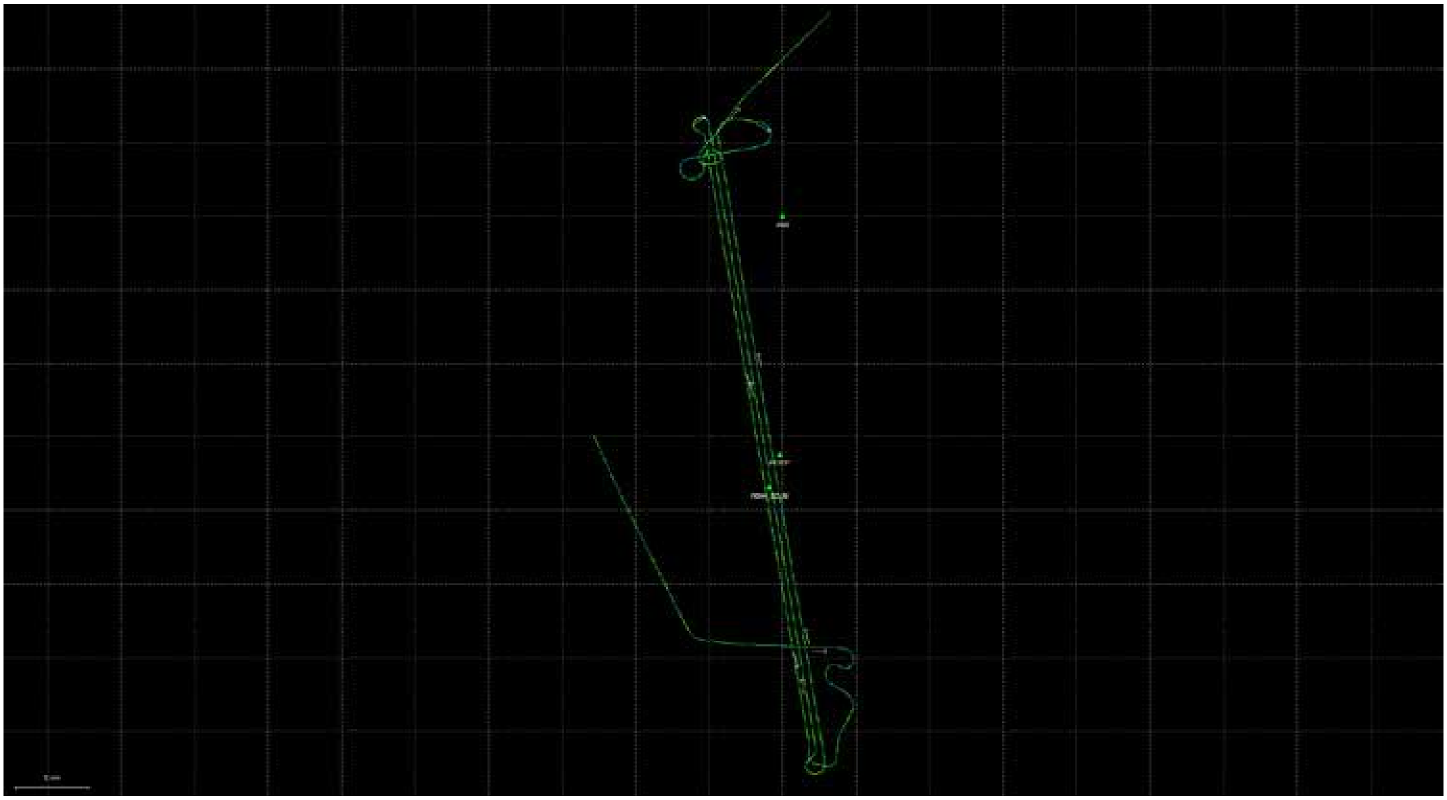
Other Acquisition Notes:

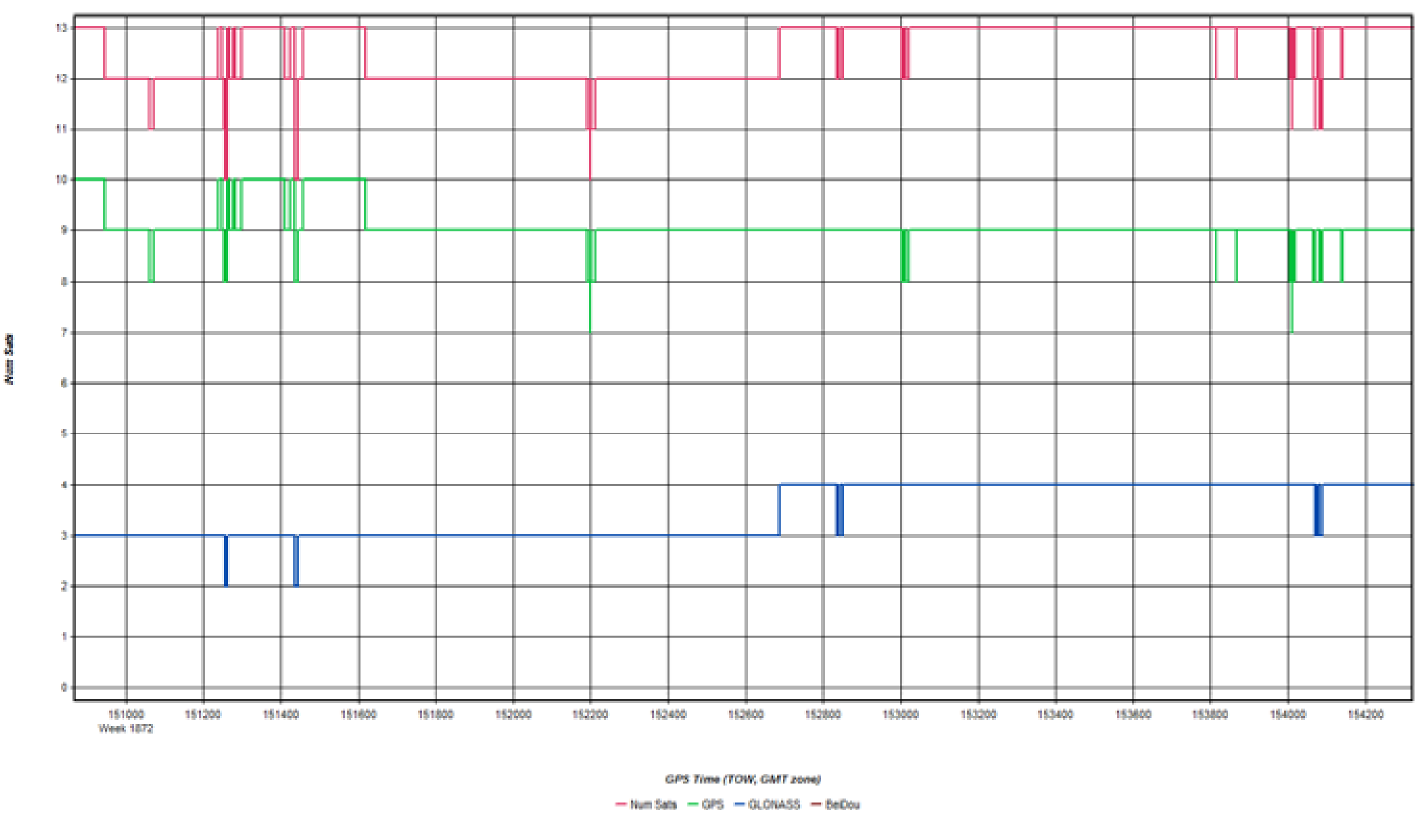
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

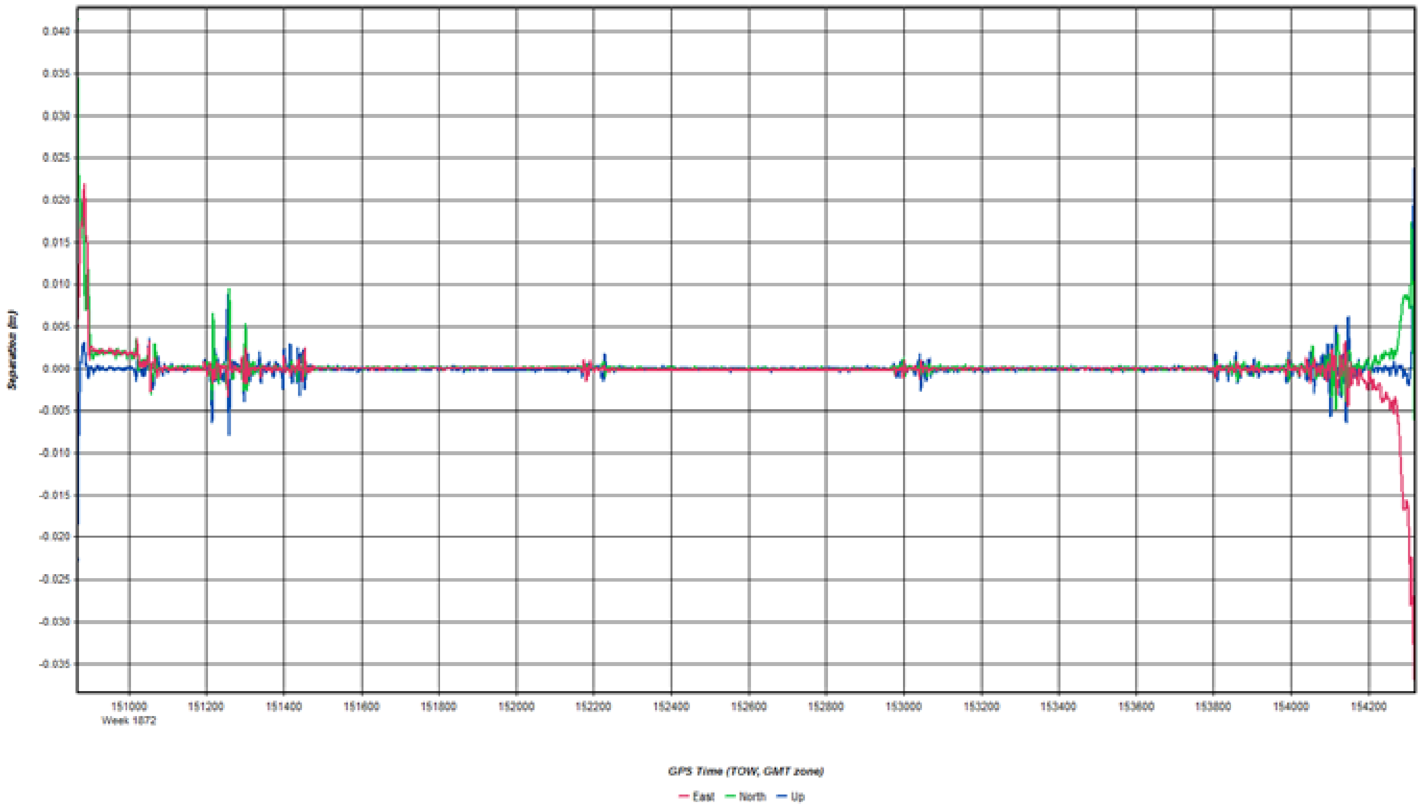
Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
269	2.34	9705	190714			end nw to se
270	2.54	10145	190425			
271	5.83	10119	185910			
272	5.88	10145	185425			
273	6.13	10066	184935			nw to se
274	6.31	10033	184447			
275	7.07	9895	183924			CROSSLINE:191122
276	9.03	9745	183310			
277	9.62	9672	182615			nw to se
278	11.87	9561	181828			
279	12.66	9476	180952			
280	12.87	9380	180103			
281	13.33	9292	175157			nw to se
282	13.63	9229	174301			
283	14.09	9111	173339			
284	14.18	9033	172416			hybrid AGL
285	14.31	8967	171439			Start nw to se

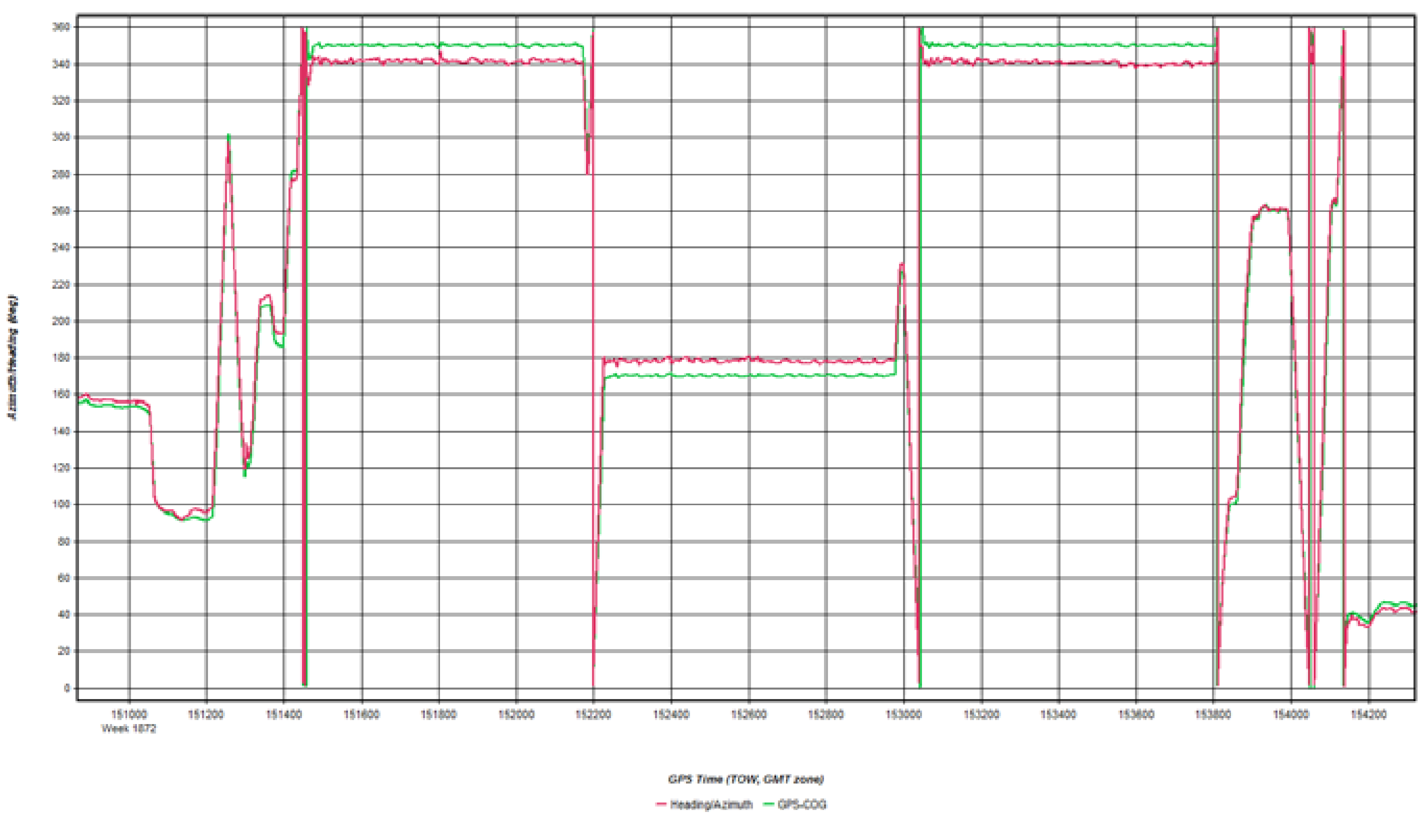
Nov 23, 2015-A

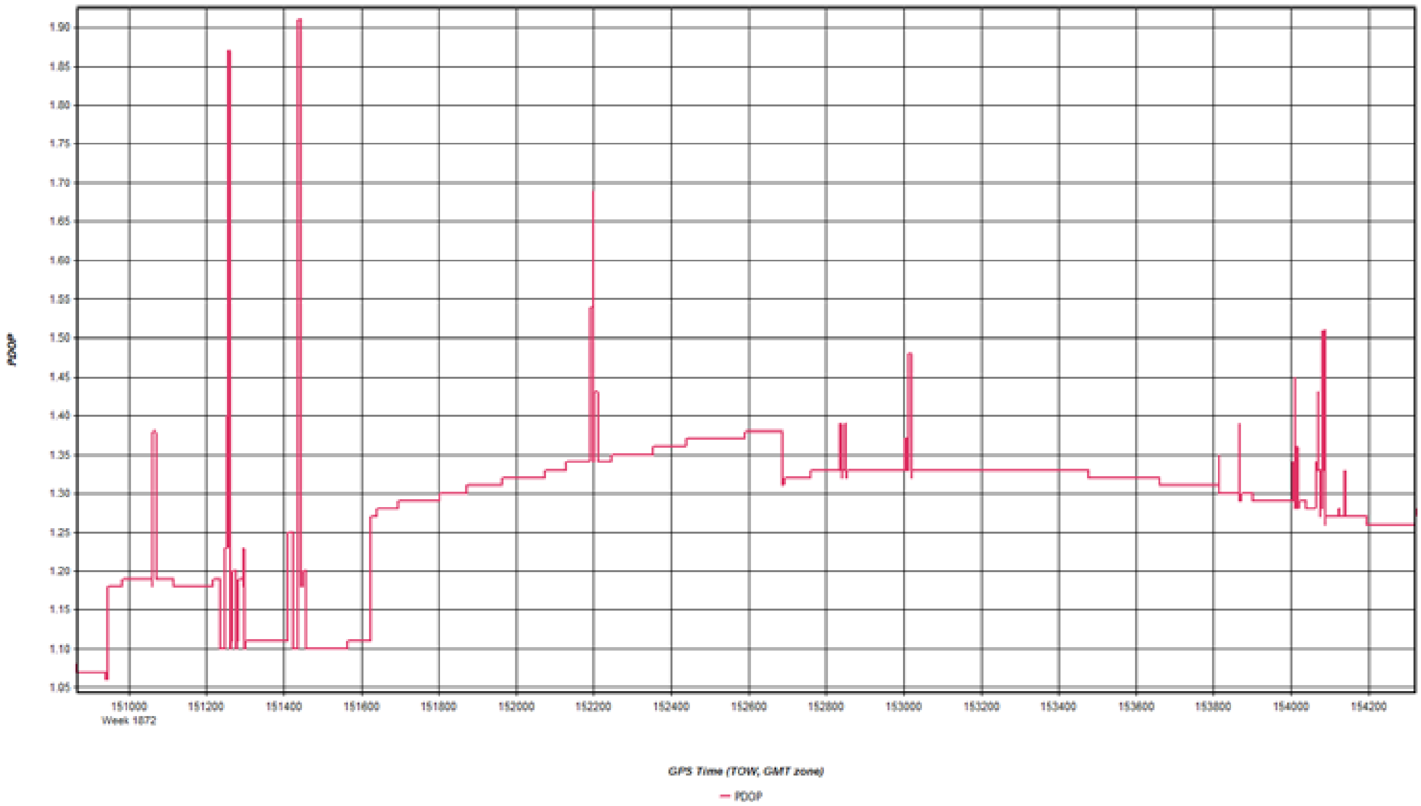


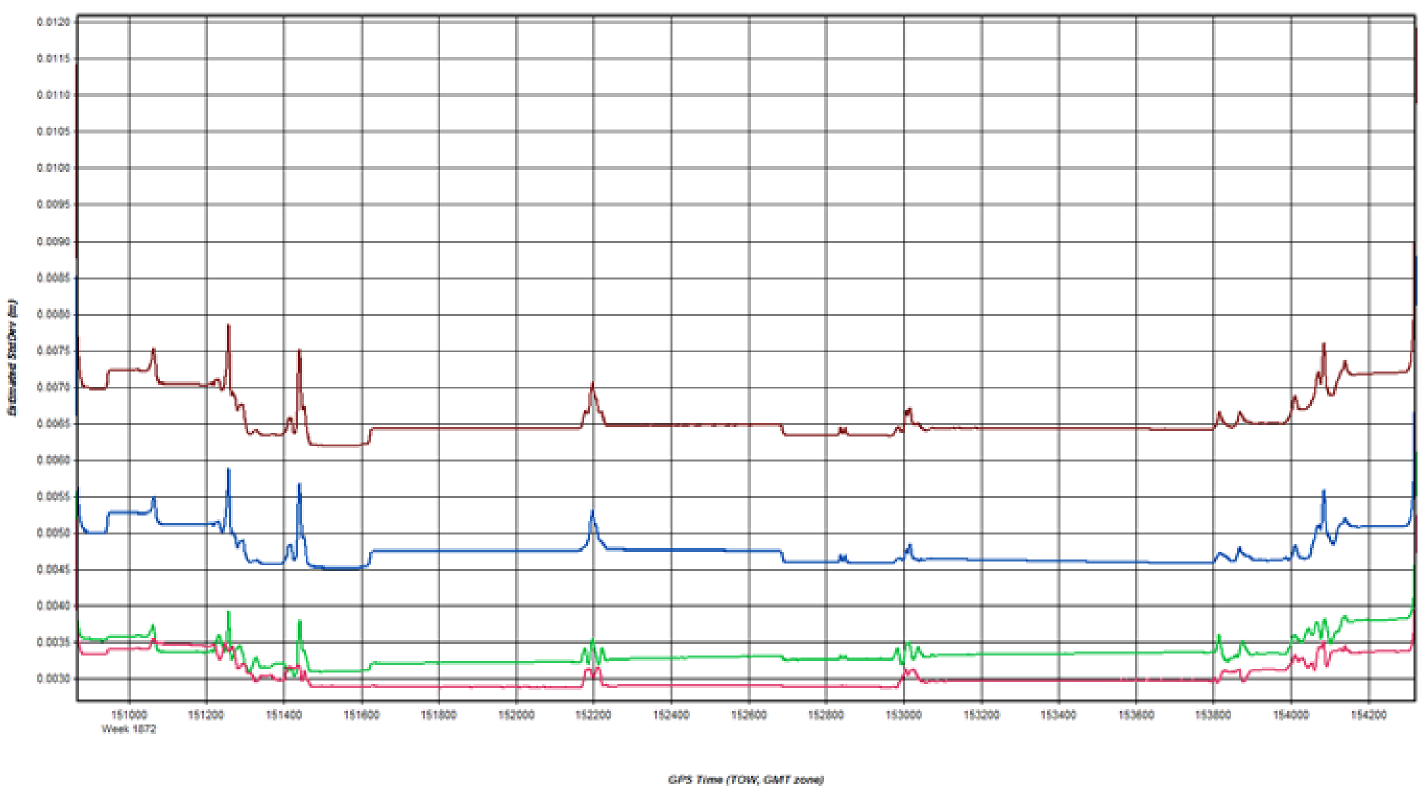


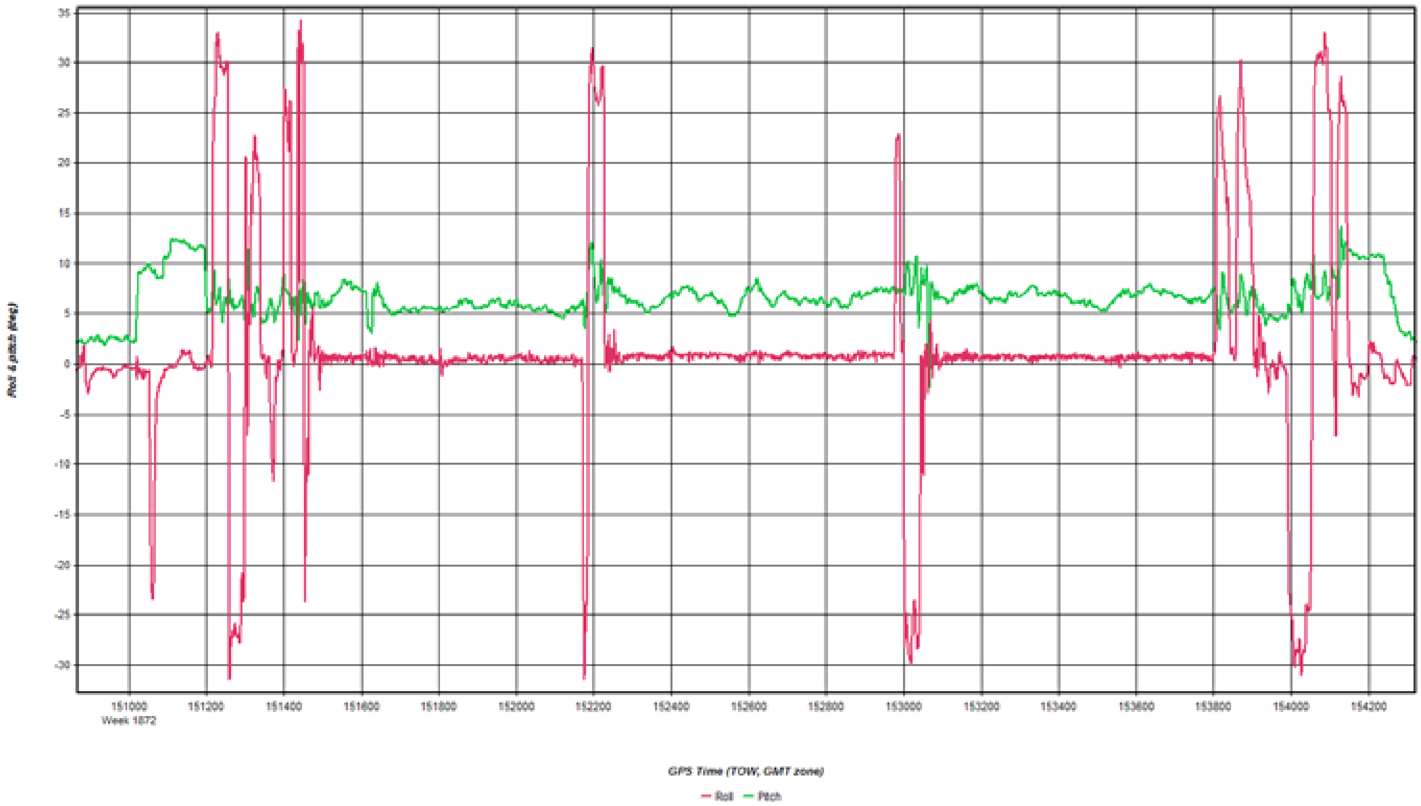
Num Sats
151000
Week 1872
151200
151400
151600
151800
152000
152200
152400
152600
152800
153000
153200
153400
153600
153800
154000
154200
GPS Time (TOW, GMT zone)
Num Sats
GPS
GLONASS
BeiDou

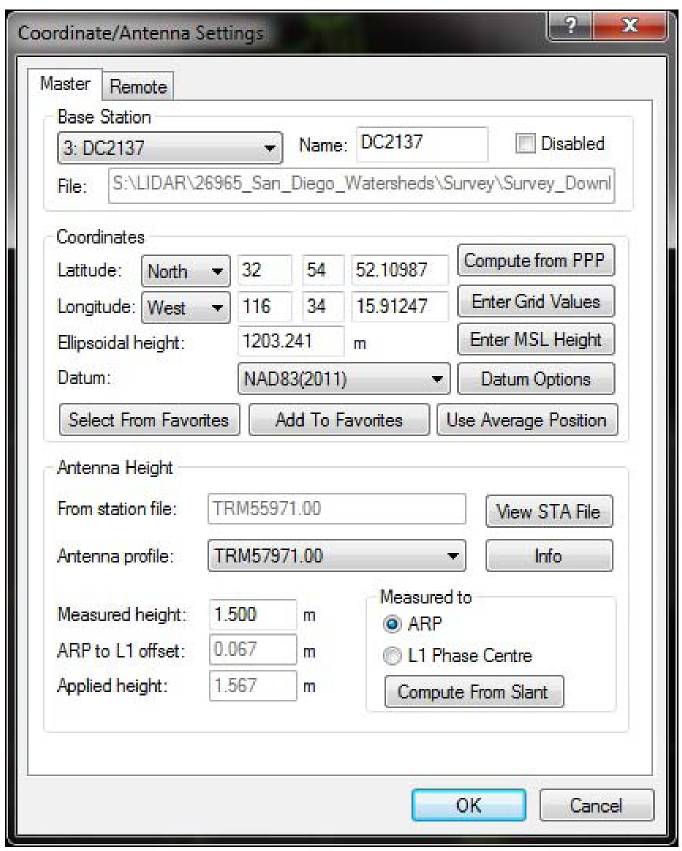

Separation (m)
GPS Time (TOW, GMT zone)
Week 1872
East
North
Up

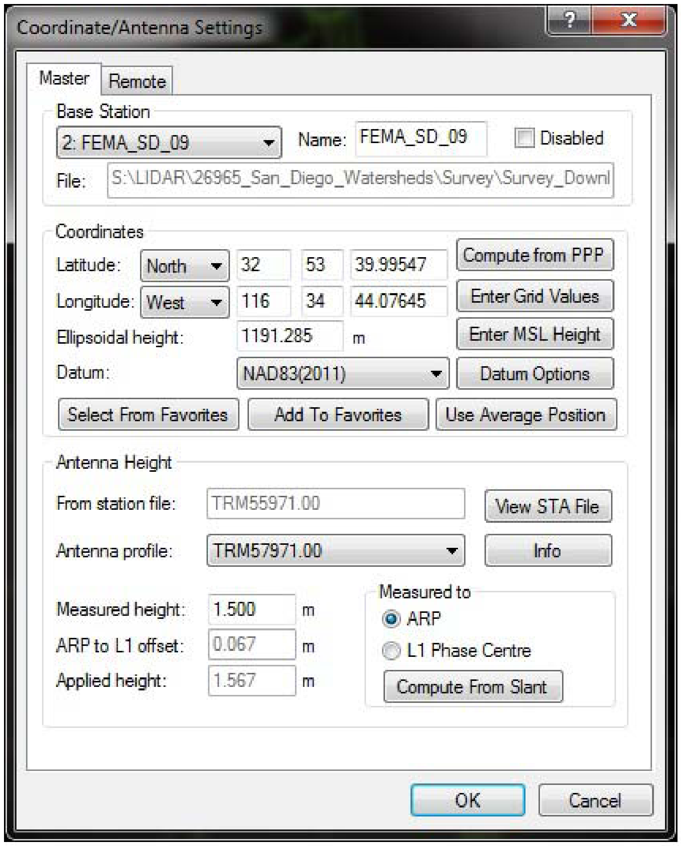

Azimuth/Heading (deg)
GPS Time (TOW, GMT zone)
Week 1872
Heading/Azimuth
GPS-COG

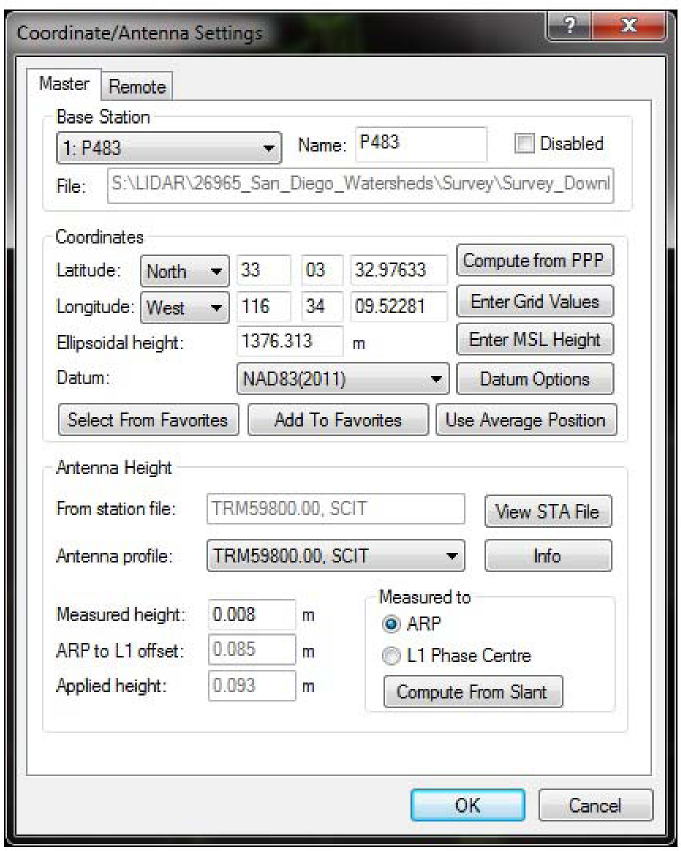

PDOP
1.90
1.85
1.80
1.75
1.70
1.65
1.60
1.55
1.50
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
151000
Week 1872
151200
151400
151600
151800
152000
152200
152400
152600
152800
153000
153200
153400
153600
153800
154000
154200
GPS Time (TOW, GMT zone)
PDOP


Estimated Std Dev (m)
0.0120
0.0115
0.0110
0.0105
0.0100
0.0095
0.0090
0.0085
0.0080
0.0075
0.0070
0.0065
0.0060
0.0055
0.0050
0.0045
0.0040
0.0035
0.0030
151000
Week 1872
151200
151400
151600
151800
152000
152200
152400
152600
152800
153000
153200
153400
153600
153800
154000
154200
GPS Time (TOW, GMT zone)
East
North
Height
Trace


Roll & pitch (deg)
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
151000
Week 1872
151200
151400
151600
151800
152000
152200
152400
152600
152800
153000
153200
153400
153600
153800
154000
154200
GPS Time (TOW, GMT zone)
Roll
Pitch


Coordinate/Antenna Settings
Master
Remote
Base Station
3: DC2137
Name:
DC2137
Disabled
File:
S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude:
North
32
54
52.10987
Compute from PPP
Longitude:
West
116
34
15.91247
Enter Grid Values
Ellipsoidal height:
1203.241
m
Enter MSL Height
Datum:
NAD83(2011)
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file:
TRM55971.00
View STA File
Antenna profile:
TRM57971.00
Info
Measured height:
1.500
m
ARP to L1 offset:
0.067
m
Applied height:
1.567
m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
2: FEMA_SD_09
Name: FEMA_SD_09
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 32 53 39.99547
Longitude: West 116 34 44.07645
Ellipsoidal height: 1191.285 m
Datum: NAD83(2011)
Compute from PPP
Enter Grid Values
Enter MSL Height
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM55971.00
View STA File
Antenna profile: TRM57971.00
Info
Measured height: 1.500 m
ARP to L1 offset: 0.067 m
Applied height: 1.567 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel


Coordinate/Antenna Settings
Master
Remote
Base Station
1: P483
Name: P483
Disabled
File: S:\LIDAR\26965_San_Diego_Watersheds\Survey\Survey_Downl
Coordinates
Latitude: North 33 03 32.97633
Longitude: West 116 34 09.52281
Ellipsoidal height: 1376.313 m
Datum: NAD83(2011)
Compute from PPP
Enter Grid Values
Enter MSL Height
Datum Options
Select From Favorites
Add To Favorites
Use Average Position
Antenna Height
From station file: TRM59800.00, SCIT
View STA File
Antenna profile: TRM59800.00, SCIT
Info
Measured height: 0.008 m
ARP to L1 offset: 0.085 m
Applied height: 0.093 m
Measured to
ARP
L1 Phase Centre
Compute From Slant
OK
Cancel

Flight Log

San Diego Watersheds South SN8146

QSI Project #	26965
Project Point Density (pts/m^2)	2ppms
Sensor Name	SN8146

Flight Plan Settings		
DEM Used for Planning	Yes	
Target Speed (kts)	105	
Max Bank Angle in Turns (°)	20	
Minimum Line Overlap (%)	38	
Pulses in Air Mode	SPiA	
Scan Pattern	Triangle	
Gain Up	0	
Gain Down	Fixed	
FOV (°)	40	
Scan Rate (Hz)	39.9	
Autoscan	On	
Laser Power (%)	100.00	
	Min.	Max
AGL Range (m)	665	1700
Flying Alt. MSL Range (ft)	5732	9692
Swath Width Range (m)	484	1237
Pulse Rate Range (Hz)	158000	158000

*Shading = Auto-calculated

Project Flight Time Estimate	
Total Line Length (nmi)	3797
Total Line Time (hrs, no buffer)	36.2
Total Number of Lines	218
Turn Time (min)	3
Total Turn Time (hrs, no buffer)	10.9
Buffer (%)	10
MOB Dist. Round Trip (nmi)	60
Number of MOBs	8
Total Acquisition Time (hrs)	56.3

Mission Flight Time Estimate	
Start Line Name	089
Stop Line Name	091
Turn Time (min)	2
Buffer (%)	0
Acquisition Time (hrs)	0.7

Other Acquisition Notes:

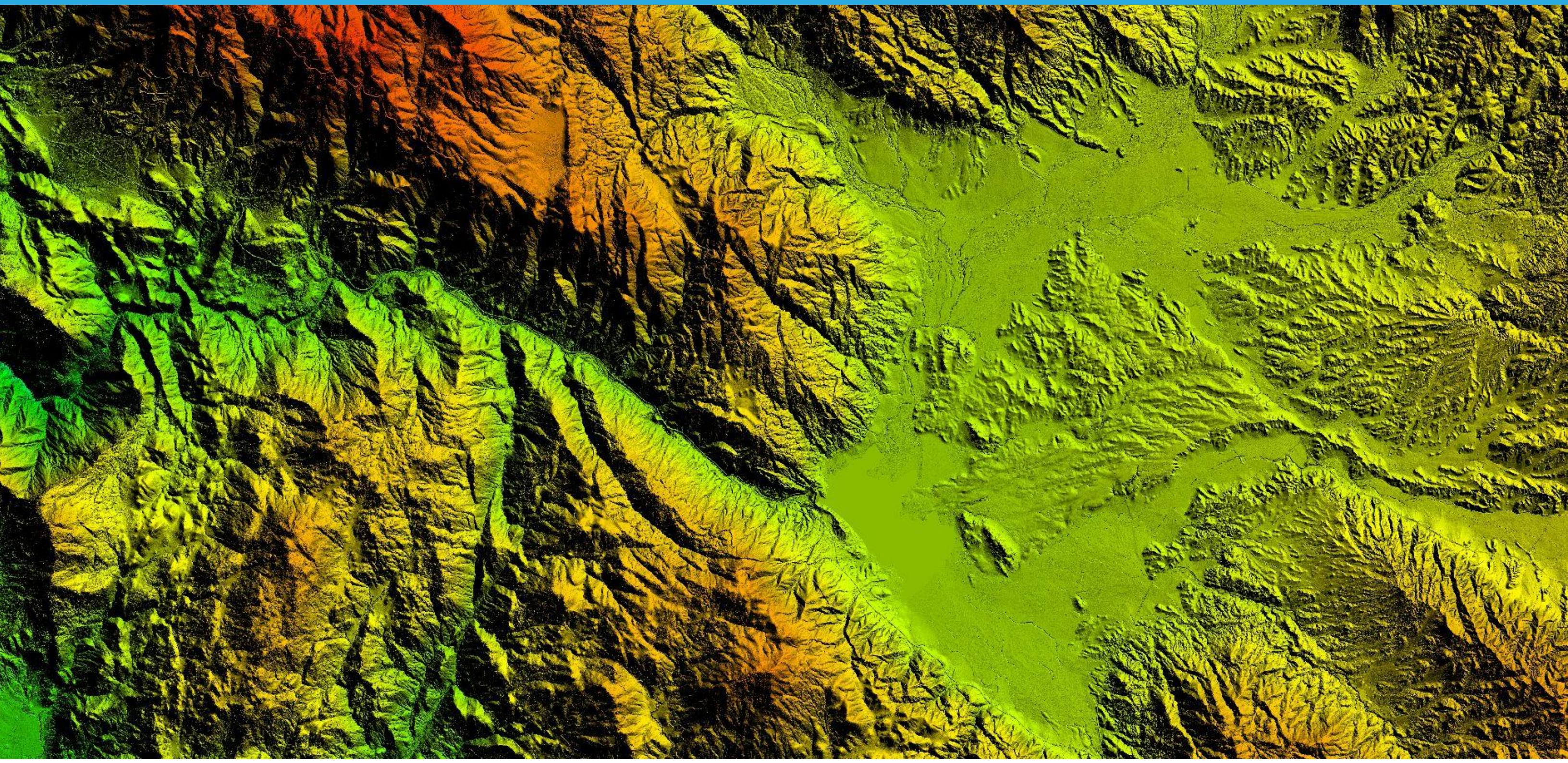
Lines should be flown at the altitude (in FEET above sea level) indicated on the flight sheet. Give this number to the pilot for each line and have him use the altimeter on his instrument panel. The plane's altimeter is adjusted for pressure. Please note that each line is at a different altitude.

Use the "Mission Flight Time Estimate" box to estimate how long a mission will take.

Line Name	Line Length [nmi]	Flying Alt. [ft MSL]	Time Stamp	Refly Time Stamp	Sats./PDOP	Notes (Direction, Atmos. Conditions, Speed, PR, Errors)
089	22.13	8773	180400			start s to n
090	22.11	8800	181714			
091	22.09	8800	183051			end s to n, CROSSLINE: 184501

October 11, 2016

FEMA STARR II San Diego LiDAR



Relative Accuracy Validation Workflow

QUANTUM SPATIAL, INC.
523 Wellington Way,
Suite 375
Lexington KY 40503

www.quantumspatial.com

Quantum Spatial was contracted by STARR II to collect QL2 LiDAR for FEMA Region 9 in San Diego County, California under FEMA Task Order HSFE09-15-J-0001. All data collected and processed by Quantum Spatial under this task order adhered to all applicable FEMA Standards, USGS LiDAR Base Specification v1.2 (2014), ASPRS LAS Specification Version 1.4-R13 (2013), and ASPRS Positional Accuracy Standards for Digital Geospatial Data v1.0 (2014). The information in this document is meant to represent the tools and processes used to achieve the relative accuracy requirements of those specifications.

Quantum Spatial uses two main tools during the calibration phase to check and validate the relative accuracy of adjoining LiDAR flightlines. These tools are built into the overall workflow to ensure that the accuracy is sufficient to meet the project requirements before moving forward with any classification or product development.

The first check is done using the terrascan reports generated after each set of corrections are made to the data. As you can see in the following 3 images, the final average error continues to decreases each set of corrections are applied to the data.

First set of corrections (Applied on a per mission bases):

```
Used loaded tie lines
Trajectories: P:\Projects\26965_FEMA_STARR_San_Diego\Lidar\TMatch\Trajectory\
Solution for line groups
Combined solution for all scanners

Starting avg 3d mismat 0.18713
Starting avg xy mismat 0.00000
Starting avg z mismatc 0.18713

Final avg 3d mismatch: 0.07550
Final avg xy mismatch: 0.00000
Final avg z mismatch:  0.07550

Execution time: 201.1 sec
Number of iterations: 46

Group          Z shift H shift R shift P shift    Scale
103015A_8146    +0.034 -0.0054 +0.0051 -0.0075 +0.00021
103115A_8146    -0.089 -0.0051 +0.0066 -0.0083 +0.00018
103115C_8146    +0.073 -0.0057 -0.0003 -0.0078 +0.00018
103115B_8146    -0.041 -0.0048 +0.0043 -0.0080 +0.00017


Number of usable observations
Group                Z Heading    Roll   Pitch   Scale
103015A_8146    929614  641567  881789  641567  929614
103115A_8146    430935  302877  394608  302877  430935
103115C_8146    122485   78302  112998   78302  122485
103115B_8146     64257   47191   58544   47191   64257
```

Second set of corrections (Applied on a per flightline basis):

```
Used loaded tie lines
Trajectories: P:\Projects\26965_FEMA_STARR_San_Diego\Lidar\TMatch\Trajectory\
Solution for individual strips
Combined solution for all scanners

Starting avg 3d mismat 0.07309
Starting avg xy mismat 0.00000
Starting avg z mismatc 0.07309

Final avg 3d mismatch: 0.05494
Final avg xy mismatch: 0.00000
Final avg z mismatch:  0.05494

Execution time: 523.4 sec
Number of iterations: 101
```

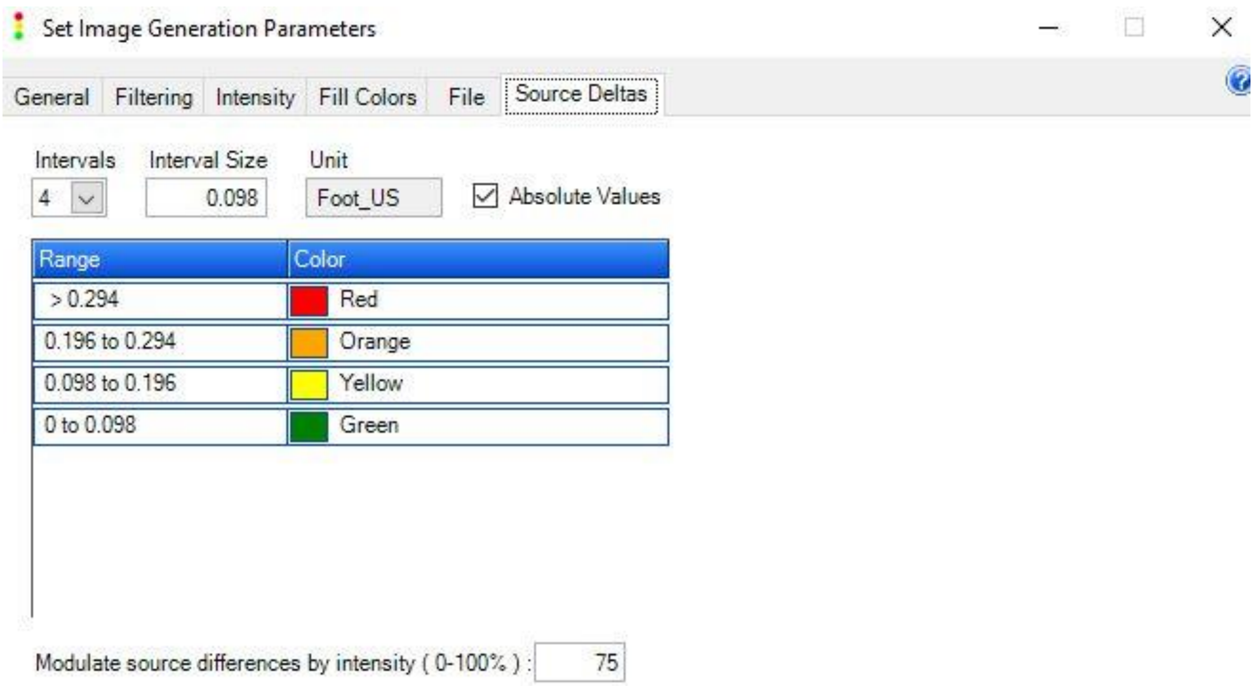
Flightline	E shift	N shift	Z shift	H shift	R shift	P shift	Scale
100	-0.117	+0.034	+0.006	-0.0025	+0.0014	+0.0015	-0.00006
101	+0.067	-0.013	-0.019	-0.0011	-0.0026	-0.0004	-0.00003
102	-0.036	-0.089	-0.031	+0.0011	+0.0032	+0.0014	-0.00002
103	+0.044	+0.046	+0.001	-0.0009	-0.0023	-0.0009	+0.00002
104	-0.057	+0.115	+0.050	+0.0006	+0.0016	+0.0011	+0.00005
106	+0.055	+0.149	-0.018	-0.0019	-0.0002	-0.0009	-0.00005
107	+0.003	+0.054	-0.002	+0.0003	+0.0019	+0.0006	-0.00003
108	+0.034	+0.076	-0.034	-0.0013	-0.0013	-0.0015	-0.00002
109	-0.050	+0.027	+0.023	+0.0026	+0.0018	+0.0008	+0.00000
111	+0.037	+0.249	-0.109	-0.0011	+0.0035	+0.0017	-0.00005
112	-0.020	+0.030	-0.033	-0.0026	+0.0017	+0.0015	-0.00004
113	-0.019	+0.001	-0.031	-0.0002	-0.0018	+0.0007	-0.00003
114	+0.020	-0.045	+0.008	+0.0009	+0.0037	+0.0007	+0.00002
115	+0.016	+0.039	-0.010	-0.0008	-0.0026	+0.0002	+0.00001
116	+0.012	+0.055	-0.039	+0.0011	+0.0007	+0.0017	+0.00003
117	+0.014	+0.031	-0.015	-0.0008	-0.0023	+0.0007	-0.00000
118	-0.039	-0.049	+0.008	+0.0023	+0.0015	+0.0018	-0.00001
119	+0.020	-0.003	-0.034	+0.0004	-0.0030	+0.0002	+0.00001

Third and final set of corrections (Applied on a per flightline basis):

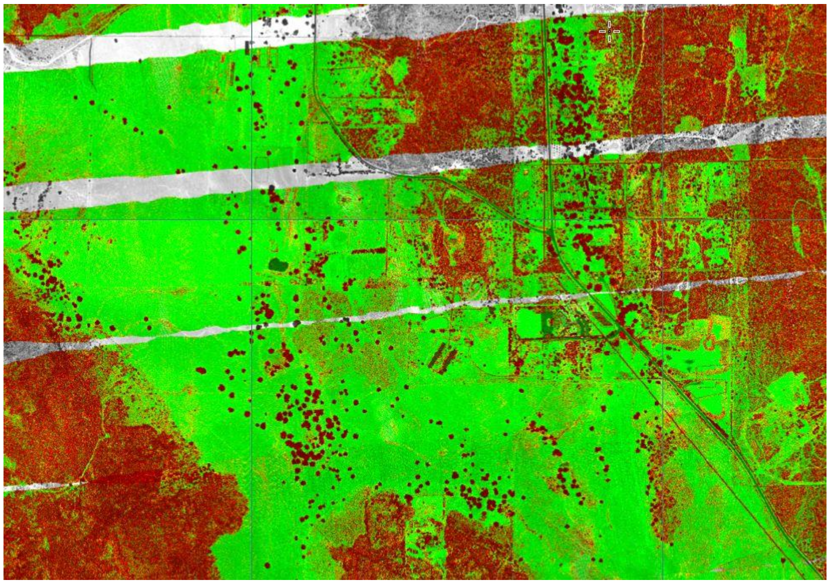
```
Used loaded tie lines
Trajectories: P:\Projects\26965_FEMA_STARR_San_Diego\Lidar\TMatch\Trajectory\
Solve xy: No
Solve z: Yes
Solve h: No
Solve r: No
Solve p: No

Starting avg 3d mismat  0.0548
Final avg 3d mismatch:  0.0481

Execution time: 356.7 sec
Number of iterations: 20
```

These values are all expressed in US Ft. So the starting error was 0.18713ft or 5.7cm. After all corrections are made the final error was 0.0481ft or 1.4cm. It is important to note that these measurements are made from the tielines used to identify errors that need to be corrected for. In order to validate the relative accuracy of the entire dataset Quantum Spatial uses DZ orthos to visualize the offset between flightlines.

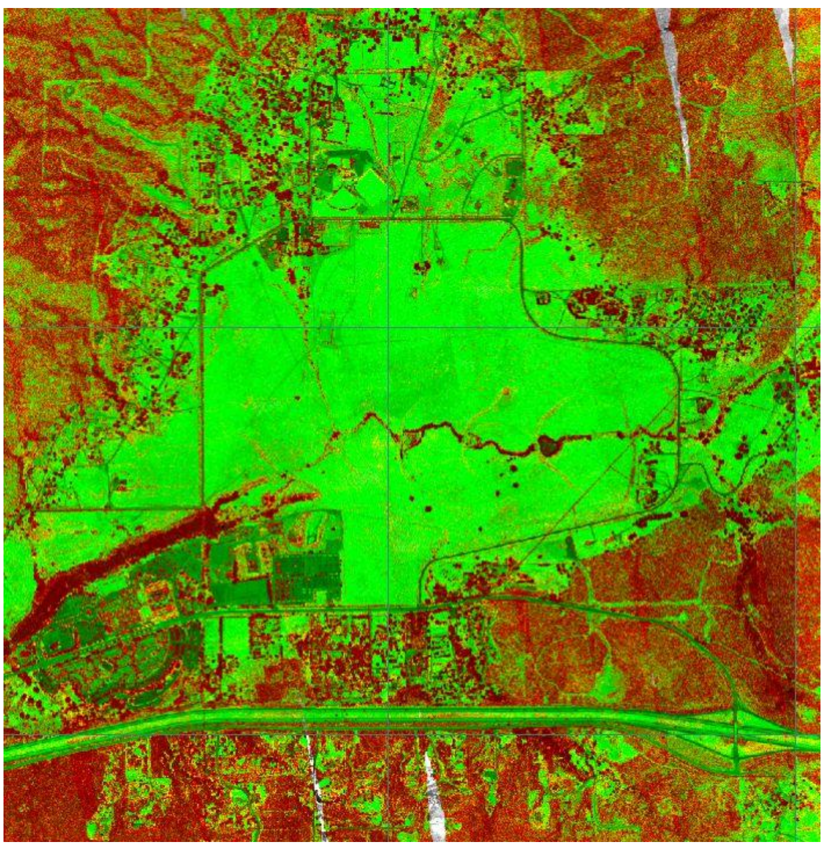
Dz Orthos provide us with a quick visual representation of flightline offset by taking standard intensity images and using parameters set by the analyst to color the difference in flightline by the magnitude of offset that exists. For a QL2 LiDAR project with working units in US Feet the color intervals are set as such:

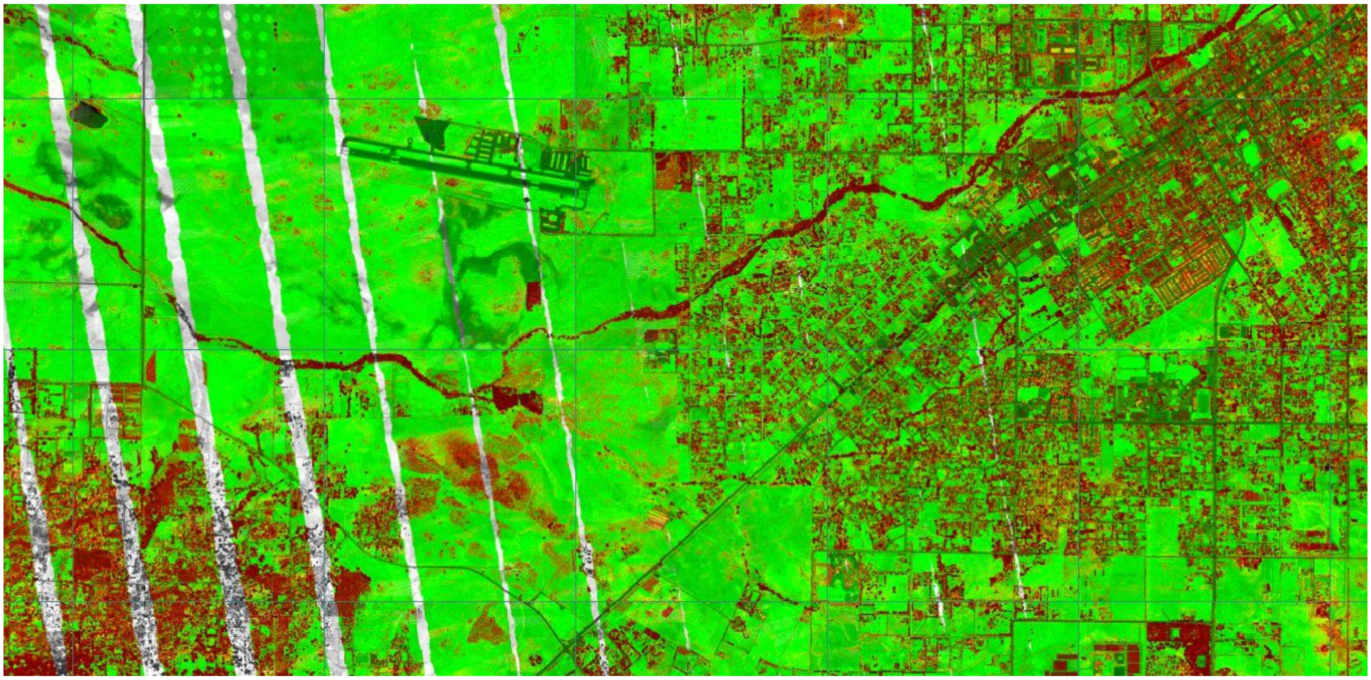


Creating the DZ Orthos with these color ranges allows us to quickly see any areas that would not meet the USGS LiDAR Base Specifications v1.2 swath overlap difference requirements for QL2 data of ≤8cm, because the areas would be colored in red.



In this image the areas of overlap are all within the spec for swath overlap relative accuracy. The areas of red are vegetation points. This testing is done against the full unclassified point cloud. Below are 2 more examples.





These tools allow Quantum Spatial to validate the relative accuracy of the dataset prior to moving forward with data classification and product generation.