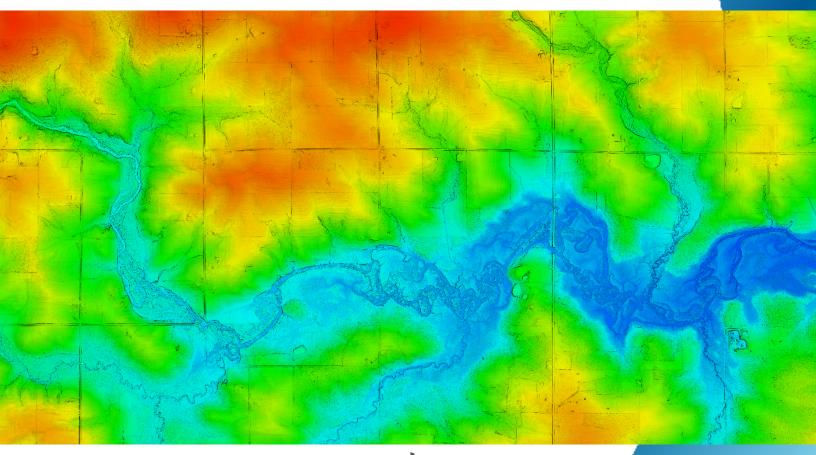
1 J GEOSPATIAL

powered by QUANTUM SPATIAL



WI_Statewide_2021_B21 LIDAR PROCESSING REPORT

> **Project ID: 218064** Work Unit: 300037

Prepared for:



National Map Help Desk: tnm help@usgs.gov

2022

Submitted:September13,2022

Prepared by:



powered by QUANTUM SPATIAL



Contents

1. Summary / Scope	1
1.1. Summary	1
1.2. Scope	1
1.3. Coverage	1
1.4. Duration	1
1.5. Issues	1
2. Planning / Equipment	4
2.1. Flight Planning	4
2.2. Lidar Sensor	4
2.3. Aircraft	6
2.4. Time Period	7
3. Processing Summary	8
3.1. Flight Logs	8
3.2. Lidar Processing	9
3.3. LAS Classification Scheme	10
3.4. Classified LAS Processing	11
3.5. Hydro-Flattened Breakline Processing	11
3.6. Hydro-Flattened Raster DEM Processing	12
3.7. Swath Separation Raster Processing	12
3.8. Maximum Surface Height Raster Processing	13
4. Project Coverage Verification	15
5. Geometric Accuracy	17
5.1. Horizontal Accuracy	17
5.2. Relative Vertical Accuracy	18
Project Report Appendices	xix
Appendix A	хх
Flight Logs	vv



List of Figures

Figure 2. Riegl VQ1560i Lidar Sensor	
Figure 3. Some of NV5 Geospatial's Planes	
Figure 4. Lidar Tile Layout	
Figure 5. Lidar Coverage	
List of Tables	
Table 1. Originally Planned Lidar Specifications	1
Table 2. Lidar System Specifications	5

List of Appendices

Appendix A: Flight Logs



1. Summary / Scope

1.1. Summary

This report contains a summary of the WI_Statewide_2021_B21, Work Unit 300037 lidar acquisition task order, issued by USGS under their Contract G16PC00016 on April 8, 2021. The task order yielded a project area covering 6,730 square miles across 8 counties in Wisconsin with work unit 300037 accounting for 606 square miles in Crawford. This project was done 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 Speci ications

Average Point Density	Flight Altitude (AGL)	Field of View	Minimum Side Overlap	RMSEz
2 pts / m ²	2,300 m	60°	20%	≤ 10 cm

1.3. Coverage

The project boundary covers 606 square miles over Wisconsin. Project extents are shown in Figure 1.

1.4. Duration

Lidar data was acquired from March 28, 2021 to April 1, 2021 in 4 total lifts. See "Section: 2.4. Time Period" or more details.

1.5. Issues

There were no issues to report.



Lidar Point Cloud	Classified Point Cloud in .LAS 1.4 format
Rasters	 2-foot Hydro-flattened Bare Earth Digital Elevation Model (DEM) in GeoTIFF format 2-foot 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



WI_Statewide_2021_B21 Crawford County Work Unit 300037 Boundary

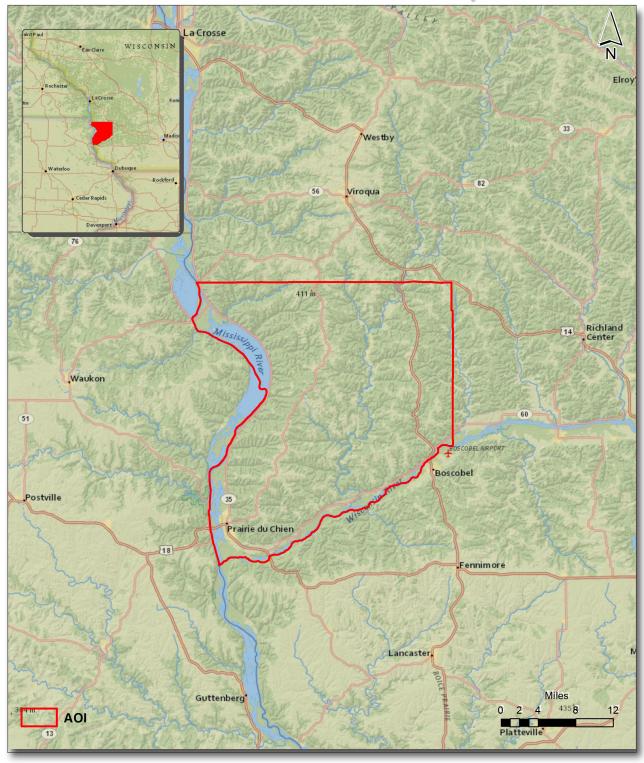


Figure 1. Work Unit Boundary



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 lidar sensors (Figure 2), serial number(s) 4040 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.

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 VQ1560i (SN4040)
Terrain and	Flying Height	2300 m
Aircraft Scanner	Recommended Ground Speed	180 kts
	Field of View	58.5°
Scanner	Scan Rate Setting Used	2 x 160 Hz
Laser	Laser Pulse Rate Used	1000 kHz
Laser	Multi Pulse in Air Mode	yes
Carramana	Full Swath Width	2577 m
Coverage	Line Spacing	0.558 m
Point Spacing	Average Point Spacing	0.71 m
and Density	Average Point Density	2 x 1.16 pts / m ²

Figure 2. Riegl VQ1560i 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

Cessna Conquest 2, Tail Number(s): N441CJ

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, LMS-Q1560 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 March 28, 2021 to April 1, 2021. Four aircraft lifts were completed. Accomplished lifts are listed below.

Lift	Start UTC	End UTC
03282021A (SN4040,N441CJ)	3/28/2021 1:13:50 PM	3/28/2021 2:27:37 PM
03292021A (SN4040,N441CJ)	3/29/2021 1:31:58 PM	3/29/2021 4:12:17 PM
03292021B (SN4040,N441CJ)	3/29/2021 7:45:44 PM	3/29/2021 10:24:59 PM
04012021B (SN4040,N441CJ)	4/01/2021 2:38:51 PM	4/01/2021 6:19:37 PM



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 2020, Revision A and are an industry standard for the classification of lidar point clouds. All data starts the process as Class 1 (Unclassified), and then through automated classification routines, the classifications are determined using TerraScan macro processing.

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

Table 3. LAS Classifications

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



3.4. Classified LAS Processing

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

All ground (ASPRS Class 2) lidar data inside of the Lake Pond and Double Line Drain hydro flattening breaklines were then classified to water (ASPRS Class 9) using proprietary tools. A buffer of 3 feet was also used around each hydro flattened feature to classify these ground (ASPRS Class 2) points to Ignored ground (ASPRS Class 20). All Lake Pond Island and Double Line Drain Island features were checked to ensure that the ground (ASPRS Class 2) points were reclassified to the correct classification after the automated classification was completed.

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

All data was manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler. Global Mapper is used as a final check of the bare earth dataset. GeoCue was then used to create the deliverable industry-standard LAS files for all point cloud data. NV5 Geospatial's proprietary software was used to perform final statistical analysis of the classes in the LAS files, on a per tile level to verify final classification metrics and full LAS header information.

3.5. Hydro-Flattened Breakline Processing

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

Elevation values were assigned to all Inland streams and rivers using NV5 Geospatial's proprietary software.

All ground (ASPRS Class 2) lidar data inside of the collected inland breaklines were then classified to water (ASPRS Class 9) using TerraScan macro functionality. A buffer of 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 2-foot. NV5 Geospatial's proprietary software was used to write appropriate horizontal and vertical projection information as well as applicable header values into the file during product generation. Each DEM is reviewed in Global Mapper to check for any surface anomalies and to ensure a seamless dataset. NV5 Geospatial ensures there are no void or no-data values (-999999) in each derived DEM. This is achieved by using propriety software checking all cell values that fall within the project boundary. NV5 Geospatial uses a proprietary tool called FOCUS on Delivery to check all formatting requirements of the DEMs against what is required before final delivery.

3.7. Swath Separation Raster Processing

Swath Separation Images are rasters that represent the interswath alignment between flight lines and provide a qualitative evaluation of the positional quality of the point cloud. NV5 Geospatial proprietary software generated 2-foot raster images in GeoTIFF format using last returns, excluding points flagged with the withheld bit, and using a point-in-cell algorithm. Images are generated with a 75% intensity opacity and (4) absolute 8-cm intervals, see below for interval coloring. Intensity images are linearly scaled to a value range specific to the project area to standardize the images and reduce differences between individual tiles. Appropriate horizontal projection information as well as applicable header values are written to the file during product generation. NV5 Geospatial uses a proprietary tool called FOCUS on Delivery to check all formatting requirements of the images against what is required before final delivery.





3.8. Maximum Surface Height Raster Processing

Maximum Surface Height rasters (topographic) represent a lidar-derived product illustrating natural and built-up features. NV5 Geospatial's proprietary software was used to take all first-return classified lidar points, excluding those flagged with a withheld bit, 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 was generated for each tile with a pixel size of 2-foot. NV5 Geospatial's proprietary software was used to write appropriate horizontal and vertical projection information as well as applicable header values into the file during product generation. Each maximum surface height raster is reviewed in Global Mapper to check for any anomalies and to ensure a seamless dataset. NV5 Geospatial ensures there are no void or no-data values (-999999) in each derived raster. 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.



WI_Statewide_2021_B21 Crawford Work Unit 300037 Tile Layout

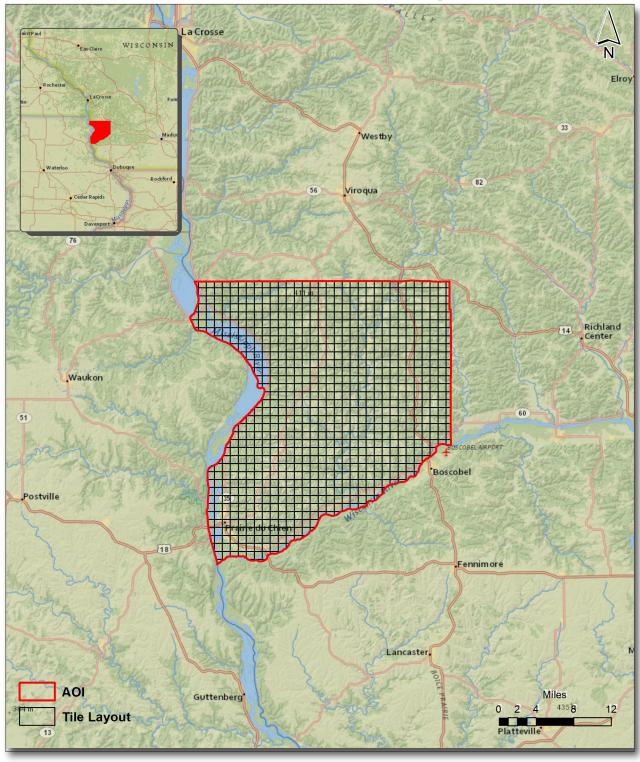


Figure 4. Lidar Tile Layout



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.



WI_Statewide_2021_B21 Crawford Work Unit 300037 Lidar Coverage

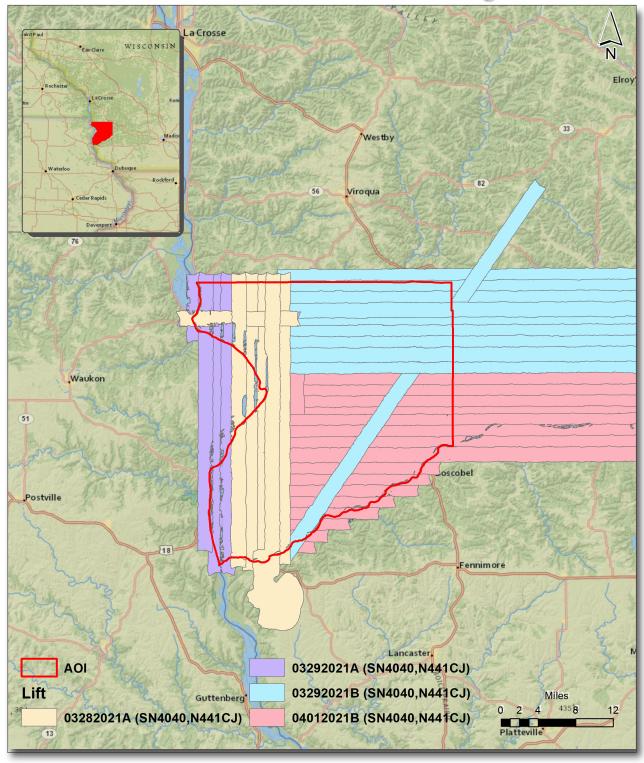


Figure 5. Lidar Coverage



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 7,545 feet, an IMU error of 0.002 decimal degrees, and a GNSS positional error of 0.015 meters (0.049 ft), this project was compiled to meet 0.25 (0.82 ft) meter horizontal accuracy at the 95% confidence level. A summary is shown below.

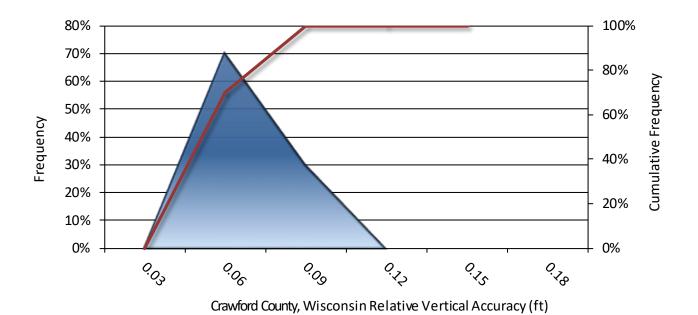
Horizontal Accuracy								
DMCE	0.47 ft							
RMSE _r	0.14 m							
ACC	0.82 ft							
ACC _r	0.25 m							



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 Statewide_2021_B21 project was 0.050 feet (0.015 meters). A summary is shown below.

Relative Vertical Accuracy									
Sample	117 flight line surfaces								
Average	0.050 ft								
Average	0.015 m								
Median	0.046 ft								
Median	0.014 m								
DNACE	0.052 ft								
RMSE	0.016 m								
Standard Deviation (1g)	0.012 ft								
Standard Deviation (1σ)	0.003 m								
1.057	0.023 ft								
1.96σ	0.007 m								



Total Compared Points (n = 10,446,343,727)



Project Report Appendices

The following section contains the appendices as listed in the WI_Statewide_2021_B21 Lidar Project Report.



Appendix A

Flight Logs

Project:	W):	I 3	DE	P					ist@quantumspatiaLc		emt File:	2021	12 200	EM HAHA	0 R 03	7076
Aircraft:	N44	IIC.T	Begin Hob	bbs: 66°	135 E	nd Hobbs:	669	977	Total: 7	7 Pilot	T Riv	Systala in	Co-Pilot:	2N 70 70_1	Tech: Iv	erson
Project: WI 3DEP Proj#: 37876 Flight Mgmt File: 2021032 Aircraft: N441CJ Begin Hobbs: 6693 5 End Hobbs: 6697.2 Total: 3, 7 Pilot: J. Billington Co-l Dep Apt: M5N Dep Time (Lcl): 757-(Z): 1257 Arr Apt: SBM Arr Time (Local): 1137-(Z): 16											11.27	Tot Tir	ne Aloft:	7 '41)		
Sta 1: Sta 2: Flyovers: Y / N If Y, times: Sta 1) Sta 2																
GPS Unit:	Y /	Sta	1: F	TP	S	ta 2:				Y / N		-		•		
3d Temp	beg:	•	End:	*c	OAT be		C E	nd:			Marchael Control			Sta2)	Beg	Storage
	Туре	12 15607	Serial # L	fn4N	Alt AGL	A	t	iiu.	°C Altin	Max		end:		270m	Beg GB End	Name/#
Lidar		8.52		10 10	MpiA Y		MSL ulses		Ht	Gdspd	130kts	Spacing PPSM			GB	
Line #						/ IN In	Air		Pulse 500) 15	100%	rray	2		Tot GB	
Line #	Hdg		End (UTC):	Gd Spd	PDOP/# Sats	GPS Altitude	Crab	Turb (0, -, +)			FLIGHT LINE I	NOTES – visil	oility, clouds, sm	oke, partial, etc.		
124	To F	1245	1010	171	da lu	M			staticf	7	5	urns	/	Cameral	Door	498V
81		133157 134154		171	198/14	2480			XF							J
80	N	135504		183	93/14											
79	5	140659		194	.88/15											
78	N	142256		170	.85/7		-			-	-					
87	E	143853		180	.82/17		-									
88	W	144940		172	.85/18		-						×		_	
89	E	150027		173	.88/18											
90	W	151118		177	,85/17											
91	E	152155		177	99/14		157		crab 15	+ 10	the ri	ant				
92	W	153300		149	1.14/15					, ,-	1110	9111				
93	E	154409		177	,92/16								y			
XF	N	155454		178	,94/17	2540			XF-1	Vorth						
123	W	160356		175	.89/17	2536			XF				-			
														1.		
				270.2	-											

buckup - Ptero_party

deliverable = SKT

Riegh 236-D

Q	A	irborne	LIDAR	R Data					:: Quantum	Spatial, Inc	C	D	ate: 3/	29	/2021
Project:	(1).	I 3	DE	P	/ email: rog dai				ist@quantumspatiaLcom)	ight Mamt File:	2421		ft: A B C D E		
Aircraft:	N44	ICT	Begin Hob	bs: 44°	77 5 E	nd Hobb	. 110	770	2 Total: 3, 7	Dilat: T D	1021	0529_	2N 7070_F		
Dep Apt	m	-1/ 1	Dep Time	(Lell: 7)	57.7.	257	- 00	17.2	Total: 3, T	Tient U. Di	LLINGION	1/27		Tech: Ve	son
CORS:	Dep Apt: M 5 N Dep Time (Lcl.): 757 (Z): 1257 Arr Apt: SBM Arr Time (Local): 1137 (Z): 1637 Tot Time Aloft: 3 340 CORS: Y / Q Sta 1: Sta 2: Flyovers: Y / N If Y times: Sta 1) Sta 2														
GPS Unit	Sta 1: Flyovers: Y / N If Y, times: Sta 1) Sta 2)														
Gd Town hor Scale State															
ou rem	15-4			°c	OAT be		°C E	nd:	°c Altimete	4	end:		270m	B eg GB	Storage Name/#
LIDAR	Fov	1 15601	Scan	1040	AGL	•	AMSL		Avg Terr Ht	Mex Gdspd 130k	Avg Pt Spacing			End GB	
	<u> </u>	8.52	Freq		MpiA Y		Pulses In Air		Rate 500	Power 100%	PPSM	2		Tot GB	
Line #	Hdg	Start (UTC):		Gd Spd	PDOP/# Sats	GPS Altitud	de Crab	Turb (0, -, +)	٠,	FLIGHT LIF	NE NOTES – vis	ibility, clouds, sm	oke, partial, etc.		
104		1245				M			staticA				Camerat	DARY. / +	Ga7./
124		133157		171	98/14	0			XF				001111100	0010	900
81		134154		183	.93/14	2475									
80	N	135504		194	.88/15	2475									
79	5	140659		168	.83/17	2479									
78	N	142256		170	.8517	2474									
87	E	143853		180	.82/17	2540									
88	W	144940		172	.85/18	2540						`			
89	E	150027		173	.88/18										
90	W	151118		177	,85/17	2535									
91	E	152155		177	99/14		15式		crab 15+	to the v	right				
92	W	153300		149	1.14/15	2543				1 1110 1	Jin				
93	E	154409			,92/16	2553	5					ÿ.			
XF	N	155454		178	94/17	2540			XF-Non	rth					
123	W	160356		175	.89/17	2536			XF			-			
						, , ,									

Total Proj Lines: Lines Flown:

Backup = Ptero_party

online Time: 2.7 Mob Time: de Liverable = 5 Kt

Lines Remain:

RiegL= 236-D

Notes:

Q	A	irborn	e LiDAI	R Data						uantur _{Imspatial.com}		tial, Inc			Date: 3/		/2021 Pg_2012.
Project:	111	r 3	DEP	1 2	Citial tog a				76		Flight M	gmt File: 2	10210	329_	5N4040-	B_R	037876
	VV	YICJ		bbs: 66°	77.7 E	nd Hobb	s: 67	00.	& Total:	7.	6 Pilot	TRIL	Enoto	Co-Pilot:	•	Tech:	Iverson
			Dep Time						Apt: MS					1: 2242		me Alof	3:38
CORS:		Sta	4			Sta 2:				yovers: Y	/ N	If Y, times	: Sta 1)		Sta2)		
		X	1	PP		Sta 2:				yovers: Y		if Y, times	-		Sta2)	,	
GPS Unit				•			*c E		*c		er begin:	87	end:			Beg GB	Storage Name/#
Gd Tem		•,		*c	OAT b		Alt	nd:	AvgT			180 645			SBM	End	
LIDAR	1-0:00	L 1560 i	e	4040	AGL		AMSL Pulses		Ht					-	230 m	Tot	
	FOV	58,52	Freq		MpiA `	4 / KI	în Air		Pulse Rate	500	7000	100%		2		GB	
Line #	Hdg	Start (UTC):	End (UTC):	Gd Spd	PDOP/# Sats	GPS Altitue	de Crab	Turb (0, -, +)				FLIGHT LINE N	NOTES – vis	sibility, clouds, sr	noke, partial, etc.	0.	_ /
		1855	2251						Stat	ic B		stu	rn5	V		fig	8 V
125	5	194543		181	98/16	2495	<i>,</i>		XF							V	
94	E	200922		179	.97/16	2507	_				£'			(2)		1	
95	W	202456		176	.9/17	2518											
96	E	204013		184	91/17	2509	7					lu .					
97	W	205609		181	.87/16	2519											
98	E	211151		175	.88/16		-										
99	W	212654		172	.95/15												
100	£	244206		177	.87/17												
101	W	215714			,98/16												
102	E	221230	2227	182	95/18	2510	_										
							-										
														•,		7	
																31	
															1		
						7.1							,		14,		
							_	= = = = = = = = = = = = = = = = = = = =				S. W. Stade Sta		1			
Total Proj	Lines:		Lines Flow	n: 0	Lines R	Remain:		0	nline Time	2.7	Mob	Time:	, 9	Notes:			

Backup = Ptero-Party

deliverable = 5kt

Ripgl = 508-D

roject:	V	IL	3 DE	P		Proj #:3	787	76	Flight	Mgmt File:	202103	28-5	N 4040.	-A-R03787
Aircraft:	N4	4155	Begin Ho	bbs:669	10,9 E	nd Hobbs:	693,	3 Total:	2,4 Pile	ot: J. Bil	Lingtor Co-Pilo	t:		Iverson
Dep Apt:	M:	SN	Dep Time	(Lcl): 7	46 (Z):	1246	Arr A	pt: UN	V Arr Tim	e (Local): (D	2 (Z): 15)	2 T	ot Time Aloi	ft: 2:26
CORS:	Y /	N Sta	1: 7	PPP	S	ta 2:		Flyo	vers: Y / N	If Y, times:	Sta1)	Sta2)		
GPS Unit:	Y /	N Sta	1:	TT	S	ta 2:		Flyo	vers: Y / N	If Y, times:	Sta1)	Sta2)		
Gd Temp	beg:	°c	End:	°c	OAT be	eg: °c	End:	°c /	Altimeter begi		end:	270		Storage Name/#
	Type	9L 1560	Serial #	4040	Alt 23	Oom Alt AMSL		Avg Terr Ht	Max Gdsp	a 180 kts	Avg Pt Spacing		End GB	
Lidar	FOV		Scan		MpiA Y	/ N Pulses		Pulse Rate	Powe	er 100%	PPSM 2		Tot GB	
Line #	Hdg	Start (UTC):		Gd Spd	PDOP/# Sats	GPS Altitude Cr	Turb (0, -, +)				OTES – visibility, clouds	, smoke, partial, e	etc.	
		1237	1524				10,7,7	Statio	CAV	5	turns v	Came	radoorv	Figure8/
86	N	131349	M	171	1.06/85	81734								
85	5	132528		180	1.14/15	2992m		Laser	Kep+ f	Firing 7	Lillnext 1	Line 84	stoped	Laser ->
84	N	134349		174	92/16	2490m		→ a	nd rest	tarted	on Line	84		
83	5	135604		174	.9//6	2492			cLouds	formin	g in a	rea		` . II
82	N	140840		173	.83/17	2489			clouds,	nearby	& torm	ing in	areat	-in Swath
124	E	142345		165	,79/18	2504		crossi	ine - C.	Louds 1	in AOI			
								111111	1	93,3	1025/	1525		
								MNU		13.5	1025/ 1038/ 1	538	M	1:13
								MSN		7	1030/	,338	900	,,,,
								Hobb	5 -	, 4				
								TXL	il Hobbs	- 7 6	<u>, </u>			
								10/0	u 110003	2.0	•			
	lane .													
								· ·						

Airborne LiDAR Data Collection Log Sheet :: Quantum Spatial, Inc (email log daily to flight_log_distribution_list@quantumspatial.com)

Date:

Lift: A 18,40 Co-Pilot: 20210401 1:40 (4) If Y, times: Sta1) If Y, times: Sta1) Flight Mgmt File: Arr Time (Local): Pilot: 0M N/x Z/x Flyovers: Flyovers: KMS Total: 0 Arr Apt: End Hobbs: 6705, 7.14:09 Proj #: Sta 2: Sta 2: 9:09 Begin Hobbs: 6700, Dep Time (Lct): Sta 1: K M S Chit

T				
	Storage Name/#			
	Beg GB	End GB	10 8	
And the second second second second				
Charles of the latest owner, the country owner,				
- Commission of the last of th	end:	1 to 00	7	
-	9	Avg Pt Spacing	7 PPSM	
		80	20%	
	gin:	9	Power	
	ter be	Max Gdspd	Po	
	Altimeter begin:			
	, 0.	Avg Terr Ht	Pulse	
		ま		
	End:	2200		
	٥.	Alt AMSL	Pulses In Air	
	.:0	C	Z	
	OAT beg:	2300	MpiA Y	
-	0 00	Alt	XHr.	
-		4040	SOOK	
-	End:	Serial # 4	an ce	
-	00	Se	32 Scan	
-		560	38.	
-	beg:	Type (C	Fo CA	
THE RESIDENCE AND PARTY OF THE PERSON NAMED IN COLUMN TWO IS NOT THE P	Temp beg	- OV	,	
	PD	=		-

FLIGHT LINE NOTES – visibility, clouds, smoke, partial, etc.	First line after system restart due to Channel 2 issue. All lines flowin						manual cross line a lory 19 to set up for line 82											
Turb	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0
Gd Spd PDOP/# Sats GPS Altitude Crab	132/260 081	178/11	18/1/28	179 0,88/128	182/88/00 291	184 0,89/28	179 125		183 1,04/27	7	2	3		174/121		182, 189, 128	176094/1261	180 081/28
End (UTC):																		
Start (UTC):	15881 822		3 1	92/162440			273 160MIG			272 64833		272 169805	7	12	17	121	921178	
Line #	103	401	105	100										113			0	53

	Notes:		
	-		The state of the s
	8		The state of the s
	0		MANAGEMENT
	Time:		
	Mob		and a second
			-
	37		-
	Je:		
	ne Time:		-
1	Ontir	0	1
1			-
-	79		-
	main:		
9.7	Lines Remain:	29	1
7110	5	0.87/2	-
7	0	0	Street Square or other
0	- ::	181	Contractor Contractor
	Flowr		-
	Lines Flowr		Coldinate Constitution
7617	25	723	CATALOGUE
	17	- 188 -	The second second
2	Lines:	185	STATE SELECTION
7	L Proj	7	And in case of
_1			

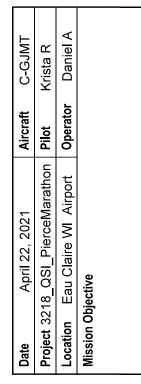
Date SN 4 mate S FLIGHT LINE NOTES - visibility, clouds, smoke, | CIR. Co-Pilot: Notes: 70h01202 6,0 (4) end: Spacing Avg Pt If Y, times: Sta1) If Y, times: Sta1) Spatial, Inc Light Mgmt File: rr Time (Local): Mob Time: lannec Pilot: begin: Max Gdspd Power ntumspatial.com る Sta Airborn 20355

drewith (AIrborn	e LiDAR Data			::: Quantum list@quantumspatial.co	m Spatial, Ind	C	Date: 4/2	2/2021
	WIBDE	P		1#: 379		Flight Mgmt File:	202107407	Lift: (A) B C D	E Pg of] D A DA 27071
		Begin Hobbs: 6	108, End Ho	bbs: 67	Total: 4	Pilot: DA			
Dep Apt	1 /	Dep Time (Lcl): 8				Arr Time (Local):			Time Alecte 11/27
CORS:	Y/N Sta) Sta 2:		Flyovers:		nes: Sta 1)		Time Aloft: 4:37
GPS Unit	t: Y/N Sta	YYY	Sta 2:		Flyovers:			Sta2)	
Gd Tem	p beg: °c	c End: °c	OAT beg:	°c End:		eter begin:		Sta2)	Beg Storage
	Type 1560:		Ale			May	end: Avg Pt		GB Name/#
	The second secon	Scan Coo I/II	The state of the s		Pulse	Gdspd 180 Power,	Spacing		GB Tot
	フ6.76	Freq 500 KML	TIPIA I / IV		Rate		0		GB
Line #	Hdg Start (UTC):		PDOP/#Sats GPS Alti	tude Crab Turb (0, -, +)			NE NOTES – visibility, cloud	s, smoke, partial, etc	
68	3 140850	180	0.82/28	0	Test tile	at 140209 t	to contirm o	channel	2 function
01	185 142552	119	0.88/27	0					
66	5 143814	186	0.70/28	0					
7 4	702145249	176	0.95/17	0					
12	103 1501116	186	119/27	0					
67	2 1521	100	20/20	0					
61	193155077	100	Nag/20	0					
60	3 160500	190	0,92/28	0					
59	183161916	102	0.96/27	0	AND MARKET				
122	93164334		0.84/31	0	Planned		line the	n mob.	to Kewaune ~ 15 min
36	5 171241		0,89/30	0	- 1	ine of		AOI	Kewarnee
	185172203		0.91/30	0					
38	5 173144	179	0.88/30	0					
39	185 174132	186	0.89/31	0					
40	5 175110	182	0.87/31	0					
41	185 180052	184	0.90/31						
42	5 181022	178	0,92/30						
Total Proj Li	ines: 125 L	ines Flown: 18	Lines Remain:	26 On	line Time: 3.9	Mob Time:	0, Note	6 :	

*

⋖	
Flight	
112	
ulian Day	





System Riegl Q1560 Unit 64 IMU Applanix AP60 GPS Rx Trimble GNSS17 Scanner 1 Drive Scanner 2 Drive		
RX Inner 1 [System	Riegl Q1560
RX Iner 1 [Unit	64
GPS Rx Trimble GNSS17 Scanner 1 Drive Scanner 2 Drive	IMU	Applanix AP60
Scanner 1 Drive Scanner 2 Drive	GPS Rx	Trimble GNSS17
Scanner 2 Drive	Scanner	1 Drive
	Scanner	2 Drive

System	Riegl Q1560	
Unit	64	
IMU	Applanix AP60	
GPS Rx	Trimble GNSS17	
Scanner 1 Drive	1 Drive	
Scanner 2 Drive	2 Drive	

Additional Notes		A	AIRBORNE
			I M A G I N G
T3C		A Cle	A Clean Harbors Company
%98 - H			
AMLS-278m			
Hpa-1016			
Time to next maintenance:		O 50 hr O 100 hr	
	Static	19	GPS Time
800Khz	Alignment	Start	End
178	Pre Mission	1317	1322
e0 degs	Post Mission	1851	1856

	Aircraft Block Time		Mis	Mission Plan	ur		Ş
Engine On 13:10 Tal	Takeoff 13:30	AGL Height	2300	m Puls	AGL Height 2300 m Pulse Rate 800Khz		Align
Engine Off 18:59 Lai	Landing 18:49	Target Speed 160 kts Scan Rate	160 k t	Scar	Rate 178		Pre Miss
Total 5.8 hrs To	Total 5.3 hrs	Laser Current 100 % FOV	100	% FOV	09	degs	Post Mis
						1	

	Comments															
Mission ID	Time Stamp	-	140330	142544	143928	150504	152737	154958	161217	163415	165537	=	-	180020	180845	-
Line Aborted	nmi to End															
Line	Time															
Time	End	1350	1422	1427	1458	1521	1545	1606	1629	1651	1658	1703	1757	1801	1823	1828
GPS Tim	Start	1345	1403	1425	1439	1505	1527	1549	1612	1634	1655	1658	1752	1800	1808	1823
Flight	Direction	1	092	ı	274	092	274	092	274	092	-	-	-	-	181	-
LiDAR	File Name															
	Flight Line	F8	1028	X-Tie	1006	1005	1004	1003	1002	1001	X-Tie	F8	F8	X-Tie	1062	F8

⋖
Flight
112
Julian Day



A Clean Harbors Company

Date	April 22, 2021	Aircraft	C-GJMT	S
Project 32	Project 3218_QSI_PierceMarathon Pilot	Pilot	Krista R	'n
Location	Location Eau Claire WI Airport	Operator	Daniel A	\blacksquare
Mission Objective	jective			5
				Sc
				Sc

System Riegl Q1560 Unit 64 IMU Applanix AP60 GPS Rx Trimble GNSS17 Scanner 1 Drive Scanner 2 Drive		
Rx Iner 1 [System	Riegl Q1560
Rx nner 1 [Unit	64
GPS Rx Trimble GNSS17 Scanner 1 Drive Scanner 2 Drive	IMU	Applanix AP60
Scanner 1 Drive Scanner 2 Drive	GPS Rx	Trimble GNSS17
Scanner 2 Drive	Scanner	1 Drive
	Scanner	2 Drive

System	Riegl Q1560		Ad
Unit	64		Ļ
NM IMU	Applanix AP60		±
GPS Rx	Trimble GNSS17		₹
Scanner 1 Drive	1 Drive		포
Scanner 2 Drive	2 Drive		F
		_	I

Additional Notes	T3C	%98 -H	AMLS-278m	Hpa-1016	Time to next maintenance:
Riegl Q1560	64	olanix AP60	imble GNSS17	Ve	ve

GPS Time	Start End	1317 1322	1851 1856	
Static	Alignment	Pre Mission	Post Mission	
	ZĮ		degs	

800Khz 178

m Pulse Rate kts | Scan Rate

2300

Mission Plan

Aircraft Block Time

Takeoff 13:30 Landing 18:49 Total 5.3 hrs

Engine Off 18:59 Engine On 13:10

5.8 hrs

Total

9

% FOV

100 160

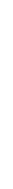
Laser Current Target Speed AGL Height

⊙ 50 hr O 100 hr

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

Page 2 of 5

\triangleleft	
Flight	
112	
Julian Day ´	



System	Riegl Q1560
Unit	64
IMO	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	1 Drive
Scanner 2 Drive	2 Drive

Daniel A

Operator

C-GJMT Krista R

Aircraft Pilot

Project 3218_QSI_PierceMarathon

April 22, 2021

Date

Location Eau Claire WI Airport

Mission Objective

Svetom	Digal O1560	۷
ystelli	INEGI GIOO	ζ
Jnit	64	—
MU	Applanix AP60	
3PS Rx	Trimble GNSS17	∢
Scanner 1 Drive	Drive	I
Scanner 2 Drive	Drive	•

Additional Notes	T3C	%98 -H	AMLS-278m	Hpa-1016	Time to next maint
Riegl Q1560	64	Applanix AP60	Trimble GNSS17	· 1 Drive	· 2 Drive

78m
© 50 hr O 100 h Start 1317

800Khz 178

m Pulse Rate kts | Scan Rate

2300

Mission Plan

Aircraft Block Time

Engine On 13:10 | Takeoff 13:30

Landing 18:49 Total 5.3 hrs

Engine Off 18:59

hrs

2.8

Total

9

% F0V

100 160

Laser Current **Target Speed** AGL Height

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

⋖
Flight
112
Julian Day



A Clean Harbors Company

Date April 22, 2021	121	Aircraft	C-GJMT
Project 3218_QSI_PierceMarathon Pilot	eMarathon	Pilot	Krista R
Location Eau Claire WI Airport	l Airport	Operator	Daniel A
Mission Objective			

System	Riegl Q1560
Unit	64
NM	Applanix AP60
GPS Rx	Trimble GNSS17
Scanner 1 Drive	1 Drive
Scanner 2 Drive	2 Drive

ystem	Riegl Q1560		Adc
nit	64		<u> </u>
Q Q	Applanix AP60		士
PS Rx	Trimble GNSS17		₹
canner 1 Drive	1 Drive		유
canner 2 Drive	2 Drive		įΞ
		•	l

Additional Notes	T3C	%98 - H	AMLS-278m	Hpa-1016	Time to next maintenance:
Riegl Q1560	64	Applanix AP60	Trimble GNSS17	I Drive	2 Drive

Static GP	Alignment Start	Pre Mission 1317	Post Mission 1851
GPS Time	End	1322	1856

800Khz 178

m Pulse Rate kts | Scan Rate

2300

Mission Plan

Aircraft Block Time

Takeoff 13:30 Landing 18:49 Total 5.3 hrs

Engine Off 18:59 Engine On 13:10

5.8 hrs

Total

9

% FOV

100 160

Laser Current Target Speed AGL Height

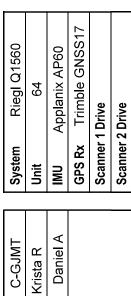
⊙ 50 hr **O** 100 hr

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

Page 4 of 5

\triangleleft	
Flight	
112	
Julian Day	

Ø
Õ
~
_
=
¥
<u>.</u> ත
=
ш
$\mathbf{\alpha}$
7
4
_
_



Operator

Aircraft Pilot

Project 3218_QSI_PierceMarathon

April 22, 2021

Date

Location Eau Claire WI Airport

Mission Objective

em	Riegl Q1560		Addit
	64		<u> </u>
	Applanix AP60		Η̈́
Æ	Trimble GNSS17		AML
nner 1	nner 1 Drive		Нра
nner 2	nner 2 Drive		Time
		_	

Additional Notes	T3C	%98 -H	AMLS-278m
)	S17

Additional Notes		4	AIRBORNE
T3C		A Clea	A Clean Harbors Company
%98 -H			
AMLS-278m			
Hpa-1016			
Time to next maintenance:		⊙ 50 hr O 100 hr	
	Static	49	GPS Time
800Khz	Alignment	Start	End
178	Pre Mission	1317	1322
e0 degs	Post Mission	1851	1856

m Pulse Rate kts Scan Rate

2300

AGL Height

₽ 2

%

100 160

Target Speed Laser Current

Mission Plan

Aircraft Block Time

Takeoff 13:30 Landing 18:49 **Total** 5.3 hrs

Engine On 13:10 Engine Off 18:59

hrs

5.8

Total

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

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

Date: 4/1/2021

CORS: Gd Temp beg: GPS Unit: Y / N Dep Apr: LLSE Aircraft: 4737W Begin Hobbs: 5794,0 End Hobbs: 5800,3 Total: 6.3 Project: UL LiDAR FOV 58,52 Scan 500 K HZ ₹ Z Sta 1: Sta 1: റ Dep Time (Lcl): 10:06 (Z): 15:06 Serial # 4045 റ് (email log daily to flight_log_distribution_list@quantumspatial.com) AGL 236 MpiA Y / Z OAT beg: Sta 2: Sta 2: Proj #: 37876 Pulses in Air റ് End Arr Apt: ICTMT Arr Time (Local): 4729 (Z): 2 120 Avg Terr Pulse Rate °c Altimeter begin: Flyovers: Y / N Flyovers: Y / N Flight Mgmt File: 20210401_504045 Gdspd / 30 + Luy 140 Spacing Pilot: Ban Lydet / Co-Pilot: If Y, times: Sta1) If Y, times: Sta1) end: Sta2) 5ta2) Tot Time Aloft: 6:23 Tech: 1/cal Tollow 00 Tot 28 28 Storage Name/*

						2.1716	K-112 JW 211519 21716	3	Kin
- Lew Sought trop laterals	{		15/222495 5	AS/2	961	211132	9 E1 751112 022502 N	5	J
-analyticad on light two list half line	AVA		.87/ 2500 -5	.87/	142	20923	241 62802 521602	S	5
	0	7	87/21 2445	1113	20130	wish	N 200907 TURBO 30	7	S
-w this starting mid line you by end	3	7	87723 2510	2/18	2218	2008	2 41 83870222HBB1	\sim	1
touched on 200 ft low by a second mid line	0	0 4	14721 2525	1447	140	19485	17: 558 This KIZEW N	2	w
	0	4	24/22 2540	2/4/2	i43	19 18 11	(h) 11 Khi 251h1	5	2
	0	~J'	461222545	A612	しいよ	141411	HSI 01711 122581	7	
	J,	6	189/21 2555	189/2	0716	18574	Ori Gressi BARK!	5	0
	Q	w	11/23 2560	31/23		1835	561 (SKB! BIRR 1	7	2
	0	-7	136/12 2570	21/981		18256	18432 186218 145	S	00
Su Cac	0	n	25.52 12/18.	3/18.		Bush	(51 EDRORI 217561 1)	?	7
Some lakes the have ice inour looks supplied	O	0	,94/10 2580	,04/20	SA1 (17531	SAI (1554! 821/21)	5	
	0	N	A421 2610	AVI	N 172845 17 203517 2	1746	SH1221		5
O lessty 75ts howing possibline	0	i'	2635	al 186.	17146 17278133 .98/19 2635	1727	UNICI	S	Ç.
	6	V	2165	12/3hi	17646 171648 176 18/21 3465	17114	176646	3	\sigma_2
6 tallwind States the -160 successible is in	0	2	m 392 12/9h	2/3h.	152	170518	165602 170518 152	S	Li
4517 870042 0 Full sun, (a) mar	0	5	42018	L1/5 hs	184431 184491 184491	1447)	164431	1	_
FLIGHT UNE NOTES – visibility, clouds, smoke, partial, etc.	O +		PDOP/# Sats GPS Altitude Crab	PDOP/# Sat): Gd Spd	End (UTC)	Hdg Start (UTC): End (UTC): Gd Spd	Hdg	Line #

Total Proj Lines: 125

Lines Flown: 17

Lines Remain: 62

Online Time: 45

Mob Time:

-∞

Eure Personstes as A		No.				
Stary: 316 Start: 263 End 263		mobe total	time time		1 Semis	Hony ton 28
<760) sats wandy from 4-8miles	2	37/21 2490	632 148	11925 2	5	0
word (7 6%) Sats waring midline	+	85/23 2495	811 138	23638) 234812	7	101
0	w	148/22 2500	142	230212 272254 142	<u>\</u>	$\frac{8}{2}$
C Latt 2.56		2530	141 988	96852V 809622	77	120
1 lug b Note		1	-	Stut Stap	HBG-	CIME A HAG
Annival KLSTE 8:15 1641, 115 & Hotel eloft: 2:48	313	Junival KL		1/1/21 B WI SPEP 37876 1/1/21 B WI SPEP 37876	111/25 g	4/1/21

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

Date: 4/2/202

Project: WI 3DEP Dep Apt: C CWA Dep Time (Lct) 2.58 GPS Unit: Y / N Aircraft: 4777 Begin Hobbs: 5204.1 Gd Temp beg: FOV 58,52 Scan SOO KITZ MPIAY IN In Air Type 156077 1 N Sta 1: P/ Sta 1: റ് Serial # YOUS AGE 2300 Mg End: ດໍ (email log daily to flight_log_distribution_listr@quantumspatial.com)

Proj #: 37876 OAT beg: (Z): 19 S8 End Hobbs: Sta 2: Sta 2: റ് Arr Apt: KSDM Total: Pulse Rate Avg Terr Flyovers: Y / N Flyovers: Y / N Altimeter begin: Arr Time (Local): 8, 2 ((z): $\sqrt{2}$ (Flight Migmt File: 202/0402 - SN4045 - C - 37876 Gdspd 180, Set + \$ Power Wodo Pilot: Dan Lulkett Co-Pilot: If Y, times: Sta1) If Y, times: Sta1) PPSM ~ end: Sta2) Sta2) Tot Time Aloft: 5:23 Tech. Noah Edelson GP End S & GB Tot Pg L of 1 Storage Name/s

CORS:

LiDAR

Online Time: 48 Notes:) On	nain:	Lines Remain:	16,1	Lines Flown:		Lines:	Total Proj Lines:
reflect first 13 support to for the 1st start						4512 V	2	2
brock light two same spotas last line 5 anxt aborted line	1 %		106/22 2500	1251		17be 9531	ч	~
- spared with the neutler 1/3 line	8	t45	24125 2445	153	1281 12 18C2	12 3562.	7	22
O <7 bos sab having 23.5 will the chart longle into the	0 -		148 m \$5/24 2440	148m		5362 10 KG	V	23
10 0 the dither troppe extensions, Stated logging - 3 Seconds the 1. H	0		84 45 2490		231456 233753 151	271856	4	24
-7 () live dight spireced gather line	70		191/23 2480		22592523/124 150	21.5925	5	25
	7 0	180	.95/23 2480	hhi	22800 14 M	224006	7	26
	0 8		B4/25 2480	725	127117 25961	727117	S	27
	0		36/26 2470	148	52012 5518/1018	12013	>	28
27 GMS Sch jacusq , 6 Seconds fely asses in	0 2		0872 9218R		213017 22026 155	215017	5	24
	0	22.8	37/25 2475	151	151 CONNIZ LIBEIZ	118812	1	2
	-9 C		85/24 2475		213712 (\$12637 155	213775	2	\ \ '
L7 BAPI SETSLEWAY wide the 1844 OF ADI	7 0		2175 2475		N 211456 212547 144	384112	>	32
	9 6	470	8-1012 22/14	151	151 255112 625012	2(0727	S	2
	7 0	593	2465		Ehi hesson 121502	821502	5	かん
	0 6		9123 ra78		571 KLAM 29143	204762	V	28
hazen skies, high broken overlast, C7 Sats GNS leming, heall by s behavefler	-2 b	470	87/23 2270		20250 walle 153	20250	17	11 4
FLIGHT LINE NOTES – visibility, clouds smoke, partial, etc.	Turb (0, -, +)	Altitude	PDOP/#Sats GPS Altitude Crab	Gd Spd	Start (UTC): End (UTC):		뮲	Line #

duy total: 4,3

Mob Time: 48 こ、つ

Flig
091
Day
ulian

ght A

LIDAR Flight Log

Applanix AP Trimble GN Riegl VQ-1 64 Scanner 1 Drive Scanner 2 Drive **GPS Rx** System Unit ₽

Pilot Andy. S-Krista R

Project 3218_QSI_PierceMarathon

April 01, 2021

Date

Location Eau Claire WI Airport

Mission Objective

C-GJMT

Aircraft

D.Arteaga

Operator

Additional Note	T2C	H-37%	AMLS-278m	Hpa-1035	
1560		09	VSS17		

A Clean Harbors Company AIRBORN

Time to next maintenance:

Aircraft Block Time	Takeoff 15:54	Landing 22:08	Total 6.2 hrs
1	Engine On 15:26	Engine Off 22:18	Total 6.9 hrs

	2	issio	Mission Plan	
AGL Height	2300	ш	m Pulse Rate	800Khz
Target Speed	160	kts	kts Scan Rate	89
Laser Current	100 % FOV	%	FOV	eo degs

Static	Alignment	Pre Mission	Post Mission
9	Start	1537	2211
GPS Time	End	1542	2216

	Comments															
Mission ID	Time Stamp	160220	160625	1	163858	165430	174722	173003	174722	180617	182444	184405	190224	192239	194227	200230
Line Aborted	nmi to End															
Line	Time															
Time	End	1603	1618	1629	1647	1706	1724	1742	1800	1819	1838	1857	1917	1937	1957	2018
GPS Tim	Start	1602	1606	1624	1638	1654	1712	1730	1747	1806	1824	1844	1902	1922	1942	2002
Flight	Direction	-	ı	ı	180	000	180	000	180	000	180	000	180	000	180	000
Lidar	File Name															
	Flight Line	Test Strip	X- tie	F8	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041

Flight	
091	
ı Day	
ulian	

⋖

LIDAR Flight Log



Scanner 1 Scanner 2 GPS Rx System IMU Unit

Pilot Andy. S-Krista R

Project 3218_QSI_PierceMarathon

April 01, 2021

Date

Location Eau Claire WI Airport

Mission Objective

C-GJMT

Aircraft

D.Arteaga

Operator

Addition	T2C	H-37%	AMLS-	Hpa-10	Time to	
Riegl VQ-1560	64	Applanix AP60	Trimble GNSS17	1 Drive	2 Drive	

nal Notes	Se		4	AIRBORNE
<i>(</i>)			A Clea	S
,				
-278m	_			
035				
o next maintenance:	aint		© 50 hr O 100 hr	
		Static	49	GPS Time
(hz		Alignment	Start	End
		Pre Mission	1537	1542
degs		Post Mission	2211	2216

	Aircraft Block Time		Missi	Mission Plan	
Engine On 15:26	Engine On 15:26 Takeoff 15:54	AGL Height	2300 m	2300 m Pulse Rate	800k
Engine Off 22:18	Engine Off 22:18 Landing 22:08	Target Speed 160 kts Scan Rate	160 kts	Scan Rate	88
Total 6.9 hrs	Total 6.9 hrs Total 6.2 hrs	Laser Current 100 % FOV	100 %	FOV	09

	Σ	issio	Mission Plan		Static
AGL Height	2300	ш	m Pulse Rate	800Khz	Alignme
Target Speed 160 kts Scan Rate	160	kts	Scan Rate	89	Pre Mission
Laser Current	100 % FOV	%	FOV	e0 degs	Post Missio

	Comments										
Mission ID	Time Stamp	202209	204254	210256	212330	1					-
Line Aborted	nmi to End										
Line	Time										
Time	End	2037	2058	2118	2138	2144					
GPS Time	Start	2022	2042	2102	2123	2139					
Flight	Direction	180	000	180	000	1					ı
LiDAR	File Name										
	Flight Line	1042	1043	1044	1045	F8					

⋖
Flight
091
Day
Julian

LIDAR Flight Log



)	April 01, 2021	Aircraft	Aircraft C-GJMT	
Project 321	Project 3218_QSI_PierceMarathon Pilot Andy. S-Krista R	Pilot A	ndy. S-Krista	я В
Location	Location Eau Claire WI Airport Operator D.Arteaga	Operator	r D.Arteag	a
Mission Objective	ective			

System Riegl Unit 6 IMU Applani	Ried VO-1560
	V & 1000
	64
	Applanix AP60
GPS Rx Trimbl	Trimble GNSS17
Scanner 1 Drive	
Scanner 2 Drive	

ystem	Riegl VQ-1560	Additional Notes
Init	64	T2C
₽ P	Applanix AP60	H-37%
PS Rx	Trimble GNSS17	AMLS-278m
canner	canner 1 Drive	Hpa-1035
canner	canner 2 Drive	Time to next main

A Clean Harbors Cor GPS Time End End

m Pulse Rate kts | Scan Rate

2300

Mission Plan

Aircraft Block Time

Takeoff 15:54 **Landing** 22:08 **Total** 6.2 hrs

Engine Off 22:18 Engine On 15:26

6.9 hrs

Total

9

% F0V

100 160

Laser Current Target Speed AGL Height

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

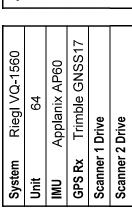
Page 3 of 5

Flight	
091	
ulian Day	

⋖

Project 3218_QSI_PierceMarathon | Pilot Andy. S-Krista R

LIDAR Flight Log



D.Arteaga

Operator

Location Eau Claire WI Airport

Mission Objective

C-GJMT

Aircraft

April 01, 2021

Date

Additional Note	T2C	H-37%
1560		090

es

AMLS- 278m Hpa-1035

A Clean Harbors Company AIRBORN IMAGING O 100 hr

⊙ 50 hr (
xt maintenance:
xt maint
Time to next

Scanner 2		AGL Height	Target Speed	Laser Current
	Aircraft Block Time	Takeoff 15:54	Landing 22:08	Total 6.2 hrs
		Engine On 15:26 Takeoff 15:54	Engine Off 22:18 Landing 22:08	Total 6.9 hrs Total 6.2 hrs

	Σ	issio	Mission Plan	
AGL Height	2300	Ε	m Pulse Rate	800Khz
Target Speed	160	kts (Scan Rate	89
Laser Current	100	%	FOV	60 degs

Static	В	GPS Time
Alignment	Start	pug
Pre Mission	1537	1542
Post Mission	2211	2216

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

Flight
091
Day
Julian

LIDAR Flight Log

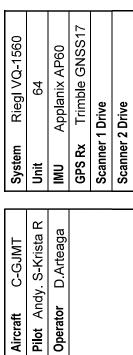
C-GJMT

Aircraft

Project 3218_QSI_PierceMarathon

April 01, 2021

Date



Operator

Eau Claire WI Airport

Location

Mission Objective

Riegl VQ-1560	Additiona
64	T2C
Applanix AP60	H-37%
Trimble GNSS17	AMLS-2
Drive	Hpa-103
Drive	Time to n

al Notes		4	AIRBORNE Imaging
		A Clea	A Clean Harbors Company
278m			
35			
next mai	next maintenance:	© 50 hr O 100 hr	
	Static	в В	GPS Time
ZĮ	Alignment	Start	End
	Pre Mission	1537	1542
degs	Post Mission	2211	2216

800Khz 89

m Pulse Rate kts | Scan Rate

2300

AGL Height

160

Target Speed

Mission Plan

Aircraft Block Time

Takeoff 15:54 **Landing** 22:08

Engine Off 22:18 Engine On 15:26

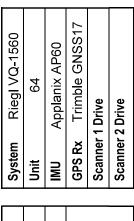
	QI QI	Mission ID	Line Aborted	Line Al	S Time	d5	Flight	LiDAR		
2211 2216	Post Mission	degs	09 \0 0	100 % FOV	Laser Current		hrs	Total 6.2	6.9 hrs	Total

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

Ë
092
Day
ulian

Flight A

LIDAR Flight Log



D.Arteaga

Operator

Project 3218_QSI_PierceMarathon

April 02, 2021

Date

Location Eau Claire WI Airport

Mission Objective

C-GJMT Andy. S

Aircraft Pilot

sete	
al No	
dition	
Ağ	

T--8C H-47% AMI S-278m

A I R B O R N E I M G I M G A Clean Harbors Company

AMLS-278m Hpa-1028

⊙ 50 hr O 100 h	
32hrs	
Time to next maintenance:	

	1	Aircraft Block Time	Bloc	k Time	
Engine On 12:56		Takeoff 13:17	5	1.17	
Engine Off 17:43	43	Landing 17:35	17	:35	
Total 4.8 hrs		Total 4.3 hrs	4.3	hrs	

	Σ	15510	MISSION FIGUR	
AGL Height	2300	Ε	m Pulse Rate	800Khz
Target Speed	160	kts	Scan Rate	178
Laser Current	100	%	% FOV	e0 degs

Static	GP GP	GPS Time
Alignment	Start	End
Pre Mission	1304	1308
Post Mission	-	-

	LiDAR	Flight	GPS Tim	Time	Line	Line Aborted	Mission ID	
Flight Line	File Name	Direction	Start	End	Time	nmi to End	Time Stamp	Comments
X-tie		1	1329	1336			132923	
F8		ı	1344	1349			-	
1046		180	1355	1411			135536	
1047		000	1415	1431			141558	
1048		180	1436	1453			143644	
1049		000	1457	1512			145729	
1050		180	1518	1535			151849	
1051		000	1539	1555			153935	
1052		180	1600	1618			160046	
1053		000	1622	1637			162212	
1054		180						DR Crashed while aproching the line
								Full system restart and troubleshooting
								for 20 minutes- Riacquire crashed

Flight
092
Julian Day

⋖

LIDAR Flight Log



Date A	April 02, 2021	Aircraft	C-GJMT
Project 3218_(Project 3218_QSI_PierceMarathon Pilot	Pilot	Andy. S
Location Eau	Location Eau Claire WI Airport	Operator	Operator D.Arteaga
Mission Objective	Ve		

System Riegl VQ-1560 Unit 64 IMU Applanix AP60 GPS Rx Trimble GNSS17 Scanner 1 Drive Scanner 2 Drive		
Rx Inner 1 [System	RiegI VQ-1560
RX Inner 1 D	Unit	64
GPS Rx Trimble GNSS17 Scanner 1 Drive Scanner 2 Drive	IMU	Applanix AP60
Scanner 1 Drive Scanner 2 Drive	GPS Rx	Trimble GNSS17
Scanner 2 Drive	Scanner	1 Drive
	Scanner	2 Drive

ystem	Riegl VQ-1560	_	Add
nit	64		Ĩ
₽	Applanix AP60		. I
PS Rx	Trimble GNSS17		AM
canner 1 Drive	1 Drive		랖
canner 2 Drive	2 Drive		Ë
		J	

Additional Notes	1-8C	H-47%	AMLS-278m	Hpa-1028	Time to next main
Riegl VQ-1560	64	planix AP60	rimble GNSS17	ive	ive

m Pulse Rate kts | Scan Rate

2300

Mission Plan

Aircraft Block Time

Takeoff 13:17 Landing 17:35 Total 4.3 hrs

Engine Off 17:43 Engine On 12:56

4.8 hrs

Total

9

% F0V

100 160

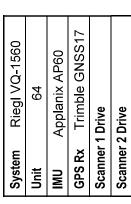
Laser Current Target Speed AGL Height

		_	 			 _	 		
	Comments								
Mission ID	Time Stamp								1
Line Aborted	nmi to End								
Line	Time								
GPS Time	End								
GPS	Start								
Flight	Direction								ı
LiDAR	File Name								
	Flight Line								

Page 2 of 5

Flight
092
ılian Day

LIDAR Flight Log



D.Arteaga

Operator

C-GJMT Andy. S

Aircraft Pilot

Project 3218_QSI_PierceMarathon

April 02, 2021

Date

Location Eau Claire WI Airport

Mission Objective

Additional Notes		
	_	

H-47% T--8C

A Clean Harbors Company AIRBORN

> AMLS-278m Hpa-1028

⊙ 50 hr **O** 100 hr 32hrs Time to next maintenance:

0			
lock Time	13:17	17:35	3 hrs
Aircraft Block Time	Takeoff	Landing 17:35	Total 4.3 hrs
	Engine On 12:56	Engine Off 17:43	hrs
	ou () Off	4.8
	Engine	Engine	Total 4.8 hrs

	Σ	issio	Mission Plan	
AGL Height	2300	ш	m Pulse Rate	800Khz
Target Speed	160	kts	kts Scan Rate	178
Laser Current	100	% FOV	FOV	e0 degs

Static GPS Tii	GPS Time
Alignment Start	pu∃
Pre Mission 1304	1308
Post Mission -	-

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

Flight
092
Julian Day

LIDAR Flight Log



A Clean Harbors Company

Date	April 02, 2021	Aircraft	C-GJMT
Project 32	Project 3218_QSI_PierceMarathon Pilot	Pilot	Andy. S
Location	Location Eau Claire WI Airport	Operator	Operator D.Arteaga
Mission Objective	jective		

System	Riegl VQ-1560
Unit	64
NWI	Applanix AP60
SPS Rx	Trimble GNSS17
Scanner 1 Drive	1 Drive
Scanner 2 Drive	2 Drive

System	Riegl VQ-1560		Ă
Unit	64		-
NMI	Applanix AP60		I
GPS Rx	Trimble GNSS17		⋖
Scanner 1 Drive	1 Drive		I
Scanner 2 Drive	2 Drive		
		•	

Additional Notes	1-8C	H-47%	AMLS-278m	Hpa-1028	Time to next maintenance:	
Riegl VQ-1560	64	pplanix AP60	rimble GNSS17	rive	rive	

GPS Time	End	1308	-	
-	Start	1304	-	
Static	Alignment	Pre Mission	Post Mission	
	ZL		degs	

800Khz 178

m Pulse Rate kts | Scan Rate

2300

AGL Height

Mission Plan

Aircraft Block Time

Takeoff 13:17 Landing 17:35 Total 4.3 hrs

Engine Off 17:43 Engine On 12:56

hrs

4.8

Total

9

₽ 2 %

100 160

Target Speed Laser Current

⊙ 50 hr **O** 100 hr

32hrs

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

Page 4 of 5

Flight A
092
ian Day
≒

LIDAR Flight Log

C-GJMT Andy. S

Aircraft Pilot

Project 3218_QSI_PierceMarathon

April 02, 2021

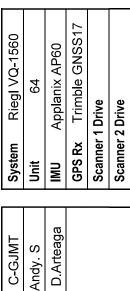
Date

Location Eau Claire WI Airport

Mission Objective



AIRBORNEIMAGING A Clean Harbors Company



Operator

System	Riegl VQ-1560		⋖
Jnit	64		
MU	Applanix AP60		_
3PS Rx	Trimble GNSS17		_
Scanner 1 Drive	1 Drive		_
Scanner 2 Drive	2 Drive		
		•	۱

Additional Notes	T8C	H-47%	AMLS-278m	Hpa-1028	Time to next maintenance:
VQ-1560	4	x AP60	e GNSS17		

GPS Time	End	1308	-
15	Start	1304	-
Static	Alignment	Pre Mission	Post Mission
	Zı		degs

800Khz 178

m Pulse Rate kts | Scan Rate

2300

Mission Plan

Aircraft Block Time

Takeoff 13:17

Engine On 12:56

Engine Off 17:43 | Landing 17:35

Total 4.3 hrs

Total 4.8 hrs

9

% FOV

100 160

Laser Current Target Speed AGL Height

⊙ 50 hr **O** 100 hr

32hrs

		Comments
	Mission ID	č
	Aborted	nmi to End
	Line A	Time
	Time	End
•	GPS	Start
	Flight	Direction
	LiDAR	File Name
		Flight Line

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

Flight
093
Julian Day

 \Box

LIDAR Flight Log



A Clean Harbors Company

	April 03, 2021	Aircraft	Aircraft C-GJMT
Project 3218_QSI_PierceMarathon Pilot	ierceMarathon	Pilot	Andy. S
Location Eau Claire WI Airport Operator D.Arteaga	re WI Airport	Operator	D.Arteaga
Mission Objective			

System	Riegl VQ-1560
Unit	64
NMI	Applanix AP60
SPS Rx	Trimble GNSS17
Scanner 1 Drive	1 Drive
Scanner 2 Drive	2 Drive

Time to next main	Scanner 2 Drive
Hpa-1018	Scanner 1 Drive
AMLS-278m	GPS Rx Trimble GNSS17
H-16%	IMU Applanix AP60
T-21C	Unit 64
Additional Notes	System Riegl VQ-1560

	Static Alignment Pre Mission Post Mission	Sta Align	
--	--	--------------	--

800Khz 178

m Pulse Rate kts | Scan Rate

2300

Mission Plan

Aircraft Block Time

Takeoff 20:16 Landing 22:58 **Total** 2.7 hrs

Engine On 20:00 Engine Off 23:02 hrs

3.0

Total

9

. М %

100 160

Laser Current Target Speed AGL Height

O 50 hr **O** 100 hr

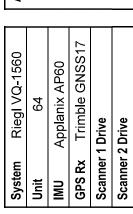
Time to next maintenance:

			_			_	_	_	_	_	_
	Comments	Data recorder error- full system	restart and cable swap						System crashed after 8 minutes on line		
Mission ID	Time Stamp		204836	-	210103	212113	214306	220425	222609		
Line Aborted	nmi to End										
Line	Time								2233		
Time	End		2049	2055	2117	2138	2159	2221	2226		
GPS Time	Start		2048	2050	2101	2121	2143	2204	180		
Flight	Direction	-	-	-	180	000	180	000	180		
LiDAR	File Name										
	Flight Line	Test Strip 01	Test Strip 02	F8	1054	1055	1056	1057	1058		

Flight E
093
ulian Day

മ

LIDAR Flight Log



D.Arteaga

Operator

Project 3218_QSI_PierceMarathon

April 03, 2021

Date

Location Eau Claire WI Airport

Mission Objective

C-GJMT Andy. S

Aircraft **Pilot**

Notes	
Additional	

Time to next maintenance:

Notes	
tional	

A Clean Harbors Company AIRBORN IMAGING

> T--21C H-16% AMLS-278m Hpa-1018

⊙ 50 hr **O** 100 hr

			Aircraft Block Time	Blo	ck Time	
Engine On 20:00	'n	20:00	Takeoff 20:16	1 2	0:16	
Engine Off 23:02	JĘ(23:02	Landing 22:58	g 2	2:58	
Total 3.0 hrs	3.0	hrs	Total 2.7 hrs	2.7	hrs	

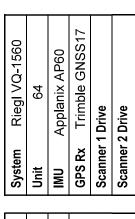
AGL Height 2300 m Pulse Rate 800Khz Target Speed 160 kts Scan Rate 178 Laser Current 100 % FOV 60 degs		Σ	Mission	n Plan	
160 kts Scan Rate 178 100 % FOV 60	AGL Height	2300	Е	Pulse Rate	800Khz
100 % FOV 60	Target Speed		kts	Scan Rate	178
	Laser Current		%	FOV	

Static	В	GPS Time
Alignment	Start	End
Pre Mission	2006	2011
Post Mission	-	-

	Comments								
Mission ID	Time Stamp								-
Line Aborted	nmi to End								
Line	Time								
GPS Time	End								
Sd9	Start								
Fliaht	Direction								-
LiDAR	File Name								
	Flight Line								

Ω	
Flight	
093	
ulian Day	





D.Arteaga

Operator

Eau Claire WI Airport

Location

Mission Objective

C-GJMT Andy. S

Aircraft Pilot

Project 3218_QSI_PierceMarathon

April 03, 2021

Date

stem	Riegl VQ-1560		Addi
it	64		1-2
o l	Applanix AP60		于
S Rx	Trimble GNSS17		AM
anner	anner 1 Drive		Нра
anner	anner 2 Drive		Ħ
		_	

201 -	2006	Pre Mission Post Mission		Knz '8 degs	178 0
GPS Time	GP Start	Static Alignment		Khz	800Khz
S Time	В	Static			
ı.	© 50 hr O 100 hr	enance:	aint	Time to next maintenance:	Time
			_	Hpa-1018	Нра-
			_	н-16% AMLS-278m	H-16% AMLS-
A Clean Harbors Cor	A Clea			ပ	T21C
AIRBOR	4		es	Additional Notes	Additi

	Comments	
Mission ID	Time Stamp	
Line Aborted	nmi to End	
Line	Time	
Time	End	
Sd9	Start	
Fliaht		
LiDAR	File Name	
	Flight Line	

m Pulse Rate kts | Scan Rate

2300

AGL Height

Mission Plan

Aircraft Block Time

Takeoff 20:16 Landing 22:58 **Total** 2.7 hrs

Engine On 20:00 Engine Off 23:02

3.0 hrs

Total

9

₽ 2 %

100 160

Target Speed Laser Current

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

Flight	
093	
ılian Day	

മ

LIDAR Flight Log



D.Arteaga

Operator

C-GJMT Andy. S

Aircraft Pilot

Project 3218_QSI_PierceMarathon

April 03, 2021

Date

Location Eau Claire WI Airport

Mission Objective

System	Riegl VQ-1560	⋖
Unit	64	
IMU	Applanix AP60	_
GPS Rx	Trimble GNSS17	1
Scanner 1 Drive	1 Drive	_
Scanner 2 Drive	2 Drive	
		l

litional Notes	
Add	

A Clean Harbors Company AIRBORN

> AMLS-278m Hpa-1018 T--21C H-16%

⊙ 50 hr **O** 100 hr Time to next maintenance:

Static	GP	GPS Time
Alignment	Start	End
Pre Mission	2006	2011
Post Mission	-	-

800Khz

m Pulse Rate kts | Scan Rate

2300

AGL Height

Mission Plan

Aircraft Block Time

Takeoff 20:16

Engine On 20:00 Engine Off 23:02

Total 2.7 hrs Landing 22:58

3.0 hrs

Total

178

degs

9

₽ 2 %

100 160

Target Speed Laser Current

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

m
Flight
093
Julian Day

LIDAR Flight Log



Date	April 03, 2021	Aircraft	C-GJMT
Project 32	Project 3218_QSI_PierceMarathon Pilot	Pilot	Andy. S
Location	Location Eau Claire WI Airport	Operator	Operator D.Arteaga
Mission Objective	jective		

System Riegl VQ-1560 Unit 64 IMU Applanix AP60 GPS Rx Trimble GNSS17 Scanner 1 Drive Scanner 2 Drive		
Rx Iner 1 [System	RiegI VQ-1560
RX Iner 1 [Unit	64
GPS Rx Trimble GNSS17 Scanner 1 Drive Scanner 2 Drive	NMI	Applanix AP60
Scanner 1 Drive Scanner 2 Drive	GPS Rx	Trimble GNSS17
Scanner 2 Drive	Scanner	1 Drive
	Scanner	2 Drive

ystem	Riegl VQ-1560	Addi
Init	64	ï
NN	Applanix AP60	于
PS Rx	Trimble GNSS17	ΑM
canner 1 Drive	1 Drive	НБ
canner 2 Drive	2 Drive	Ë

Additional Notes T-21C H-16% AMLS-278m Hpa-1018	S:	A Clea	A I R B O R N G I M A G I N G A Clean Harbors Company
Time to next maintenance:		© 50 hr O 100 hr	
	Static	45 	GPS Time
800Khz	Alignment	Start	End
178	Pre Mission	2006	2011
o degs	Post Mission	-	-

9

% FOV

100 160

Laser Current **Target Speed** AGL Height

m Pulse Rate kts Scan Rate

2300

Mission Plan

Aircraft Block Time

Engine On 20:00 | Takeoff 20:16

Landing 22:58 **Total** 2.7 hrs

Engine Off 23:02 3.0 hrs

Total

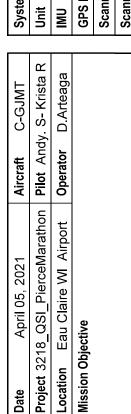
	Comments							
Mission ID	Time Stamp							
Line Aborted	nmi to End							
Line	Time							
GPS Time	End							
GPS	Start							
Fliaht	Direction							
LiDAR	File Name							
	Flight Line							

Page 5 of 5

⋖	
Flight	
095	
lian Day	

LIDAR Flight Log





System	Riegl VQ-1560
Unit	64
NWI	Applanix AP60
SPS Rx	Trimble GNSS17
Scanner 1 Drive	1 Drive
Scanner 2 Drive	2 Drive

A Clean Harbors Company AIRBORN

GPS Time	Start End	1330 1335	-
Static	Alignment	Pre Mission	Post Mission
			degs

800Khz

m Pulse Rate kts | Scan Rate

2300

Mission Plan

Aircraft Block Time

Takeoff 13:41 Landing 15:50 **Total** 2.2 hrs

Engine Off 15:53 Engine On 13:22

hrs

2.5

Total

178

9

₽ 2 %

100 160

Laser Current **Target Speed AGL Height**

⊙ 50 hr **O** 100 hr

_													
	Comments						System crashed just before we	enter the line- tried to restart while	in the air but it froze 2 times				
Mission ID	Time Stamp	135212	-	141350	143404	145534							
Line Aborted	nmi to End												
Line	Time												
Time	End	1354	1409	1429	1450	1511							
GPS Time	Start	1352	1404	1413	1434	1455							
Flight	Direction	1	ı	180	000	180	000						
LiDAR	File Name												
	Flight Line	X-Tie	F8	1058	1059	1060	1061						

Flight	
095	
ılian Day	

Project 3218_QSI_PierceMarathon | Pilot Andy. S- Krista R

LIDAR Flight Log



D.Arteaga

Operator

Location Eau Claire WI Airport

Mission Objective

C-GJMT

Aircraft

April 05, 2021

Date

Addition] T-6C	%0/-H [AMLS	Hpa-1	Time to	
RiegI VQ-1560	64	Applanix AP60	Trimble GNSS17	r 1 Drive	r 2 Drive	

Additional Notes	AIRBORNE
T-6C	A Clean Harbors Company
H-70%	
AMLS-278m	
Hpa-1010	
Time to next maintenance:	⊙ 50 hr O 100 hr

	2	issio	Mission Plan		Stati
4GL Height	2300	Ε	m Pulse Rate	800Khz	Alignm
Farget Speed	160	kts	160 kts Scan Rate	178	Pre Missio
aser Current	100 % FOV	%	FOV	e0 degs	Post Missi

Aircraft Block Time

Takeoff 13:41

Engine On 13:22

Total 2.2 hrs

hrs

2.5

Total

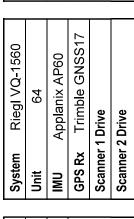
Engine Off 15:53 | Landing 15:50

	Static	GP	GPS Time
	Alignment	Start	End
	Pre Mission	1330	1335
Sc	Post Mission	-	-
Ī			

	Comments								
Mission ID	Time Stamp								-
Line Aborted	nmi to End								
Line	Time								
GPS Time	End								
S49	Start								
Flight	Direction								-
LiDAR	File Name								
	Flight Line								

⋖

LIDAR Flight Log



Pilot Andy. S- Krista R

Project 3218_QSI_PierceMarathon

April 05, 2021

Date

Location Eau Claire WI Airport

Mission Objective

C-GJMT

Aircraft

D.Arteaga

Operator

tem	Riegl VQ-1560		Ado
_	64		Ť
_	Applanix AP60		Ξ
S RX	Trimble GNSS17		¥
nner	nner 1 Drive		유
nner	nner 2 Drive		≓
		-	

Additional Notes
T-6C
%0-H /
AMLS-278m
Hpa-1010

A Clean Harbors Company AIRBORN IMAGING

⊙ 50 hr O 100 hr
ance:
ime to next maintenance

	Scanner 1 Drive	1 Drive		Hpa-1010
	Scanner 2 Drive	2 Drive		Time to next
Aircraft Block Time		Miss	Mission Plan	
Takeoff 13:41	AGL Height	2300	AGL Height 2300 m Pulse Rate 800Khz	800Khz
Landing 15:50	Target Speed	160 kt	Target Speed 160 kts Scan Rate	178
Total 2.2 hrs	Laser Current 100 % FOV	100 %	% Fov	эр 09

Engine On 13:22 Engine Off 15:53 Total 2.5 hrs

	Static	В	GPS Time
ZL	Alignment	Start	End
	Pre Mission	1330	1335
degs	Post Mission	-	-
Ī			

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

Flight	
095	
ılian Day	

LIDAR Flight Log



Pilot Andy. S- Krista R

Project 3218_QSI_PierceMarathon

April 05, 2021

Date

Location Eau Claire WI Airport

Mission Objective

C-GJMT

Aircraft

D.Arteaga

Operator

System	Riegl VQ-1560	•
Unit	64	•
NMI	Applanix AP60	_
GPS Rx	Trimble GNSS17	_
Scanner 1 Drive	1 Drive	_
Scanner 2 Drive	2 Drive	

Additional Notes	T-6C	H-70%	AMLS-278m	Hpa-1010	
VQ-1560	–	ix AP60	le GNSS17		

	- M A G - N G
T-6C	A Clean Harbors Company
H-70%	
AMLS-278m	
Hpa-1010	
Time to next maintenance:	● 50 hr O 100 hr

GPS Time	End	1335	1
19	Start	1330	-
Static	Alignment	Pre Mission	Post Mission
	Zı		degs

800Khz 178

m Pulse Rate kts | Scan Rate

2300

AGL Height

Mission Plan

Aircraft Block Time

Takeoff 13:41 Landing 15:50 9

₽ 2 %

100 160

Total 2.2 hrs

hrs

2.5

Total

Engine Off 15:53 Engine On 13:22

Target Speed Laser Current

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

	Flight
(095
	ılian Day

C-GJMT

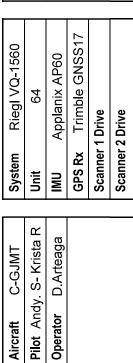
Aircraft

Project 3218_QSI_PierceMarathon

April 05, 2021

Date

LIDAR Flight Log



Operator

Eau Claire WI Airport

Location

Mission Objective

ix AP60 H-70° H-70	Riegl VQ-1560
712	64
	Applanix AP60
Hpa-	Trimble GNSS17
Time	

AIRBORNEIMAGING A Clean Harbors Company

t Start	GPS Time End 1335
Post Mission -	•
_	

800Khz 178

m Pulse Rate kts | Scan Rate

2300

Mission Plan

Aircraft Block Time

Takeoff 13:41 Landing 15:50 **Total** 2.2 hrs

Engine Off 15:53 Engine On 13:22

hrs

2.5

Total

9

₽ 2 %

100 160

Laser Current **Target Speed AGL Height**

⊙ 50 hr **O** 100 hr

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