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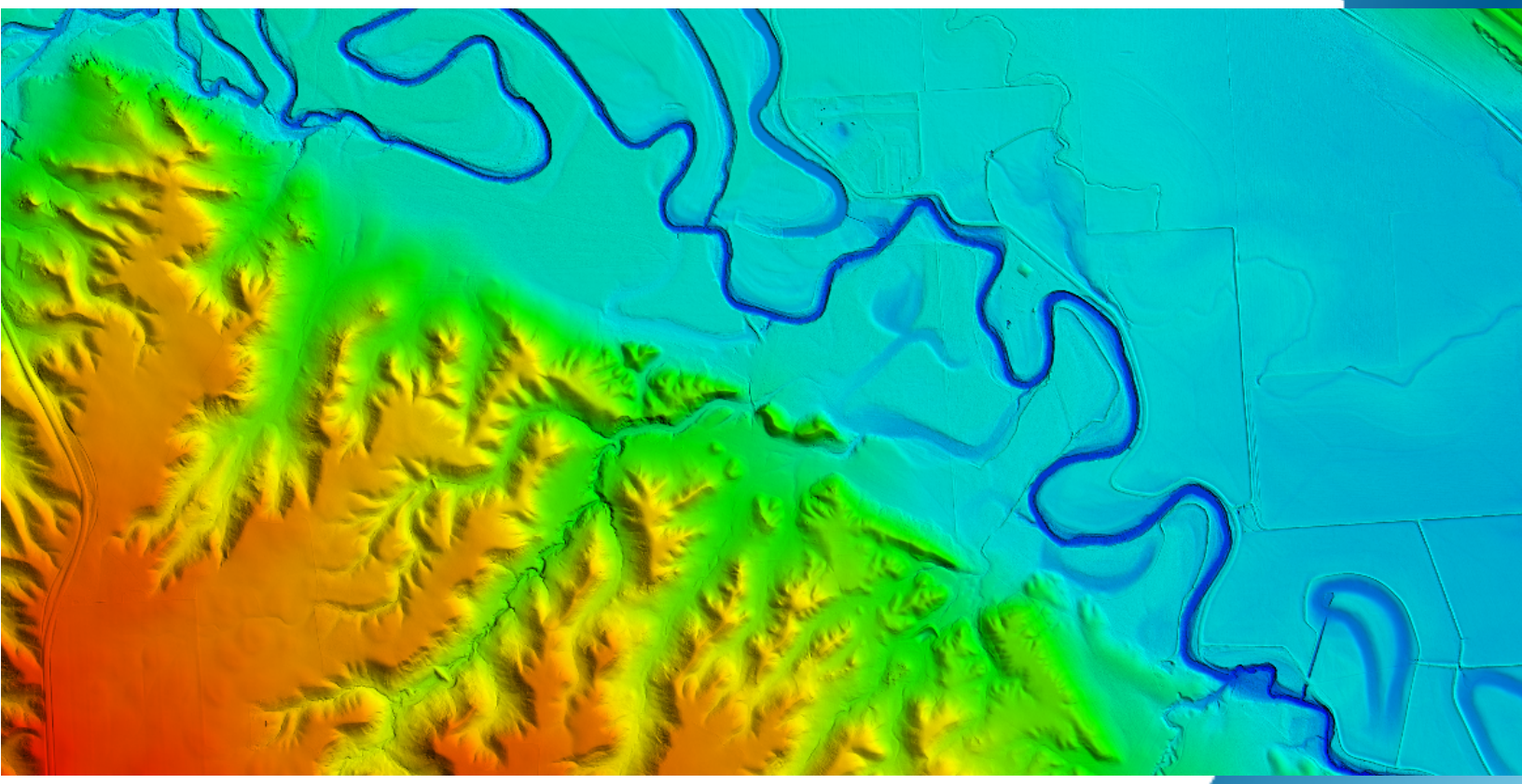

MT_Statewide_Phase2_2020_B20 LIDAR PROCESSING REPORT

2022

Project ID: 197114

Work Unit: 230589

Submitted: August 6, 2022

Prepared for:

USGS

science for a changing world

Prepared by:

NV5 GEOSPATIAL

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1. Summary / Scope

1.1. Summary

This report contains a summary of the 36170_MT_Phase2_2020_B20, Work Unit 230589 lidar acquisition task order, issued by USGS under their Contract G16PC0016 on 08/12/2020. The task order yielded a project area covering 2,927 square miles over Montana at Quality Level 2. 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	2500 m	58.5°	20%	≤ 10 cm

1.3. Coverage

The project boundary covers 2,927 square miles over Montana. Project extents are shown in Figure 1.

1.4. Duration

Lidar data was acquired from August 12, 2020 and September 8, 2020 in 16 total lifts. See “Section: 2.4. Time Period” for more details.

1.5. Issues

Some tiles in the area of interest had snow on the surface. These were classified as 21 under the LAS classifications.

36170_MT_Phase2_2020_B20 Work Unit 230589 Projected Coordinate System: NAD_1983_2011_StatePlane_Montana_FIPS_2500 Horizontal Datum: NAVD83 (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) • Continuous Hydro-flattened Breaklines
Reports	Reports in PDF format • Focus on Delivery • Focus on Accuracy • Survey Report • Processing Report
Metadata	XML Files (*.xml) • Breaklines • Classified Point Cloud • DEM • Intensity Imagery

36170_MT_Phase2_2020_B20
Work Unit 230589 Boundary

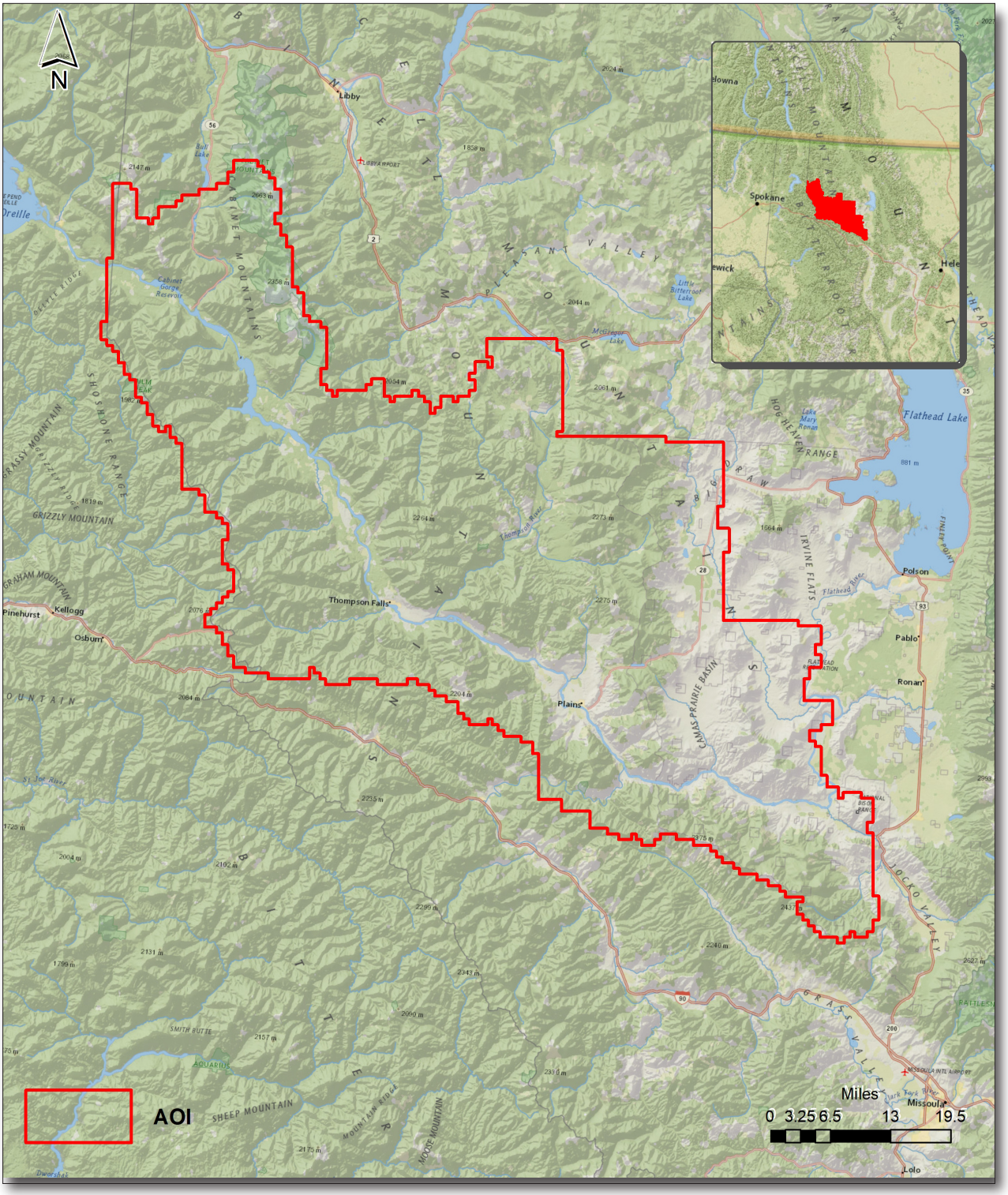


Figure 1. Work Unit Boundary

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 RiPARAMETER planning software.

2.2. Lidar Sensor

NV5 Geospatial utilized Riegl VQ1560i and VQ1560ii lidar sensors (Figure 2), serial number(s) 4040 for data acquisition.

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.

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 (4040)
Terrain and Aircraft Scanner	Flying Height	2,305 m
	Recommended Ground Speed	145 kts
Scanner	Field of View	60°
	Scan Rate Setting Used	81 lps
Laser	Laser Pulse Rate Used	350 kHz
	Multi Pulse in Air Mode	yes
Coverage	Full Swath Width	2,583 m
	Line Spacing	2,066 m
Point Spacing and Density	Average Point Spacing	0.64 m
	Average Point Density	2.45 pts / m^2

Figure 2. Riegl VQ1560ii Lidar Sensor

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

- Piper Navajo (twin-piston), Tail Number(s): N6GR
- Cessna Caravan (single-turboprop), Tail Number(s): N840JA
- 1977 Piper PA-31-325 (fixed wing multi engine), Tail Number(s): N22GE

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 VQ1560ii 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 speci ic lights were conducted between August 12, 2020 and September 8, 2020. Sixteen aircra t li ts were completed. Accomplished li ts are listed below.

Lift	Start UTC	End UTC
08122020A (SN4040,N22GE)	8/12/2020 2:02:33 PM	8/12/2020 4:33:40 PM
08142020A (SN4040,N22GE)	8/14/2020 3:09:57 PM	8/14/2020 6:38:31 PM
08152020A (SN4040,N22GE)	8/15/2020 2:47:30 PM	8/15/2020 5:39:33 PM
08162020A (SN4040,N22GE)	8/16/2020 3:26:36 PM	8/16/2020 6:46:29 PM
08302020A1 (SN4040,N22GE)	8/30/2020 4:31:35 PM	8/30/2020 4:41:12 PM
08302020A2 (SN4040,N22GE)	8/30/2020 4:44:55 PM	8/30/2020 6:04:36 PM
08302020B (SN4040,N22GE)	8/30/2020 8:29:05 PM	8/30/2020 10:33:14 PM
09022020A (SN4040,N22GE)	9/02/2020 3:05:09 PM	9/02/2020 5:54:26 PM
09032020A (SN4040,N22GE)	9/03/2020 3:20:54 PM	9/03/2020 6:58:16 PM
09032020B (SN4040,N22GE)	9/03/2020 9:11:47 PM	9/03/2020 11:57:04 PM
09042020A (SN4040,N22GE)	9/04/2020 3:50:43 PM	9/04/2020 6:52:45 PM
09042020B (SN4040,N22GE)	9/04/2020 10:01:48 PM	9/05/2020 12:28:28 AM
09052020A (SN4040,N22GE)	9/05/2020 6:01:21 PM	9/05/2020 9:24:28 PM
09062020A (SN4040,N22GE)	9/06/2020 5:25:05 PM	9/06/2020 6:26:51 PM
09082020A (SN4040,N22GE)	9/08/2020 3:54:37 PM	9/08/2020 7:03:37 PM
09082020B (SN4040,N22GE)	9/08/2020 9:38:43 PM	9/09/2020 12:35:34 AM

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 RiPROCESS 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
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.
21	Snow	Ground points that fall on snow, where identifiable

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 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 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

Class 2 lidar in conjunction with the hydro breaklines were used to create a 1-meter Raster DEM. Using automated scripting routines within proprietary software, a GeoTIFF file was created for each tile. Each surface is reviewed using Global Mapper to check for any surface anomalies or incorrect elevations found within the surface.

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. Proprietary software was used to create 1-meter raster images in GeoTIFF format.

36170_MT_Phase2_2020_B20
Work Unit 230589 Tile Layout

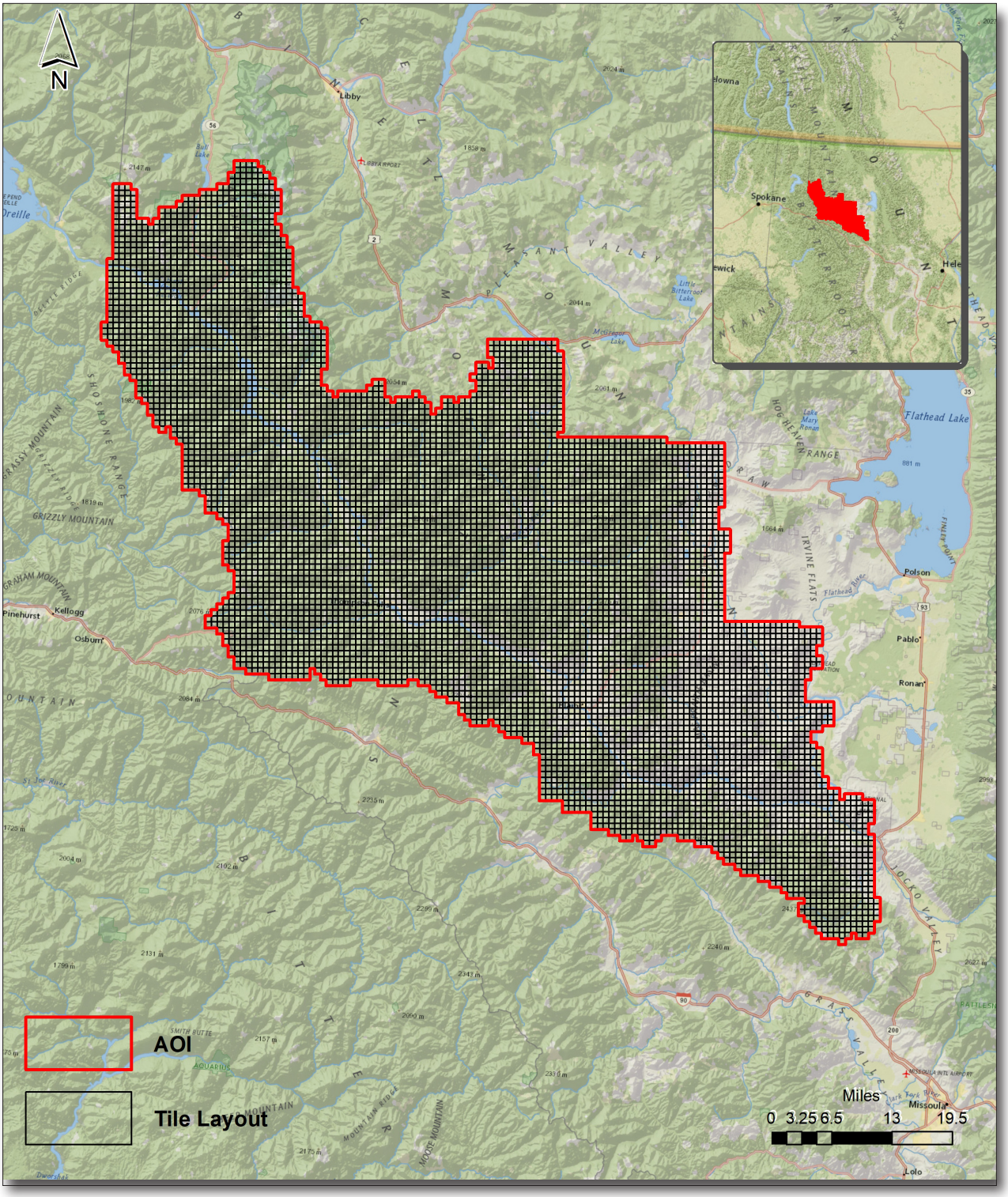


Figure 4. Lidar Tile Layout

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.

36170_MT_Phase2_2020_B20
Work Unit 230589 Lidar Coverage

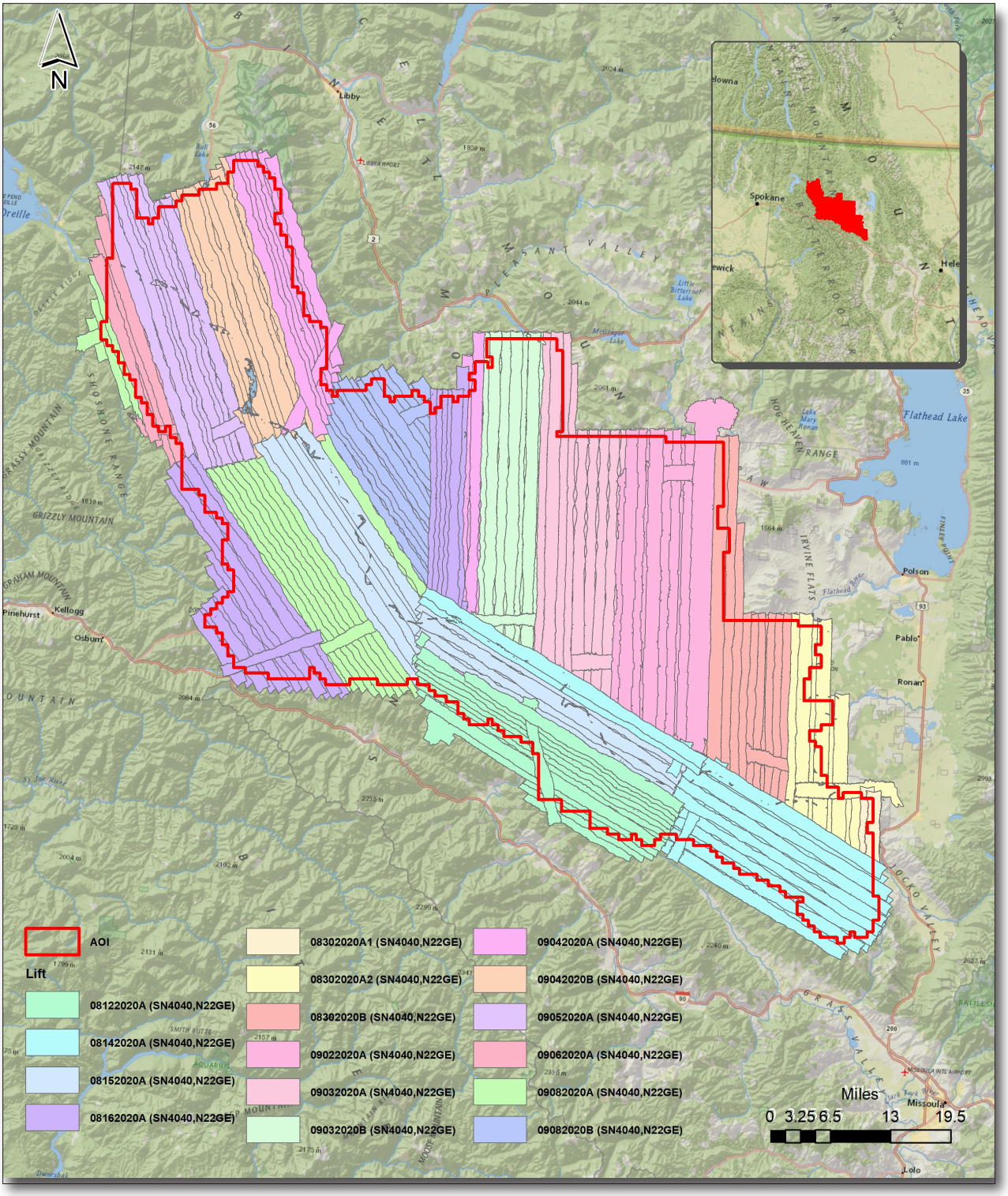


Figure 5. Lidar Coverage

5. Geometric Accuracy

5.1. Horizontal Accuracy

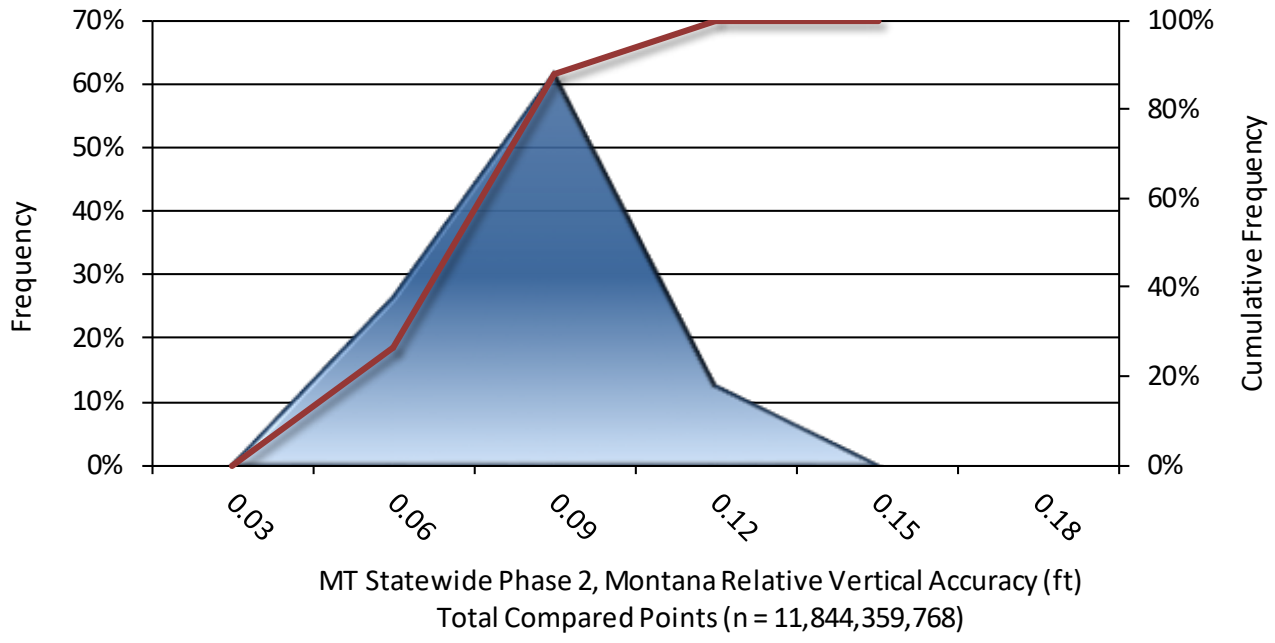
Lidar horizontal accuracy is a function of Global Navigation Satellite System (GNSS) derived positional error, flying altitude, and INS derived attitude error. The obtained $RMSE_r$ value is multiplied by a conversion factor of 1.7308 to yield the horizontal component of the National Standards for Spatial 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 2305 meters, an IMU error of 0.002 decimal degrees, and a GNSS positional error of 0.015 meters, this project was compiled to meet 0.25 meter horizontal accuracy at the 95% confidence level. A summary is shown below.

Horizontal Accuracy	
$RMSE_r$	0.47 ft
	0.14 m
ACC_r	0.82 ft
	0.25 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 36170_MT_Phase2_2020_B20 project was 0.063 feet (0.019 meters). A summary is shown below.

Relative Vertical Accuracy	
Sample	186 flight line surfaces
Average	0.063 ft
	0.019 m
Median	0.072 ft
	0.022 m
RMSE	0.073 ft
	0.022 m
Standard Deviation (1σ)	0.017 ft
	0.005 m
1.96σ	0.034 ft
	0.010 m



Project Report Appendices

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

Appendix A

Flight Logs

Julian Day 309	Flight A

LIDAR Flight Log

Date	November 04 , 2020	**Aircraft**	C-FFRY
Project	3202_QSI_Montana_Phase1	**Pilot**	Mac. McQuarrie
Location	Estevan Airport	**Operator**	Dan Arteaga
Mission Objective			

System	Riegl VQ-1560ii GSM
Unit	S2223543
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	43
Scanner 2 Drive	

Additional Notes

T-12C
H-44%
hpa-1008
AMLS-581m

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	17:30	**Takeoff**	18:05	
Engine Off	23:20	**Landing**	23:05	
Total	5.8 hrs	**Total**	5.0 hrs	

Mission Plan			
AGL Height	2300 m	**Pulse Rate**	500(x2) kHz
Target Speed	160 kts	**Scan Rate**	267Hz
Laser Current	100 %	**FOV**	60 degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1756	1801
Post Mission	2307	2312

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End	Time Stamp _____	
F8		-	1859	1904				
1103	432030901	352	1907	1913			190751	9nm South End
1102	432030902	172	1915	1921			191545	9nm South End
1101	432030903	352	1922	1936			192257	
1100	432030904	172	1937	1950			193726	
1099	432030905	352	1952	2004			195219	
1098	432030906	172	2007	2019			200732	
1097	432030907	352	2020	2030			202023	
1096	432030907	172	2032	2044			203256	
1095	432030908	352	2045	2056			204520	
1094	432030909	172	2057	2109			205750	
1093	432030910	352	2110	2121			211018	
1092	432030911	172	2122	2133			212229	
1091	432030912	352	2134	2145			213457	
1090	432030913	172	2146	2157			214645	

Julian Day 309	Flight A

LIDAR Flight Log

AIRBORNE IMAGING
A Clean Harbors Company

Date	November 04 , 2020	**Aircraft**	C-FFRY
Project	3202_QSI_Montana_Phase1	**Pilot**	Mac. McQuarrie
Location	Estevan Airport	**Operator**	Dan Arteaga
Mission Objective			

System	Riegl VQ-1560ii GSM
Unit	S2223543
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	43
Scanner 2 Drive	

Additional Notes

T-12C
H-44%
hpa-1008
AMLS-581m

Time to next maintenance: _____ ○ 50 hr ◉ 100 hr

Aircraft Block Time				
Engine On	17:30	**Takeoff**	18:05	
Engine Off	23:20	**Landing**	23:05	
Total	5.8 hrs	**Total**	5.0 hrs	

Mission Plan					
AGL Height	2300	m	**Pulse Rate**	500(x2)	kHz
Target Speed	160	kts	**Scan Rate**	267	Hz
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	1756	1801
Post Mission	2307	2312

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID	Comments
			Start	End	Time	nmi to End	Time Stamp _____	
1089	432030914	352	2158	2209			215840	
X-tie	432030915	-	2210	2217			221040	
F8		-	2217	2222				
		-						
		-						

Julian Day	150	Flight	A

LIDAR Flight Log

AIRBORNE IMAGING
A Clean Harbors Company

Date	May 30, 2021	**Aircraft**	C-GKSX
Project	3222_NV5_MontanaWest	**Pilot**	A. Murray
Location	Great Falls, MT	**Operator**	J. Grayson
Mission Objective			

System	Riegl VQ-1560ii
Unit	51
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	14:52	**Takeoff**	15:11	
Engine Off	20:18	**Landing**	20:06	
Total	5.4 hrs	**Total**	4.9 hrs	

Mission Plan			
AGL Height	2000 m	**Pulse Rate**	700 khz/ch
Target Speed	160 kts	**Scan Rate**	129hz/ch
Laser Current	100 %	**FOV**	60 degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	14:58	15:03
Post Mission	20:11	20:16

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 210530	Comments
			Start	End	Time	nmi to End		
Figure 8		-	15:51	15:56			-	
1002		W	15:59	16:02			155902	
1003		E	16:06	16:18			160612	
1004		W	16:22	16:34			162228	
1005		E	16:38	16:50			163824	
1006		W	16:54	17:08			165430	
1007		E	17:10	17:22			171013	
1008		W	17:26	17:38			172606	
1009		E	17:41	17:53			174148	
1010		W	17:57	18:08			175718	
1011		E	18:12	18:24			181238	
1012		W	18:28	18:39			182813	
1013		E	18:43	18:54			184307	
1014		W	18:57	19:09			185753	
X-Tie		N	19:13	19:15			191305	

Julian Day	150	Flight	A

LIDAR Flight Log

AIRBORNE IMAGING
A Clean Harbors Company

Date	May 30, 2021	**Aircraft**	C-GKSX
Project	3222_NV5_MontanaWest	**Pilot**	A. Murray
Location	Great Falls, MT	**Operator**	J. Grayson
Mission Objective			

System	Riegl VQ-1560ii
Unit	51
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

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Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 210530	Comments
			Start	End	Time	nmi to End		
Figure 8		-	19:18	19:23			-	

Julian Day	150	Flight	A

LIDAR Flight Log

Date	May 30, 2021	**Aircraft**	C-GKSX
Project	3222_NV5_MontanaWest	**Pilot**	A. Murray
Location	Great Falls, MT	**Operator**	J. Grayson
Mission Objective			

System	Riegl VQ-1560ii
Unit	51
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

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			Start	End	Time	nmi to End		

Julian Day	150	Flight	A

LIDAR Flight Log

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Mission Objective			

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GPS Rx	Trimble GNSS17
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Scanner 2 Drive	

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Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 khz/ch	
Target Speed	160	kts	**Scan Rate**	129hz/ch	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	14:58	15:03
Post Mission	20:11	20:16

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 210530	Comments
			Start	End	Time	nmi to End		

Julian Day	150	Flight	A

LIDAR Flight Log

AIRBORNE IMAGING
A Clean Harbors Company

Date	May 30, 2021	**Aircraft**	C-GKSX
Project	3222_NV5_MontanaWest	**Pilot**	A. Murray
Location	Great Falls, MT	**Operator**	J. Grayson
Mission Objective			

System	Riegl VQ-1560ii
Unit	51
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	14:52	**Takeoff**	15:11	
Engine Off	20:18	**Landing**	20:06	
Total	5.4 hrs	**Total**	4.9 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 khz/ch	
Target Speed	160	kts	**Scan Rate**	129hz/ch	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	14:58	15:03
Post Mission	20:11	20:16

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 210530	Comments
			Start	End	Time	nmi to End		

Julian Day	151	Flight	A

LIDAR Flight Log

Date	May 31, 2021	**Aircraft**	C-GKSX
Project	3222_NV5_MontanaWest	**Pilot**	A. Murray
Location	Great Falls, MT	**Operator**	J. Grayson
Mission Objective			

System	Riegl VQ-1560ii
Unit	51
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time					
Engine On	16:16	**Takeoff**	16:33		
Engine Off	20:16	**Landing**	20:05		
Total	4.0 hrs	**Total**	3.5 hrs		

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 khz/ch	
Target Speed	160	kts	**Scan Rate**	129hz/ch	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	16:20	16:25
Post Mission	20:09	20:14

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 210531	Comments
			Start	End	Time	nmi to End		
Figure 8		-	17:09	17:14			-	
1015		W	17:17	17:25			171706	Snapshot issue, partial reflight req'd
1015		W	17:31	17:35			173139	Partial reflight
1016		E	17:38	17:49			173836	
1017		W	17:53	18:05			175335	
1018		E	18:08	18:18			180806	
1019		W	18:22	18:33			182223	
1020		E	18:36	18:41			183650	Snapshot issue, partial reflight req'd
1020		E	18:45	18:52			184542	Partial reflight
1021		W	18:55	19:06			185530	
1022		E	19:09	19:12			190948	
X-tie		N	19:17	19:19			191731	
Figure 8		-	19:19	19:24			-	

Julian Day	151	Flight	A

LIDAR Flight Log

Date	May 31, 2021	**Aircraft**	C-GKSX
Project	3222_NV5_MontanaWest	**Pilot**	A. Murray
Location	Great Falls, MT	**Operator**	J. Grayson
Mission Objective			

System	Riegl VQ-1560ii
Unit	51
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time					
Engine On	16:16	**Takeoff**	16:33		
Engine Off	20:16	**Landing**	20:05		
Total	4.0 hrs	**Total**	3.5 hrs		

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 khz/ch	
Target Speed	160	kts	**Scan Rate**	129hz/ch	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	16:20	16:25
Post Mission	20:09	20:14

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 210531	Comments
			Start	End	Time	nmi to End		

Julian Day	151	Flight	A

LIDAR Flight Log

Date	May 31, 2021	**Aircraft**	C-GKSX
Project	3222_NV5_MontanaWest	**Pilot**	A. Murray
Location	Great Falls, MT	**Operator**	J. Grayson
Mission Objective			

System	Riegl VQ-1560ii
Unit	51
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time					
Engine On	16:16	**Takeoff**	16:33		
Engine Off	20:16	**Landing**	20:05		
Total	4.0 hrs	**Total**	3.5 hrs		

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 khz/ch	
Target Speed	160	kts	**Scan Rate**	129hz/ch	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	16:20	16:25
Post Mission	20:09	20:14

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 210531	Comments
			Start	End	Time	nmi to End		

Julian Day	151	Flight	A

LIDAR Flight Log

Date	May 31, 2021	**Aircraft**	C-GKSX
Project	3222_NV5_MontanaWest	**Pilot**	A. Murray
Location	Great Falls, MT	**Operator**	J. Grayson
Mission Objective			

System	Riegl VQ-1560ii
Unit	51
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time					
Engine On	16:16	**Takeoff**	16:33		
Engine Off	20:16	**Landing**	20:05		
Total	4.0 hrs	**Total**	3.5 hrs		

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 khz/ch	
Target Speed	160	kts	**Scan Rate**	129hz/ch	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	16:20	16:25
Post Mission	20:09	20:14

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 210531	Comments
			Start	End	Time	nmi to End		

Julian Day 151	Flight A

LIDAR Flight Log

AIRBORNE IMAGING
A Clean Harbors Company

Date	May 31, 2021	**Aircraft**	C-GKSX
Project	3222_NV5_MontanaWest	**Pilot**	A. Murray
Location	Great Falls, MT	**Operator**	J. Grayson
Mission Objective			

System	Riegl VQ-1560ii
Unit	51
IMU	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

Additional Notes

Time to next maintenance: _____ ◉ 50 hr ○ 100 hr

Aircraft Block Time				
Engine On	16:16	**Takeoff**	16:33	
Engine Off	20:16	**Landing**	20:05	
Total	4.0 hrs	**Total**	3.5 hrs	

Mission Plan					
AGL Height	2000	m	**Pulse Rate**	700 khz/ch	
Target Speed	160	kts	**Scan Rate**	129hz/ch	
Laser Current	100	%	**FOV**	60	degs

Static Alignment	GPS Time	
	Start	**End**
Pre Mission	16:20	16:25
Post Mission	20:09	20:14

Flight Line	LiDAR File Name	Flight Direction	GPS Time		Line Aborted		Mission ID Time Stamp 210531	Comments
			Start	End	Time	nmi to End		

Project Name:	Montana Statewide Phase 2 R036170	
Date	**Mission ID**	**Sensor**
8/12/2020	20200812 SN4040	Riegl VQ-1560ii S2224040
8/12/2020	20200812 SN3546	Riegl VQ-1560i S2223546
8/13/2020	20200813 SN3546	Riegl VQ-1560i S2223546
8/14/2020	20200814 SN3546	Riegl VQ-1560i S2223546
8/14/2020	20200814 SN4040	Riegl VQ-1560ii S2224040
8/15/2020	20200815 SN3546	Riegl VQ-1560i S2223546
8/15/2020	20200815 SN4040	Riegl VQ-1560ii S2224040
8/16/2020	20200816 SN3546	Riegl VQ-1560i S2223546
8/16/2020	20200816 SN4040	Riegl VQ-1560ii S2224040
8/18/2020	20200818 SN3546	Riegl VQ-1560i S2223546
8/19/2020	20200819 SN3546	Riegl VQ-1560i S2223546
8/27/2020	20200827 SN4046	Riegl VQ-1560ii S2224046
8/28/2020	20200828 SN4046	Riegl VQ-1560ii S2224046
8/29/2020	20200829 SN4046	Riegl VQ-1560ii S2224046
8/30/2020	20200830 SN4040	Riegl VQ-1560i S2224040
9/2/2020	20200902 SN4040	Riegl VQ-1560i S2224040
9/3/2020	20200903 SN4040	Riegl VQ-1560i S2224040
9/4/2020	20200904 SN4040	Riegl VQ-1560i S2224040
9/4/2020	20200904 SN4046	Riegl VQ-1560ii S2224046
9/5/2020	20200905 SN4046	Riegl VQ-1560ii S2224046
9/5/2020	20200905 SN4040	Riegl VQ-1560i S2224040
9/6/2020	20200906 SN4040	Riegl VQ-1560i S2224040
9/6/2020	20200906 SN4046	Riegl VQ-1560ii S2224046
9/8/2020	20200908 SN4040	Riegl VQ-1560i S2224040
9/8/2020	20200908 SN4046	Riegl VQ-1560ii S2224046
9/9/2020	20200909 SN4046	Riegl VQ-1560ii S2224046
9/11/2020	20200911 SN4040	Riegl VQ-1560i S2224040

9/11/2020	20200911 SN4040	Riegl VQ-1560i S2224040
9/12/2020	20200912 SN4040	Riegl VQ-1560i S2224040
9/16/2020	20200916 SN4040	Riegl VQ-1560i S2224040
9/21/2020	20200921 SN4040	Riegl VQ-1560i S2224040
9/23/2020	20200923 SN4040	Riegl VQ-1560ii S2224040
9/26/2020	20200926 SN4040	Riegl VQ-1560ii S2224040
10/2/2020	20201002 SN4040	Riegl VQ-1560i S2224040
10/3/2020	20201003 SN4040	Riegl VQ-1560i S2224040
10/3/2020	20201003 SN3546	Riegl VQ-1560i S2223546
10/4/2020	20201004 SN4040	Riegl VQ-1560i S2224040
10/4/2020	20201004 SN3546	Riegl VQ-1560i S2223546
10/5/2020	20201005 SN3546	Riegl VQ-1560i S2223546
10/6/2020	20201006 SN3546	Riegl VQ-1560i S2223546
10/7/2020	20201007 SN4040	Riegl VQ-1560i S2224040
10/7/2020	20201007 SN4040	Riegl VQ-1560i S2224040
10/9/2020	20201009 SN4040	Riegl VQ-1560i S2224040
10/10/2020	20201010 SN4040	Riegl VQ-1560i S2224040
11/4/2020	20201104 SN3061	Riegl VQ-1560i S2223061

Aircraft Make/Model	Aircraft Tail Number	Project Name
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	704MD	Montana Statewide Phase 2 R036170
Cessna Caravan	704MD	Montana Statewide Phase 2 R036170
Cessna Caravan	704MD	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	704MD	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	704MD	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	704MD	Montana Statewide Phase 2 R036170
Cessna Caravan	704MD	Montana Statewide Phase 2 R036170
Cessna Caravan	604MD	Montana Statewide Phase 2 R036170
Cessna Caravan	604MD	Montana Statewide Phase 2 R036170
Cessna Caravan	604MD	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	604MD	Montana Statewide Phase 2 R036170
Cessna Caravan	604MD	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	604MD	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	604MD	Montana Statewide Phase 2 R036170
Cessna Caravan	604MD	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170

Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	208NR	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	208NR	Montana Statewide Phase 2 R036170
Cessna Caravan	208NR	Montana Statewide Phase 2 R036170
Cessna Caravan	208NR	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Piper Navajo	22GE	Montana Statewide Phase 2 R036170
Cessna Caravan	840JA	Montana Statewide Phase 2 R036170

Flight Plan	Lines Flown
MT_Statewide_West_QL2	110-122
MontanaStatewide_Phase2_R036170	141-147
Montana Statewide Phase 2 R036170	148-151, 178-189
Montana Statewide Phase 2 R036170	170-177
MT Statewide west 1560ii ql2	86-102
Montana Statewide Phase 2 R036170	557-572
MT statewide west 1560i Q2	103-109, 22-27
Montana Statewide Phase 2 R036170	540-556
mt statewide west 1560i QL2	1-12, 123-128
Montana Statewide Phase 2 R036170	535-539, 573
Montana Statewide Phase 2 R036170	299-302
MT_Statewide_1560i_QL1	526-534, 574-577
MT_Statewide_1560i_QL1, BaseQL1_MT_Cty_MSO_reflies	BaseQL1_MT_Cty_MSO_reflies, 1-11, MT Statewide, 133-140
MT_Statewide_1560i_QL1	148,151
MT_StateWide_West_1560i_QL2	167-186
MT_StateWide_West_1560i_QL2	157-166
MT_StateWide_West_1560i_QL2	133-156
MT_StateWide_West_1560i_QL2	68-85, 129-132
MT_Statewide_1560i_QL1	QL1 525-494
MT_Statewide_1560i_QL1	132-116
MT_StateWide_West_1560i_QL2	56-67, 110
QL2_N_ID_reflies & MT_StateWide_West_1560i_QL2	51-55
MT_Statewide_1560i_QL1	115-108
QL2 West	13-21,28-50
MT_Statewide_1560i_QL1	299-297
MT_Statewide_1560i_QL1	28-10
MT_Statewide_1560i_QL1	427-454

MT_Statewide_1560i_QL1	427-454
MT_Statewide_1560i_QL1	1,2,455-459,494-499
MT_Statewide_East_1560i_QL2	144-155
MT_StateWide_East_1560i_QL2 and MT_Statewide_1560i_QL1	MT Statewide East QL2:193-209, MT Statewide QL1:8-9, 427R-428R
MT_Statewide_1560i_QL1	MT Phase 2 StateWide QL1: 296PR2, 3-7
MT_StateWide_1560i_QL1	295, 296PR2, 297 PR
MT_Statewide_1560i_QL1	85-99
MT_Statewide_1560i_QL1	271-295
MT Statewide Phase2 R036170_Fieldlog	30-54
MT_Statewide_1560i_QL1	303-314
MT Statewide Phase2 R036170_Fieldlog	53-64
MT Statewide Phase2 R036170_Fieldlog	64-71
MT Statewide Phase2 R036170_Fieldlog	315-329
MT_Statewide_1560i_QL1	477-493
MT_Statewide_1560i_QL1	Line 84- had clouds, Sept21&23 Reflights, Line 190-194
MT_Statewide_1560i_QL1	206-211, 232-248
MT_Statewide_1560i_QL1	249-264
Montana Statewide Phase 2 R036170	QL2: 1-13, 168-184

# Reflies	Flight 1 Wheels Up	Flight 1 Wheels Down	Flight 1 Begin Hobbs	Flight 1 End Hobbs	Flight 1 Total Hobbs
0	7:46:00 AM	10:54:00 AM	10765.5	10768.6	3.1
0	7:15:00 AM	9:40:00 AM	14759.1	14761.5	2.4
2	7:07:00 AM	12:08:00 PM	14761.5	14766.6	5.1
0	6:55:00 AM	12:30:00 PM	14766.6	14772.1	5.5
	8:55:00 AM	12:50:00 PM	10768.6	10772.5	3.9
0	7:00:00 AM	12:15:00 PM	14772.1	14777.4	5.3
	8:28:00 AM	12:02:00 PM	10772.5	10776.1	3.6
0	10:33:00 AM	3:35:00 PM	14778.9	14784	5.1
	8:52:00 AM	1:12:00 PM	10776.1	10780	3.9
0	1:45:00 PM	4:35:00 PM	14784	14786	2
0	1:10:00 PM	5:18:00 PM	14786.9	14790.9	4
	9:30:00 AM	2:37:00 PM	4955.6	4960.6	5
	9:31:00 AM	2:55:00 PM	4960.6	4965.7	5.1
	9:37:00 AM	12:09:00 PM	4965.7	4968.1	2.4
0	9:19:00 AM	12:18:00 AM	10795.9	10798.9	3
0	8:40:00 AM	12:18:00 AM	10801.9	10805.5	3.6
	8:50:00 AM	1:19:00 PM	10805.5	10809.9	4.4
0	9:18:00 AM	1:35:00 PM	10813.5	10817.7	4.2
	8:48:00 AM	2:43:00 PM	14978.9	14984.8	5.9
	8:31:00 AM	1:42:00 PM	14984.8	14990	5.2
	11:32:00 AM	4:00:00 PM	10821.2	10825.6	4.4
	8:30:00 AM	1:00:00 PM	10825.6	10829.8	4.2
	8:32:00 AM	11:30:00 AM	14990	14993	3
0	9:15:00 AM	1:30:00 PM	10829.8	10834.1	4.3
	8:11:00 AM	8:57:00 AM	14993	14993.7	0.7
	8:40:00 AM	1:03:00 PM	14995	15000.2	5.2
	8:55:00 AM	1:00:00 PM	10838.8	10842.9	4.1

	8:55:00 AM	1:00:00 PM	10838.8	10842.9	4.1
	8:40:00 AM	10:00:00 AM	10846.5	10847.7	1.2
	10:33:00 AM	2:14:00 AM	10852.7	10856.3	3.6
2	9:15:00 AM		10856.9	10861.6	4.7
	10:30:00 AM	1:12:00 PM	10864.6	10867.3	2.7
	10:25:00 AM	11:58:00 AM	10868.5	10870.1	1.6
	1:30:00 PM	4:18:00 PM	10870.8	10873.6	2.8
	9:00:00 AM	1:30:00 PM	10873.6	10877.9	4.3
	12:03:00 PM	5:04:00 PM	7732.4	7737.4	5
	10:41:00 AM	3:00:00 PM	10880.2	10884.5	4.3
1	10:48:00 AM	1:06:00 PM	7737.4	7739.7	2.3
	9:14:00 AM	10:54:00 AM	7739.7	7741.4	1.7
	8:56:00 AM	9:31:00 AM	7741.4	7742	0.6
0	12:10:00 AM	4:32:00 PM	10885.2	10889.6	4.4
	9:21:00 AM	1:46:00 PM	10889.6	10893.7	4.1
	8:49:00 AM	12:00:00 PM	10894.9	10898.1	3.2
	8:30:00 AM	12:00:00 PM	10901.2	10904.6	3.4
0	9:00:00 AM	3:09:00 PM	12446.7	12452.9	6.2

Flight 2 Wheels Up	Flight 2 Wheels Down	Flight 2 Begin Hobbs	Flight 2 End Hobbs	Flight 2 Total Hobbs	Daily Hobbs Total	On-Line Hobbs
				0	3.10	2.2
				0	2.40	1.5
				0	5.10	4.0
				0	5.50	4.9
				0	3.90	3.5
3:45:00 PM	5:15:00 PM	14777.4	14778.9	1.5	6.80	5.5
				0	3.60	2.9
				0	5.10	4.5
				0	3.90	3.3
				0	2.00	2.3
				0	4.00	2.9
				0	5.00	4.0
				0	5.10	3.8
				0	2.40	1.0
2:00:00 PM	4:47:00 PM	10798.9	10801.5	2.6	5.60	3.5
				0	3.60	
2:35:00 PM	6:19:00 PM	10809.9	10813.5	3.6	8.00	6.2
3:15:00 PM	7:00:00 PM	10817.7	10821.2	3.5	7.70	5.3
				0	5.90	5.0
				0	5.20	4.5
				0	4.40	3.4
				0	4.20	
				0	3.00	2.5
3:00:00 PM	7:09:00 PM	10834.1	10838.1	4	8.30	5.9
3:11:00 PM	5:18:00 PM	14993.7	14995.9	2.2	2.90	1.0
3:57:00 PM	5:32:00 PM	15000.2	15002.8	2.6	7.80	3.0
2:37:00 PM	6:13:00 PM	10842.8	10846.5	3.7	7.80	6.1

2:37:00 PM	6:13:00 PM	10842.8	10846.5	3.7	7.80	6.1
10:44:00 AM	12:54:00 PM	10847.7	10849.8	2.1	3.30	2.2
3:41:00 AM	4:16:00 PM	10856.3	10856.9	0.6	4.20	2.7
3:26:00 PM	6:20:00 PM	10861.6	10864.6	3	7.70	5.6
				0	2.70	1.7
2:25:00 PM	3:07:00 AM	10870.1	10870.8	0.7	2.30	0.8
				0	2.80	2.0
3:00:00 PM	5:30:00 PM	10877.9	10880.2	2.3	6.60	5.0
				0	5.00	2.6
				0	4.30	3.3
				0	2.30	1.6
				0	1.70	1.2
12:02:00 PM	5:08:00 PM	7742	7747.1	5.1	5.70	4.1
				0	4.40	3.2
				0	4.10	2.6
1:23:00 PM	4:38:00 PM	10898.1	10901.2	3.1	6.30	4.6
				0	3.40	2.0
				0	6.20	5.0

MOB Hobbs	Operator	Pilot	Base of Operations
0.9	Christopher Sanchez	Matthew Archan	KMSO
0.9	Miranda Geller	Chris LaRosa	KGPI
1.0	Miranda Geller	Chris LaRosa	KGPI
0.7	Miranda Geller	Chris LaRosa	KGPI
	Annie Pasternack	Alex Sessions	KMSO
1.6	Miranda Geller	Chris LaRosa	KGPI
	Annie Pasternack	Alex Sessions	KMSO
0.8	Miranda Geller	Chris LaRosa	KGPI
	Annie Pasternack	Alex Sessions	KMSO
0.6	Miranda Geller	Chris LaRosa	KGPI
1.4	Miranda Geller	Chris LaRosa	KGPI
1.0	Scott White	Jamon Neilson	KMSO
1.3	Scott White	Jamon Neilson	KMSO
1.4	Scott White	Jamon Neilson	KMSO
2.4	Jonathon Swan	Greg Simonds	KMSO
	Jonathon Swan	Greg Simonds	KMSO
1.8	Jonathon Swan	Greg Simonds	KMSO
1.4	Jonathon Swan	Jamon Neilson	KMSO
0.9	Stephanie Cohee	Chris Griffin	KGPI
0.7	Stephanie Cohee	Chris Griffin	KGPI
1.0	Jonathon Swan	Jamon Neilson	KMSO
	Jonathon Swan	Jamon Neilson	KMSO
0.5	Stephanie Cohee	Chris Griffin	KGPI
2.4	Jonathon Swan	Jamon Neilson	KMSO
1.2	Stephanie Cohee	Chris Griffin	KGPI
3.9	Stephanie Cohee	Chris Griffin	KTTD
2.7	Jonathon Swan	Chad Unangst	KGTF

2.7	Jonathon Swan	Chad Unangst	KGTF
3.3	Jonathon Swan	Chad Unangst	KGTF
1.5	Gary Tao	Chad Unangst	KGTF
2.1	Gary Tao	Chad Unangst	KGTF
1.0	Gary Tao	Chad Unangst	KGTF
1.3	Gary Tao	Jamon Neilson	KGPI
0.8	Jonathon Swan	Jamon Neilson	KFCA
1.6	Jonathon Swan	Jamon Neilson	KFCA
2.4	Erin Guillory	Bob Cale	KGPI
1.0	Jonathon Swan	Jamon Neilson	KFCA
0.7	Erin Guillory	Bob Cale	KGPI
0.5	Erin Guillory	Bob Cale	KGPI
1.6	Erin Guillory	Bob Cale	KGPI
1.2	Jonathon Swan	Jamon Neilson	KGTF
1.5	Jonathon Swan	Jamon Neilson	KGTF
0.9	Jonathon Swan	Chad Unangst	KGTF
1.4	Jonathon Swan	Chad Unangst	KGTF
0.8	Miranda Geller	Chris LaRosa	KGTF

Notes

Flew lines on the MTStatewide West project near MSO

Got lift early but wx picked up quickly and ceiling began to drop about 2 hours in, rain by the time we landed

Clouds started forming after a few hours, otherwise a great day

Another good day, lots of clouds forming during acq though

smooth air until about noon, clouds forming in the afternoon.

Great day, almost zero clouds in the whole range. Tried for a second lift but had 40-50 knot gusts and shear winds.

clear, smooth.

Another great day over gorgeous mountains, winds much more calm
beautiful morning, turbulence began around 10 am, we moved to north south lines around 11 to see if that helped, it didnt.

Morning and early afternoon were rainy and cloudy, got a later lift and had lots of low clouds and turbulence.

Got a later lift and did a little acq until turb and rain hit.
Bumpy all day over the mountains, but flew until we needed fuel.

Got the Mt Cnty reflies plan then jumped back up north to work on QL1 Montana Statewide plan.

We headed up and got a few lines in over the valley, we went to target the rest of our lines over the mountains and started getting rocked. Extremely violent downdrafts made it unable to climb so we had to call it.

2 lifts today. Second lift was a bit turbulent with some up and down drafts.

1 lift today. Clouds popped above us then dropped creating turbulence and +\- 1000' up\down drafts. We were unable safely to hold the line. Jamon arrived today.

2 lifts today. Some light turbulence otherwise smooth and cloud free.

2 lifts today. Clear Skies. Epic Day.

We flow on the southern block of the AOI and were able to acq all of that block before fuel needs. Good day of acq.

Thick haze today, but ranges were good and we could see though the smoke haze. We hit turbulence in the early afternoon and the plane performance was having trouble keeping up with the environmental conditions. Good day of acq. Plane is being hangered due to predicted wind and possible snow.

1 lift. Smoky Hazy Conditions.

1 lift today to wrap up the Idaho Reflights and then continued on MT.No Second lift due to pilot fatigue. Smooth Clear.

Got off to an early start today, but after a couple hours of flying, northern low clouds drifted in and were unable to thread the needle. Got a good chunk acquired of the AOI, before we were pushed out by the system rolling in.

2 Lifts today. Finished the West QL2 Flight lines. Smooth and Clear Skies.

The mountains were covered with a fresh coat of snow powder this morning, so we were unable to collect. AW provided us with a possible new plan for tomorrow and also more lines on the east of our current AOI. We attempted to collect there, but ran into snow on the northern section of the lines. We decided to run 3 lines and then we ran into clouds on the last line. I transferred this to Darth and will add to tomorrow deliverable, as I believe that the data needs to be reflown anyways.
After a successful morning acq flight collecting the southern block in the eastern AOI, we headed back to KGPI for fuel.

2 lifts today. Smooth Clear. No Snow.

2 lifts today. Smooth Clear. No Snow.

Lift 1 - Laser worked fine. Smoke in area made it unsafe to navigate in the mtns. Moved to the lower lying areas as the visibility was better and Chad said the Wind Shear was too much to continue. Headed back to GTF for fuel.

Lift 2- Flew down near Lewistown MT to finish lines 455-459

Acquired lines 144-155 of Statewide MT - East QL2/ Phase 2 AOI in hazy smoky layer conditions just below operational altitudes. Received good returns as monitored by RiAcquire.

Crew of N22GE performed 2 lifts today. First lift completed lines 193-209 of MT Statewide East QL2 AOI. Second lift consisted of lines 427 reflight, 8-9 of MT Statewide QL1 AOI.

Crew of N22GE acquired lines 3-7 and 296PR2 of MT Phase2 Statewide QL1 AOI on a single lift.

Acquired 1 whole line and 2 partial reflights of Phase 2 Priority QL1 lines of 36170 MT AOI in scattered cloud conditions. Line 295 may require reflight of portions of southern 21 nm due to clouds and severe pitch on mount during flight.

Took off as soon as the plane was released from MX. Flew a short lift as the left engine was running hot. Landed to check if the cowl was closed and talk to mechanic before he went home. Cowl Flap was closed so we opened it back up.

2 lifts today to wrap up the secondary lines.

Mob from McCall to Kalispell today. Collected upon arrival. Conditions clear and smooth.

One lift today after the morning fog burned.

It was too turbulent to go back up.

Late start today due to fog. Flew on our high elev block until turbulence picked up.

Mostly clear skies today except for in our AOI! We got as many lines as we could before we were clouded out. Stood by for it to clear but it did not.

Went up to collect on high elevation and reflies, but AOIs were clouded out. We landed and received instruction to fly on the East side of the mountains, so we went back up and collected.

One lift today after plane was released from MX. Attempted the lines 190 tracking east first but it was way too turbulent near the mountains so we fell back on lines over the plains

Jamon called and coordinated with DHS this AM. We took off and aimed for the NW lines. Got onsite and there were clouds. Attempted ACQ and Aborted. Flew to the Sept21,23 Reflight areas and captured those. Checked the northern lines again and they were still cloudy so we flew lines 190-194 and landed. SBM had the Mechanic do some work on the Prop. Plane is now back in service.

2 lifts today. Mountain lines were clouded out.

Flew a lift in the AM. Tried for the westernmost lines but the turbulence was too bad. Moved east until we found a spot to work in. Landed and swapped the sensor to 704MD. Ran the system up on the ground and all seemed operational.

Very windy, so we stuck to n-s at lower altitudes lines to avoid shear. Wanted to go for a double lift but ceiling descended and we had to head back.

MT_Statewide_East_15601_QL2

Name	Lengt	Alt. [ft	Date	#	r SN#	Op	Time Stamp	? (office QC)
1	16.7	9944	20201104	A	3061	MG	221534	Accepted
2	16.7	9941	20201104	A	3061	MG	220703	Accepted
3	16.7	9938	20201104	A	3061	MG	215830	Accepted
4	16.7	9934	20201104	A	3061	MG	214951	Accepted
5	16.7	9931	20201104	A	3061	MG	214100	Accepted
6	16.7	9928	20201104	A	3061	MG	213214	Accepted
7	18.3	9925	20201104	A	3061	MG	212156	Accepted
8	18.3	9918	20201104	A	3061	MG	211244	Accepted
9	18.3	9915	20201104	A	3061	MG	210256	Accepted
10	18.3	9911	20201104	A	3061	MG	205338	Accepted
11	18.8	9908	20201104	A	3061	MG	204331	Accepted
12	18.8	9905	20201104	A	3061	MG	203400	Accepted
13	27.5	9902	20201104	A	3061	MG	201731	Accepted
14	28.0	9898	20210527	B	3546	MM	184908	Accepted
15	28.0	9895	20210527	B	3546	MM	190511	Accepted
16	28.0	9892	20210601	A	3546	MM	140819	Accepted
17	28.6	9885	20210601	A	3546	MM	142541	Accepted
18	28.6	9882	20210601	A	3546	MM	144105	Accepted
19	28.6	9879	20210601	A	3546	MM	145854	Accepted
20	28.6	9875	20210601	A	3546	MM	151422	Accepted
21	29.1	9872	20210601	A	3546	MM	153347	Accepted
22	29.1	9869	20210531	A	3546	MM	175718	Accepted
23	29.1	9862	20210531	A	3546	MM	174108	Accepted
24	29.1	9862	20210531	A	3546	MM	175218	Accepted
25	29.6	9852	20210531	A	3546	MM	170931	Accepted
26	29.6	9852	20210531	A	3546	MM	165350	Accepted
27	29.6	9846	20210531	A	3546	MM	163723	Accepted
28	29.6	9843	20210531	A	3546	MM	162144	Accepted
29	29.7	9839	20210531	A	3546	MM	160514	Accepted
30	30.2	9833	20210531	A	3546	MM	154839	Accepted
31	30.2	9829	20210527	B	3546	MM	192455	Accepted
32	30.2	9829	20210527	B	3546	MM	194146	Accepted
33	30.2	9823	20210527	B	3546	MM	195748	Accepted
34	30.7	9823	20210527	B	3546	MM	201426	Accepted
35	30.7	9820	20210527	B	3546	MM	203051	Accepted
36	30.7	9820	20210527	B	3546	MM	204753	Accepted
37	31.3	9816	20210527	B	3546	MM	212124	Accepted
38	31.3	9806	20210527	B	3546	MM	213818	Accepted
39	31.3	9800	20210529	A	3546	MM	152150	Accepted
40	31.3	9790	20210529	A	3546	MM	153917	Accepted
41	31.2	9787	20210530	A	3546	MM	165655	Accepted
42	31.2	9783	20210530	A	3546	MM	164013	Accepted
43	29.8	9783	20210530	A	3546	MM	162333	Accepted

44	28.1	9780	20210529	A	3546	MM	155611	Accepted
45	17.7	9777	20210529	A	3546	MM	161059	Accepted
46	17.2	9774	20210529	A	3546	MM	162142	Accepted
47	16.7	9774	20210529	A	3546	MM	163155	Accepted
48	15.0	9770	20210529	A	3546	MM	164207	Accepted
49	27.4	9446					Do Not Fly	
50	31.2	9449					Do Not Fly	
51	31.2	9442					Do Not Fly	
52	31.2	9446					Do Not Fly	
53	30.7	9446					Do Not Fly	
54	30.7	9439					Do Not Fly	
55	30.1	9426					Do Not Fly	
56	29.6	9426					Do Not Fly	
57	28.0	9436					Do Not Fly	
58	28.0	9432					Do Not Fly	
59	28.0	9429					Do Not Fly	
60	28.0	9426					Do Not Fly	
61	28.0	9419					Do Not Fly	
62	28.0	9409					Do Not Fly	
63	28.0	9409					Do Not Fly	
64	27.5	9416					Do Not Fly	
65	27.4	9413					Do Not Fly	
66	26.9	9413					Do Not Fly	
67	26.9	9406					Do Not Fly	
68	26.9	9406					Do Not Fly	
69	26.4	9406					Do Not Fly	
70	25.3	9406					Do Not Fly	
71	24.2	9406					Do Not Fly	
72	22.6	9403					Do Not Fly	
73	23.1	9403					Do Not Fly	
74	24.8	9400					Do Not Fly	
75	25.3	9400					Do Not Fly	
76	25.8	9400					Do Not Fly	
77	26.9	9400					Do Not Fly	
78	28.3	9396					Do Not Fly	
79	28.3	9393					Do Not Fly	
80	28.3	9393					Do Not Fly	
81	28.3	9403					Do Not Fly	
82	28.3	9416					Do Not Fly	
83	28.3	9419					Do Not Fly	
84	28.3	9419					Do Not Fly	
85	28.3	9426					Do Not Fly	
86	26.7	9488					Do Not Fly	
87	26.7	9521					Do Not Fly	
88	26.7	9593					Do Not Fly	
89	26.7	9613					Do Not Fly	
90	26.2	9623					Do Not Fly	
91	26.2	9623					Do Not Fly	
92	26.2	9655					Do Not Fly	

93	26.2	9564					Do Not Fly	
94	26.2	9564					Do Not Fly	
95	27.8	9570					Do Not Fly	
96	27.8	9580					Do Not Fly	
97	27.8	9593					Do Not Fly	
98	27.8	9603					Do Not Fly	
99	27.2	9613					Do Not Fly	
100	27.2	9626					Do Not Fly	
101	27.2	9636					Do Not Fly	
102	27.2	9649					Do Not Fly	
103	27.2	9655					Do Not Fly	
104	27.2	9662					Do Not Fly	
105	27.2	9685					Do Not Fly	
106	27.2	9705					Do Not Fly	
107	16.4	9856					Do Not Fly	
108	16.4	9879					Do Not Fly	
109	16.4	9902					Do Not Fly	
110	11.8	9905					Do Not Fly	
111	17.7	9774	20210603	A	3546	MM	155635	Accepted
112	18.3	9777	20210603	A	3546	MM	154623	Accepted
113	18.3	9783	20210603	A	3546	MM	153612	Accepted
114	19.9	9783	20210603	A	3546	MM	152526	Accepted
115	20.4	9783	20210603	A	3546	MM	151415	Accepted
116	20.4	9787	20210603	A	3546	MM	150308	Accepted
117	20.4	9790	20210603	A	3546	MM	145153	Accepted
118	19.3	9793	20210603	A	3546	MM	144026	Accepted
119	19.9	9797	20210603	A	3546	MM	142911	Accepted
120	21.0	9800	20210603	A	3546	MM	141721	Accepted
121	21.5	9803	20210602	A	3546	MM	181432	Accepted
122	22.1	9803	20210602	A	3546	MM	180219	Accepted
123	22.1	9806	20210602	A	3546	MM	175036	Accepted
124	22.1	9810	20210602	A	3546	MM	173812	Accepted
125	22.1	9816	20210602	A	3546	MM	172631	Accepted
126	22.6	9816	20210602	A	3546	MM	171413	Accepted
127	23.1	9820	20210602	A	3546	MM	170205	Accepted
128	23.1	9823	20210602	A	3546	MM	164916	Accepted
129	23.1	9826	20210602	A	3546	MM	163705	Accepted
130	23.1	9829	20210602	A	3546	MM	162435	Accepted
131	23.7	9833	20210602	A	3546	MM	161202	Accepted
132	25.2	9836	20210602	A	3546	MM	155813	Accepted
133	25.3	9839	20210602	A	3546	MM	144514	Accepted
134	25.8	9846	20210602	A	3546	MM	153116	Accepted
135	25.8	9849	20210602	A	3546	MM	151729	Accepted
136	25.8	9852	20210602	A	3546	MM	150303	Accepted
137	24.7	10138	20210519	A	3546	MS	193641	Accepted
138	25.3	10174	20210519	A	3546	MS	192355	Accepted
139	25.3	10194	20210519	A	3546	MS	191115	Accepted
140	25.3	10203	20210519	A	3546	MS	185843	Accepted
141	24.7	10213	20210519	A	3546	MS	184607	Accepted

142	24.7	10213	20210519	A	3546	MS	183352	Accepted
143	24.7	10239	20210519	A	3546	MS	182114	Accepted
144	24.7	10269	20200916	A	4040	Gary Tao	171118	Accepted
145	24.7	10354	20200916	A	4040	Gary Tao	172501	Accepted
146	24.7	10410	20200916	A	4040	Gary Tao	173800	Accepted
147	24.2	10463	20200916	A	4040	Gary Tao	175210	Accepted
148	24.2	10489	20200916	A	4040	Gary Tao	180510	Accepted
149	24.2	10486	20200916	A	4040	Gary Tao	1818106	Accepted
150	23.9	10456	20200916	A	4040	Gary Tao	183123	Accepted
151	23.5	10456	20200916	A	4040	Gary Tao	184419	Accepted
152	23.2	10459	20200916	A	4040	Gary Tao	185718	Accepted
153	22.7	10479	20200916	A	4040	Gary Tao	190943	Accepted
154	7.5	10518	20200916	A	4040	Gary Tao	192537	Accepted
155	5.8	10581	20200916	A	4040	Gary Tao	193112	Accepted
156	6.2	9767	20210530	A	3546	MM	160833	Accepted
157	14.8	9764	20210530	A	3546	MM	155725	Accepted
158	17.5	9757	20210530	A	3546	MM	154709	Accepted
159	20.2	9747	20210530	A	3546	MM	153556	Accepted
160	20.2	9741	20210530	A	3546	MM	152446	Accepted
161	20.2	9751	20210530	A	3546	MM	151321	Accepted
162	20.2	9793	20210530	A	3546	MM	150207	Accepted
163	20.2	9869	20210530	A	3546	MM	145031	Accepted
164	20.2	10059	20210530	A	3546	MM	143905	Accepted
165	20.2	10157	20210529	A	3546	MM	171456	Accepted
166	19.7	10134	20210530	A	3546	MM	142718	Accepted
167	19.7	10039	20210529	A	3546	MM	170226	Accepted
168	6.4	10692	20201104	A	3061	MG	200407	Accepted
169	6.4	10627	20201104	A	3061	MG	195947	Accepted
170	6.4	10594	20201104	A	3061	MG	195501	Accepted
171	11.8	10551	20201104	A	3061	MG	194603	Accepted
172	12.9	10515	20201104	A	3061	MG	193816	Accepted
173	13.9	10482	20201104	A	3061	MG	193045	Accepted
174	14.5	10446	20201104	A	3061	MG	192222	Accepted
175	15.0	10423	20201104	A	3061	MG	191350	Accepted
176	16.6	10404	20201104	A	3061	MG	190440	Accepted
177	17.7	10381	20201104	A	3061	MG	185506	Accepted
178	18.8	10358	20201104	A	3061	MG	184508	Accepted
179	19.9	10328	20201104	A	3061	MG	183456	Accepted
180	20.4	10285	20201104	A	3061	MG	182416	Accepted
181	19.9	10259	20201104	A	3061	MG	181352	Accepted
182	23.1	10230	20201104	A	3061	MG	180114	Accepted
183	23.7	10203	20201104	A	3061	MG	174852	Accepted
184	23.7	10203	20201104	A	3061	MG	1773503	Accepted
185	26.4	10374	20210531	A	3546	MM	135412	Accepted
186	26.4	10377	20210531	A	3546	MM	140802	Accepted
187	26.4	10426	20210531	A	3546	MM	142423	Accepted
188	26.4	10472	20210531	A	3546	MM	143831	Accepted
189	26.4	10495	20210531	A	3546	MM	145356	Accepted
190	26.4	10528	20210531	A	3546	MM	150837	Accepted

191	26.4	10554	20210531	A	3546	MM	152539	Accepted
192	26.4	10587	20210519	A	3546	MS	174928	Accepted
193	26.4	10620	20200921	A	4040	Gary Tao	154227	Accepted
194	26.4	10640	20200921	A	4040	Gary Tao	155642	Accepted
195	26.4	10659	20200921	A	4040	Gary Tao	161038	Accepted
196	26.4	10686	20200921	A	4040	Gary Tao	162519	Accepted
197	26.4	10712	20200921	A	4040	Gary Tao	164019	Accepted
198	26.4	10735	20200921	A	4040	Gary Tao	165421	Accepted
199	26.4	10784	20200921	A	4040	Gary Tao	170853	Accepted
200	26.4	10801	20200921	A	4040	Gary Tao	172317	Accepted
201	26.4	10837	20200921	A	4040	Gary Tao	173804	Accepted
202	26.4	10853	20200921	A	4040	Gary Tao	175224	Accepted
203	26.4	10892	20200921	A	4040	Gary Tao	180643	Accepted
204	26.4	10925	20200921	A	4040	Gary Tao	182101	Accepted
205	26.4	10948	20200921	A	4040	Gary Tao	183517	Accepted
206	23.1	10974	20200921	A	4040	Gary Tao	184858	Accepted
207	23.1	11007	20200921	A	4040	Gary Tao	190136	Accepted
208	23.1	11027	20200921	A	4040	Gary Tao	191533	Accepted
209	23.1	11070	20200921	A	4040	Gary Tao	192746	Accepted
210	28.3	10200					Do Not Fly	
211	28.3	10246					Do Not Fly	
212	28.3	10239					Do Not Fly	
213	28.3	10210					Do Not Fly	
214	27.2	10180					Do Not Fly	
215	27.2	10141					Do Not Fly	
216	27.2	10121					Do Not Fly	
217	26.1	10105					Do Not Fly	
218	25.1	10082					Do Not Fly	
219	24.5	10062					Do Not Fly	
220	24.5	10039					Do Not Fly	
221	24.5	10003					Do Not Fly	
222	24.5	9980					Do Not Fly	
223	24.0	9951					Do Not Fly	
224	22.9	9918					Do Not Fly	
225	22.4	9888					Do Not Fly	
226	22.4	9859					Do Not Fly	
227	21.8	9826					Do Not Fly	
228	20.7	9810					Do Not Fly	
229	20.7	9777					Do Not Fly	
230	20.7	9757					Do Not Fly	
231	20.7	9731					Do Not Fly	
232	20.7	9705					Do Not Fly	
233	20.7	9675					Do Not Fly	
234	20.7	9655					Do Not Fly	
235	19.7	9629					Do Not Fly	
236	19.7	9613					Do Not Fly	
237	19.7	9593					Do Not Fly	
238	19.7	9570					Do Not Fly	
239	19.1	9551					Do Not Fly	

240	18.6	9537					Do Not Fly	
241	18.0	9537					Do Not Fly	
242	16.4	9528					Do Not Fly	
243	16.4	9514					Do Not Fly	
244	16.4	9495					Do Not Fly	
245	15.9	9488					Do Not Fly	
246	14.3	9488					Do Not Fly	
247	8.5	9508					Do Not Fly	
248	28.8	9734					Do Not Fly	
249	28.8	9724					Do Not Fly	
250	28.8	9718					Do Not Fly	
251	28.8	9705					Do Not Fly	
252	28.8	9701					Do Not Fly	
253	28.8	9688					Do Not Fly	
254	28.9	9682					Do Not Fly	
255	28.9	9672					Do Not Fly	
256	28.9	9665					Do Not Fly	
257	28.9	9655					Do Not Fly	
258	28.9	9636					Do Not Fly	
259	28.9	9623					Do Not Fly	
260	28.9	9613					Do Not Fly	
261	28.9	9603					Do Not Fly	
262	28.9	9603					Do Not Fly	
263	28.9	9636					Do Not Fly	
264	28.9	9688					Do Not Fly	
265	28.9	9715					Do Not Fly	
266	28.9	9754					Do Not Fly	
267	28.9	9859					Do Not Fly	
268	28.9	9816					Do Not Fly	
269	28.9	9774					Do Not Fly	
270	28.9	9734					Do Not Fly	
271	28.9	9695					Do Not Fly	
272	28.9	9649					Do Not Fly	
273	28.9	9619					Do Not Fly	
274	28.9	9570					Do Not Fly	
275	28.9	9531					Do Not Fly	
276	28.9	9505					Do Not Fly	
277	28.9	9478					Do Not Fly	
278	28.9	9455					Do Not Fly	
279	28.9	9449					Do Not Fly	
280	28.9	9446					Do Not Fly	
281	28.9	9446					Do Not Fly	
282	28.0	9455					Do Not Fly	
283	18.3	9468					Do Not Fly	
284	13.9	9475					Do Not Fly	
285	11.2	9478					Do Not Fly	
286	10.2	9491					Do Not Fly	
287	5.8	9505					Do Not Fly	
288	5.3	9386					Do Not Fly	

289	7.5	9383					Do Not Fly	
290	18.3	9360					Do Not Fly	
291	19.9	9360					Do Not Fly	
292	19.9	9363					Do Not Fly	
293	21.5	9363					Do Not Fly	
294	22.0	9360					Do Not Fly	
295	22.6	9363					Do Not Fly	
296	22.6	9373					Do Not Fly	
297	22.6	9386					Do Not Fly	
298	22.6	9386					Do Not Fly	
299	22.6	9396					Do Not Fly	
300	22.6	9406					Do Not Fly	
301	22.6	9400					Do Not Fly	
302	23.1	9373					Do Not Fly	
303	23.1	9390					Do Not Fly	
304	23.1	9383					Do Not Fly	
305	23.1	9377					Do Not Fly	
306	23.1	9377					Do Not Fly	
307	23.1	9380					Do Not Fly	
308	23.1	9383					Do Not Fly	
309	23.1	9383					Do Not Fly	
310	23.1	9386					Do Not Fly	
311	23.7	9386					Do Not Fly	
312	23.7	9380					Do Not Fly	
313	23.7	9390					Do Not Fly	
314	23.7	9390					Do Not Fly	
315	23.7	9393					Do Not Fly	
316	23.7	9393					Do Not Fly	
317	23.7	9396					Do Not Fly	
318	23.7	9400					Do Not Fly	
319	24.2	9403					Do Not Fly	
320	24.2	9409					Do Not Fly	
321	24.2	9409					Do Not Fly	
322	24.2	9416					Do Not Fly	
323	24.2	9419					Do Not Fly	
324	24.2	9423					Do Not Fly	
325	20.4	9426					Do Not Fly	
326	20.4	9429					Do Not Fly	
327	21.0	9436					Do Not Fly	
328	21.0	9439					Do Not Fly	
329	21.0	9446					Do Not Fly	
330	21.0	9449					Do Not Fly	
331	17.7	9452					Do Not Fly	
332	11.2	9491					Do Not Fly	
333	10.7	9610					Do Not Fly	

Mission, & SN	Timestamp	es (Direction, Atmos. Conditions, Speed, PR, Errors)
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	*stopped 3 M from N end. Remaining flown 20210530	
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		QSI_Fort Belknap Tribe lands
		QSI_Fort Belknap Tribe lands
		Smoke layer Below, Ground Visible, Hazy, Good Returns
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		Smoke layer Below, Ground Visible, Hazy, Good Returns
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MT_Statewide_East_1560i_QL2

QSI Project #	R036170	
Project Point Density (pts/m	2 ppms	
Sensor Name	VQ 1560i	
Please Ship Data to:	LEX	
Flight Plan Settings		
Mission Parameter	**Scanner 1**	**Scanner 2**
Planned Altitude AGL (m)	2305	2305
Target Speed (kts)	145	145
Scanner Parameter		
Measurement Program (PRR)	350	350
Laser Power (%)	100	100
Measurement Output (range/wf	Range	Range
MTA Zone	DEM	DEM
Line Start/Stop	60° / 120°	60° / 120°
Effective FOV (°)	58.5	58.5
Line Speed/Increment	ress Uniform Point Spacin	

Additional Flight Paramaters	
Max Bank Angle in Turns (°)	20
Minimum Line Overlap (%)	55

Laser Safety Parameters	
NOHD (m)	238
ENOHD (m)	1584

Accepted
Refly
N/A

MT_Statewide_West_15601_QL2

Name	Lengt	Alt. [ft	Date	#	r SN#	Op	Time Stamp	? (office QC)
1	7.6	11217	20200816	1	4040	ASP	926	Accepted
2	8.3	11394	20200816	1	4040	ASP	933	Accepted
3	9.5	11650	20200816	1	4040	ASP	939	Accepted
4	10.2	11204	20200816	1	4040	ASP	946	Accepted
5	10.9	11033	20200816	1	4040	ASP	953	Accepted
6	13.8	10896	20200816	1	4040	ASP	1003	Accepted
7	15.3	10764	20200816	1	4040	ASP	1011	Accepted
8	23.3	10679	20200816	1	4040	ASP	1024	Accepted
9	25.4	10584	20200816	1	4040	ASP	1035	Accepted
10	25.8	10518	20200816	1	4040	ASP	1049	Accepted
11	26.2	10459	20200816	1	4040	ASP	1101	Accepted
12	26.5	10417	20200816	1	4040	ASP	1115	Accepted
13	26.2	10377	20200908	1	4040	JSwan	x	Accepted
14	26.2	10331	20200908	1	4040	JSwan	x	Accepted
15	26.4	10295	20200908	1	4040	JSwan	x	Accepted
16	27.2	10256	20200908	1	4040	JSwan	x	Accepted
17	27.4	10220	20200908	1	4040	JSwan	x	Accepted
18	27.6	10190	20200908	1	4040	JSwan	x	Accepted
19	27.7	10125	20200908	1	4040	JSwan	x	Accepted
20	27.5	10075	20200908	1	4040	JSwan	x	Accepted
21	28.1	10052	20200908	1	4040	JSwan	x	Accepted
22	28.1	10016	20200815	1	4040	ASP	1130	Accepted
23	27.8	9849	20200815	1	4040	ASP	1117	Accepted
24	27.5	9849	20200815	1	4040	ASP	1104	Accepted
25	26.3	9849	20200815	1	4040	ASP	1051	Accepted
26	24.6	9839	20200815	1	4040	ASP	1039	Accepted
28	23.3	9846	20200908	1	4040	JSwan	x	Accepted
29	23.0	9849	20200908	1	4040	JSwan	x	Accepted
30	22.8	9898	20200908	2	4040	JSwan	x	Accepted
31	22.5	9934	20200908	2	4040	JSwan	x	Accepted
32	22.3	9977	20200908	2	4040	JSwan	x	Accepted
33	21.9	10026	20200908	2	4040	JSwan	x	Accepted
34	21.2	10089	20200908	2	4040	JSwan	x	Accepted
35	20.4	10177	20200908	2	4040	JSwan	x	Accepted
36	19.6	10223	20200908	2	4040	JSwan	x	Accepted
37	18.5	10295	20200908	2	4040	JSwan	x	Accepted
38	16.7	10361	20200908	2	4040	JSwan	x	Accepted
39	15.7	10413	20200908	2	4040	JSwan	x	Accepted
40	14.5	10495	20200908	2	4040	JSwan	x	Accepted
41	13.5	10577	20200908	2	4040	JSwan	x	Accepted
42	12.6	10712	20200908	2	4040	JSwan	x	Accepted
43	11.7	10876	20200908	2	4040	JSwan	x	Accepted
44	10.6	11007	20200908	2	4040	JSwan	x	Accepted

45	8.9	11115	20200908	2	4040	JSwan	x	Accepted
46	5.3	11152	20200908	2	4040	JSwan	x	Accepted
47	3.9	11007	20200908	2	4040	JSwan	x	Accepted
48	3.9	10833	20200908	1	4040	JSwan	x	Accepted
49	10.4	10194	20200908	1	4040	JSwan	x	Accepted
50	15.6	9921	20200908	1	4040	JSwan	x	Accepted

51	17.9	9623	20200906	1	4040	JSwan	x	Accepted
52	18.7	9623	20200906	1	4040	JSwan	x	Accepted
53	23.1	9626	20200906	1	4040	JSwan	x	Accepted
54	25.1	9665	20200906	1	4040	JSwan	x	Accepted
55	27.1	9672	20200906	1	4040	JSwan	x	Accepted
56	28.4	9678	20200905	1	4040	JSwan	x	Accepted
57	28.4	9688	20200905	1	4040	JSwan	x	Accepted
58	28.5	9695	20200905	1	4040	JSwan	x	Accepted
59	28.5	9695	20200905	1	4040	JSwan	x	Accepted
60	28.5	9695	20200905	1	4040	JSwan	x	Accepted
61	28.4	9695	20200905	1	4040	JSwan	x	Accepted
62	28.3	9688	20200905	1	4040	JSwan	x	Accepted
63	28.2	9688	20200905	1	4040	JSwan	x	Accepted
64	25.4	9682	20200905	1	4040	JSwan	x	Accepted
65	25.4	9682	20200905	1	4040	JSwan	x	Accepted
66	25.5	9682	20200905	1	4040	JSwan	x	Accepted
67	25.9	9692	20200905	1	4040	JSwan	x	Accepted
68	26.0	9685	20200904	2	4040	JSwan	x	Accepted
69	26.0	9685	20200904	2	4040	JSwan	x	Accepted
70	26.1	9688	20200904	2	4040	JSwan	x	Accepted
71	26.2	9757	20200904	2	4040	JSwan	x	Accepted
72	26.2	9780	20200904	2	4040	JSwan	x	Accepted
73	26.3	9783	20200904	2	4040	JSwan	x	Accepted
74	26.4	9803	20200904	2	4040	JSwan	x	Accepted
75	27.1	9849	20200904	2	4040	JSwan	x	Accepted
76	27.5	10003	20200904	2	4040	JSwan	x	Accepted
77	27.9	10200	20200904	2	4040	JSwan	x	Accepted
78	27.3	10299	20200904	1	4040	JSwan	x	Accepted
79	26.6	10387	20200904	1	4040	JSwan	x	Accepted
80	25.8	10610	20200904	1	4040	JSwan	x	Accepted
81	24.8	10748	20200904	1	4040	JSwan	x	Accepted
82	23.8	10846	20200904	1	4040	JSwan	x	Accepted
83	22.6	11106	20200904	1	4040	JSwan	x	Accepted
84	21.5	11319	20200904	1	4040	JSwan	x	Accepted
85	20.3	11188	20200904	1	4040	JSwan	x	Accepted
86	20.6	9997	20200814	1	4040	ASP	1150	Accepted
87	21.1	9997	20200814	1	4040	ASP	1139	Accepted
88	22.2	9993	20200814	1	4040	ASP	1127	Accepted
89	22.5	9993	20200814	1	4040	ASP	1116	Accepted
90	22.8	9993	20200814	1	4040	ASP	1104	Accepted
91	22.9	9997	20200814	1	4040	ASP	1053	Accepted
92	22.9	10013	20200814	1	4040	ASP	1041	Accepted

93	23.0	10348	20200814	1	4040	ASP	1030	Accepted
94	22.9	10509	20200814	1	4040	ASP	1017	Accepted
95	22.9	10738	20200814	1	4040	ASP	1006	Accepted
96	22.8	11083	20200814	1	4040	ASP	953	Accepted
97	22.6	11545	20200814	1	4040	ASP	943	Accepted
98	22.1	11844	20200814	1	4040	ASP	931	Accepted
99	21.0	11634	20200814	1	4040	ASP	920	Accepted
100	20.8	11427	20200814	1	4040	ASP	910	Accepted
101	30.4	9908	20200814	1	4040	ASP	1203	Accepted
102	30.5	9898	20200814	1	4040	ASP	1218	Accepted
103	30.3	9898	20200815	1	4040	ASP	1010	Accepted
104	30.0	9902	20200815	1	4040	ASP	956	Accepted
105	29.7	9908	20200815	1	4040	ASP	942	Accepted
106	29.5	9951	20200815	1	4040	ASP	928	Accepted
107	29.3	9974	20200815	1	4040	ASP	914	Accepted
108	29.0	9974	20200815	1	4040	ASP	901	Accepted
109	28.8	9974	20200815	1	4040	ASP	847	Accepted
110	28.6	9974	20200812	1	4040	CS	161555	Accepted
111	28.4	9977	20200812	1	4040	CS	160428	Accepted
112	28.1	9990	20200812	1	4040	CS	154829	Accepted
113	27.9	9993	20200812	1	4040	CS	154109	Accepted
114	27.6	9997	20200812	1	4040	CS	152235	Accepted
115	27.5	9997	20200812	1	4040	CS	151157	Accepted
116	27.4	9997	20200812	1	4040	CS	145949	Accepted
117	27.1	10010	20200812	1	4040	CS	144755	Accepted
118	26.0	10020	20200812	1	4040	CS	143458	Accepted
119	21.7	10043	20200812	1	4040	CS	142434	Accepted
120	13.7	10085	20200812	1	4040	CS	141530	Accepted
121	12.5	10689	20200812	1	4040	CS	140917	Accepted
122	10.0	11096	20200812	1	4040	CS	140233	Accepted
123	20.1	10587	20200816	1	4040	ASP	1130	Accepted
124	20.4	9990	20200816	1	4040	ASP	1141	Accepted
125	20.7	9980	20200816	1	4040	ASP	1151	Accepted
126	21.0	9957	20200816	1	4040	ASP	1203	Accepted
127	21.2	9980	20200816	1	4040	ASP	1214	Accepted
128	23.7	9915	20200816	1	4040	ASP	1226	Accepted
129	25.0	9915	20200904	1	4040	JSwan	X	Accepted
130	25.3	9911	20200904	1	4040	JSwan	X	Accepted
131	27.8	9908	20200904	1	4040	JSwan	X	Accepted
132	28.1	9908	20200904	1	4040	JSwan	X	Accepted
133	28.4	9921	20200903	2	4040	JSwan	X	Accepted
134	28.7	9921	20200903	2	4040	JSwan	X	Accepted
135	29.1	9947	20200903	2	4040	JSwan	X	Accepted
136	29.4	9980	20200903	2	4040	JSwan	X	Accepted
137	29.7	9918	20200903	2	4040	JSwan	X	Accepted
138	29.9	9921	20200903	2	4040	JSwan	X	Accepted
139	30.2	9921	20200903	2	4040	JSwan	X	Accepted
140	30.6	9938	20200903	2	4040	JSwan	X	Accepted
141	30.9	9931	20200903	2	4040	JSwan	X	Accepted

142	31.4	9918	20200903	2	4040	JSwan	X	Accepted
143	31.8	9931	20200903	1	4040	JSwan	X	Accepted
144	32.2	9931	20200903	1	4040	JSwan	X	Accepted
145	32.7	9944	20200903	1	4040	JSwan	X	Accepted
146	30.1	9944	20200903	1	4040	JSwan	X	Accepted
147	24.3	9944	20200903	1	4040	JSwan	X	Accepted
148	24.6	9961	20200903	1	4040	JSwan	X	Accepted
149	25.0	9961	20200903	1	4040	JSwan	X	Accepted
150	25.3	9961	20200903	1	4040	JSwan	X	Accepted
151	25.6	10039	20200903	1	4040	JSwan	X	Accepted
152	25.9	10171	20200903	1	4040	JSwan	X	Accepted
153	26.2	10187	20200903	1	4040	JSwan	X	Accepted
154	26.5	10322	20200903	1	4040	JSwan	X	Accepted
155	26.8	10564	20200903	1	4040	JSwan	X	Accepted
156	27.1	10613	20200902	1	4040	JSwan	X	Accepted
157	27.5	10801	20200902	1	4040	JSwan	X	Accepted
158	27.9	11056	20200902	1	4040	JSwan	X	Accepted
159	28.4	11086	20200902	1	4040	JSwan	X	Accepted
160	28.9	10932	20200902	1	4040	JSwan	X	Accepted
161	29.3	10548	20200902	1	4040	JSwan	X	Accepted
162	29.8	10348	20200902	1	4040	JSwan	X	Accepted
163	29.8	10272	20200902	1	4040	JSwan	X	Accepted
164	30.4	10269	20200902	1	4040	JSwan	X	Accepted
165	30.9	10262	20200902	1	4040	JSwan	X	Accepted
166	31.5	10010	20200902	1	4040	JSwan	X	Accepted
167	32.0	9997	20200830	2	4040	JSwan	X	Accepted
168	32.6	9997	20200830	2	4040	JSwan	X	Accepted
169	24.9	9997	20200830	2	4040	JSwan	X	Accepted
170	16.8	10000	20200830	2	4040	JSwan	X	Accepted
171	17.2	9997	20200830	2	4040	JSwan	X	Accepted
172	17.7	10003	20200830	2	4040	JSwan	X	Accepted
173	18.1	10003	20200830	2	4040	JSwan	X	Accepted
174	18.6	10003	20200830	2	4040	JSwan	X	Accepted
175	19.0	10007	20200830	2	4040	JSwan	X	Accepted
176	19.4	10003	20200830	2	4040	JSwan	X	Accepted
177	19.8	10003	20200830	1	4040	JSwan	X	Accepted
178	20.3	10010	20200830	1	4040	JSwan	X	Accepted
179	20.3	10010	20200830	1	4040	JSwan	X	Accepted
180	20.9	10013	20200830	1	4040	JSwan	X	Accepted
181	14.4	10010	20200830	1	4040	JSwan	X	Accepted
182	14.9	10016	20200830	1	4040	JSwan	X	Accepted
183	6.9	10092	20200830	1	4040	JSwan	X	Accepted
184	7.4	10121	20200830	1	4040	JSwan	X	Accepted
185	7.8	10148	20200830	1	4040	JSwan	X	Accepted
186	7.3	10171	20200830	1	4040	JSwan	X	Accepted

Mission, & SN	Timestamp	(Direction, Atmos. Conditions, Speed, PR, Error

		Clr Smooth
		Clr Smooth
		Clr Smooth
		Clr Smooth
		Clr Smooth
		Hazy Smoky Conditions
		Hazy Smoky Conditions
		Hazy Smoky Conditions
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		Hazy Smoky Conditions
		Hazy Smoky Conditions
		Hazy Smoky Conditions
		Hazy Smoky Conditions
		Hazy Smoky Conditions
		Hazy Smoky Conditions

20200905A	4040-JSwan	**miles FWE.** 285*, Clouds, line abort@~6.5mi FWE,
		104*, Overcast Above, Smooth. Misfire in turn.
		285*, Overcast Above, Smooth
		104*, Overcast Above, Smooth
		285*, Overcast Above, Smooth
		104*, Overcast Above, Smooth
		285*, Overcast Above, Smooth
		104*, Overcast Above, Smooth
		285*, Overcast Above, Smooth
		104*, Overcast Above, Smooth, Misfire in turn.
		285*, Overcast Above, Smooth
		104*, Overcast Above, Smooth
		285*, Overcast Above, Smooth, Misfire in turn.

20200903A		Reflown on 0903
		Turbulent with up and down drafts
		Turbulent with up and down drafts
		Turbulent with up and down drafts
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		Turbulent with up and down drafts
		Turbulent with up and down drafts

MT_Statewide_West_1560i_QL2

QSI Project #	R036170	
Project Point Density (pts/m	2 ppms	
Sensor Name	VQ 1560i	
Please Ship Data to:	LEX	
Flight Plan Settings		
Mission Parameter	**Scanner 1**	**Scanner 2**
Planned Altitude AGL (m)	2305	2305
Target Speed (kts)	145	145
Scanner Parameter		
Measurement Program (PRR)	350	350
Laser Power (%)	100	100
Measurement Output (range/wf	Range	Range
MTA Zone	DEM	DEM
Line Start/Stop	60° / 120°	60° / 120°
Effective FOV (°)	58.5	58.5
Line Speed/Increment	ress Uniform Point Spacin	

Additional Flight Paramaters

Max Bank Angle in Turns (°)	20
Minimum Line Overlap (%)	55

Laser Safety Parameters

NOHD (m)	238
ENOHD (m)	1584