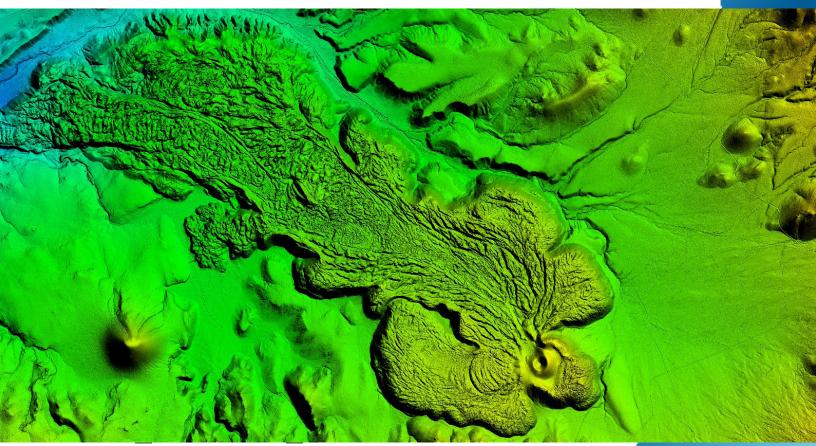
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EarthMRI_2020_D20
LIDAR PROCESSING REPORT

Project ID: 198162 Work Unit: 300013 2022

Submitted:September13,2022

Prepared for:



Prepared by:





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1. Summary / Scope

1.1. Summary

This report contains a summary of the NV_WestCentral_EarthMRI_2020_D20, Work Unit 300013 lidar acquisition task order, issued by USGS under their Contract G16PC00016 on 09/15/2020. The task order yielded a project area covering 4,294 square miles over Nevada. 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 / m2	2305 m	58.5°	20%	≤ 10 cm

1.3. Coverage

The project boundary covers 4,294 square miles over Nevada. Project extents are shown in Figure 1.

1.4. Duration

Lidar data was acquired from October 15, 2020 and November 02, 2020 in 48 total lifts. See "Section: 2.4. Time Period" for more details.

1.5. Issues

There were no issues to report.



NV_WestCentral_EarthMRI_2020_D20 Work Unit 300013

Projected Coordinate System: UTM Zone 11 Horizontal Datum: NAD83(2011)

Vertical Datum: NAVD88 (GEOID 18)

Units: Meters

Lidar Point Cloud	Classified Point Cloud in .LAS 1.4 format
Rasters	 1-meter Hydro-flattened Bare Earth Digital Elevation Model (DEM) in GeoTIFF format 1-meter Intensity images in GeoTIFF format
Vectors	Shapefiles (*.shp) Project Boundary Lidar Tile Index Calibration and QC Checkpoints (NVA/VVA) Building Footprint Polygons Geodatabase (*.gdb) Continuous Hydro-flattened Breaklines
Reports	Reports in PDF format • Focus on Delivery • Focus on Accuracy • Processing Report
Metadata	XML Files (*.xml) • Breaklines • Classified Point Cloud • DEM • Intensity Imagery



NV_WestCentral_EarthMRI_2020_D20 Work Unit 300013 Boundary

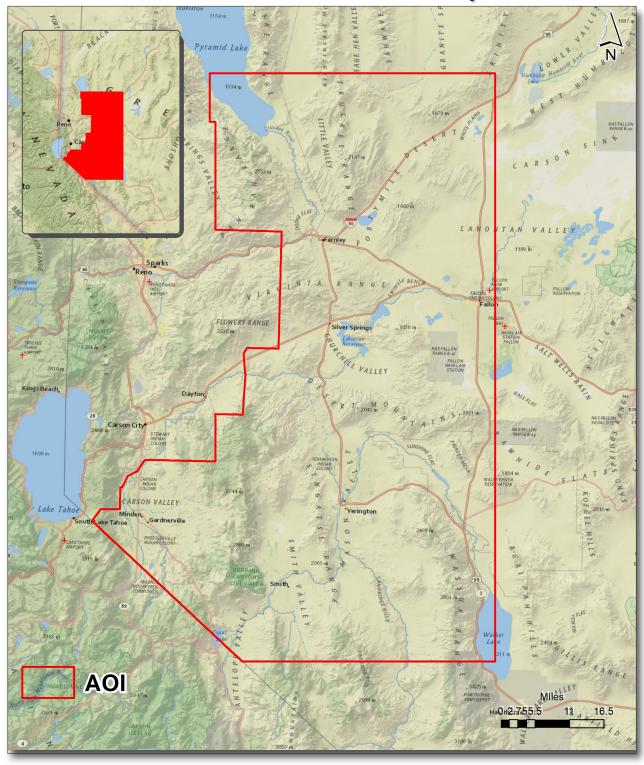


Figure 1. Work Unit Boundary



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 using Leican Terrain Mapper and RiParameter planning software.

2.2. Lidar Sensor

NV5 Geospatial utilized Leican Terrain Mapper, Riegl VQ1560i, and Riegl VQ1560ii lidar sensors (Figure 2), serial number(s) SN4040,SN2737, and TM 9054, for data acquisition.

The Riegl 1560i system has a laser pulse repetition rate of up to 2 MHz resulting in more than 1.3 million measurements per second. The system utilizes a Multi-Pulse in the Air option (MPIA). The sensor is also equipped with the ability to measure up to an unlimited number of targets per pulse from the laser.

The Riegl 1560II system is a dual channel waveform processing airborne scanning system. It has a laser pulse repetition rate of up to 4 MHz resulting in up to 2.66 million measurements per second. The system utilizes a Multi-Pulse in the Air option (MPIA) and an integrated IMU/GNSS unit.

Aerial LiDAR data was collected utilizing a Lecia Terrain Mapper. The Terrain Mapper is a discrete return topographic LiDAR mapping system manufactured by Leica Geosystems.

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

		Riegl VQ1560ii (SN4040)	Riegl VQ1560i (SN2737)	Terra Mapper (TM_9054)
Terrain and	Flying Height	2,305 m	2,200 m	2,800 m
Aircraft Scanner	Recommended Ground Speed	145 kts	150 kts	165 kts
	Field of View	58.5°	58.5°	40°
Scanner	Scan Rate Setting Used	350 Hz	350 Hz	92.3 Hz
Lacon	Laser Pulse Rate Used	81 kHz	158 kHz	650 kHz
Laser	Multi Pulse in Air Mode	yes	yes	yes
Carraga	Full Swath Width	2,583 m	2,465 m	2,016 m
Coverage	Line Spacing	2,066 m	1,972 m	1,411 m
Point Spacing	Average Point Spacing	0.65 m	0.65 m	0.65 m
and Density	Average Point Density	2.4 pts / m ²	2.4 pts / m ²	2 pts / m²

Figure 2. Riegl VQ1560ii, Riegl VQ1560i, and Terra Mapper Lidar Sensors





2.3. Aircraft

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

Lidar Collection Planes

- Cessna Caravan (single-turboprop), Tail Number(s): N704MD
- Piper PA-31, Tail Number(s): C-FKMA
- Cessna Conquest 2 (twin-turboprop), Tail Number(s): N207SS

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 Riegl VQ1560i/VQ1560ii and Terrain Mapper lidar systems. Some of NV5 Geospatial's operating aircraft can be seen in Figure 3 below.

Figure 3. Some of NV5 Geospatial's Planes





2.4. Time Period

Project specific flights were conducted between October 15, 2020 and November 02, 2020. Forty-Eight aircraft lifts were completed. Accomplished lifts are listed below.

10162020A (SN4040,N704MD)	20201015154055 (TM_9054, N20755)
10172020A (SN4040,N704MD)	20201015214029 (TM_9054, N20755)
10182020A (SN4040,N704MD)	20201016160448 (TM_9054, N20755)
10192020A (SN4040,N704MD)	20201016212443 (TM_9054, N20755)
10212020A (SN4040,N704MD)	20201017153134 (TM_9054, N20755)
10222020A (SN2737,C-FKMA)	20201017233020 (TM_9054, N20755)
10222020A (SN4040,N704MD)	20201018153433 (TM_9054, N20755)
10232020A (SN4040,N704MD)	20201019153450 (TM_9054, N20755)
10242020A (SN2737,C-FKMA)	20201019220635 (TM_9054, N20755)
10242020A (SN4040,N704MD)	20201020153032 (TM_9054, N20755)
10242020B (SN4040,N704MD)	20201020215328 (TM_9054, N20755)
10272020A (SN4040,N704MD)	20201021153349 (TM_9054, N20755)
10282020A (SN4040,N704MD)	20201022190618 (TM_9054, N20755)
10292020A (SN2737,C-FKMA)	20201023011115 (TM_9054, N20755)
10302020A (SN2737,C-FKMA)	20201023045845 (TM_9054, N20755)
10302020B (SN4040,N704MD)	20201023161702 (TM_9054, N20755)
10312020A (SN4040,N704MD)	20201023221044 (TM_9054, N20755)
11022020A (SN2737,C-FKMA)	20201024164840 (TM_9054, N20755)
	20201026163842 (TM_9054, N20755)
	20201027154831 (TM_9054, N20755)
	20201027220902 (TM_9054, N20755)
	20201028152217 (TM_9054, N20755)
	20201028212920 (TM_9054, N20755)
	20201029151957 (TM_9054, N20755)
	20201029212657 (TM_9054, N20755)
	20201030153459 (TM_9054, N20755)
	20201030173615 (TM_9054, N20755)
	20201031155542 (TM_9054, N20755)
	20201031201122 (TM_9054, N20755)

20201104171729 (TM_9054, N20755)



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 and 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. 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 georeferenced 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 and 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.

Point clouds were created using the RiPROCESS and HxMap 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
Leica Inertial Explorer	8.90
Leica HxMap	2.6.0
Applanix + POSPac	8.6
RiPROCESS	1.8.6
GeoCue	2020.1.22.1
Global Mapper	19.1;20.1
TerraModeler	21.008
TerraScan	21.016
TerraMatch	21.007



3.3. LAS Classification Scheme

The classification classes are determined by Lidar Base Specifications 2.1 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
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 headsup 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 3 feet/1 meter 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 3 feet was also used around each hydroflattened 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

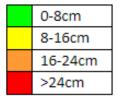
Hydro-Flattened DEMs (topographic) represent a lidar-derived product illustrating the grounded terrain and associated breaklines (as described above) in raster form. NV5 Geospatial's proprietary software was used to take all input sources (bare earth lidar points, bridge and hydro breaklines, etc.) and 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. Appropriate horizontal and vertical projection information as well as applicable header values are written 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. Intensity Image Processing

GeoCue software was used to create the deliverable intensity images. All withheld points were ignored during this process. This helps to ensure a more aesthetically pleasing image. The GeoCue software was then used to verify full project coverage as well. GeoTIFF files with a cell size of 1-meter were then provided as the deliverable for this dataset requirement.

3.8. Height 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-meter 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.





NV_WestCentral_EarthMRI_2020_D20 Work Unit 300013 Tile Layout

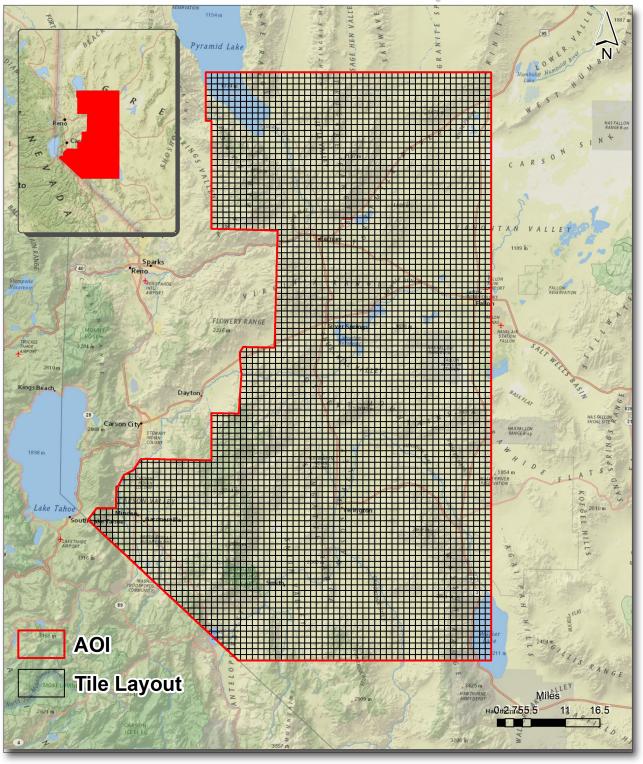


Figure 4. Lidar Tile Layout



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 5.



NV_WestCentral_EarthMRI_2020_D20 Work Unit 300013 Lidar Coverage

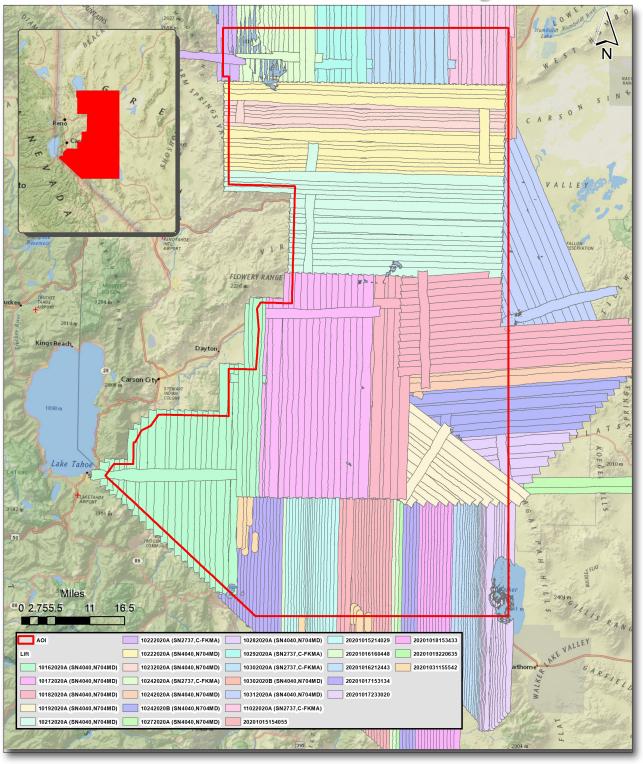


Figure 5. Lidar Coverage



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 2,800 meters, an IMU error of 0.002 decimal degrees, and a GNSS positional error of 0.015 meters, this project was compiled to meet 0.30 meter horizontal accuracy at the 95% confidence level. A summary is shown below.

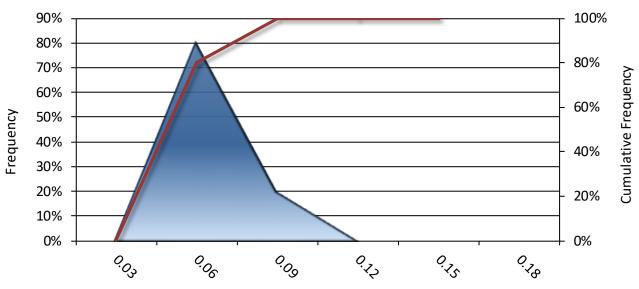
Horizontal Accuracy	
RMSE _r	0.58 ft
	0.17 m
100	1 ft
ACC _r	0.30 m



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 NV_WestCentral_EarthMRI_2020_D20 project was 0.051 feet (0.016 meters). A summary is shown below.

Relative Vertical Accuracy		
Sample	398 flight line surfaces	
A	0.051 ft	
Average	0.016 m	
Madian	0.047 ft	
Median	0.014 m	
RMSE	0.051 ft	
	0.016 m	
Standard Deviation (1σ)	0.009 ft	
	0.003 m	
	0.018 ft	
1.96σ	0.005 m	



Nevada QL2 Delivery 2, Nevada Relative Vertical Accuracy (ft) Total Compared Points (n = 60,921,846,586)



Project Report Appendices

The following section contains the appendices as listed in the <<Report Name>> Lidar Project Report.



Appendix A

Flight Logs

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7					12126	.8/29	141	20:40	20:31	247	497
	-				12109	.8/30	146	18:00	20:24	107	468
6.					12103	.9/27	137	20.21	20:13	347	499
					12119	3/28	143	20:10	20.02	167	500
					12231	-9/27	137	20.00	19:51	347	50
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Flight Mgmt File: 20201017_SN4040-A-R037339 Date: 10-17-20 INTER B C D E

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- Tech: Schoone	Pilot: UNANGST Co-Pilot:	Total: 6.0 Pilot:	4.98	4. مكة & 4 إ End Hobbe:	H End H	B: 14830.4	Begin Hobbs: 14 830.4	MD B	N704MD	Alreraft:	Ā
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oject:	Project: USGS-EARTH-MRI-NEUADA-QLA	ARTH-	MRI-A	JEVADA	670	Proj#:	R037339	10000000000000000000000000000000000000	Flight Mgmt File:	ຄ	0201018-5N4040-A. R037339	4040.A.	R037539	
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nain: 7/J	111	11394	<u></u>	11430	11433	11437	11437	11437	11437	11437	11443	11437	11427	11420	11410	ווילוס	01111	1117	1/394	GPS Altitude Crab	Z In Air	1 AMSL	°°	2:	2:	16:35	End Hobbs: ルタタハ	Proj #:	
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		140 .9/33 11387	Freq MpIA Y N Pulses Rule 350KH2 Power 100% Hug Start[UTC] End[UTC] Gd Spd POOP/san GPS Allthoude Crab	Type Sc End:	(b) Sta 1: PPP Sta 2: Flyovers: Y (d) If Y, times: Sta 1) Sta 2) **C End: **C OAT bag: **C End: **C Altimeter begin: end: Sta 2) **Sco ii Smile 4 O+0 AGL 23.05 Aut August 25.05 August 25.

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10-22-20

Project: USGS EARTH MAI NEVADA QLA Total Proj Linea: 512 Dep Apt: KANO Alreraft: N704MO Begin Hobbs: 14859.7 End Hobbs: 14865.4 Total: 5.7 GPS Unit: Y/W CORS: Y / (N) Sta 1: LDAR Gd Temp beg: CROSS 85h 429 8 C h 430 417 258 21.14 21:30 432 184 F . 27 437 436 434 77 18.55 433 258 18:37 18.53 435 258 19:13 Z 25% 17.20 17:37 55:18 358 258 20:39 258 19:50 20:07 258 17:59 18:16 챃 77 21:33 21:49 돐 77 20:09 20:24 77 19:32 19:48 21.81 66 72 17:41 17:57 77 30 67 17:00 17:16 Start (VIC) End (VIC) 20:28 20:35 156011 ر. د. Sta 1: 121:12 22:09 30:55 18:34 Dep Time (Lct): 49:42 (Z): 16:42 Serial * 4040 Unes Flown: 129 / 16 10.19 15:29 143 E Gd Spd 781 134 55 139 130 125 53 36 861 136 01-157 B 132 130 ດໍ .8/30 AGL 2305/1 19/27 11368 19/31 11290 9/28 19/32 11338 9/28 11302 10/29 78511 18/82 31811 38/6 1.0/26 11371 15/27 19/27 11368 8/28 11368 PDOP/# Sats GPS Altitude Crab (emall log daily to flight_log_distribution_list@quantumspatial.com) 1.0/26 112016 9/29 11381 1.0/26 11371 5/28 11305 MpiA Y / N In Air OAT beg: Unes Remain: 357 Sta 2: Sta 2: 1137/ 11368 11368 Proj #: Ro37339 റ് 뎚 Turb Arr Apt: 大人へいの Arr Time (Local): 15:23 (Z): 22:23 Online Time: HICH BIGN CIRRUS - LOW SEE NORTH OF POSITION ¥ Te⊓ Pulse 350 KHZ റീ Flyovers: Y / (N) If Y, times: Sta1) Flyovers: Y /N Altimeter begin: 5.1 Flight Mgmt File: 20201022_SN4040_A:R037339 Power Max Gdapd Pilot: NEILSON Mob Time: O, G If Y, times: Sta1) 100% ğ FLIGHT LINE NOTES - visibility, douds, smoke, partial, etc. SHIP DRIVE! 30.22 end: BACK UP PPSM Avg Pt Spadng Co-Pilot: Notes: M155.0N 7 EASYSTURE OFFUN WD. 2545 THE WB C D E Sta2) Sta2) Tot Time Aloft: 5.7 1.18.5 80 Tech: 8 5/2°5 69.01 2/3 Pg_l of_ Schoone CRO 246100

450/49%/20.2

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Date: 10-23-20

طروبالارتال		(email log daily to flight_log_distribution_list@quantumspatial.com)	ution_list@quantumspatial.com)		Uft (A) B C D E	CDE Pglot
Project: USGS EAR	EARTH MAI QUA	Proj #: 1203-	R037339 FU	Flight Mgmt File: 2020	20201023_SN404	SA4040-A-R037339
Alreraft: N704MD	Begin Hobbs: 14865,4	5.4 End Hobbs: 14870.8	0.8 Total: 5.4	Pilot: NEILSON	Co-Pilot:	- Tech: Schoone
Dep Apt: IXRNO	Dep Time (Lcl): 69:43	(Z): 16:43	Arr Apt: ҚҚЫО Ап	Arr Time (Local):	(Z): .	Tot Time Aloft:
CORS: Y I(N) St	Sta 1: OPP	Sta 2:	Flyovers: Y /(N)	N If Y, times: Sta1)) Sta2)	2)
GPS Unit: Y / (N) St	Sta 1:	Sta 2:	Flyovers: Y /(N)	N If Y, times: Sta1)) Sta2)	2)
Gd Temp beg: 5	°c End: 14 °c	OAT beg: °c End:	i: °c Altimeter begin:	30.16	end: 30.09	40% GB 391.97 Storage
LiDAR Type 1560 11	0 40H.	VIE 9302H WHE	Avg Terr Ht	Max 160 Avg Pt Gdepd 160 Spadng		<u> </u>
FOV	Freq	MpiA Y / N Pulses	Pulse 350KHZ	100%	PRSM 2.37	91.98 00 45,99 2/3
Lhe * Hdg Start(VTC):	End (UTC): Gd Spd	PDOP/#Sats GPS Altitude Crab (Turb (0, _, •)	FLIGHT LINE NOTES	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.	tal etc
1419 77 16:58	17:00 150	11338	ABORT. LINE -	Flamila/22 Skc	SMOOTH AIR	
50:Cl CL 08h	17:21 140	18/28 11364		- 1		
421 258 n.24	17:40 137	8/27 11361				
422 77 17:43	142 00.81	1.0/24 11355				
423 258 18.04		1.0/25 11355				
424 77 18:22	18:38 152	1.0/26 11355				
425 258 18-41	18.58 135	1.0/26 11358		dIHS	DR. VE;	SAN DISK- 2567
426 77 19:01	19:17 151	1.0/25 11368		3.	BACK UP: EASYSTERE - OCHD	15- 0604B
427 258 19:20	19:37 127	10/27 11368				
CR055 N 19:39	19:42 148	8/31 1				
384 166 2533	20,28 145	10/27 12418				
385 347 20:31	20:57 142	80481 66/6				
386 167 20:40	20:46 141	10/28 12408				
387 347 20:50	20:56 140	1.0/27 1245				
388 167 21:00	21:07 142	1.0/28 12401				
389 347 21:10	21:16 142	1.0/28 12395				
CROSS W 21:19	21:22 132	1 98/0.				
Total Proj Linea: 542	Unes Flown: 160/14	Unes Remain: 368	Online Time: 4/.4/	Mob Time: 1.0	Notes: MISSIAN 8	8
	174			- 1	4110/37 1/30116	

																													_
2000	Total Proj Lines:	237	25	258	CRASS	267	200	રુક	264	263	262	361	260	259	258	257	256	558	1,50	Line *		LIDAR	Gd Temp beg:	GPS Unit: Y /(N)	OORS:	Dep Apt: KRNO	Alrcraft: N704MD	Project:	TOWN CHAIN
2	y Lines:	252	36	253	2	253	73	253	73	253	73	253	73	253	2	<i>8</i> 53	73	253	73	3PH	Ş		8	17	7 /N	XRZ	HOLN	USGS	B
31:08	542	20:52	20:36	30-18	30.08	19:49	19:33	19:17	19:00	18-45	18:29	18:14	17:59	17:44	7:29	17:14	16:59	16:45	16:30.57	Start (VTC)		156011	5°c	Sta 1:	ک Sta 1:		0	EARTH MAI	
27.10	Lines Flown: 198	21:06	20:48	20:33	20:13	30:02	19:45	19:29	19:13	18:57	14:81	18:26	18:11	25:41	17:40	17:26	11:7	16:56	14:91	EM (VTC):	Freq	1 -		=	1: PPP	Dep Time (Lcl): 09:00	Begin Hobbe: 14870.8		
20%		137	156	127	151	139	150	144	150	142	145	147	145	134	145	148	146	145	148	ଜ୍ୟୁ		1040	ر. الا		Pρ	ld): 09:0	16. 148.2°	OLY NEVADA	_
2	-	,9/29	19/29	.9/32	.9/33	19/31	.9/30	36/15	36/28	.9/29	1.0/27	.9/27	1.0/25	1.0/25	1.0/25	1,6/6	58/12	88/8.	16/8.	PDOP/# Sata	MPIA Y / N	AGL 2305M	OAT beg:	۲ ک	ş	1		46A	email rog dail
~	Lines Remain:	11364	11394	11387	~	11883	11919	12083	12011	11945	08811	11824	וררוו	11722	1)686	11660	11640	11627	1624	GPS Altitude	1		6	Sta 2:	Sta 2:	(Z): 16:00	d Hobbe:	Proj *:	A to tright To
	333			7																Crab Turb	Pulses In Air	AMSL Alt	°c End:	Į		AT /	End Hobbs: 14876.3	Reserson	email log daily to riight_log_distribution_list@quantumspatial.com)
	Online Time:																		SKC	_	Pulae Rate	Avg Terr	°c	Fl _y	FJ.	ATT Apt: KR30	Total:		_Ust@quantum
	no: 4.5									The second secon		1							Vis Zio		356KH2	7	Altimeter begin:	Flyovers: Y / 🚯	Flyovers: Y /(N)		5.5	_	spatial.com)
	M _o																		SMOOT		Power	Max	er begin:			rr Time (l	Pllot:	Flight Mgmt File:	
	Mob Time:												-1	(1)					SMOOTH AR	FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.	100%	青	30.0€	If Y, times: Stal)	lf Y, times: Stal)	Arr Time (Local): 14:30	NEUSON	ı	
£117	10												BACKUP	SHIP DRIVE:						NOTES - visi	PPSM	Avg Pt Speding	end:	: Sta1)	: Sta1)		ž	202010	
4114 / 53 % / 30.05	Notes:												٠,	- 1						bility, clouds,	2.37		29.93			(Z): 21:30	Co-Pilot:	20201024- SN4040-A-R037339	
130.05	: MISSION 9												FASYSTURE - 00-10	SANDISK 2567						smoke, partia	1			Sta2)	Sta2)	3	"	DHOHO	Utte (A) B C D
	ν9												RE -06	<i>₹</i> 567						r, etc			1	_		Tot Time Aloft:		-A-R	CDE
													47.								0, 55,9 100	81725/ E	80.615 E			Aloft:	Tech:	37339	_
																							CS Storage				Schoone	•	Pg I of CX
																				- []	8	いるこれ	2.3				Ф		ſ

Total Proj Lines:							-	CROSS N	248 252 I	244 720	243 252	72	35,	7	239 252	2	Line * Hdg S	 -	FOV	γ	Gd Temp beg:	GPS Unit: Y / (%)		1 %	Alrcraft: N704/MD	Project: US65	and their	
549 Pune							_	00:53 00:57	252 00:42 00:51	72 00:29 00:38	252 00:16 00:36	P1:00 80-00	23:47 23:59			23:00 23:12	Start (UTC): End (UTC):	Fred	Š	1560 11 SariaL .	22°c End:	Sta 1:	Sta 1:	ľ		EARTH MRI		borne LiDA
Mod Hown: Avoy.	٧I						:	140	133	150	137	152	145	147	135	1418	GdSpd		+	HOHO ALL	3, 51		PPP	Dep Time (Lcl): 15-3 8	Begin Hobbe: 14876.3	I NEVADA QLZ	(em	R Data Co
Lines Remain:	╢							1 /24)	14811 12/11	12/24 11499	CIHII LE/15.	18/28 11374	19611 88/8	19611 88/8	19/27 11361	19/29 11364	PDOP/# Sats GPS Altitude	Mpia Y / N		2305M	OAT beg:	Sta 2:	Sta 2:	(Z): 22:38	ı	χ2 Pro]#:	all log daily to flight	Mection L
0 0 0	3 7 2								<u> </u>	9				_			de Crab (0,-,+)	in Air	Plan	Alt	°c End:				6.26.841.8	: Ro37339	log_distribution_list	og Sheet
Online Time: 0.0	ш												GPS ROLLOVER			Ske		Rate 350 KH2	2 7	Avg Terr	°c Altimete	Flyovers: Y / (1)	Flyovers: Y /W	Arr Apt: KRNO Ar	Total: 2.6		email log daily to flight_log_distribution_list@quantumspatial.com)	Airborne LiDAR Data Collection Log Sheet :: Quantum Spatial, Inc
Mob Time:												3				ų.	FUGHT UN	100%		Mex	Altimeter begin: 30,02	/ (i) If Y, times: Sta1)	/⑥	Arr Time (Local): 18:30 (Z): 01:30	Pilot: كاE١٤٥٥٨	Flight Mgmt File:		Spatial, Inc
0,4																	FUGHT LINE NOTES – visibility, clouds, smoke, partial, etc.	TOM!	1	احِ٠	88.62:bne	s: Sta1))s: Sta1)	:20 (Z):01:	Co-Pilot:	2020102		
Notes: MISSION																	uds, smoke, partial, etc		,		380/	Sta2)	Sta2)		lot:	1. SNHOHO.	LIFE A B C D E	Date: 10
O																		a 24.01 2/3	75%.1	בא נונים ה כמי	Beg Storage Storage			Tot Time Aloft: 27	Tech: Schoone	20201024. SN4040-B-R037339	D E Pox of A	24-80

1. John USGS EARTH MIKE NEWART GKI/Q(2 rro] #: Ru37339 Flight Mgmt File: 20201027-5N4040-A-R037339	uantumspatial.com)	Airborne LiDAR Data Collection Log Sheet :: Quantum Spatial Inc
N4040-A.RB7339	Unt B C D C PO L OF B	Date:

Wissian 13	Priod time: 1.0 Notes:	Cinaro inito.	- 1		-			8,0	
11		Online Time: U.A	386	Lines Remain:	3	Lines Flown: 249/	542	otal Proj Unes:	otal Pro
			~	11578	154 9/31	20.09 1	19:54	250	13
BOLY I CHAMEL WOOKING - ABORT	23.05M 145 KM 350KH2 81185 100% 0	(৯১৯) ৯ঃ	`	31 11578	- 19/31	19:50	-	256	13
	- 1	- 1		1 8	146 8/38	19:37 10	15:34	3	CROSS
	2 CO MPLETE	Ø1 15	7	131 JOY27	:/e, 3H	19:32 1	19:28	341	180
			7	31 10427	145 .8/31	19:25	19:21	101	100
			4	31 10424	18/8.	19:18	19:13	175	99
			20		142 9/29	19:11	19:06	161	86
				11401 68	130 .9/29	19:04 1	18:59	341	97
			=	11401 62	146 1.0/29	18.56	18:51	<u>e</u>	96
- [57	70401 76	133 1.0/27	18:48	18.43	341	95
PASSEDE ((CF:		77	127 16397	139 1.0/	104-81	18:35	ē	46
SANDISK DETU	SHIP DRIVE		88	.9/28 lo388	133 .9,	18:33	18:29	341	22
			3.	.9/28 10368	137 .9,	18.25	18:19	ē	92
			23	_	133 1.0/	18:16	18:08	341)	5
			Š	_	146 1.0/26	18.05 1	17:57	101	90
			ઝ	38601 DG/0.1		17:55	17:47	3-11	89
		- 1	2	36 10315	1.0/24	17:44	17:36	16)	88
	1828M 148KN 700KHZ129178 100% S	2		20501 16/8,	138 .9,	1734 1	17:27	341	87
ke, partial, etc	FUGHT LINE NOTES – visibility, clouds, smoke, partial, etc.	Turb (0.~.+)	ស្វិ	PDOP/= Sats GPS Altitude	Gd Spd PDOP	Emd/UTC): C	Start MG	Æ	2
8 3		Pulse Rate	In Air	MPIA Y / N		Freq			
249.14	Mex 160 Avg Pt Gdepd 160 Speding	Avg Terr He	AMSI Alt		AGE AFF	Choho	15(0011	ğ ş	LIDAR
Sog 3/6 86 Storage	Altimeter begin: 30,31 end:30.31	•°C	°c End:	OAT beg:	o.	-1	2, 17	Gd Temp beg:	d Ten
Sta2)	Flyovers: Y / 🚯 FY, times: Sta 1)	Flyove		Sta 2:			N Sta 1:	π Υ /⊗	GPS Unit:
Sta2)	Flyovers: Y / 🕦	Flyove		Sta 2:		1: 1:	N Sta 1:		00 13 13 13 13 13 13 13 13 13 13 13 13 13
Tot Time Aloft:	Arr Time (Local): 14:53 (Z): 21:53	Arr Apt: Kapo		(Z): 16:42	4:09:1/2	Dep Time (Lcd): 09:4/2		Dep Apt: スペック	g
Tech: Schoone	A Pilot: NEILSON Co-Pilot:	13.2 Total: 5.	bbs: 14893.2	End Hobbe:	1.18885	Begin Hobbe: いりとなかし	5		Alrcraft:
_R037339	Tight Mgmt File: るの201027_SN	R037339	J*: 70	/aca Pro	NEUADA GLI/QLA Proj #:		Project: USGS EARTH MRI	. vse	roject
10-01-00	talcom)	email log daily to flight_log_distribution_Ust@quantumspatial.com)	Ight_log_distril	l log daily to fi	(emai			3	שרבווללינני

	Total Proj Lines: Lines Flown:								CRoss S 31:27 21:28 18/33 1	9 256 21:09 21:23 149 51/32 11515	76 20.50 21:06 125 5/32	_	12 76 20:12 20:30 121 19/31 11568	Line # Hdg Start (UTC): End (UTC): Gd Spd PDOP/*Ssts GPS Altitude Crab (Freq MpiA Y / N Pulses	4640 AGL	°c End: °c	N Sta 1:	2	Dep Time (Lcd): (Z):	NOUND	USGS EARTH MAI NEVADA QLI/CX 2 Proj #:	time (email tog daily
Online Time:														Turb	Pulae Rate	Avg Terr	°c	Flyover	Flyoven	Arr Apt:	Total:	R037339	bution_list@quantumspatial
Mob Time: Notes:														FUGHT LINE NOTES - visibility, douds, smoke, partial, etc.		Max 160 Avg Pt Gdspd 160 Spading	Altimeter begin: end:	Flyovers: Y / (N) If Y, times: Sta1)	Flyovers: Y /(N) If Y, times: Sta1)	Arr Time (Local): (Z):	Pilot: NEWSON Co-Pilot:	Flight Mgmt File: 2020 1027-5N4040-A-R037339	ilcom)
#														uds smoke partial etc	Ter 2/3		Seg Storage	Sta2)	Sta2)	Tot Time Aloft:	Not: - Tech: Schoone	-SN4040-A-R037339	Uft (A) B C D E POR of S

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Airborne LiDAR Data Collection Log Sheet :: Quantum Spatial, Inc

Date: 10-28-20

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Project:	PROJECT: USGS EARTH MRI NEUADA QLA	RI NEJADA	QL2 Proj #: R037339		light Mgmt File: 202010	Flight Mgmt File: 20201028_SN4040_A_R037339	
Aircraft:	Alrcraft: N704MD Beg	Begin Hobbs: १५४५३. ह		End Hobba: 1-18987 Total: 5.5	Pilot: NEILSON	- 1	Schoone
Dep Apt:	Dep Apt: 人々いり Dep	Time (Lcl): 09.	Dep Time (Lcl): 09:50 (Z): 16:50	Arr Apt: KRNO Ar	Arr Time (Local): 15:20 (Z): 22:20	Tot Time Aloft:	
				ı	2		
CORS:	Sta 1:	999	Sta 2:	Flyovers: Y /(N)	(N) If Y, times: Sta1)	Sta2)	
GPS Unit: Y /()	Y / (3) Sta 1:	-	Sta 2:	Flyovens: Y /(N)	(N) If Y, times: Sta1)	Sta2)	
Gd Temp beg:	5 ℃	End: 19 °c	OAT beg: °c End:	ငိ	Altimeter begin: 30,32 end: 3	- 1	Storage
LIDAR	156011	Sorial o HoHo	AGE 230571 ALE	Avg Terr	Max A00 Avg Pt		25 (20
	FOV Scan	ă 5	Mpia Y / N Pulace	Pulse 35KHZ	100%	7.64	0 44.79 8/3
Une *	Hdg Start (VTC): End (VTC):	GdSpd	PDOP/e Sats GPS Altitude Crab	Turb	FUGHT LINE NOTES - visib	FLIGHT LINE NOTES – visibility, douds, smoke, partial, etc.	
_	75 17:22 17:31	142	8/26 12162	SKC			
ຍ	356 17:33 17:45 146		1.0/24 11850				
			-				

	267	Unes Remain: 267		Lines Flown: えらり/えし	548 u		Total Proj Linea:
		130 Y	150 1.0/30	20:46	30:44 2	5	c2055
		130 1	145 1.0/30	20:27	84.33	Z	C0055
		1.1/27 11591	1.1 751	20:31	252 20:29	252	253
	91	1.0/29 11545	145 1.0,	20.26	72 20:24	りる	252
	9	10/28 11529	154 1.0	20-21	252 20-17	a 5a	251
	-,	9/30 11515	139 ,9	20-14	2010	12	250
	نه	.9/30 11452	154 .9	عاه.٥٥	252 20:01		816
	W	.8/33 11643	136 .8	19:58	19:52 19:58	Z Z	218
	0	.8/30 11660	155 .8	19:49	352 19:41 19:49	252	247
	3	5/31 11063	145 .5	19:39	78 19:31	181	246
	ν 1	8/28 11515	158 .8	19:22	256 19-10	256	~
BACK UP - EASYSTURE OFFILD	2	9/28 11535	135 9	19:07	18:52	25	7
SHIP DAVE SANDIEK 2570	3	10/26 11683	135 1.0	18:50	18:34	256	6
	4	1.1/25 11834	132 1.1	18:32	18:19	75	5
	4	48C11 48/81	e.1 Lh1	91:81	18:04	256	4
	જે	10/24 Har	136 10	80:81	17:49	35	B
	Ö	1.0/24 11850	146 1.0	17:45	256 17:33	256	စွာ
SKC		20181 0E/3:	142 6	17:31	17:22	7	_
Turb FLIGHT LINE NOTES – visibility, clouds, smoke, pardal, etc.	Crab	PDOP/# Sats GPS Altitude	Gd Spd PD	╁	Start (UTC): End (UTC):	¥	Line *
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41.6/40%/30.33

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Project: USGS EARTH MRI NEVADA QLA Proj *: 12037339	TOTA 6"50"	O
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8 5	Jail fog dail	ollect
Proj *:	y to rught_t	tion La
22	og_distrib	og Sho
7339	rtion_list@	et
Flight Mg	email log daily to flight_log_distribution_list@quantumspatial.com)	Airborne LiDAR Data Collection Log Sheet :: Quantum Spatial, Inc
20102		
mt File: 20201028 SN4040-A-R037339	Lift (A)B C D E P	Date: 10-28-20
-	000)

Sheller .	141	I amount of daily to to gur to	and the second s	Uft (Lift (A)B C D E POQ of A
Project:	USGS EARTH MRI NEVADA QLQ Proj #: 12037339	+ Q(∂ Pro] #:	12037339 Flight Mgmt	File: 20201028_S	0410-A-R037339
Alreraft:	Aircraft: ハフゥリハウ Begin Hobbs:	End Hobbs:	Total: Pllot:	SEILSON CO-PILOTE	Tech: Schoone
Dep Apt:	Dep Time (Lcl):	(Z):	Arr Apt: Arr Time (Local):	cal): (Z):	Tot Time Aloft:
CORs:	Y /(1) Sta 1:	Sta 2:	Flyovers: Y / 🕦 HY	, times: Sta1)	Sta2)
GPS Unit:	GPS Unit: Y /(N) Sta 1:	Sta 2:	Flyovers: Y /W If Y	Y, times: Sta 1)	Sta2)
Gd Temp beg:	°c End:	°c OAT beg: °c	°c End: °c Altimeter begin:	end:	Seg Storage
DAR	1900 11 0901 Addo	AGE 2305/ ANS	Avg Terr Max Ht Gdapd	Avg Pt Speding	EM CRU 20194R
	FOV Scan	MpIA Y / N Pulses	Pulse 350KH2 Power	100% PRSM 2	Tox 8/3

	. 9 Notes:	Mob Time:	Online Time: 4.1	9	Linea Remain:	Linea F		Lines Flown:		Total Proj Lines:	Tota
					11.355	.9 29	142	20:44	9 203536	13 229	9
					11,355	"	148	20:33	8202545	92 048	2
					11.335	"	/38	20:23	29201645	91 20	1
SIXVI	WD My Rock	Drive :	8/ú		11,364	1.0 27	150	20:13	248 200816	90 00	1
	05100257n	per Onive:	Ship		1,332	.9728	136		229200057	89 20	T
					11,391	6Ph6.	140	19:55	048 195155	88 04	T
					11,584	18631	142	84:61	229/194554	87 2	T
					11,588	3/	145	14:41	048/93848	86 09	T
		8	Record 008					7	257 193159	Ctie 26	×
					11.299	18729	158		346191814	413 3	1.
					1	.8329	145	9 19:15	166 190609	41214	T
					11,299	.8528	145	19:02	346/85412	411 3	T
					P,	18927	139	0 18:51	166184200	1	
					F.	.9926		1 18:39	346/83001	409 3	L
					11,335	.9925	145	18:36	6 181718	408 166	1
					11,348	.48 26	142	18:4	346 180507	407 3	T.
			S-turn					18:02	17:59		T
			Static					17:17	17:12		T
oke, partial, etc.	E NOTES - visibility, clouds, smoke, partial	FUGHT LINE NOTES -		ab (0,-,+)	GPS Altitude Crab	PDOP/+ Sats	Gd Spd	End (UTC):	Hdg Start (UTC):	Line # H	T
7× 5.44. 00	PPSM	Power	Rate		z	MpIA Y	375 KHZ	Freq 3			1
Ga 8019	Avg Pt Spacing	Max Gdapd	Avg Terr He		AMSL	AGL	4040	Serial e	1560 ii	LIDAR FOV	F
ges 848 4 Storage	end:	er begin:	°c Altimeter begin:	End:	beg: °c	PA A	00	°c End:		Gd Temp beg:	Te
Sta2)	ea: Sta 1)	IN If Y, timea: Sta1)	Flyovers: Y		Sta 2:	9		Sta 1:	(2)	GPS Unit: Y	I
Sta2)		IN If Y, times: Sta1)	A :B.		Sta 2:	S.		Sta 1:	3	CORS: Y	Q
Tot Time Aloft: 5,0	15:34 (Z): 22:34	Arr Time (Local): /	KRNO	Arr Apt:	17:36	10:36 (Z):	(Lot)	Dep Time	KRNO	Dep Apt: /	To
Tech: SKROHN	LSON Co-Pilot:	Pilot: JNEILSON	Total: 5.6	14906.1	End Hobbe:	(bbs: 14901.	Begin Hobbs:	704MD	Aircraft: N	T≥
4040 A RO323	20201030_SN	Flight Mgmt File:	The second second	RO 37339	100000	Nevada/O	MRI Neu	arth m	HSGS E	6	17
Utt. (A) 8 C D E Pg L of A		antumspatial.com)	st@qu	listribution_Li	Int_log	email log da	1			-	72
		Contiol Inc	:	O Sheet		College	Data	LIDAR	Airborne LIDAR Data Collection)	

Gd Temp beg: Type 1560ii Aircraft: Dep Apt: Project: (USGS Earth MRI Nevada/1012 Proj#: Aircraft: N704 MD Begin Hobbs: 14901.1 End Hobbs: CORS: GPS Unit: Y 1/1 95 94 Lime * 96 18 239 205834 21:09 248 21/232 21:23 248 21/4655 21:53 239 21565/ 22:10 049 204645 20:56 Hdg Start (UTC): End (UTC): Y 10 Airborne LiDAR Data Collection Log Sheet 22:11 Sta 1: Sta 1: Dep Time (Lcl.): /0.36 (Z): /7:36 23 Freq 375kHz Serial a End: 40% Gd Spd 135 150 152 150 .89 30 11,335 | email log daily to flight_log_distribution_list@quantu PDOP/# Sats GPS Altitude Crab .85 .9130 MPIA Y / N OAT beg: = 8 Sta 2: 11,269 11,348 11,342 11.348 Ale AMSL Puleos In Air ° 14906.1 R037339 End: ATT APE: KRNO :: Quantum Spatial, inc Total: S-turns Avg Terr Ht Pulse Rate o° Flyovers: Y / 🕦 Flyovers: Altimeter begin: Max Gdapd Power 5.0 YIN Arr Time (Local): 15 Flight Mgmt File: Pilot: If Y, times: Sta1) If Y, times: Sta1) :34 (Z): 22:34 NOTES – visibility, clouds, smoke, partial, etc. 2620 1034-SN4040- A- R037339 Co-Pllot: Tech: Avg Pr Speding UME (A)8 C D E Sta2) Sta2) Tot Time Aloft: 4.348 801.9 46.5 5.0

Total Proj Linea:

Lines Flown:

Lines Remain:

Online Time:

41

9

Airborne LIDAR Data Quantum Spatial, inc

1,000 1660!! N TOU MD 1 / (S) Y 13 Sea 1: Dep Th 4040 MPIA Y / N 123 /L: 22 or begin: If Y, time 5ta (2) Sta 2) 6.708 m ROHN

	0	.729	27/	38	301	1 30 /	29	333185754 19:09 165 " 11.361 0	143 184145 18:53 150 .89 29 11 355 0	24 11	28 /	26 113	143/18905 17:51 148 15:71 8088 11 EF	136 .89	139 .89	cx. 6HJ	16:49 16:51	16:13 16:18	
Online Time: 4.8 Mob Time: 7 Notes:																8.6	S-turn	Static	

Airborne LiDAR Data Collection Log Sheet Quantum Spatial, inc

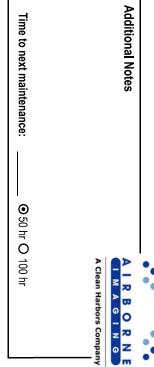
Project: USGS Ea
Aircreft: N 704 MD
Dep Apt: KRNO Total Proj Linea: Gd Temp beg: GPS Unit: CORS: X-tie X-tie LIDAR 187 190 188 192 078 204755 20:43 258 210026 21:10 078 211249 21:23 268 212600 21:36 17121390221:4 143 203204 323 202615 1/® Y 13 KRNO 704 MD Begin Hobbs: 14906. 156011 22:54 23:01 21:41 Sta 1: Sta 1: Dep Time (Lal): 9:22 20:29 HH:16 Serial # 5 40% 149 145 146 1 140 150 0 .9330 " .9330 " .8631 11,604 .92 " .9330 11,637 OAT beg: MPIA Y / N Vaca Proj #: TC: 16:22 End Hobba: Sta 2: Sta 2: ° R037339 14911.6 Arr Apt: 0 0 0 0 0 0 Online Time: 4.8 Recordors Record Static Total: o° Flyovers: Altimeter begin:

Max
Gdspd
Power 019 YIN Arr Time (Local): Flight Mgmt File: 2020/03/ 3 Pllot: JNEILSON Mob Time: 7 If Y, times If Y, times: Sta1) a: Sta 1) (Z): 22:53 SN 4040_ Sta2) Sta2) Tot Time Aloft: 10/31/2020 A-R037339 SKROHN

Julian Day 296 | Flight A

Date October 22, 2020	Aircraft C-FKMA
Project 3204 QSI PyramidLake	Pilot A. Stepanowich
Location Reno, NV	Operator B. Eisenbart
Mission Objective	

System	Riegl VQ-1560i 37
Unit	37
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	1 Drive
Scanner 2 Drive	2 Drive



	Aircraft Block Time
Engine On 14:51	Takeoff 15:05
Engine Off 21:29	Landing 21:19
Total 6.6 hrs	Total 6.2 hrs

	M	Mission	n Plan		
AGL Height	2200	3	Pulse Rate	700khz	zr
Target Speed	150	kts	Scan Rate	320hz	Z
Laser Current	100	%	% FOV	60	degs

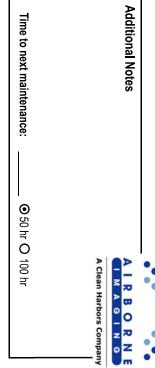
Static	GF	GPS Time
Alignment	Start	End
Pre Mission	14:54	14:59
Post Mission	21:22	21:27

	LiDAR	Flight	GPS	GPS Time	Line	Line Aborted	Mission ID	
Flight Line	File Name	Direction	Start	End	Time	nmi to End	Time Stamp 201022	Comments
PPP-8	_	-	15:14	15:18			-	figure 8
2071		344°	15:21	15:36			152115	
2072		164°	15:39	15:54			153938	
2073		344	15:57	16:12			155751	
2074		164°	16:16	16:31			161614	
2075		344°	16:34	16:49			163447	
2076		164°	16:52	17:07			165259	
2077		344°	17:11	17:26			171134	
2078		164°	17:29	17:44			172948	
2079		344°	17:48	18:03			174825	
2080		164°	18:06	18:21			180651	
2081		344°	18:25	18:41			182548	
2082		164°	18:44	18:59			184415	
2083		344°	19:03	19:18			190302	
2084		164°	19:21	19:37			192121	

Julian Day 296 | Flight A

Date	October 22, 2020	Aircraft	C-FKMA
Project	Project 3204 QSI PyramidLake	Pilot A	Pilot A. Stepanowich
Location	Reno, NV	Operator	Operator B. Eisenbart
Mission Objective	bjective		

System Unit	Riegl VQ-1560i 37
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	1 Drive
Scanner 2 Drive	2 Drive



	Aircraft Block Time
Engine On 14:51 Takeoff	Takeoff 15:05
Engine Off 21:29	Landing 21:19
Total 6.6 hrs Total 6.2 hrs	Total 6.2 hrs

AGL Height 2200 m Pulse Rate 700khz Target Speed 150 kts Scan Rate 320hz Laser Current 100 % FOV 60 degs		~	lissio	Mission Plan		
150 kts Scan Rate 320hz 100 % FOV 60	AGL Height	2200	m	Pulse Rate	700khz	
t 100 % FOV 60	Target Speed	150	kts	Scan Rate	320hz	
	Laser Current	100		FOV		gs

Static	GP	GPS Time
Alignment	Start	End
Pre Mission	14:54	14:59
Post Mission	21:22	21:27

Flight Line 2085 2086 2087 2088 X-TIE PPP-8	LiDAR File Name	Flight Direction 344° 164° 344° 164° 254°	GPS Start 19:40 19:59 20:19 20:39 20:59 21:04	GPS Time End 19:56 20:16 20:36 20:55 21:04 21:08	Time	nmi to End	Mission ID Time Stamp 201022 194037 195937 201944 203913 205938	01022 7 7 7 8
YPP-8	1	254°	20:59 21:04	21:04			205938	

Julian Day 298 Flight A

LIDAR Flight Log

Date October 24, 2020	Aircraft	C-FKMA
Project 3204 QSI PyramidLake	Pilot A	Pilot A. Stepanowich
Location Reno, NV	Operator	Operator B. Eisenbart
Mission Objective		

Scanner 2 Drive	Scanner 1 Drive	GPS Rx	IMU	Unit	System
2 Drive	1 Drive	Trimble GNSS17	Applanix AP60	37	Riegl VQ-1560i

gnt Log

Additional Notes
Gimbal/snapshot issues on start up required two system restarts

A I R B O R N E

Time to next maintenance: © 50 hr O 100 hr

Α	Aircraft Block Time
Engine On 14:45	Takeoff 15:33
Engine Off 22:18	Landing 22:09
Total 7.6 hrs	Total 6.6 hrs

	M	Mission	n Plan		
AGL Height	2200	Ħ	m Pulse Rate	700khz	Z
Target Speed	150	kts	Scan Rate	320hz	
Laser Current	100	%	FOV	60	degs

Static	GF	GPS Time
Alignment	Start	End
Pre Mission	15:22	15:27
Post Mission	22:11	22:16

	LiDAR	Fliaht	GPS Time	Time	Line	Line Aborted	Mission ID	
Flight Line	File Name	Direction	Start	End	Time	nmi to End	Time Stamp 201024	Comments
PPP-8	-	1	15:41	15:46			-	figure 8
2089		345°	16:05	16:22			160517	
2090		165°	16:26	16:43			162616	
2091		345°	16:47	17:05			164717	
2092		165°	17:08	17:27			170854	
2093		345°	17:30	17:48			173026	
2094		165°	17:52	18:10			175225	
2095		345°	18:13	18:31			181352	
2096		165°	18:35	18:53			183532	
2097		345°	18:57	19:15			185714	
2098		165°	19:18	19:37			191850	
2099		345°	19:40	19:58			194036	
2100		165°	20:02	20:19			200203	
2101		345°	20:23	20:41			202331	
2102		165°	20:45	21:03			204520	

Julian Day 298 Flight A

LIDAR Flight Log

Date	October 24, 2020	Aircraft	C-FKMA
Project	Project 3204 QSI PyramidLake	Pilot A.	Pilot A. Stepanowich
Location	Reno, NV	Operator	Operator B. Eisenbart
Mission	Mission Objective		

Scanner 2 Drive	Scanner 1 Drive	GPS Rx	IMU	Unit	System
2 Drive	1 Drive	Trimble GNSS17	Applanix AP60	37	Riegl VQ-1560i

L Log

Additional Notes

Gimbal/snapshot issues on start up required two system restarts

Time to next maintenance:

O 50 hr O 100 hr

		~	Mission	n Plan	
	AGL Height	2200	3	Pulse Rate	ate
	Target Speed	150	kts	Scan Rate	ate
	Laser Current	100	%	% FOV	

Total 7.6

hrs

Engine On 14:45

Takeoff

15:33

Aircraft Block Time

Engine Off 22:18

Landing 22:09 **Total** 6.6 hrs

Static	GP	GPS Time
Alignment	Start	End
Pre Mission	15:22	15:27
Post Mission	22:11	22:16

									_		
	Flight Line	2103	2104	X-TIE	PPP-8						
I iDAR	File Name				-						
Fliaht	Direction	345°	165°	255°	-						
GPS Time	Start	21:06	21:28	21:50	21:55						
Time	End	21:25	21:47	21:55	22:00						
Line	Time										
Line Aborted	nmi to End										
Mission ID	Time Stamp 201024	210650	212856	215046	-						
	Comments				figure 8						

Julian Day 303 Flight A

LIDAR Flight Log

Date	October 29, 2020	Aircraft	C-FKMA
Project	Project 3204 QSI PyramidLake	Pilot	G. Toews
Location	Reno, NV	Operator	Operator B. Eisenbart
Mission	Mission Objective		

Scanner 2 Drive	Scanner 1 Drive	GPS Rx	IMU	Unit	System
2 Drive	1 Drive	Trimble GNSS17	Applanix AP60	37	Riegl VQ-1560i

Additional Notes

Maintenance in the morning,
Airport TFR restriction in the evening
required shorter mission

A Clean Harbors Company

Time to next maintenance: © 50 hr O 100 hr

 Aircraft Block Time

 Engine On 19:10
 Takeoff 19:32

 Engine Off 00:10
 Landing 23:59

 Total 5.0 hrs
 Total 4.5 hrs

	M	Mission	n Plan		
AGL Height	2200	Ħ	m Pulse Rate	700khz	Z
Target Speed	150	kts	Scan Rate	320hz	
Laser Current	100	%	FOV	60	degs

Static	GF	GPS Time
Alignment	Start	End
Pre Mission	19:14	19:19
Post Mission	00:03	00:08

Figure 8	•			23:45	23:41	ı	ı	PPP-8
	233321			23:36	23:33	255°		X-TIE
	230926			23:27	23:09	165°		2114
	224806			23:06	22:48	345°		2113
	222637			22:44	22:26	165°		2112
	220505			22:23	22:05	345°		2111
	214324			21:11	21:43	165°		2110
	212141			21:39	21:21	345°		2109
	205943			21:18	20:59	165°		2108
	203752			20:56	20:37	345°		2107
	201617			20:34	20:16	165°		2106
	195427			20:12	19:54	345°		2105
Figure 8	-			19:50	19:46			PPP-8
Comments	Time Stamp 201029	nmi to End	Time	End	Start	Direction	File Name	Flight Line
	Mission ID	Line Aborted	Lin	GPS Time	GPS	Flight	LiDAR	

Julian Day 304 Flight A

		bjective	Mission Objective
Operator B. Eisenbart	Operator	Reno, NV	Location
G. Toews	Pilot	Project 3204 QSI PyramidLake	Project
C-FKMA	Aircraft	October 30, 2020	Date

GPS Rx Trimble GNSS17	710
	GPS Rx Trimble GNSS Scanner 1 Drive
	Scanner 1 Drive

Additional Notes	AIRBORNE
TFR restricted takeoff in the AM	A Clean Harbors Company
Time to next maintenance:	⊙ 50 hr O 100 hr

	Aircraft Block Time	
Engine On 18:01	Takeoff 18:21	A
Engine Off 01:15 Landing 01:04	Landing 01:04	Ta
Total 7.2 hrs Total 6.7 hrs	Total 6.7 hrs	La
		1

	M	Mission I	n Plan		
AGL Height	2200	3	Pulse Rate	700khz	۱z
Target Speed	150	kts	Scan Rate	320hz	Z
Laser Current	100	%	FOV	60	degs

Static	GP	GPS Time
Alignment	Start	End
Pre Mission	18:06	18:11
Post Mission	01:07	01:12

	LiDAR	Fliaht	GPS Time	Time	Line	Line Aborted	Mission ID	
Flight Line	File Name	Direction	Start	End	Time	nmi to End	Time Stamp 201030	Comments
PPP-8	-	-	18:39	18:43			-	Figure 8
2115		345°	18:49	19:08			184950	
2116		165°	19:11	19:29			191111	
2117		345°	19:32	19:50			193245	
2118		165°	19:54	20:13			195446	
2119		345°	20:16	20:34			201628	
2120		165°	20:37	20:55			203743	
2121		345°	20:59	21:17			205929	
2122		165°	21:21	21:40			212116	
2123		345°	21:43	22:01			214310	
2124		165°	22:04	22:23			220454	
2125		345°	22:26	22:45			222647	
2126		165°	22:48	23:06			224844	
2127		345°	23:09	23:28			230954	
2128		165°	23:31	23:49			233141	

Julian Day 304 Flight A

Mission Objective	Location	Project	Date
bjective	Reno, NV	Project 3204 QSI PyramidLake	October 30, 2020
	Operator	Pilot	Aircraft
	Operator B. Eisenbart	G. Toews	C-FKMA

	Scanner 1 Drive	GPS Rx Trimble GNSS17	IMU Applanix AP60	Unit 37	System Riegl VQ-1560i	
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Additional Notes TFR restricted takeoff in the AM Time to next maintenance: © 50 hr O 1	takeoff in the AM	takeoff in the AM	-	
⊙ 50 hr O	© 50 hr O	⊙ 50 hr O	Time to next maintenance:	.dditional Notes TFR restricted takeoff in the
⊙ 50 hr O 1	A I R A Clean H A Clean H	A I R B O R I M A G I N A Clean Harbors Co O 50 hr O 100 hr		e AM
	Clean H	Clean Harbors Co	⊙ 50 hr ○ 1	

I						1
<u></u>		6.7 hrs	Total 6.7 hrs	hrs	Total 7.2 hrs	Tot
ĭ) 01:04	Landing 01:04	01:15	Engine Off 01:15	Enc
Ą		18:21	Engine On 18:01	18:01	jine On	Enç
	ime	Aircraft Block Time	Aircraft			

	N	Mission	n Plan		
AGL Height	2200	3	Pulse Rate	700khz	hz
Target Speed	150	kts	Scan Rate	320hz	Z
Laser Current	100	%	% FOV	60	degs

Static	GP	GPS Time
Alignment	Start	End
Pre Mission	18:06	18:11
Post Mission	01:07	01:12

Figure 8	ı			00:46	00:42	ı	ı	PPP-8
	003649			00:42	00:36	255°		X-TIE
	001459			00:32	00:14	165°		2130
	235252			00:12	23:52	345°		2129
Comments	Time Stamp 201030	nmi to End	Time	End	Start	Direction	File Name	Flight Line
	Mission ID	Line Aborted	Lin	Time	GPS Time	Flight	LiDAR	

Julian Day 307 Flight A

Date	November 2, 2020	Aircraft	C-FKMA
Project	3204 QSI PyramidLake	Pilot	G. Toews
Location	Reno, NV	Operator	Operator B. Eisenbart
Mission	Mission Objective		

	11
GPS Rx Trimble GNSS17	r10
	Scanner 1 Drive

Time to next maintenance:	Delay on startup to calibrate replaced sandel	Additional Notes
⊙ 50 hr ○ 100 hr	A Clean Harbors Company	AIRBORNE

					Γ
	Total 6.7 hrs	Tota	hrs	Total 7.5 hrs	_
	Landing 01:54	Landi	02:05	Engine Off 02:05	Ш
	Takeoff 19:15	Takec	18:35	Engine On 18:35	ш
Φ	Aircraft Block Time	Aircrat			

	M	Mission	n Plan		
AGL Height	2200	3	Pulse Rate	700khz	zr
Target Speed	150	kts	Scan Rate	320hz	Z
Laser Current	100	%	% FOV	60	degs

Static	GP	GPS Time
Alignment	Start	End
Pre Mission	18:39	18:44
Post Mission	01:57	02:02

	LiDAR	Fliaht	GPS Time	Time	Line	Line Aborted	Mission ID	
Flight Line	File Name	Direction	Start	End	Time	nmi to End	Time Stamp 201102	Comments
PPP-8	_	1	19:33	19:37			-	Figure 8
2131		345°	19:41	20:00			194141	
2132		165°	20:03	20:22			200347	
2133		345°	20:25	20:44			202559	
2134		165°	20:47	21:05			204720	
2135		345°	21:09	21:26			210908	
2136		165°	21:29	21:48			212953	
2137		345°	21:51	22:09			215123	
2138		165°	22:12	22:31			221213	
2139		345°	22:34	22:52			223430	
2140		165°	22:55	23:13			225508	
2141		345°	23:17	23:35			231706	
2142		165°	23:38	23:58			233852	
2143		345°	00:01	00:18			000103	
2144		165°	00:22	00:38			002238	

Julian Day 307 | Flight A

Date	November 2, 2020	Aircraft	C-FKMA
Project	: 3204 QSI PyramidLake	Pilot	G. Toews
Location	Reno, NV	Operator	Operator B. Eisenbart
Mission Objective	Objective		

Scanner 2 Drive	Scanner 1 Drive	GPS Rx	IMU	Unit	System
Drive	Drive	Trimble GNSS17	Applanix AP60	37	Riegl VQ-1560i

⊙ 50 hr ○ 100 hr	Time to next maintenance:
A Clean Harbors Company	Delay on startup to calibrate replaced sandel
AIRBORNE	Additional Notes

	Aircraft Block Time
Engine On 18:35	Takeoff 19:15
Engine Off 02:05	Landing 01:54
Total 7.5 hrs	Total 6.7 hrs

	~	lissio	Mission Plan		
AGL Height	2200	Ħ	m Pulse Rate	700khz	Z
Target Speed	150	kts	kts Scan Rate	320hz	7
Laser Current	100 % FOV	%	FOV	60	degs

Static	GF	GPS Time
Alignment	Start	End
Pre Mission	18:39	18:44
Post Mission	01:57	02:02

										
					PPP-8	X-TIE	2146	2145	Flight Line	
					ı				File Name	LiDAR
					1	255°	165°	345°	Direction	Flight
					01:26	01:21	01:03	00:42	Start	GPS Time
					01:30	01:26	01:19	01:00	End	Time
									Time	Lin
									nmi to End	Line Aborted
					-	012137	010328	004202	Time Stamp 201102	Mission ID
					Figure 8				Comments	

Project Name: N	Montana Statewide	Phase 2 R036170
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10/13/2020 20201013_SN3061 Riegl VQ-1560i SN3061 10/16/2020 20201016 SN4040 Riegl VQ-1560i SN4040 10/17/2020 20201017 SN4040 Riegl VQ-1560i SN4040 10/18/2020 20201018 SN4040 Riegl VQ-1560i SN4040 10/19/2020 20201019 SN4040 Riegl VQ-1560i SN4040 10/20/2020 20201020 SN4040 Riegl VQ-1560i SN4040 10/21/2020 20201021 SN4040 Riegl VQ-1560i SN4040 10/21/2020 20201021 SN4040 Riegl VQ-1560i SN4040 10/21/2020 20201021 SN4046 Riegl VQ-1560i SN4040 10/22/2020 20201022 SN4046 Riegl VQ-1560i SN4040 10/22/2020 20201022 SN4046 Riegl VQ-1560i SN4040 10/22/2020 20201022 SN4046 Riegl VQ-1560i SN4040 10/23/2020 20201022 SN4046 Riegl VQ-1560i SN4046 10/23/2020 20201022 SN4046 Riegl VQ-1560i SN4046 10/23/2020 20201023 SN4040 Riegl VQ-1560i SN4040 10/23/2020 20201023 SN4040 Riegl VQ-1560i SN4040 10/24/2020 20201024 SN4046 Riegl VQ-1560i SN4040 Riegl VQ-1560i SN4040 10/24/2020 20201024 SN4040 Riegl VQ-1560i SN4040 10/25/2020 20201025 SN4040 Riegl VQ-1560i SN4040 10/25/2020 20201025 SN4040 Riegl VQ-1560i SN4040 Riegl VQ-1560i SN4040 10/25/2020 20201025 SN4046 Riegl VQ-1560i SN4040 Riegl	Date	Mission ID	Sensor
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11/5/2020 2020115 SN4040 Riegl VQ-1560i SN4040 11/19/2020 20201119 SN3061 Riegl VQ-1560i SN3061	11/3/2020	2020113 SN4040	Riegl VQ-1560i SN4040
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	11/5/2020	2020115 SN4040	Riegl VQ-1560i SN4040
11/20/2020 20201120 SN3061 Riegl VQ-1560i SN3061	11/19/2020	20201119 SN3061	Riegl VQ-1560i SN3061
11/20/2020 20201120 SN3061 Riegl VQ-1560i SN3061			
3	11/20/2020	20201120 SN3061	Riegl VQ-1560i SN3061

Aircraft Make/Model	Aircraft Tail Number	Project Name
Cessna Caravan	840JA	USGS Earth MRI R037339
Cessna Caravan	704MD	USGS Earth MRI R037339
Cessna Caravan	704MD	USGS Earth MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	208JA	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	208JA	USGS_Earth_MRI R037339
Cessna Caravan	208JA	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	208JA	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	208JA	USGS_Earth_MRI R037339
Cessna Caravan	208JA	USGS Earth MRI R037339
Cessna Caravan	704MD	USGS Earth MRI R037339
Cessna Caravan	704MD	USGS Earth MRI R037339
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Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	840JA	USGS_Earth_MRI R037339
Cessna Caravan	840JA	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	840JA	USGS Earth MRI R037339
Cessna Caravan	704MD	USGS Earth MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	840JA	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessna Caravan	704MD	USGS_Earth_MRI R037339
Cessila Calavali	704IVID	0303_Lartii_WiN N037339
Cessna Caravan	840JA	USGS_Earth_MRI R037339
Cessna Caravan	840JA	USGS_Earth_MRI R037339

			Flight 1
Flight Plan	Lines Flown	# Reflies	Wheels Up
USGS_EARTH_NV_1560I_QL1	1-6, 11-32	0	9:05:00 AM
USGS_EARTH_NEVADA_1560I_QL2	490-517 QL2	0	9:50:00 AM
USGS_EARTH_NEVADA_1560I_QL2	518-536	0	9:23:00 AM
USGS_EARTH_NEVADA_1560I_QL2	537-542, 221-234	0	8:12:00 AM
USGS_EARTH_NEVADA_1560I_QL2	208-220, 14-23	0	9:33:00 AM
USGS EARTH NEVADA 15601 QL2	24-36 & 268-273	0	9:26:00 AM
USGS_EARTH_NEVADA_1560I_QL2	439-458	0	9:35:00 AM
USGS_EARTH_NV_1560I_QL1	QL1 7-10, 33-56, 67-74	0	9:44:00 AM
USGS_EARTH_NEVADA_1560I_QL2	415-419, 428-438	0	9:42:00 AM
USGS_EARTH_NEVADA_1560I_QL2	QL2 119-121, 459-470	0	9:59:00 AM
USGS_EARTH_NEVADA_1560I_QL2	QL2 471-489	0	9:38:00 AM
USGS_EARTH_NEVADA_1560I_QL2	384-389 & 420-427	0	9:43:00 AM
USGS_EARTH_NV_1560I_QL1	QL1 57-66, 102-139	0	8:02:00 AM
USGS_EARTH_NEVADA_1560I_QL2	235-245 & 254-267	0	9:00:00 AM
USGS_EARTH_NEVADA_1560I_QL2	331-340	0	2:50:00 PM
USGS_EARTH_NV_1560I_QL1	QL1 151-161 QL1 75-86, 140-150, 162-	0	2:39:00 PM
USGS_EARTH_NV_1560I_QL1	166	0	10:01:00 AM
USGS_EARTH_NEVADA_1560I_QL2	309-330	0	9:47:00 AM
USGS_EARTH_NV_1560I_QL1	87-101 QL1 & 9-13 QL2 1-8, 158-159, 246-253,	0	9:42:00 AM
USGS_EARTH_NEVADA_1560I_QL2	306-308	0	9:50:00 AM
USGS_EARTH_NEVADA_1560I_QL2	407-413	0	11:29:00 AM
USGS_EARTH_NEVADA_1560I_QL2	86-99	0	10:36:00 AM
USGS_EARTH_NEVADA_1560I_QL2	37-53	3	10:40:00 AM
USGS_EARTH_NEVADA_1560I_QL2	341-373	0	9:04:00 AM
USGS_EARTH_NEVADA_1560I_QL2	414, 183-207	0	9:22:00 AM
USGS_EARTH_NEVADA_1560I_QL2	100-118, 156, 160-163, 296-300	0	9:20:00 AM
USGS EARTH NEVADA 15601 QL2	164-166, 167-182	0	9:29:00 AM
USGS EARTH NEVADA 1560I QL2	122-141	0	9:25:00 AM
	157, 161-163, 301-305,		
USGS_EARTH_NEVADA_1560I_QL2	374-383	0	8:58:00 AM
USGS_EARTH_NEVADA_1560I_QL2	53-66	0	9:15:00 AM
USGS_EARTH_NEVADA_1560I_QL2	67-80	0	12:06:00 AM
USGS_EARTH_NEVADA_1560I_QL2	81-85	0	10:56:00 AM
LICOC FARTH NEWARA 45001 010	144-155, 274-279, 294-	0	0.40.00 454
USGS_EARTH_NEVADA_1560I_QL2	295	0	8:48:00 AM
	142-143, 280-293, 390-		
USGS_EARTH_NEVADA_1560I_QL2	406	0	8:27:00 AM

Flight 1	Flight 1	Flight 1 End	Flight 1 Total		Flight 2	Flight 2
	Begin Hobbs		Hobbs	Wheels Up	Wheels Down	Begin Hobbs
2:50:00 PM	2350.2	2355.9	5.7			
4:22:00 PM	14823.9	14830.4	6.5			
3:23:00 PM	14830.4	14836.4	6			
1:46:00 PM	14836.4	14841.9	5.5			
3:46:00 PM	14841.9	14848.1	6.2			
3:03:00 PM	14848.1	14853.7	5.6			
3:42:00 PM	14853.7	14859.7	6			
4:05:00 PM	8271.3	8277.7	6.4			
3:23:00 PM	14859.7	14865.4	5.7			
4:20:00 PM 3:55:00 PM	8277.7 8284.1	8284.1 8290.4	6.4 6.3			
3:10:00 PM	14865.4	14870.8	5.4			
0.10.001 W	1 1000.1	11070.0	0.1			
1:20:00 PM	8290.4	8295.7	5.3	2:23:00 PM	5:41:00 PM	8295.7
2:30:00 PM	14870.8	14876.3	5.5	3:38:00 PM	6:20:00 PM	14876.3
6:00:00 PM	14878.9	14882.1	3.2			
5:50:00 PM	8499	8502.2	3.2			
3:52:00 PM	8502.2	8508	5.8			
3:40:00 PM	14882.1	14888	5.9			
2:53:00 PM	14888	14893.2	5.2			
3:20:00 PM	14893.2	14898.7	5.5			
1:55:00 PM	14898.7	14901.1	2.4			
3:34:00 PM	14901.1	14906.1	5			
4:15:00 PM	12417	12422.4	5.4			
3:12:00 PM	12422.4	12428.6	6.2	4:11:00 PM	6:54:00 PM	12428.6
2:53:00 PM	14906.1	14911.6	5.5	4:26:00 PM	6:15:00 PM	14911.6
2:30:00 PM	12431.3	12436.6	5.3	3:32:00 PM	5:00:00 PM	12436.6
2:34:00 PM	14913.5	14918.5	5	3:51:00 PM	5:28:00 PM	14918.5
2:51:00 PM	14920.2	14925.6	5.4			
1:34:00 PM	12438.5	12443.1	4.6			
2:46:00 PM	14925.6	14931.1	5.5			
2:38:00 PM	14931.1	14936.6	5.5			
2.00.00 i ivi	1 100 1.1	1 1000.0	0.0			
2:30:00 PM	14936.6	14940.2	3.6			
3:30:00 PM	2500.7	2507.4	6.7			
2:45:00 PM	2507.4	2513.8	6.4	3:25:00 PM	5:50:00 PM	2513.8

Flight 2 End	Flight 2 Total	Daily Hobbs	On-Line		
Hobbs	Hobbs	Total	Hobbs	MOB Hobbs	Operator
	0	5.70	5.0	0.7	Justen Maxey
	0	6.50	5.9	0.6	Jim Schoone
	0	6.00	5.3	0.7	Jim Schoone
	0	5.50	4.8	0.7	Jim Schoone
	0	6.20	5.3	0.9	Jim Schoone
	0	5.60	4.4	1.2	Jim Schoone
	0	6.00	5.7	0.3	Jim Schoone
	0	6.40	4.9	1.5	Noah Edelson
	0	5.70	5.1	0.6	Jim Schoone
	0	6.40	3.7	1.4	Noah Edelson
	0	6.30	4.7	1.6	Noah Edelson
	0	5.40	4.4	5.4	Jim Schoone
8299	3.3	8.60	6.6	2.0	Noah Edelson
14878.9	2.6	8.10	6.5	1.6	Jim Schoone
	0	3.20	2.2	1.0	Jim Schoone
	0	3.20	2.0	1.2	Noah Edelson
	0	5.80	4.3	1.5	Noah Edelson
	0	5.90			Jim Schoone
	0	5.20	4.0	1.2	Jim Schoone
	0	5.50	4.4	1.0	Jim Schoone
	0	2.40	1.5	0.9	Steve Krohn
	0	5.00	4.1	0.9	Steve Krohn
	0	5.40	3.8	1.6	Miranda Geller
12431.3	2.7	8.90	7.1	1.7	Miranda Geller
14913.5	1.9	7.40	6.0	1.4	Steve Krohn
12438.5	1.9	7.20	5.4	1.9	Miranda Geller
14920.2	1.7	6.70	4.9	1.8	Steve Krohn
	0	5.40	4.2	1.2	Steve Krohn
	0	4.60	3.5	1.0	Miranda Geller
	0	5.50	3.9	1.6	Steve Krohn
	0	5.50	3.8	1.7	Steve Krohn
	0	3.60	1.4	2.2	Steve Krohn
	0	6.7	5.7	1	Spencer Beck
					·
2516.2	2.4	8.8	5.4	3.4	Spencer Beck

	Base of
Pilot	Operations
Chris Griffin	KSVE
Chad Unangst	KRNO
Nathan Sharp	KRNO
Jamon Neilson	KRNO
Nathan Sharp	KRNO
Nathan Sharp Jamon Neilson	KRNO KRNO
Jamon Neilson	KKNO
Nathan Sharp	KRNO
Jamon Neilson	KRNO
Jamon Neilson	KRNO
Nathan Sharp	KRNO
Nathan Sharp	KMCC
Jamon Neilson	KRNO
Chris LaRosa	KRNO
Chris LaRosa	KRNO
Jamon Neilson	KRNO
Chris LaRosa	KRNO
	KRNO
Jamon Neilson	KRNO
Chris LaRosa	KRNO
Jamon Neilson	KRNO
Jamon Neilson	KRNO
Pat Baumgarten	KRNO
Dan Braden	KEKO
Dan Braden	KBDN

Notes

Good flight on MRI. No issues

Completed 28 lines in QL2 under clear conditions except for smoke on the south end of the first 4 passes.

Conditions clear and smooth.

Conditions clear.

Sky contions clear. Light turbulance on lines 20-23

Clear skies & smooth air.

All lines completed under clear conditions.

We sipped on fuel with little turbulence and was able to get in a long 6+ hour lift on QL1

High Broken Cirrus

Flight went smooth as could be for the 4 hours.

Perfectly smooth flight, flew everything we wanted to fly without issues

Conditions clear with smooth air.

We took advantage of the restricted airspace surrounding most of the QL1 lines being inactive today and flew a doubleheader with no complications.

Completed lines in R-4810 & R-4804A

Site was clouded over untin 2PM. We went on one short hop in the PM

Had to wait until about 1pm for clouds to clear before getting in a short lift in restricted airspace before sunset.

Surprisingly got access to restricted areas after being told they would be hot on the ground and almost finished QL1 before heading to KMCC for maintenance

Completed Restricted area R-4813 A

Completed QL1 & 9-13 on QL2

completed lines in R-4810 & R-4804 a

After some early morning maintenance issues we got up and completed some lines in the QL2 area, but had to call it an early day due to a TFR that popped up.

Reflew the lines from yesterday where channel 2 failed, as well as other lines.

Great day for acq, had to wait to get lift due to TFR and ramp freeze.

Restricted area was cold so we maximized our time by getting two lifts. Beautiful moonrise!

Two lifts today to cover restricted areas only open on weekends.

Got 2 lifts since we had access to restricted area.

Two lifts today to finish out blocks that were in Restricted Areas.

Catptured 20 lines on one lift today.

Another nice day in beautiful NV. Got access to restricted area and was able to acq on the 3 lines that were missing ch 2 data from 11/01.

Captured 14 lines in QL2.

We captured 14 lines in one lift on QL2 today.

One short lift today due to military operations in the MOAs and Restricted areas. Capture 5 lines on the QL2 blocks. (Lines 81-85)

One lift for USGS Earth MRI. We collected data on the western portion of the remaining lines. There is just over one full lift left on the project. We were working around patches of clouds all day. We ran into clouds at the end of some long lines and decided to do partial re-flies on those lines. There was a small amount of snow on the tops of ridges that we noted on the flight sheet.

One lift for USGS Earth MRI, project complete. We completed the remaining lines on USGS Earth MRI. There was some snow on the tops of the ridges that is noted in the flight sheet. An f-18 came and checked us out while we were on line. We landed for fuel and mobed to Oregon. We intended to land at CVO, but some unexpected fog there caused us to re-route to Bend