

San Joaquin WU300026 LIDAR PROCESSING REPORT

Project ID: 217611
Work Unit: WU300026

Prepared for:



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Prepared by:

N|V|5 GEOSPATIAL

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1. Summary / Scope

1.1. Summary

This report contains a summary of the San Joaquin, Work Unit 300026 lidar acquisition task order, issued by USGS under their Cooperative Agreement number: G21AC10232-00. The work unit yielded a project area covering 2,133 square miles over California. This project was done at Quality Level 1. 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
10 pts / m2	1600 m	40°	30%	≤ 10 cm

1.3. Coverage

The work unit yielded a project area covering 2,133 square miles over California. Work Unit extents are shown in Figure 1.

1.4. Duration

Lidar data was acquired from March 2, 2021 to April 4, 2021 in 12 total lifts. See “Section: 2.4. Time Period” for more details.

1.5. Issues

There were no issues to report.

<p align="center">San Joaquin WU300026 Work Unit WU300026 Projected Coordinate System: State Plane California IV Horizontal Datum: NAD83 (2011) Vertical Datum: NAVD88 (GEOID 18) Units: US Survey Feet</p>	
Lidar Point Cloud	Classified Point Cloud in .LAS 1.4 format
Rasters	<ul style="list-style-type: none"> • 1-foot Hydro-flattened Bare Earth Digital Elevation Model (DEM) in GeoTIFF format • 1-foot Intensity images in GeoTIFF format • 2-foot Maximum Surface Height Raster in GeoTIFF format • 2-foot Swath Separation Images in GeoTIFF format
Vectors	Shapefiles (*.shp) <ul style="list-style-type: none"> • Project Boundary • Lidar Tile Index • Calibration and QC Checkpoints (NVA/VVA) • Flightline Swaths Geodatabase (*.gdb) • Continuous Hydro-flattened Breaklines
Reports	Reports in PDF format <ul style="list-style-type: none"> • Focus on Delivery • Focus on Accuracy • Survey Report • Work Unit Reports • Processing Report
Metadata	XML Files (*.xml) <ul style="list-style-type: none"> • Breaklines • Classified Point Cloud • DEM • MSHR • Intensity Imagery

San Joaquin WU300026 Work Unit WU300026 Boundary

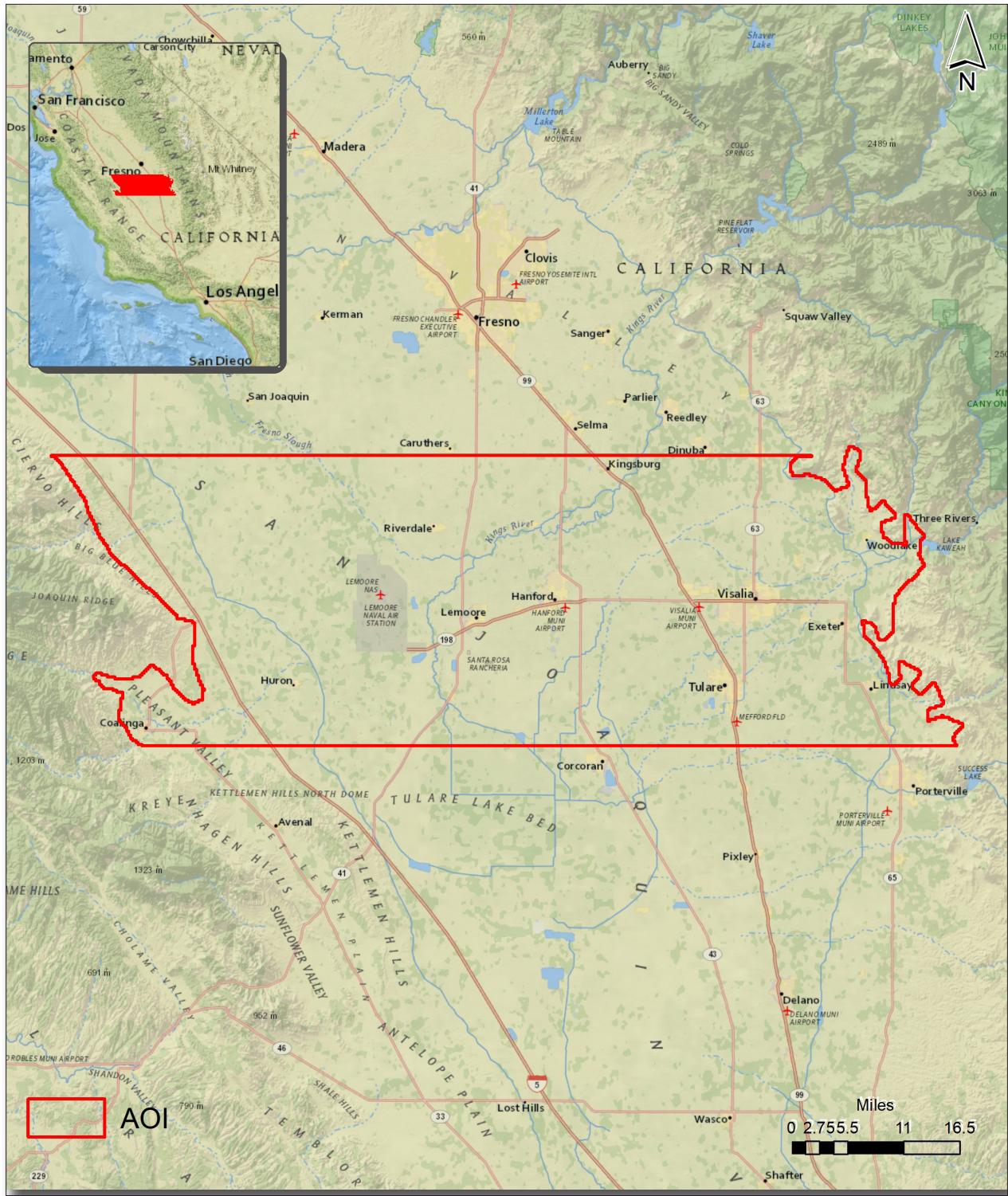


Figure 1. Work Unit Boundary

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.

Detailed project flight planning calculations were performed for the project by Towell Inc. using planning software.

2.2. Lidar Sensor

Towell Inc. utilized Optech Galaxy Prime lidar sensors (Figure 2), serial number(s) 5060411, for data acquisition.

This systems is capable of collecting data at a maximum frequency of 550 kHz. These systems utilize a Multi-Pulse in the Air option (MPIA). These sensors are also equipped with the ability to measure up to 8 returns per outgoing pulse

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

Table 2. Lidar System Specifications

		Optech Galaxy Prime
Terrain and Aircraft Scanner	Flying Height	1600 m
	Recommended Ground Speed	125 kts
Scanner	Field of View	40°
	Scan Rate Setting Used	100 Hz
Laser	Laser Pulse Rate Used	1000 kHz
Coverage	Full Swath Width	1165 m
	Line Spacing	815.29 m
Point Spacing and Density	Average Point Spacing	0.3 m
	Average Point Density	13.35 pts / m ²

Figure 2. Optech Galaxy Lidar Sensor



2.3. Aircraft

All flights for the project were accomplished through the use of customized aircraft. Plane type and tail numbers are listed below.

Lidar Collection Planes

- Aspen Partenavia P-68, Tail Numbers: 300LF, N68VA

These aircraft provided an ideal, stable aerial base for lidar acquisition. These aerial platforms have relatively fast cruise speeds, which are beneficial for project mobilization / demobilization while maintaining relatively slow stall speeds, proving ideal for collection of high-density, consistent data posting using a state-of-the-art Optech lidar system.

2.4. Time Period

Work Unit specific flights were conducted between March 2, 2021 to April 4, 2021. Twelve aircraft lifts were completed. Accomplished lifts are listed below.

Lift
3/22/2021
3/24/2021
3/25/2021
3/26/2021
3/27/2021
3/28/2021
3/29/2021
3/30/2021
3/31/2021
4/1/2021
4/3/2021
4/4/2021

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

Applanix + POSPac 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. Applanix POSPac 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 Applanix POSPac 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.

Point clouds were created using the Optech LMS software. The generated point cloud is the mathematical three dimensional composite of all returns from all laser pulses as determined from the aerial mission. The point cloud is imported into GeoCue distributive processing software. Imported data is tiled and then calibrated using TerraMatch and proprietary software. Using TerraScan, the vertical accuracy of the surveyed ground control is tested and any bias is removed from the data. TerraScan and TerraModeler software packages are then used for automated data classification and manual cleanup. The data are manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler.

DEMs and Intensity Images are then generated using proprietary software. In the bare earth surface model, above-ground features are excluded from the data set. Global Mapper is used as a final check of the bare earth dataset.

Finally, proprietary software is used to perform statistical analysis of the LAS files.

Software	Version
Optech LMS	4.4
Applanix + POSPac	8.6
GeoCue	2020.1.22.1
Global Mapper	19.1;20.1
TerraModeler	21.008
TerraScan	21.016
TerraMatch	21.007
StripAlign	2.21

3.3. LAS Classification Scheme

The classification classes are determined by Lidar Base Specifications 2020 Rev. A 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:

Table 3. LAS Classifications

	Classification Name	Description
1	Processed, but Unclassified	Laser returns that are not included in the ground class, or any other project classification
2	Bare earth	Laser returns that are determined to be ground using automated and manual cleaning algorithms
7	Low Noise	Laser returns that are often associated with scattering from reflective surfaces, or artificial points below the ground surface
8	Model Key Points	Educated thinned dataset of the Class 2 ground class used to create the contours
9	Water	Laser returns that are found inside of hydro features
17	Bridge Deck	Laser returns falling on bridge decks
18	High Noise	Laser returns that are often associated with birds or artificial points above the ground surface
20	Ignored Ground	Ground points that fall within the given threshold of a collected hydro feature.

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 proprietary tools. A buffer of 1.5 feet was also used around each hydro flattened feature to classify these ground (ASPRS Class 2) points to Ignored ground (ASPRS Class 20). 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.

Any noise that was identified either through manual review or automated routines was classified to the appropriate class (ASPRS Class 7 and/or ASPRS Class 18) followed by flagging with the withheld bit.

All data was manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler. Global Mapper is used as a final check of the bare earth dataset. GeoCue was then used to create the deliverable industry-standard LAS files for all point cloud data. NV5 Geospatial's 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 Processing

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 streams and rivers using NV5 Geospatial's 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 1.5 feet was also used around each hydro-flattened feature. These points were moved from ground (ASPRS Class 2) to Ignored Ground (ASPRS Class 20).

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

Breaklines are reviewed against lidar intensity imagery to verify completeness of capture. All breaklines are then compared to TINs (triangular irregular networks) created from ground only points prior to water classification. The horizontal placement of breaklines is compared to terrain features and the breakline elevations are compared to lidar elevations to ensure all breaklines match the lidar within acceptable tolerances. Some deviation is expected between breakline and lidar elevations due to monotonicity, connectivity, and flattening rules that are enforced on the breaklines. Once completeness, horizontal placement, and vertical variance is reviewed, all breaklines are reviewed for topological consistency and data integrity using a combination of Esri Data Reviewer tools and proprietary tools.

3.6. Hydro-Flattened Raster DEM Processing

Hydro-Flattened DEMs (topographic) represent a lidar-derived product illustrating the grounded terrain and associated breaklines (as described above) in raster form. NV5 Geospatial’s proprietary software was used to take all input sources (bare earth lidar points, bridge and hydro breaklines, etc.) and create a Triangulated Irregular Network (TIN) on a tile-by-tile basis. Data extending past the tile edge is incorporated in this process so that proper triangulation can occur. From the TIN, linear interpolation is used to calculate the cell values for the raster product. The raster product is then clipped back to the tile edge so that no overlapping cells remain across the project area. A 32-bit floating point GeoTIFF DEM was generated for each tile with a pixel size of value-units. NV5 Geospatial’s proprietary software was used to write appropriate horizontal and vertical projection information as well as applicable header values into the file during product generation. Each DEM is reviewed in Global Mapper to check for any surface anomalies and to ensure a seamless dataset. NV5 Geospatial ensures there are no void or no-data values (-999999) in each derived DEM. This is achieved by using propriety software checking all cell values that fall within the project boundary. NV5 Geospatial uses a proprietary tool called FOCUS on Delivery to check all formatting requirements of the DEMs against what is required before final delivery.

3.7. Swath Separation Raster Processing

Swath Separation Images are rasters that represent the interswath alignment between flight lines and provide a qualitative evaluation of the positional quality of the point cloud. NV5 Geospatial proprietary software generated 1-foot raster images in GeoTIFF format using last returns, excluding points flagged with the withheld bit, and using a point-in-cell algorithm. Images are generated with a 75% intensity opacity and (4) absolute 8-cm intervals, see below for interval coloring. Intensity images are linearly scaled to a value range specific to the project area to standardize the images and reduce differences between individual tiles. Appropriate horizontal projection information as well as applicable header values are written to the file during product generation. NV5 Geospatial uses a proprietary tool called FOCUS on Delivery to check all formatting requirements of the images against what is required before final delivery.

	0-8cm
	8-16cm
	16-24cm
	>24cm

3.8. Top of Canopy DSM Processing

First-return highest hit lidar points from the vegetation class were used to create a 1 foot raster DSM. Using automated scripting routines within proprietary software, TIF files were created for each tile. Each surface is reviewed using Global Mapper to check for any surface anomalies or incorrect elevations found within the surface.

3.9. Raster DSM Processing

A normalized digital surface model was created by removing the DEM surface from the DSM surface. This allows for the visualization of all features (cars, trees, buildings, etc.) that are above the ground level. Each surface is reviewed using Global Mapper to check for any surface anomalies or incorrect elevations found within the surface.

San Joaquin WU300026 Work Unit WU300026 Tile Layout

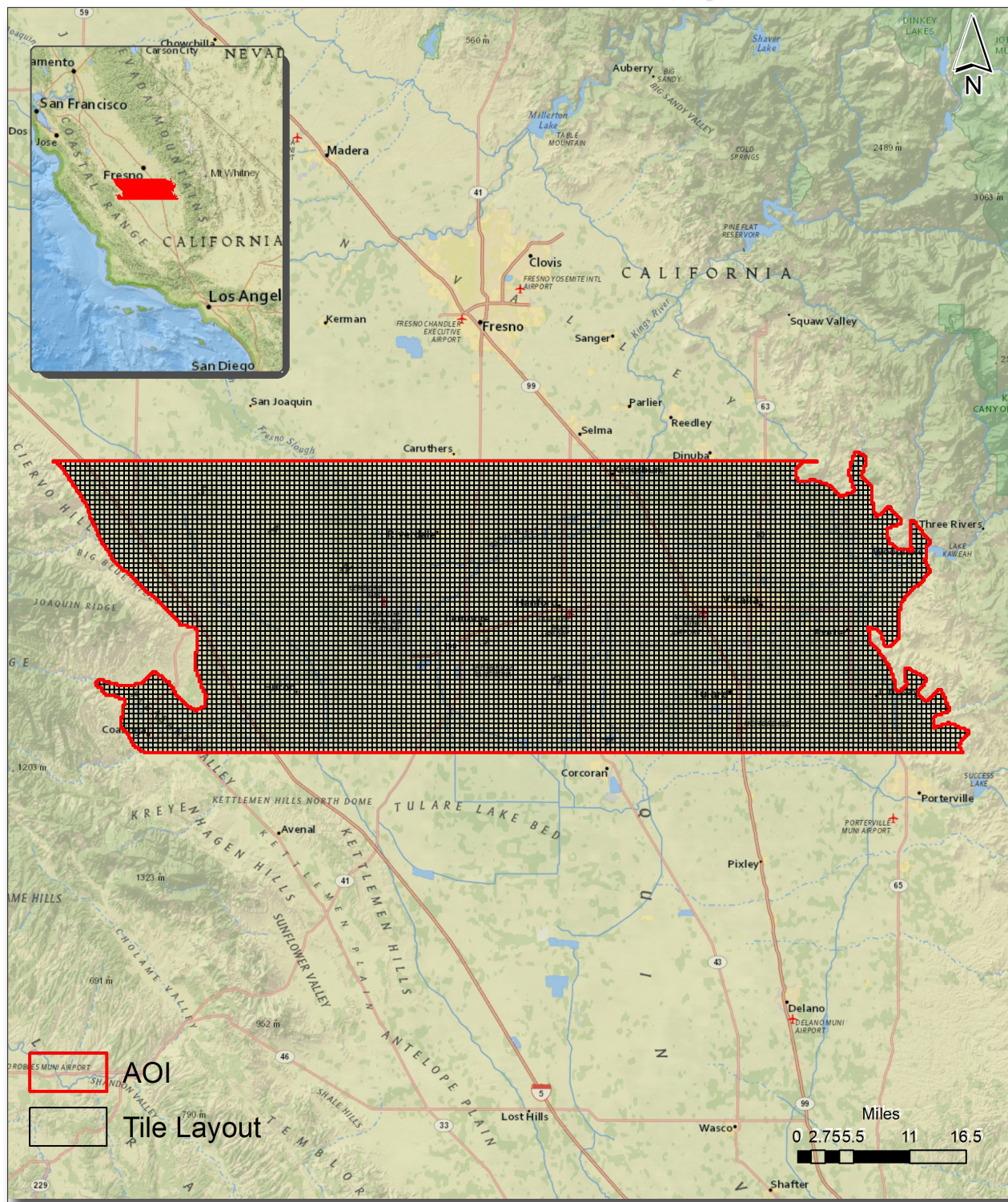


Figure 3. Lidar Tile Layout

4. Project Coverage Verification

A proprietary tool (FOCUS on Flight) produces grid-based polygons of each flightline, depicting exactly where lidar points exist. These swath polygons are reviewed against the project boundary to verify adequate project coverage. Please refer to Figure 4.

San Joaquin WU300026 Work Unit WU300026 Lidar Coverage

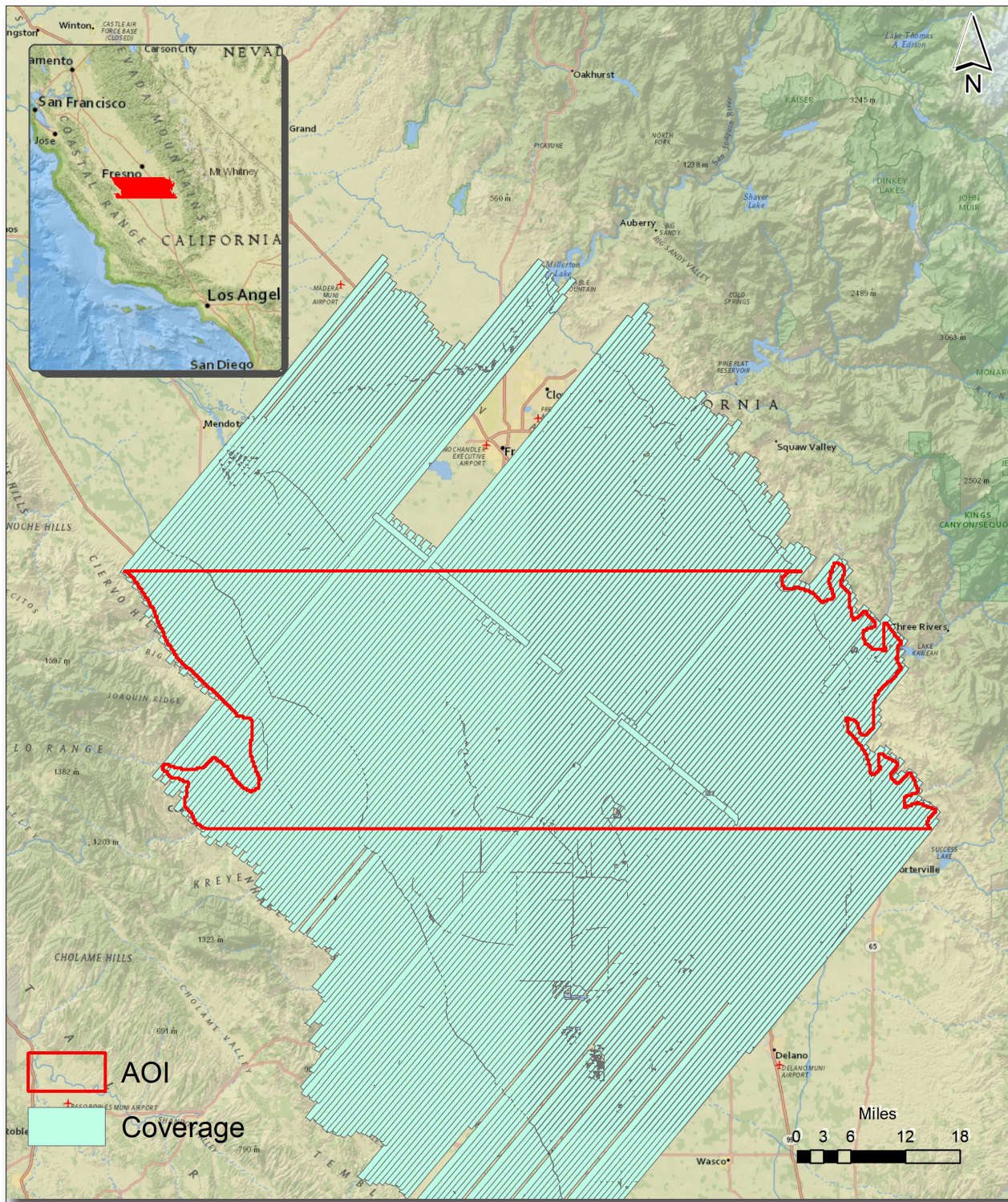


Figure 4. Lidar Coverage

5. Geometric Accuracy

5.1. Horizontal Accuracy

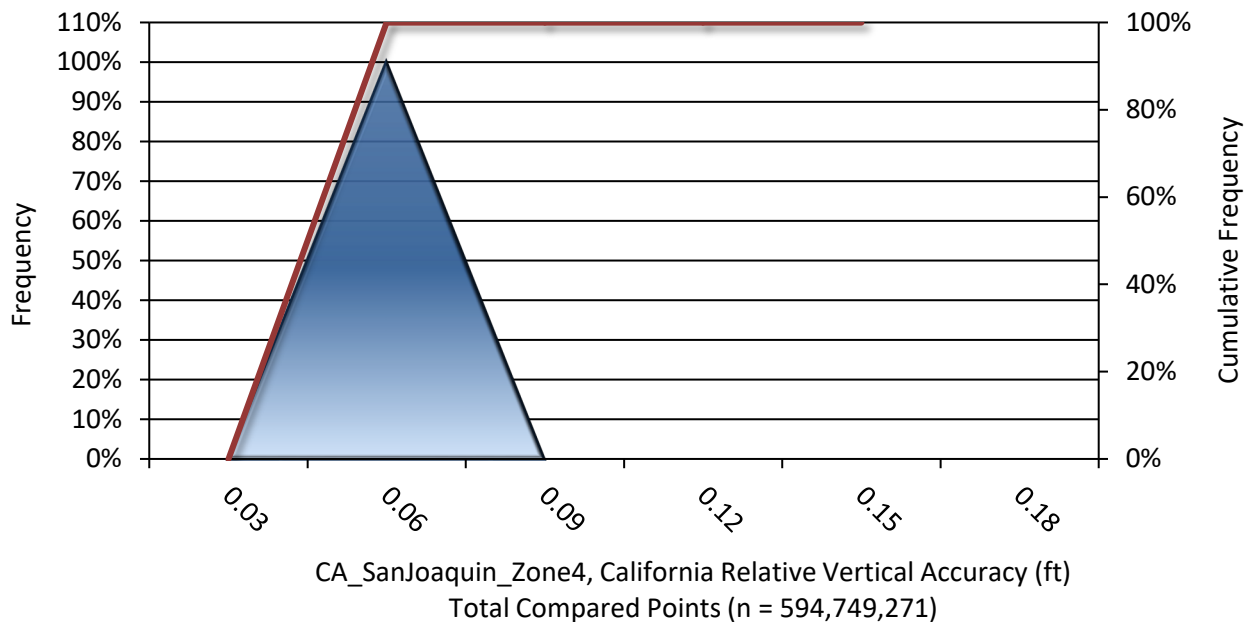
Lidar horizontal accuracy is a function of Global Navigation Satellite System (GNSS) derived positional error, flying altitude, and INS derived attitude error. The obtained $RMSE_r$ value is multiplied by a conversion factor of 1.7308 to yield the horizontal component of the National Standards for Spatial Data Accuracy (NSSDA) reporting standard where a theoretical point will fall within the obtained radius 95% of the time. Based on a flying altitude of 2000 meters, an IMU error of 0.002 decimal degrees, and a GNSS positional error of 0.015 meters, this project was compiled to meet 0.22 meter horizontal accuracy at the 95% confidence level. A summary is shown below.

Horizontal Accuracy	
$RMSE_r$	0.41 ft
	0.13 m
ACC_r	0.71 ft
	0.22 m

5.2. Relative Vertical Accuracy

Relative vertical accuracy refers to the internal consistency of the data set as a whole: the ability to place an object in the same location given multiple flight lines, GPS conditions, and aircraft attitudes. When the lidar system is well calibrated, the swath-to-swath vertical divergence is low (<0.10 meters). The relative vertical accuracy was computed by comparing the ground surface model of each individual flight line with its neighbors in overlapping regions. The average (mean) line to line relative vertical accuracy for the San_Joaquin WU300026 project was 0.037 feet (0.011 meters). A summary is shown below.

Relative Vertical Accuracy	
Sample	17 flight line surfaces
Average	0.037 ft
	0.011 m
Median	0.039 ft
	0.012 m
RMSE	0.041 ft
	0.012 m
Standard Deviation (1σ)	0.005 ft
	0.002 m
1.96σ	0.010 ft
	0.003 m



Project Report Appendices

The following section contains the appendices as listed in the San Joaquin WU300026 Lidar Project Report.

Appendix A

Flight Logs

LIDAR FLIGHT LOG

Date: 2021-21

Mission(s): A

Survey Information		Base Station Data	
Project Name: DWR San Joaquin Valley 14750-147	052A	Station Name: NA	
Flight Vendor / Tail No: ASPEN / 300LF		Receiver Type & SN: Tem 5700 / #7248	
Airport Start/End: KBFL -		Antenna & Measurement Type: Zephyr	
Time of T/O: 9:50AM	Time of Landing: 3:10 PM	Antenna Height - meters: 1.274	
General Weather Conditions: CLEAR		Antenna Height - feet: 4.180	Checks?

Survey Information		Base Station Data	
Project Name: DWR San Joaquin Valley 14750-147		Station Name:	
Flight Vendor / Tail No:		Receiver Type & SN:	
Airport Start/End:		Antenna & Measurement Type:	
Time of T/O:	Time of Landing:	Antenna Height - meters:	
General Weather Conditions:		Antenna Height - feet:	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.): 052A - STARTED L50 - END L 37, HOBBS: ~~5.2~~ 5.2



LIDAR FLIGHT LOG

Date: 2-22-2024

Mission(s): A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF	Receiver Type & SN: TRM 5700 / #7248
Airport Start/End: KBFL - KBFL	Antenna & Measurement Type: Zephyr
Time of T/O: 7:20AM Time of Landing: 12:45pm	Antenna Height - meters: 1.365m
General Weather Conditions: CLEAR	Antenna Height - feet: 4.480ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

OS3A - L37 - L^{1/2}26, L^{1/2}55 - 51

Very rough moving over to the west for remainder of flight!



LIDAR FLIGHT LOG

Date: 2-23-2021

Mission(s): A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300 LF / P-68	Receiver Type & SN: TRM5700 / # 7248
Airport Start/End: KBFL - KBFL	Antenna & Measurement Type: Zephyr
Time of T/O: 7:30am	Time of Landing: 12:35pm
Antenna Height - meters: 1.307m 1.307m	Antenna Height - feet: 4.290ft
General Weather Conditions: CLEAR	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O:	Time of Landing:
Antenna Height - meters:	Antenna Height - feet:
General Weather Conditions:	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.): (L26 - L21) (L490 - 495) (L204)

Date: 2-24-2021

Mission(s): A

Survey Information		Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	055A	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF / P-68		Receiver Type & SN: TRM 5700 / # 7248
Airport Start/End: KBFL - KBFL		Antenna & Measurement Type: Zephyr
Time of T/O: 11:45am	Time of Landing: 3:30pm	Antenna Height - meters: 1.333m
General Weather Conditions: CLEAR		Antenna Height - feet: 4.375 ft
		Checks?

Survey Information		Base Station Data
Project Name: DWR San Joaquin Valley 14750-147		Station Name:
Flight Vendor / Tail No:		Receiver Type & SN:
Airport Start/End:		Antenna & Measurement Type:
Time of T/O:	Time of Landing:	Antenna Height - meters:
General Weather Conditions:		Antenna Height - feet:
		Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

MX - 50 hour this morning. Postfile: 055AA

(L255 - L265)

Date: 2-25-2021

Mission(s): A

Survey Information	056A	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147		Station Name: NA
Flight Vendor / Tail No: ASPEN		Receiver Type & SN: Trm 5700 / #7248
Airport Start/End: KBFL - KBFL		Antenna & Measurement Type: Zephyr / Bottom Knotch
Time of T/O: 7:30AM	Time of Landing: 12:30pm	Antenna Height - meters: 1.379m
General Weather Conditions: CLEAR		Antenna Height - feet: 4.525 ft
		Checks?

Survey Information		Base Station Data
Project Name: DWR San Joaquin Valley 14750-147		Station Name:
Flight Vendor / Tail No:		Receiver Type & SN:
Airport Start/End:		Antenna & Measurement Type:
Time of T/O:	Time of Landing:	Antenna Height - meters:
General Weather Conditions:		Antenna Height - feet:
		Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

(L65 - L1/277)

Sent map to: danielle.gorrell@faa.gov

Date: 2-26-2021

Mission(s): A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: JA
Flight Vendor / Tail No: ASPEN / N300LF / P-68	Receiver Type & SN: TRM 5700 / #7248
Airport Start/End: KBFL - KBFL	Antenna & Measurement Type: Zephyr / Bottom Notch
Time of T/O: 7:00am Time of Landing: 1:00pm	Antenna Height - meters: 1.432m
General Weather Conditions: CLEAR	Antenna Height - feet: 4.700ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

(L1277 - L1290)
 ↑
 complete

6hr

Date: 2-27-2021

Mission(s): A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF / P-68	Receiver Type & SN: TRM 5700 / #7248
Airport Start/End: 105 KBFL - KBFL	Antenna & Measurement Type: Zephyr / Bottom Notch
Time of T/O: 6:50 AM Time of Landing: 9:35 am	Antenna Height - meters: 1.335 m
General Weather Conditions: CLEAR	Antenna Height - feet: 4.380 ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

058A (L 1/2 90-92) Moving northwest, clouds forming here!
 (L 103-1/2 104) South half 104 complete!



LIDAR FLIGHT LOG

Date: 2-28-2021

Mission(s): A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN/N300LF/P-68	Receiver Type & SN: TRM 5700 / #7248
Airport Start/End: KBFL - KBFL	Antenna & Measurement Type: Zephyr / Bottom Natch
Time of T/O: 6:30am Time of Landing: 12:00pm	Antenna Height - meters: 1.250m
General Weather Conditions: High clouds / CLEAR BELOW 12K	Antenna Height - feet: 4.100 ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

(L93 - L102) 3/4 North 1/2 L104

Pilot: BLAIS

LIDAR: PETERSEN

5.5 hrs

Optech Galaxy Prime s/n 5060411
Last manufacturer service date: July 30, 2020

Date: 3-1-2021

Mission(s): A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF / P-68	Receiver Type & SN: TRM 5700 / #7248
Airport Start/End: KBFL - KBFL	Antenna & Measurement Type: Zephyr / BN
Time of T/O: 7:10am	Antenna Height - meters: 1.295m
Time of Landing: 1:00pm	Antenna Height - feet: 4.250ft
General Weather Conditions: CLEAR	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O:	Antenna Height - meters:
Time of Landing:	Antenna Height - feet:
General Weather Conditions:	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

(L105 - L115/North Half)

Blais, Peterson

G. Ohrs

Date: 3-2-2021

Mission(s): A

Survey Information		Base Station Data	
Project Name: DWR San Joaquin Valley 14750-147		Station Name: NA	
Flight Vendor / Tail No: ASPEN/N300LF/P-68		Receiver Type & SN: TRM 5700 / #7248	
Airport Start/End: KBFL - KBFL		Antenna & Measurement Type: Zephyr / BN	
Time of T/O: 1:20pm	Time of Landing: 4:00pm	Antenna Height - meters: 1.383m	
General Weather Conditions: CLEAR		Antenna Height - feet: 4.540ft	Checks?

Survey Information		Base Station Data	
Project Name: DWR San Joaquin Valley 14750-147		Station Name:	
Flight Vendor / Tail No:		Receiver Type & SN:	
Airport Start/End:		Antenna & Measurement Type:	
Time of T/O:	Time of Landing:	Antenna Height - meters:	
General Weather Conditions:		Antenna Height - feet:	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

(L115-L119 North Haff)

Pos File: 061AA

Date: 3-3-2021

Mission(s): A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF / P-68	Receiver Type & SN: TRM 5700 / #7248
Airport Start/End: KBFL - KBFL	Antenna & Measurement Type: Zephyr / BN
Time of T/O: 7:10am Time of Landing: 1:10pm	Antenna Height - meters: 1.391m
General Weather Conditions: High Ovr. Cast.	Antenna Height - feet: 4.565ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.): (219 - 2129 North Hill)

Date: 3-4-2021

Mission(s): A

Survey Information		Base Station Data	
Project Name: DWR San Joaquin Valley 14750-147	063A	Station Name: NA	
Flight Vendor / Tail No: ASPEN/N300LF/P-68		Receiver Type & SN: TRM 5700/#7248	
Airport Start/End: KBFL - KBFL		Antenna & Measurement Type: Zephyr / BN	
Time of T/O: 5:05am	Time of Landing: 10:20am	Antenna Height - meters: 1.309m	
General Weather Conditions: CLEAR		Antenna Height - feet: 4.295ft	Checks?

Survey Information		Base Station Data	
Project Name: DWR San Joaquin Valley 14750-147		Station Name:	
Flight Vendor / Tail No:		Receiver Type & SN:	
Airport Start/End:		Antenna & Measurement Type:	
Time of T/O:	Time of Landing:	Antenna Height - meters:	
General Weather Conditions:		Antenna Height - feet:	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

(L129 - L138NH)

ONLY 5.3 hrs, N300LF MX 100hr

Blais, Petersen

LIDAR FLIGHT LOG

Date: 3/7/21
 Mission(s): A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: FRESNO
Flight Vendor / Tail No: ASPEN - N300LF	Receiver Type & SN: 5700 / 7248
Airport Start/End: FRESNO - FAY	Antenna & Measurement Type: ZEPHYR - BV
Time of T/O: 9:00 AM	Time of Landing: 2:20 PM
General Weather Conditions: PARTLY CLOUDY	Antenna Height - meters: 1.478
	Antenna Height - feet: 4.849
	Checks? <input checked="" type="checkbox"/>

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O:	Time of Landing:
General Weather Conditions:	Antenna Height - meters:
	Antenna Height - feet:
	Checks? <input type="checkbox"/>

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 3/8/21

Mission(s): 067A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: FRESNO
Flight Vendor / Tail No: ASPEN / N300LF	Receiver Type & SN: 5700 / 7248
Airport Start/End: FRESNO / FAT	Antenna & Measurement Type: ZEPHYR - BN
Time of T/O: 8:30 AM Time of Landing: 2:30 pm	Antenna Height - meters: 1.460
General Weather Conditions: PARTLY CLOUDY	Antenna Height - feet: 4.789 <input checked="" type="checkbox"/> Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet: <input type="checkbox"/> Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 3/09/21

Mission(s): 068A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: FRESNO
Flight Vendor / Tail No: ASPEN / N300LF	Receiver Type & SN: 5700 / # 7248
Airport Start/End: FRESNO / KFAT	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 8:39 AM Time of Landing: 11:00 AM	Antenna Height – meters: 1.465
General Weather Conditions: OVERCAST	Antenna Height – feet: 4.807
	<input checked="" type="checkbox"/> Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet:
	<input type="checkbox"/> Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 3/13/21
Mission(s): 072

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: FRESNO
Flight Vendor / Tail No: ASPEN / N300LF	Receiver Type & SN: 5700 / # 7248
Airport Start/End: FRESNO / KFAT	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 9:00 AM Time of Landing: 12:00 PM	Antenna Height - meters: 1.476
General Weather Conditions: PTLY CLOUDY	Antenna Height - feet: 4.844
	<input checked="" type="checkbox"/> Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	<input type="checkbox"/> Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Optech Galaxy Prime s/n 5060411
Last manufacturer service date: July 30, 2020

TOWILL

LIDAR FLIGHT LOG

Date: 3-4-2021

Mission(s): A


TOWILL
 SURVEYING | MAPPING | GIS

LIDAR FLIGHT LOG

Date: 3/14/21

Mission(s): 073

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: FRESNO
Flight Vendor / Tail No: ASPEN / N300LF	Receiver Type & SN: 5700 / # 7248
Airport Start/End: FRESNO / KFAT	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 9:30 AM Time of Landing: 3:00 PM	Antenna Height - meters: 1.484
General Weather Conditions: PTLY CLOUDY	Antenna Height - feet: 4.869
	<input checked="" type="checkbox"/> Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	<input type="checkbox"/> Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 3/17/21

Mission(s): 076A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: FRESNO
Flight Vendor / Tail No: ASPEN / N360LF	Receiver Type & SN: 5700 / # 7248
Airport Start/End: FRESNO / KFAT	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 9:00 Time of Landing: 2:30	Antenna Height – meters: 1.469
General Weather Conditions: CLEAR	Antenna Height – feet: 4.818 <input checked="" type="checkbox"/> Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet: <input type="checkbox"/> Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 3/18/21

Mission(s): 077A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: FRESNO
Flight Vendor / Tail No: ASPEN / N300LF	Receiver Type & SN: 5700 / #7248
Airport Start/End: FRESNO / KFAT	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 9:00AM Time of Landing: 3:00pm	Antenna Height – meters: 1.428
General Weather Conditions: CLEAR / HAZY	Antenna Height – feet: 4.682 <input checked="" type="checkbox"/> Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet: <input type="checkbox"/> Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 3-21-2021

Mission(s):

Survey Information	080A	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147		Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF		Receiver Type & SN: TRM5700 / #7248
Airport Start/End: KFAT - KFAT		Antenna & Measurement Type: Zephyr / BN
Time of T/O: 8:30am	Time of Landing: 11:50am	Antenna Height - meters: 1.515m
General Weather Conditions: Low Building Clouds		Antenna Height - feet: 4.970ft

No factor

Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O:	Time of Landing:
Antenna Height - meters:	
General Weather Conditions:	Antenna Height - feet:

Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

080A START

- L182 - Complete (S)
- L183 - Southwest Half (N)
- L184 - Southwest Half (S)
- L185 - Southwest Half (N)
- L186 - Southwest Half (S)
- L187 - Southwest Half (N)

Optech Galaxy Prime s/n 5060411
Last manufacturer service date: July 30, 2020

START (S) of tie line next mission

Date: 3-22-2021

Mission(s):

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF	Receiver Type & SN: TRM5700 / #7248
Airport Start/End: KFAT - KFAT	Antenna & Measurement Type: Zephyr / BN
Time of T/O: 6:40am Time of Landing: 1:30	Antenna Height - meters: 1.456m
General Weather Conditions: CLEAR	Antenna Height - feet: 4.780ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

081A - START L183 - L195
500GB
6.7 hrs

Optech Galaxy Prime s/n 5060411
Last manufacturer service date: July 30, 2020

Date: 3-24-2021

Mission(s):

Survey Information	083A	* Base Station Data *
Project Name: DWR San Joaquin Valley 14750-147		Station Name: 083A * No Flight crew Base *
Flight Vendor / Tail No: ASPEN / N300LF		Receiver Type & SN: 083A USE Towill Surveyors
Airport Start/End: KOXR - KFAT		Antenna & Measurement Type: Base data for 083
Time of T/O: 9:40am	Time of Landing: 4:10 am 4:10 am	Antenna Height - meters:
General Weather Conditions: SKY CLEAR		Antenna Height - feet: Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O:	Time of Landing:
Antenna Height - meters:	Antenna Height - feet:
General Weather Conditions:	Antenna Height - feet: Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

START L196-L204/083A

Date: 3-25-2021

Mission(s):

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN	Receiver Type & SN: TRM5700 / #7248
Airport Start/End: KFAT - KFAT	Antenna & Measurement Type: Zephyr / BN
Time of T/O: 7:40am Time of Landing: 10:50am	Antenna Height - meters: 1.280m
General Weather Conditions: HIGH OVC	Antenna Height - feet: 4.200ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds instrument anomalies, etc.):

^{084A} start L205 - L208 COMPLETE FULL LINES

TRIED L209 But clouds and fives underneath the plane
 ↑
 Incomplete!

Date: 3-26-2021

Mission(s):

Survey Information	085A	Base Station Data	
Project Name:	DWR San Joaquin Valley 14750-147	Station Name:	NA
Flight Vendor / Tail No:	ASPEN / N300LF	Receiver Type & SN:	5700 TRM / #7248
Airport Start/End:	KFAT - KFAT	Antenna & Measurement Type:	Zephyr / BN
Time of T/O:	7:15am	Time of Landing:	12:25pm
Antenna Height - meters:	1.441m	Antenna Height - feet:	4.730ft
General Weather Conditions:	CLEAR BUT REPORTING CLDS	Checks?	

Survey Information		Base Station Data	
Project Name:	DWR San Joaquin Valley 14750-147	Station Name:	NA
Flight Vendor / Tail No:	ASPEN / N300LF	Receiver Type & SN:	TRM5700 / #7248
Airport Start/End:	KFAT - KFAT	Antenna & Measurement Type:	Zephyr / BN
Time of T/O:	12:51pm	Time of Landing:	3:25pm
Antenna Height - meters:	1.441m	Antenna Height - feet:	4.730ft
General Weather Conditions:	Scattered North East Half	Checks?	

OF LINES

<p>Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.): PETERSEN ? PORTELLO</p> <p>085B START L219 (SW) Southwest half only L220 (NE) Southwest half only L221 (SW) Southwest half only L222 (NE) Southwest half only L223 (SW) Southwest half only L224 (NE) Southwest half only</p>	<p>085A START L209 - L213 COMPLETE LINES</p> <p>L214 (NE) Southwest half only L215 (SW) Southwest half only L216 (NE) Southwest half only L217 (SW) Southwest half only L218 (NE) Southwest half only</p> <p>TURNED AROUND @ TIE LINE</p> <p>Optech Galaxy Prime s/n 5060411 Last manufacturer service date: July 30, 2020</p>
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Date: 3-27-2021

Mission(s):

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF / P-68	Receiver Type & SN: Trim5700 / #7248
Airport Start/End: KFAT - KFAT	Antenna & Measurement Type: Zephyr / BN
Time of T/O: 7:32am Time of Landing: 1:30pm	Antenna Height - meters: 1.432m
General Weather Conditions: SKC	Antenna Height - feet: 4.700ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, 086A-START L255 - L266 ^{South West} half instrument anomalies, etc.):

Date: 3-28-2021

Mission(s):

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF	Receiver Type & SN: TRM5700 / #7248
Airport Start/End: KFAT - KFAT 1:15pm	Antenna & Measurement Type: Zephyr / BN
Time of T/O: 7:15am Time of Landing:	Antenna Height - meters: 1.524m
General Weather Conditions: SKC	Antenna Height - feet: 5.000ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.): 087A - START (L266 NE HALF - L280)



LIDAR FLIGHT LOG

Date: 3-29-2021

Mission(s):

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF / P-68	Receiver Type & SN: TRM5700 / #7248
Airport Start/End: KFAT - KFAT	Antenna & Measurement Type: Zephyr / BN
Time of T/O: 7:22am Time of Landing: 1:05 pm	Antenna Height - meters: 1.454m
General Weather Conditions:	Antenna Height - feet: 4.770ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.): (088A START L214 - L228)

Date: 3-30-2021

Mission(s): A+B

Survey Information	089A	Base Station Data	
Project Name:	DWR San Joaquin Valley 14750-147	Station Name:	NA
Flight Vendor / Tail No:	ASPEN / N300LF / P-68	Receiver Type & SN:	TRM 5700 / #7248
Airport Start/End:	KFAT - KFAT	Antenna & Measurement Type:	Zephyr / BN
Time of T/O:	7:20am	Time of Landing:	12:05pm
Antenna Height - meters:	1.530m	Antenna Height - feet:	5.020ft
General Weather Conditions:	SKC	Checks?	

Survey Information	089B	Base Station Data	
Project Name:	DWR San Joaquin Valley 14750-147	Station Name:	NA
Flight Vendor / Tail No:	089A ASPEN / N300LF	Receiver Type & SN:	TRM 5700 / #7248
Airport Start/End:	KFAT - KFAT	Antenna & Measurement Type:	Zephyr / BN
Time of T/O:	12:55pm	Time of Landing:	3:15pm
Antenna Height - meters:	1.530m	Antenna Height - feet:	5.020ft
General Weather Conditions:	SKC	Checks?	

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

(START L229 - L236½) 089A

089B - START L236½ (NE) - L239½ (SW)



LIDAR FLIGHT LOG

Date: 3-31-2021

Mission(s):

Survey Information	090A	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147		Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF / P-68		Receiver Type & SN: TRM5700 / #7248
Airport Start/End: KFAT - KFAT		Antenna & Measurement Type: Zephyr / BN
Time of T/O: 7:20am	Time of Landing: 1:25pm	Antenna Height - meters: 1.460m
General Weather Conditions: SKC		Antenna Height - feet: 4.790ft
		Checks?

Survey Information	Base Station Data	
Project Name: DWR San Joaquin Valley 14750-147	Station Name:	
Flight Vendor / Tail No:	Receiver Type & SN:	
Airport Start/End:	Antenna & Measurement Type:	
Time of T/O:	Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

(090A-START - 2239 1/2 (SW) - 2253 Full
2254 Full)

Date: 4-1-2021

Mission(s):

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N300LF / P-68	Receiver Type & SN: TRM5700 / #7248
Airport Start/End: KFAT - KFAT	Antenna & Measurement Type: Zephyr / BN
Time of T/O: 8:18am Time of Landing: 12:40pm	Antenna Height - meters: 1.463m
General Weather Conditions: SKC	Antenna Height - feet: 4.800ft
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.): START L ~~240~~ 1/2 (NE) - 252 ALL COMPLETE

Date: 4/3/21

Mission(s): 093A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MADERA -
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / #7248
Airport Start/End: MADERA / KMAE	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 11 AM Time of Landing: 4:30	Antenna Height - meters: 1.479
General Weather Conditions: CLEAR	Antenna Height - feet: 4.858
	<input checked="" type="checkbox"/> Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	<input type="checkbox"/> Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 4/4/21

Mission(s): 094A, B

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MADERA
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / # 7248
Airport Start/End: MADERA / KMAE	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 2:00pm Time of Landing: 4:30	Antenna Height - meters: 1.478
General Weather Conditions: CLEAR	Antenna Height - feet: 4.849 - 1.478 ✓ Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MADERA
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / # 7248
Airport Start/End: MADERA	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 4:50pm Time of Landing: 8:15	Antenna Height - meters: 1.478
General Weather Conditions: CLEAR	Antenna Height - feet: 4.849 - 1.478 ✓ Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 4/5/21

Mission(s): 095A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MADERA
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / #7248
Airport Start/End: MADERA / KMAE	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 2:00 Time of Landing: 8:00 pm	Antenna Height – meters: 1.481
General Weather Conditions: CLEAR	Antenna Height – feet: 4.851 - 1.481 ✓ Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet: Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 4/6/21

Mission(s): 096A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MADERA
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / # 7248
Airport Start/End: MADERA / KMAE	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 3:00 Time of Landing: 8:30	Antenna Height - meters: 1.427
General Weather Conditions: CLEAR	Antenna Height - feet: 4.682 - 1.427 <input checked="" type="checkbox"/> Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet: <input type="checkbox"/> Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

LIDAR FLIGHT LOG

Date: 4/7/21

Mission(s): 097A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MADERA
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / # 7248
Airport Start/End: MADERA / KMAE	Antenna & Measurement Type: ZEPHR / BN
Time of T/O: 2:00 Time of Landing: 5:30	Antenna Height – meters: 1.520
General Weather Conditions: CLEAR	Antenna Height – feet: 4,985 – 1.519 Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet: Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 4/9/21

Mission(s): 099A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MERCED
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / # 7248
Airport Start/End: MERCED	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 1:15 Time of Landing: 5:00	Antenna Height - meters: 1.463
General Weather Conditions: CLEAR	Antenna Height - feet: 4.801 - 1.463 ✓ Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet: Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 4/10/21
Mission(s): 100A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MERCED
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / # 7248
Airport Start/End: MERCED	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 11:45 Time of Landing: 4:30	Antenna Height - meters: 1.497
General Weather Conditions: CLEAR	Antenna Height - feet: 4.910 - 1.497 Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet: Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 4/11/21

Mission(s): 101A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MERCED
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / #17248
Airport Start/End: MERCED	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 11:30 Am Time of Landing: 4:45 pm	Antenna Height – meters: 1.504
General Weather Conditions: CLEAR	Antenna Height – feet: 4,933 – 1,504 Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet: Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 4/12/21

Mission(s): 102A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MERCED
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / #7248
Airport Start/End: MERCED	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 11:20 AM Time of Landing: 5:00 PM	Antenna Height - meters: 1.527
General Weather Conditions: CLEAR	Antenna Height - feet: 5.009 - 1.527 ✓ Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet: Checks?

Comments (notable in-flight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 4/13/21

Mission(s): 103A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MERCED
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / # 7248
Airport Start/End: MERCED	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 11:15 AM Time of Landing: 5:00 PM	Antenna Height – meters: 1.499
General Weather Conditions: CLEAR	Antenna Height – feet: 4.918 – 1.499 Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet: Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):



LIDAR FLIGHT LOG

Date: 4/14/21
Mission(s): 104A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MERCED
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: S700 / # 7248
Airport Start/End: MERCED	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 11:15AM Time of Landing: 1:30 PM	Antenna Height – meters: 1.523
General Weather Conditions: CLOUDY / LOW CLOUDS	Antenna Height – feet: 4.995 – 1.523
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Optech Galaxy Prime s/n 5060411
Last manufacturer service date: July 30, 2020

Date: 4/15/21

Mission(s): IOSA

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MERCED
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / #7248
Airport Start/End: MERCED	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 11:20 AM Time of Landing: 5:15 PM	Antenna Height - meters: 1.484
General Weather Conditions: CLEAR	Antenna Height - feet: 4.870 - 1.484
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):



LIDAR FLIGHT LOG

Date: 4/17/21

Mission(s): 107A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MERCED
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: S700 / #7248
Airport Start/End: MERCED	Antenna & Measurement Type: ZEPHR / BN
Time of T/O: 11:20 AM Time of Landing: 5:30 PM	Antenna Height - meters: 1.486
General Weather Conditions: CLEAR	Antenna Height - feet: 4.873 - 1.485
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 4/18/21

Mission(s): 108A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MERCED
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / # 7248
Airport Start/End: MERCED	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 11:20AM Time of Landing: 4:30	Antenna Height – meters: 1.537
General Weather Conditions: CLEAR	Antenna Height – feet: 5.040 – 1.536 Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet: Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Date: 109A

Mission(s): 4/19/21

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MODESTO
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: S700 / # 7248
Airport Start/End: MODESTO	Antenna & Measurement Type: ZEPHYR / BN
Time of T/O: 12:30 Time of Landing: 4:00	Antenna Height – meters: 1.443
General Weather Conditions: CLEAR	Antenna Height – feet: 4.738 - 1.443
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height – meters:
General Weather Conditions:	Antenna Height – feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):



LIDAR FLIGHT LOG

Date: 4/21/21

Mission(s): 111A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: MODESTO
Flight Vendor / Tail No: ASPEN / N68VA	Receiver Type & SN: 5700 / #7248
Airport Start/End: MODESTO	Antenna & Measurement Type: Zephyr / BN
Time of T/O: 11:30 AM Time of Landing: 5:15 PM	Antenna Height - meters: 1.469
General Weather Conditions: CLEAR	Antenna Height - feet: 4.819 - 1.469
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):

Optech Galaxy Prime s/n 5060411
Last manufacturer service date: July 30, 2020

Date: 4-28-2021

Mission(s): 118A

Survey Information	118A	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147		Station Name: NA
Flight Vendor / Tail No: ASPEN / N68VA / P-68		Receiver Type & SN: TRM 5700 / # 7248
Airport Start/End: KMOD - KMOD		Antenna & Measurement Type: Zephyr / BN
Time of T/O: 10:00am	Time of Landing: 3:45pm	Antenna Height - meters: 1.402m
General Weather Conditions: SKC		Antenna Height - feet: 4.600ft
		Checks?

Survey Information	Base Station Data	
Project Name: DWR San Joaquin Valley 14750-147	Station Name:	
Flight Vendor / Tail No:	Receiver Type & SN:	
Airport Start/End:	Antenna & Measurement Type:	
Time of T/O:	Time of Landing:	
	Antenna Height - meters:	
General Weather Conditions:	Antenna Height - feet:	
		Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.): START 1443 - 1461

Date: 4-29-2021

Mission(s): 119A

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name: NA
Flight Vendor / Tail No: ASPEN / N68VA / P-68	Receiver Type & SN: NA
Airport Start/End: KMOD - KMOD	Antenna & Measurement Type: NA
Time of T/O: 9:55am Time of Landing: 2:20pm	Antenna Height - meters: NA
General Weather Conditions: SKC	Antenna Height - feet: NA
	Checks?

Survey Information	Base Station Data
Project Name: DWR San Joaquin Valley 14750-147	Station Name:
Flight Vendor / Tail No:	Receiver Type & SN:
Airport Start/End:	Antenna & Measurement Type:
Time of T/O: Time of Landing:	Antenna Height - meters:
General Weather Conditions:	Antenna Height - feet:
	Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.): START L461 - L485



LIDAR FLIGHT LOG

Date: 4-30-2021

Mission(s): 120A

Survey Information	120A	Base Station Data			
Project Name:	DWR San Joaquin Valley 14750-147	Station Name: NA			
Flight Vendor / Tail No:	ASPEN / N68VA / P-68	Receiver Type & SN: NA			
Airport Start/End:	KMOD - KMOD	Antenna & Measurement Type: NA			
Time of T/O:	9:15am	Time of Landing:	12:20pm	Antenna Height - meters:	NA
General Weather Conditions:	SKC	Antenna Height - feet:	NA	Checks?	

Survey Information	Base Station Data			
Project Name:	DWR San Joaquin Valley 14750-147	Station Name:		
Flight Vendor / Tail No:		Receiver Type & SN:		
Airport Start/End:		Antenna & Measurement Type:		
Time of T/O:		Time of Landing:		Antenna Height - meters:
General Weather Conditions:		Antenna Height - feet:		Checks?

Comments (notable inflight disturbances, head/tail/crosswinds, instrument anomalies, etc.):