Airborne LiDAR Report

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FEMA HQ – Carbon WY QL2 Lidar

Contract Number: G10PC00057
Task Number: G15PD00641

Contractor: Woolpert, Inc.
Woolpert Project # 75826

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Airborne LiDAR Report

UNITED STATES GEOLOGICAL SURVEY

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Section 1: Overview

TASK ORDER NAME: FEMA HQ – Carbon WY QL2 Lidar

Project: #75826

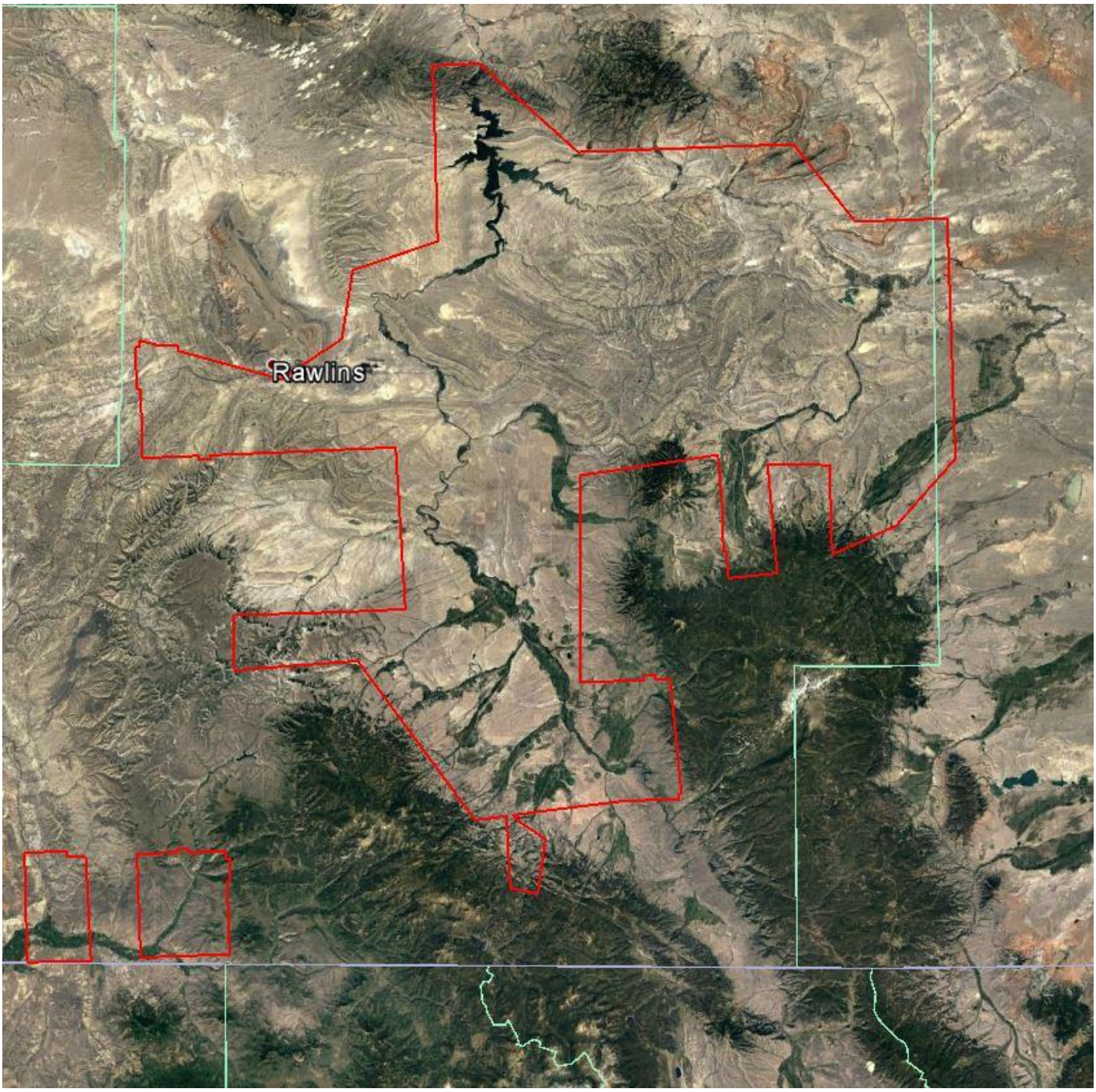
This report contains a comprehensive outline of the FEMA HQ – Carbon WY QL2 Lidar Processing task order for the United States Geological Survey (USGS). This task is issued under USGS Contract No. G10PC00057, Task Order No. G15PD00641. This task order requires lidar data to be acquired over portions of Carbon County, WY (approximately 2,425 square miles). The lidar was collected and processed to meet a maximum Nominal Post Spacing (NPS) of 0.7 meters. The NPS assessment is made against single swath, first return data located within the geometrically usable center portion (typically ~90%) of each swath.

The data was collected using a Dual-Head DragonEye (DE) sensor. The sensor was mounted in a Leica PAV100 gyro-stabilized mount integrated with a NovAtel SPAN GNSS and LCI-100C IMU. This sensor collects up to four returns (echo) per pulse, as well as intensity data, for the first three returns. The aerial lidar was collected at the following sensor specifications:

Table 1.1: Dual-Head DragonEye (DE) Specifications	
Post Spacing	0.7 m
AGL (Above Ground Level) average flying height	1600 m
Average Ground Speed:	125 knots / 144 mph
Field of View (full)	40 degrees
Pulse Rate	320 (2015) 360 (2016)
Scan Rate	50 Hz
Side Lap	15%

LiDAR data was produced in NAD83(2011) UTM13N. Coordinate positions were specified in units of meters. The vertical datum used for the project was referenced to NAVD 1988, meters, GEOID12B.

Figure 1.1: Lidar Task Order AOI



Section 2: Acquisition

The LiDAR data was acquired with a Leica Leica Dual-Head DragonEye (DE) sensor, on board Woolpert's Cessna aircraft. The Leica system, developed by Leica of Herrburgg, Switzerland. The innovative dual scanner head design of the DragonEye features a unique oblique scan pattern. In one single pass, each ground target may be illuminated by four laser shots at multiple incidence angles from ±8 to ±20 degrees, maximizing vertical surface definition and minimizing shadows in the survey data. Each topographic laser operates in the infra-red spectrum at 1064nm. Up to 15 returns per pulse are acquired from each laser.

Figure 2.1: The Leica DragonEye LiDAR System has the following specifications:

Laser Characterization	
Laser wavelength [6]	1064 nm
Laser divergence	0.5 mrad ($1/e^2$)
Pulse repetition frequency (PRF)	Up to 1 MHz
Return pulses	Programmable up to 15 returns, with full waveform record option
Operation altitude [1]	300 – 1600 m AGL
Scanner pattern	Dual head oblique scanner
Scanner speed	Programmable up to 70 RPS per scanner (i.e., 280 scans/second)
Field of view	±8° and ±20° front/back, ±20° left/right
Swath width	70 % of AGL
Point density [2]	> 16 pts/m^2
Ranging accuracy [2], [3], [4]	2 cm (1σ)
Vertical accuracy [2], [3], [5]	6 cm (1σ)
Horizontal accuracy [2], [3], [5]	25 cm (1σ)

Prior to mobilizing to the project site, flight crews coordinated with the necessary Air Traffic Control personnel to ensure airspace access.

Crews were onsite, operating a Global Navigation Satellite System (GNSS) Base Station for the airborne GPS support.

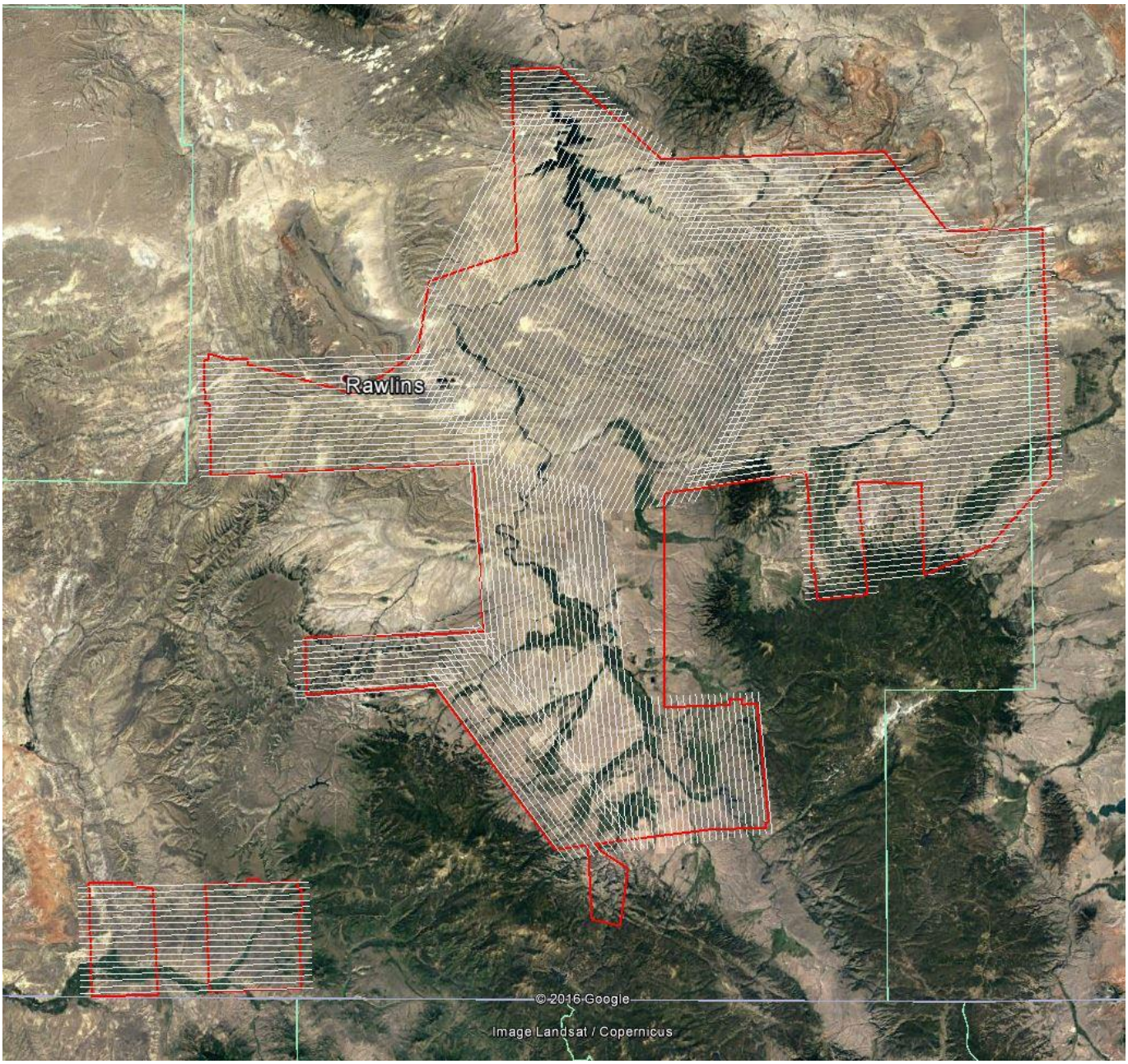
The LiDAR data was collected in thirty (30) missions, flown as close together as the weather permitted, to ensure consistent ground conditions across the project area. An initial quality control process was performed immediately on the lidar data to review the data coverage, airborne GPS data, and trajectory solution.

Table 2.1: Airborne Lidar Acquisition Flight Summary

Table 2.2: Airborne Lidar Acquisition Flight Summary

Date of Mission	Lines Flown	Mission Time (UTC) Wheels Up/Wheels Down
October 25, 2015	**114-134**	**15:12 – 19:43**
October 25, 2015	**155-160**	**21:32 – 23:31**
October 27, 2015	**137-141, 154**	**15:53 – 17:27**
October 28, 2015	**142-154**	**14:47 – 18:32**
October 28, 2015	**166-182**	**20:52 – 00:04**
November 3, 2015	**41-63**	**16:02 – 19:44**
November 3, 2015	**110-113**	**23:46 – 01:17**
November 7, 2015	**93-109**	**15:30 – 21:08**
November 7, 2015	**58-68**	**22:57 – 01:16**
November 8, 2015	**43, 44, 53-57**	**14:30 – 16:52**
November 8, 2015	**1-11**	**21:23 – 23:13**
November 9, 2015	**161, 218-223**	**15:08 – 17:36**
November 9, 2015	**293-304, 320-338**	**20:11 – 00:56**
June 17, 2016	**210-229**	**14:22 – 18:39**
June 18, 2016	**247-266**	**12:25 – 17:15**
June 19, 2016	**161-165, 230-248**	**12:43 – 16:53**
June 19, 2016	**267, 268**	**18:06 – 19:14**
June 20, 2016	**41, 276-279**	**12:16 – 14:45**
June 21, 2016	**135, 136, 305-319, 321, 326, 333, 335, 337, 350, 355-357**	**12:12 -16:50**
June 22, 2016	**267-269, 272-292**	**12:27 – 17:35**
June 23, 2016	**12-40**	**12:24 – 16:11**
June 24, 2016	**71-73, 75-92**	**13:02 – 17:12**
June 25, 2016	**51, 52, 60-63, 69, 70, 85, 110, 113, 339-349**	**12:20 – 17:18**
June 26, 2016	**172, 174, 176, 178, 180, 182, 270, 271, 344-349, 351-354, 358, 363-366**	**15:16 – 19:14**
July 23, 2016	**184-209, 417-423, 426, 430-432**	**12:28 – 17:24**
July 24, 2016	**41-50, 373-395**	**12:31 – 17:47**
July 25, 2016	**396-416, 433-435, 449-456**	**12:23 – 16:25**
July 26, 2016	**424-429, 436-448**	**12:11 – 15:35**
July 26, 2016	**367-372, 457**	**16:16 – 17:43**
July 27, 2016	**458-467**	**14:16 – 16:07**

Figure 2.2: LiDAR Flight Layout, FEMA HQ – Carbon WY QL2 Lidar



Section 3: LiDAR Data Processing

Applications and Work Flow Overview

Initial data coverage analysis and quality checks to ensure there were no potential system issues were carried out in the field prior to demobilization of the sensor. In general, data were initially processed in Leica's Lidar Survey Studio (LSS) using final processed trajectory information. LAS files from LSS were imported to a Terrascan project where spatial algorithms were used to remove gross system noise and a basic ground classification was conducted per flight line for Terra Match use. TMatch was then run on the project, and a comparison to the lidar control points was conducted. Final trajectory data were post processed in NovAtel Inertial Explorer. Base station data were converted to GPB format and imported with aircraft GNSS and IMU data. Inertial Explorer accounts for the fixed offset between the reference point and IMU and uses a multi-pass algorithm to compute a tightly-coupled solution. Lidar processing was conducted using the Leica Lidar Survey Studio (LSS) software. Calibration information, along with processed trajectory information were combined with the raw laser data to create an accurately georeferenced lidar point cloud for the entire survey in LAS v1.2 format. All points from the topographic lasers include 16-bit intensity values. Additional QC steps were then performed in LSS prior to import to Terrascan. For example, spot checks were made on the data to ensure the front and back of the scans remained in alignment and no calibration or system issues were apparent prior to further data editing in Terrascan.

Global Navigation Satellite System (GNSS)–Inertial Measurement Unit (IMU) Trajectory Processing

Equipment

Flight navigation during the LiDAR data acquisition mission is performed using IGI CCNS (Computer Controlled Navigation System). The pilots are skilled at maintaining their planned trajectory, while holding the aircraft steady and level. If atmospheric conditions are such that the trajectory, ground speed, roll, pitch and/or heading cannot be properly maintained, the mission is aborted until suitable conditions occur.

The aircraft is configured with a NovAtel SPAN GNSS and LCI-100C IMU.

Base stations were set by acquisition staff and were used to support the LiDAR data acquisition. The base stations used during the LiDAR acquisition missions are listed on the next page:

The GNSS base station operated during the Lidar acquisition missions is listed below:

Table 3.1: GNSS Base Station

Station (Name)	Latitude (DMS)	Longitude (DMS)	Ellipsoid Height (L1 Phase center) (Meters)
RWL1	41 47 58.33649	107 12 30.11279	2041.206
MP0573	41 25 2.32509	106 57 42.29997	2265.755
MP0214	41 30 21.49548	106 47 14.52302	2059.726
DWX1	41 2 1.80161	107 30 11.68875	1959.342
AA2125	41 42 26.68890	106 26 21.79244	2204.837
NR0387	42 4 7.49831	106 52 56.23029	1938.402

LiDAR Data Processing

When the sensor calibration, data acquisition, and GPS processing phases were complete, the formal data reduction processes by Woolpert lidar specialists included:

- Processed individual flight lines to derive a raw "Point Cloud" LAS file. Matched overlapping flight lines, generated statistics for evaluation comparisons, and made the necessary adjustments to remove any residual systematic error.
- Calibrated LAS files were imported into the task order tiles and initially filtered to create a ground and non-ground class. Then additional classes were filtered as necessary to meet client specified classes.
- Once all project data was imported and classified, survey ground control data was imported and calculated for an accuracy assessment. As a QC measure, Woolpert has developed a routine to generate accuracy statistical reports by comparisons against the TIN and the DEM using surveyed ground control of higher accuracy. The lidar is adjusted accordingly to meet or exceed the vertical accuracy requirements.
- The lidar tiles were reviewed using a series of proprietary QA/QC procedures to ensure it fulfills the task order requirements. A portion of this requires a manual step to ensure anomalies have been removed from the ground class.
- The lidar LAS files are classified into the Default (Class 1), Ground (Class 2), Low noise (Class 7), Water (Class 9), Ignored ground (Class 10), Bridge Decks (Class 17), High Noise (Class 18) classifications.
- FGDC Compliant metadata was developed for the task order in .xml format per product.
- The horizontal datum used for the task order was referenced to NAD83(2011) UTM13N meters. The vertical datum used for the task order was referenced to NAVD 1988, meters, GEOID12B.

Section 4: Hydrologic Flattening

HYDROLOGIC FLATTENING OF LIDAR DEM DATA

FEMA HQ – Carbon WY QL2 Lidar processing task order required the compilation of breaklines defining water bodies and rivers. The breaklines were used to perform the hydrologic flattening of water bodies, and gradient hydrologic flattening of double line streams and rivers. Lakes, reservoirs and ponds, at a minimum size of 2-acre or greater, were compiled as closed polygons. The closed water bodies were collected at a constant elevation. Rivers and streams, at a nominal minimum width of 30 meters (100 feet), were compiled in the direction of flow with both sides of the stream maintaining an equal gradient elevation.

LIDAR DATA REVIEW AND PROCESSING

Woolpert utilized the following steps to hydrologically flatten the water bodies and for gradient hydrologic flattening of the double line streams within the existing lidar data.

1. Woolpert used the newly acquired lidar data to manually draw the hydrologic features in a 2D environment using the lidar intensity and bare earth surface. Open Source imagery was used as reference when necessary.
2. Woolpert utilizes an integrated software approach to combine the lidar data and 2D breaklines. This process “drapes” the 2D breaklines onto the 3D lidar surface model to assign an elevation. A monotonic process is performed to ensure the streams are consistently flowing in a gradient manner. A secondary step within the program verifies an equally matching elevation of both stream edges. The breaklines that characterize the closed water bodies are draped onto the 3D lidar surface and assigned a constant elevation at or just below ground elevation.
3. The lakes, reservoirs and ponds, at a minimum size of 2-acre or greater and streams at a minimum size of 30 meters (100 feet) nominal width, were compiled to meet task order requirements. **Figure 4.1** illustrates an example of 30 meters (100 feet) nominal streams identified and defined with hydrologic breaklines. The breaklines defining rivers and streams, at a nominal minimum width of 30 meters (100 feet), were draped with both sides of the stream maintaining an equal gradient elevation.
4. All ground points were reclassified from inside the hydrologic feature polygons to water, class nine (9).
5. All ground points were reclassified from within a buffer along the hydrologic feature breaklines to buffered ground, class ten (10).
6. The lidar ground points and hydrologic feature breaklines were used to generate a new digital elevation model (DEM).

Figure 4.1: Example Hydrologic Breaklines

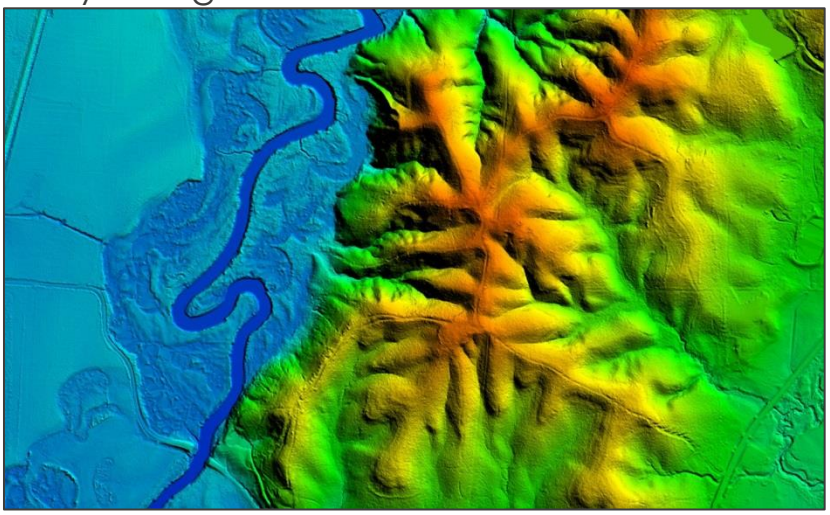


Figure 4.2 reflects a DEM generated from original lidar bare earth point data prior to the hydrologic flattening process. Note the "tinning" across the lake surface.

Figure 4.3 reflects a DEM generated from lidar with breaklines compiled to define the hydrologic features. This figure illustrates the results of adding the breaklines to hydrologically flatten the DEM data. Note the smooth appearance of the lake surface in the DEM.

Figure 4.2

Figure 4.3

Terrascan was used to add the hydrologic breakline vertices and export the lattice models. The hydrologically flattened DEM data was provided to USGS in ERDAS .IMG format.

The hydrologic breaklines compiled as part of the flattening process were provided to the USGS as an ESRI Shapefile The breaklines defining the water bodies greater than 2-acre and for the gradient flattening of all rivers and streams at a nominal minimum width of 30 meters (100 feet) were provided as a Polygon-Z and Polyline-Z shape file, respectively.

DATA QA/QC

Initial QA/QC for this task order was performed in Global Mapper v15, by reviewing the grids and hydrologic breakline features. Additionally, ESRI software and proprietary methods were used to review the overall connectivity of the hydrologic breaklines.

Edits and corrections were addressed individually by tile. If a water body breakline needed to be adjusted to improve the flattening of the DEM data, the area was cross referenced by tile number, corrected accordingly, a new DEM file was regenerated and reviewed.

Section 5: Accuracy Assessment

Final Vertical Accuracy Assessment

The vertical accuracy statistics were calculated by comparison of the LiDAR bare earth points to the ground surveyed QA/QC points.

Table 5.1: Overall Vertical Accuracy Statistics		
Average error	0.004	meter
Minimum error	-0.138	meter
Maximum error	0.137	meter
Average magnitude	0.046	meter
Root mean square	0.058	meter
Standard deviation	0.058	meter

Table 5.2: RAW Swath Quality Check Point Analysis NVA

Point ID	Easting (meter)	Northing (meter)	Elevation (meter)	TIN Elevation (meter)	Dz (meter)
2001	279355.501	4552919.278	1924.455	1924.350	-0.105
2001A	279358.901	4552950.932	1924.463	1924.370	-0.093
2002	277674.283	4548376.097	1913.898	1913.760	-0.138
2003	279760.395	4549516.989	1943.190	1943.090	-0.100
2004	294852.231	4545854.014	2028.756	2028.760	0.004
2005	301634.000	4554613.841	2151.174	2151.120	-0.054
2006	299235.039	4551301.952	2033.079	2032.980	-0.099
2006A	299211.506	4551278.148	2032.732	2032.630	-0.102
2007	309315.736	4586856.350	2340.882	2340.860	-0.022
2008	314197.181	4588050.148	2424.688	2424.670	-0.018
2008A	314255.550	4588118.965	2421.611	2421.590	-0.021
2009	311910.954	4589776.735	2378.158	2378.160	0.002
2009A	311887.128	4589737.779	2377.589	2377.550	-0.039
2010	295049.390	4627388.449	2031.474	2031.540	0.066
2011	307936.492	4627435.711	2113.242	2113.270	0.028
2012	302844.169	4620590.259	2191.780	2191.790	0.010
2013	363646.183	4569391.925	2164.336	2164.330	-0.006
2014	365653.440	4576766.452	2301.069	2301.070	0.001
2015	366889.635	4565343.375	2258.945	2258.930	-0.015
2015A	366869.898	4565378.690	2259.613	2259.610	-0.003
2016	349366.191	4566925.009	2208.157	2208.200	0.043
2017	345881.097	4589261.116	2123.560	2123.480	-0.080
2018	329490.250	4585342.717	2223.980	2223.960	-0.020
2019	339348.972	4571753.066	2296.090	2296.160	0.070
2020	344838.376	4579613.959	2168.239	2168.150	-0.089
2021	324133.070	4627296.973	2011.177	2011.240	0.063

2022	346586.008	4624877.390	2019.426	2019.480	0.054
2023	338242.726	4626838.831	1982.577	1982.670	0.093
2024	382160.248	4615992.277	2214.720	2214.790	0.070
2025	399398.068	4605349.486	2348.587	2348.490	-0.097
2025A	399289.301	4605391.732	2348.800	2348.750	-0.050
2026	406126.234	4612225.996	2212.745	2212.830	0.085
2026A	406153.764	4612178.603	2212.729	2212.790	0.061
2027	404679.875	4637455.975	2006.351	2006.450	0.099
2028	368683.165	4636714.550	2069.715	2069.720	0.005
2029	343212.269	4600444.553	2041.317	2041.270	-0.047
2030	338967.897	4616961.096	2073.650	2073.590	-0.060
2031	341685.211	4669286.900	1948.152	1948.170	0.018
2032	382770.868	4652826.399	1998.152	1998.130	-0.022
2033	399293.499	4622980.052	2073.673	2073.810	0.137
2034	340862.766	4659785.974	2005.350	2005.390	0.040
2035	329092.126	4638537.867	1957.431	1957.490	0.059
2036	362192.229	4653731.229	2027.378	2027.340	-0.038
2037	352864.213	4637073.554	2077.203	2077.210	0.007
2037A	352832.741	4637095.560	2077.430	2077.430	0.000
2038	359831.881	4629881.195	2127.840	2127.860	0.020
2039	393569.127	4642773.794	2016.146	2016.140	-0.006
2040	373741.193	4650022.275	1997.978	1997.950	-0.028
2040A	373752.370	4650053.247	1997.504	1997.470	-0.034
2041	375358.395	4630588.884	2207.215	2207.340	0.125
2042	354507.233	4614019.182	2077.089	2077.010	-0.079
2043	302834.531	4627771.443	2108.173	2108.160	-0.013
2044	**337174.780**	**4587273.405**	**2250.891**	**2250.870**	**-0.021**
2044A	337254.277	4587307.928	2248.495	2248.500	0.005
2045	357298.236	4564947.165	2205.618	2205.550	-0.068
2046	357071.183	4576958.949	2129.434	2129.430	-0.004
2046A	357092.952	4576931.450	2129.277	2129.270	-0.007
2047	338995.328	4633875.779	2016.501	2016.540	0.039
2047A	338993.003	4633960.368	2016.268	2016.300	0.032
2048	332108.475	4631710.010	1974.919	1975.040	0.121
2048A	332016.495	4631685.946	1977.362	1977.440	0.078
2049	381088.813	4623308.935	2236.888	2236.860	-0.028
2050	396444.169	4633023.668	2057.367	2057.480	0.113
2051	384250.129	4598234.871	2530.846	2530.910	0.064
2052	381954.703	4608482.982	2310.988	2310.970	-0.018
2053	372697.978	4623098.115	2231.255	2231.250	-0.005
2054	358835.675	4621250.205	2100.886	2100.910	0.024
2054A	358832.637	4621251.310	2100.825	2100.810	-0.015
2055	363717.164	4639816.938	2196.663	2196.700	0.037
2055A	363692.794	4639839.455	2195.832	2195.860	0.028
2056	403864.013	4623186.693	2186.141	2186.170	0.029

2056A	403865.726	4623217.642	2185.732	2185.790	0.058
2057	391007.153	4619936.865	2162.597	2162.580	-0.017
2058	367358.665	4629180.997	2097.758	2097.790	0.032
2059	336058.174	4612364.561	2112.718	2112.650	-0.068
2059A	336072.754	4612392.841	2114.173	2114.110	-0.063
2060	403364.942	4619433.991	2202.720	2202.770	0.050
2061	299799.205	4544469.920	2125.981	2125.920	-0.061
2062	371776.437	4645869.985	2078.945	2078.950	0.005
2062A	371793.683	4645898.813	2078.973	2078.970	-0.003
2063	353768.327	4627947.565	2120.425	2120.410	-0.015
2064	299625.938	4618557.727	2217.193	2217.140	-0.053
2064A	299650.365	4618580.059	2217.111	2217.060	-0.051
2065	366656.816	4621655.222	2181.060	2181.100	0.040
2066	365424.632	4647382.497	2104.837	2104.850	0.013
2066A	365472.921	4647366.023	2106.504	2106.540	0.036
2067	391857.710	4629442.240	2161.124	2161.190	0.066
2068	373189.427	4618324.710	2236.390	2236.450	0.060
2069	363624.189	4617603.373	2139.495	2139.580	0.085
2070	348377.739	4619288.325	2012.822	2012.830	0.008
2071	340611.510	4669669.400	2004.007	2003.920	-0.087
2072	374559.810	4655705.565	2001.227	2001.200	-0.027
2073	378648.805	4620563.554	2240.678	2240.700	0.022
2074	407939.842	4635407.817	2045.518	2045.600	0.082
2075	395637.717	4631404.715	2063.560	2063.590	0.030
2076	349915.763	4642229.417	1978.869	1978.920	0.051
2077	299709.882	4628658.287	2067.204	2067.230	0.026
2077A	299712.901	4628602.389	2067.477	2067.470	-0.007
2078	316105.127	4590807.426	2300.868	2300.880	0.012
2079	297910.267	4548892.933	2017.282	2017.200	-0.082
2080	395442.443	4608900.684	2358.438	2358.500	0.062
2081	388586.195	4647839.529	2061.966	2061.990	0.024
2084	358600.003	4571316.360	2147.292	2147.340	0.048
2084A	358574.235	4571295.573	2148.637	2148.660	0.023
2085	277389.702	4556811.637	1937.905	1937.800	-0.105
2086	355523.934	4595936.616	2116.078	2116.120	0.042
2087	354368.788	4606578.012	2125.822	2125.910	0.088
2088	347377.831	4559607.134	2471.460	2471.460	0.000

VERTICAL ACCURACY CONCLUSIONS

Raw Swath Non-Vegetated Vertical Accuracy (NVA) Tested 0.139 Meters Non vegetated vertical accuracy at a 95 percent confidence level, derived according to NSSDA, in open terrain using (RMSEz) x 1.96000 as defined by the National Standards for Spatial Data Accuracy (NSSDA); assessed and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the TIN using all points.

LAS Swath Non-Vegetated Vertical Accuracy (NVA) Tested 0.114 Meters Non vegetated vertical accuracy at a 95 percent confidence level, derived according to NSSDA, in open terrain using (RMSEz) x 1.96000 as defined by the National Standards for Spatial Data Accuracy (NSSDA); assessed and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the TIN using ground points.

Table 5.3: NVA Check Point Analysis DEM

Point ID	Easting (meter)	Northing (meter)	Elevation (meter)	DEM Elevation (meter)	Dz (meter)
2001	279355.501	4552919.278	1924.455	1924.350	0.105
2001 A	279358.901	4552950.932	1924.463	1924.380	0.083
2002	277674.283	4548376.097	1913.898	1913.770	0.128
2003	279760.395	4549516.989	1943.190	1943.100	0.090
2004	294852.231	4545854.014	2028.756	2028.770	-0.014
2005	301634.000	4554613.841	2151.174	2151.150	0.024
2006	299235.039	4551301.952	2033.079	2032.990	0.089
2006 A	299211.506	4551278.148	2032.732	2032.640	0.092
2007	309315.736	4586856.350	2340.882	2340.860	0.022
2008	314197.181	4588050.148	2424.688	2424.650	0.038
2008 A	314255.550	4588118.965	2421.611	2421.580	0.031
2009	311910.954	4589776.735	2378.158	2378.150	0.008
2009 A	311887.128	4589737.779	2377.589	2377.520	0.069
2010	295049.390	4627388.449	2031.474	2031.540	-0.066
2011	307936.492	4627435.711	2113.242	2113.270	-0.028
2012	302844.169	4620590.259	2191.780	2191.770	0.010
2013	363646.183	4569391.925	2164.336	2164.330	0.006
2014	365653.440	4576766.452	2301.069	2301.070	-0.001
2015	366889.635	4565343.375	2258.945	2258.940	0.005
2015 A	366869.898	4565378.690	2259.613	2259.620	-0.007
2016	349366.191	4566925.009	2208.157	2208.180	-0.023
2017	345881.097	4589261.116	2123.560	2123.470	0.090
2018	329490.250	4585342.717	2223.980	2223.950	0.030
2019	339348.972	4571753.066	2296.090	2296.130	-0.040
2020	344838.376	4579613.959	2168.239	2168.150	0.089
2021	324133.070	4627296.973	2011.177	2011.240	-0.063
2022	346586.008	4624877.390	2019.426	2019.490	-0.064
2023	338242.726	4626838.831	1982.577	1982.670	-0.093
2024	382160.248	4615992.277	2214.720	2214.780	-0.060
2025	399398.068	4605349.486	2348.587	2348.520	0.067
2025 A	399289.301	4605391.732	2348.800	2348.760	0.040
2026	406126.234	4612225.996	2212.745	2212.820	-0.075
2026 A	406153.764	4612178.603	2212.729	2212.770	-0.041

2027	404679.875	4637455.975	2006.351	2006.460	-0.109
2028	368683.165	4636714.550	2069.715	2069.720	-0.005
2029	343212.269	4600444.553	2041.317	2041.260	0.057
2030	338967.897	4616961.096	2073.650	2073.590	0.060
2031	341685.211	4669286.900	1948.152	1948.170	-0.018
2032	382770.868	4652826.399	1998.152	1998.110	0.042
2033	399293.499	4622980.052	2073.673	2073.790	-0.117
2034	340862.766	4659785.974	2005.350	2005.410	-0.060
2035	329092.126	4638537.867	1957.431	1957.490	-0.059
2036	362192.229	4653731.229	2027.378	2027.380	-0.002
2037	352864.213	4637073.554	2077.203	2077.210	-0.007
2037 A	352832.741	4637095.560	2077.430	2077.430	0.000
2038	359831.881	4629881.195	2127.840	2127.880	-0.040
2039	393569.127	4642773.794	2016.146	2016.150	-0.004
2040	373741.193	4650022.275	1997.978	1997.930	0.048
2040 A	373752.370	4650053.247	1997.504	1997.470	0.034
2041	375358.395	4630588.884	2207.215	2207.300	-0.085
2042	354507.233	4614019.182	2077.089	2077.010	0.079
2043	302834.531	4627771.443	2108.173	2108.160	0.013
2044	337174.780	4587273.405	2250.891	2250.870	0.021
2044 A	337254.277	4587307.928	2248.495	2248.490	0.005
2045	357298.236	4564947.165	2205.618	2205.530	0.088
2046	357071.183	4576958.949	2129.434	2129.440	-0.006
2046 A	357092.952	4576931.450	2129.277	2129.270	0.007
2047	338995.328	4633875.779	2016.501	2016.530	-0.029
2047 A	338993.003	4633960.368	2016.268	2016.330	-0.062
2048	332108.475	4631710.010	1974.919	1975.060	-0.141
2048 A	332016.495	4631685.946	1977.362	1977.440	-0.078
2049	381088.813	4623308.935	2236.888	2236.850	0.038
2050	396444.169	4633023.668	2057.367	2057.470	-0.103
2051	384250.129	4598234.871	2530.846	2530.920	-0.074
2052	381954.703	4608482.982	2310.988	2310.930	0.058
2053	372697.978	4623098.115	2231.255	2231.250	0.005
2054	358835.675	4621250.205	2100.886	2100.900	-0.014
2054 A	358832.637	4621251.310	2100.825	2100.810	0.015
2055	363717.164	4639816.938	2196.663	2196.690	-0.027
2055 A	363692.794	4639839.455	2195.832	2195.890	-0.058
2056	403864.013	4623186.693	2186.141	2186.180	-0.039
2056 A	403865.726	4623217.642	2185.732	2185.780	-0.048
2057	391007.153	4619936.865	2162.597	2162.600	-0.003
2058	367358.665	4629180.997	2097.758	2097.780	-0.022

2059	336058.174	4612364.561	2112.718	2112.610	0.108
2059 A	336072.754	4612392.841	2114.173	2114.110	0.063
2060	403364.942	4619433.991	2202.720	2202.740	-0.020
2061	299799.205	4544469.920	2125.981	2125.880	0.101
2062	371776.437	4645869.985	2078.945	2078.930	0.015
2062 A	371793.683	4645898.813	2078.973	2078.970	0.003
2063	353768.327	4627947.565	2120.425	2120.410	0.015
2064	299625.938	4618557.727	2217.193	2217.140	0.053
2064 A	299650.365	4618580.059	2217.111	2217.060	0.051
2065	366656.816	4621655.222	2181.060	2181.100	-0.040
2066	365424.632	4647382.497	2104.837	2104.850	-0.013
2066 A	365472.921	4647366.023	2106.504	2106.510	-0.006
2067	391857.710	4629442.240	2161.124	2161.200	-0.076
2068	373189.427	4618324.710	2236.390	2236.450	-0.060
2069	363624.189	4617603.373	2139.495	2139.550	-0.055
2070	348377.739	4619288.325	2012.822	2012.830	-0.008
2071	340611.510	4669669.400	2004.007	2003.910	0.097
2072	374559.810	4655705.565	2001.227	2001.190	0.037
2073	378648.805	4620563.554	2240.678	2240.700	-0.022
2074	407939.842	4635407.817	2045.518	2045.600	-0.082
2075	395637.717	4631404.715	2063.560	2063.580	-0.020
2076	349915.763	4642229.417	1978.869	1978.910	-0.041
2077	299709.882	4628658.287	2067.204	2067.230	-0.026
2077 A	299712.901	4628602.389	2067.477	2067.500	-0.023
2078	316105.127	4590807.426	2300.868	2300.880	-0.012
2079	297910.267	4548892.933	2017.282	2017.190	0.092
2080	395442.443	4608900.684	2358.438	2358.510	-0.072
2081	388586.195	4647839.529	2061.966	2062.000	-0.034
2084	358600.003	4571316.360	2147.292	2147.320	-0.028
2084 A	358574.235	4571295.573	2148.637	2148.650	-0.013
2085	277389.702	4556811.637	1937.905	1937.790	0.115
2086	355523.934	4595936.616	2116.078	2116.130	-0.052
2087	354368.788	4606578.012	2125.822	2125.890	-0.068
2088	347377.831	4559607.134	2471.460	2471.430	0.030

VERTICAL ACCURACY CONCLUSIONS

Bare-Earth DEM Non-Vegetated Vertical Accuracy (NVA) Tested 0.114 Meters Non-Vegetated vertical accuracy at a 95 percent confidence level, derived according to NSSDA, in open terrain using (RMSEz) x 1.96000 as defined by the National Standards for Spatial Data Accuracy (NSSDA); assessed and reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM.

Table 5.4: VVA Quality Check Point Analysis DEM					
Point ID	Easting (meter)	Northing (meter)	Elevation (meter)	DEM Elevation (meter)	Dz (meter)
3001	277775.214	4548449.029	1912.336	1912.240	0.096
3002	276861.319	4557877.667	1940.698	1940.640	0.058
3002 A	276855.073	4557920.164	1940.688	1940.640	0.048
3003	294804.485	4545896.192	2032.295	2032.320	-0.025
3005	301192.476	4554964.252	2078.262	2078.220	0.042
3006	298578.828	4550371.999	2023.852	2023.770	0.082
3007	308901.427	4586974.930	2363.174	2363.320	-0.146
3007 A	308887.817	4586955.359	2366.432	2366.530	-0.098
3008	313926.606	4587431.584	2427.789	2427.670	0.119
3009	311875.789	4589814.448	2381.035	2381.150	-0.115
3009 A	311830.545	4589740.783	2382.556	2382.620	-0.064
3010	307966.791	4627415.741	2112.372	2112.340	0.032
3011	302741.666	4627743.399	2106.473	2106.520	-0.047
3012	302860.353	4620550.659	2190.468	2190.500	-0.032
3013	299651.898	4618536.408	2215.815	2215.700	0.115
3014	365546.043	4576861.923	2311.039	2311.040	-0.001
3015	362886.681	4572098.044	2211.956	2212.120	-0.164
3016	349346.456	4566902.732	2207.638	2207.660	-0.022
3017	339506.363	4571835.108	2296.324	2295.870	0.454
3018	344818.456	4579679.695	2164.840	2164.750	0.090
3019	342774.340	4600475.190	2045.826	2045.770	0.056
3020	324205.464	4627302.380	2011.024	2011.020	0.004
3021	338287.255	4626970.665	1980.552	1980.680	-0.128
3021 A	338279.603	4627035.784	1978.595	1978.780	-0.185
3021 B	337939.618	4627057.322	1982.090	1982.280	-0.190
3022	338293.933	4627062.023	1974.244	1974.350	-0.106
3023	382406.432	4615999.883	2213.994	2213.970	0.024
3024	381837.512	4607705.147	2314.306	2314.290	0.016
3025	384262.233	4598230.965	2532.353	2532.450	-0.097
3026	384209.597	4598254.078	2526.277	2526.310	-0.033
3027	399168.728	4605567.999	2347.928	2348.000	-0.072
3028	397485.900	4603900.894	2389.761	2389.680	0.081
3029	390347.597	4620011.140	2134.191	2134.110	0.081
3030	390350.836	4619814.933	2152.673	2152.740	-0.067
3031	404713.819	4637429.981	2006.584	2006.650	-0.066
3032	368750.106	4636761.292	2072.407	2072.500	-0.093
3033	332547.825	4631727.143	1963.960	1964.060	-0.100

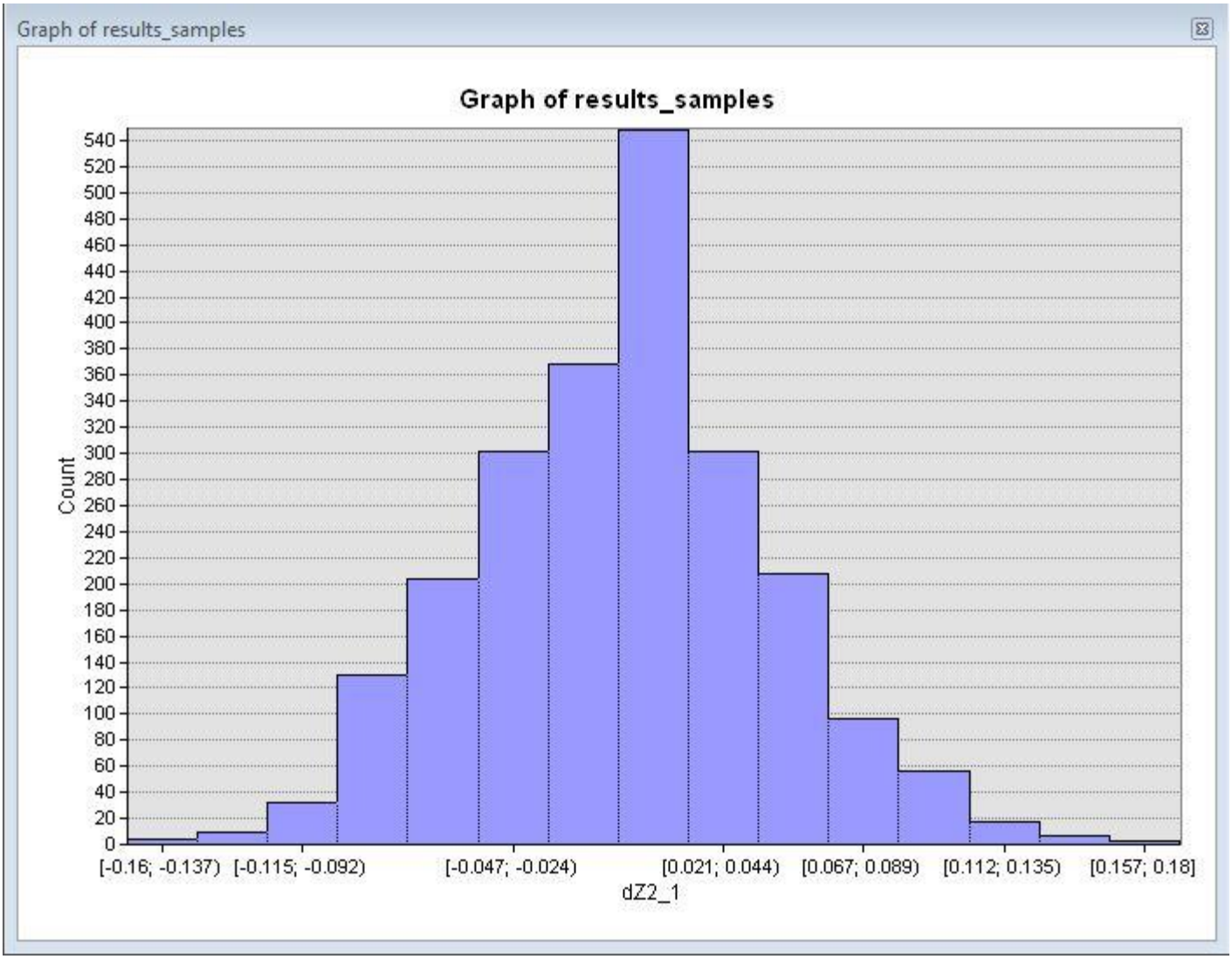
3033 A	332533.607	4631749.246	1964.211	1964.330	-0.119
3034	332081.824	4631699.002	1975.592	1975.620	-0.028
3034 B	332017.845	4631695.625	1976.337	1976.470	-0.133
3035	354428.328	4614017.637	2077.428	2077.310	0.118
3036	366610.206	4621693.503	2182.267	2182.450	-0.183
3037	373942.000	4618413.399	2228.584	2228.180	0.404
3038	399281.080	4622996.123	2075.544	2075.640	-0.096
3038 A	399246.115	4622978.192	2076.692	2076.750	-0.058
3039	340536.186	4669648.646	2007.087	2006.910	0.177
3040	341710.955	4669269.803	1946.657	1946.650	0.007
3040 A	341739.882	4669265.966	1946.356	1946.440	-0.084
3041	340849.745	4659760.641	2006.224	2006.370	-0.146
3042	393640.380	4643090.482	2011.154	2011.240	-0.086
3043	382738.239	4652817.263	1996.218	1996.320	-0.102
3044	348405.905	4619250.356	2012.373	2012.520	-0.147
3045	353767.101	4627907.160	2115.695	2115.740	-0.045
3046	365476.214	4647388.741	2107.170	2107.160	0.010
3047	367353.178	4629221.363	2097.988	2098.000	-0.012
3048	329346.115	4637738.950	1956.388	1956.390	-0.002
3048 A	329377.606	4637772.946	1956.199	1956.160	0.039
3049	336096.750	4612334.139	2108.529	2108.410	0.119
3049 A	336117.953	4612303.615	2108.278	2108.260	0.018
3050	346587.472	4624759.173	2019.302	2019.310	-0.008
3051	353119.577	4638226.842	2082.780	2082.800	-0.020
3052	359845.290	4629913.647	2126.638	2126.630	0.008
3053	362226.059	4653691.807	2027.656	2027.640	0.016
3054	373721.298	4650033.075	1998.344	1998.270	0.074
3055	403896.669	4610840.194	2225.517	2225.630	-0.113
3056	374597.131	4655734.382	2001.667	2001.680	-0.013
3057	378669.286	4620596.608	2242.693	2242.730	-0.037
3058	407890.670	4635401.170	2045.103	2045.250	-0.147
3059	395677.986	4631434.519	2063.265	2063.360	-0.095
3060	363763.169	4639818.295	2196.157	2196.200	-0.043
3060 A	363788.616	4639764.750	2195.969	2195.990	-0.021
3061	339022.177	4633977.997	2017.303	2017.340	-0.037
3061 A	339051.493	4633994.483	2017.846	2017.880	-0.034
3062	342627.924	4590674.385	2121.278	2121.260	0.018
3062 A	342610.978	4590680.005	2120.840	2120.850	-0.010
3063	352588.139	4622613.980	2030.487	2030.610	-0.123
3064	295164.416	4627273.934	2031.336	2031.390	-0.054
3064 A	295061.088	4627296.362	2031.214	2031.230	-0.016

3065	297502.337	4547833.851	2002.777	2002.660	0.117
3066	347381.262	4559687.358	2463.832	2463.980	-0.148
3067	358159.226	4595777.365	2136.247	2136.330	-0.083
3068	353043.607	4606633.999	2128.485	2128.580	-0.095

Vertical Accuracy Conclusions

Vegetated Vertical Accuracy (VVA) Tested 0.185 Meters at the 95th percentile reported using National Digital Elevation Program (NDEP)/ASPRS Guidelines and tested against the DEM. VVA Errors larger than 95th percentile include:
Point 3017, Easting 339506.363, Northing 4571835.108, Z-Error 0.454 Meters
Point 3021 B, Easting 337939.618, Northing 4627057.322, Z-Error 0.190 Meters
Point 3037, Easting 373942.000, Northing 4618413.399, Z-Error 0.404 Meters

Figure 5.1: LIDAR Relative Accuracy Histogram for FEMA HQ – Carbon WY QL2 Lidar



Relative Accuracy Assessment and Conclusion

Relative accuracy also known as "between swath" accuracy was tested through a series of well distributed flight line overlap locations. The relative accuracy for the FEMA HQ – Carbon WY QL2 Lidar measured at 0.047 meters RMSDz.

Approved by:	Name	Signature	Date
Associate Member, Lidar Specialist Certified Photogrammetrist #1381	Qian Xiao		January 2017

Section 6: LiDAR Acquisition Flight Logs

This section contains the Flight Log(s) covering the project. Flight Logs list mission specific details such as crew members, airports, weather conditions, real time PDOP values and document any issues encountered during the mission. Flight Logs are filled out by the sensor operator during the acquisition flight.

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Scappoose (SPB)
LOCATION / AREA:	Scappoose, OR / SPB Calibration Site	**DATE:**	21 October 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	Various (see remarks)	**CLOUDS:**	Clear
BASE STATION:	1S4-D	**WIND:**	5kts @ 310°

ENGINE START:	0:20	**ENGINE OFF:**	2:55	**ENGINE TIME:**	02:35
GNSS START:	0:42	**GNSS START:**	2:36		
TAKEOFF:	0:49	**TOUCHDOWN:**	2:33	**AIR TIME**	01:44

FL #	START TIME	END TIME	TOPO PRF	TOPO PWR	BATHY PWR CHII	REMARKS
	00:21:00					Heading to GNSS Point
	00:28:00					Setting up GNSS Station
	00:55:00					Mission: CALIBRATION-SPB_500m
	00:55:00					Dataset: 20151021_005541
000_FL1	00:55:41	00:57:02	400	19	-	
001_FL2	01:00:01	01:01:21	400	19	-	
002_FL3	01:04:46	01:05:58	400	19	-	
003_FL4	01:09:04	01:10:17	400	19	-	
004_FL5	01:13:04	01:14:17	400	19	-	
005_FL5	01:17:09	01:18:24	500	18	-	500kHz Test Line
006_FL6	01:20:54	01:22:05	400	19	-	
	01:30:00					Mission: CALIBRATION-SPB_1500m
	01:30:00					Dataset: 20151021_013004
000_FL1	01:30:04	01:32:04	250	38	-	DNP: Wrong PRF Setting
001_FL1	01:34:53	01:36:51	170	59	-	
002_FL1	01:40:12	01:42:15	160	62	-	
003_FL1	01:45:42	01:47:38	150	66	-	
004_FL1	01:51:09	01:53:11	180	55	-	
	01:57:00					Mission: CALIBRATION-SPB_1000m
	01:57:00					Dataset: 20151021_015749
000_FL1	01:57:49	01:59:30	250	35	-	
001_FL2	02:02:54	02:04:34	250	35	-	
002_FL3	02:08:16	02:09:50	250	35	-	
003_FL4	02:13:01	02:14:39	250	35	-	
004_FL5	02:17:15	02:18:49	250	35	-	
005_FL6	02:24:18	02:25:50	250	35	-	
	02:44:00					Remove GNSS System
	02:50:00					Taxi to Hanger

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 11	**DATE:**	25 October 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	RWL1	**WIND:**	15-20kts @ 220°

ENGINE START:	14:40	**ENGINE OFF:**	19:48	**ENGINE TIME:**	05:08
GNSS START:	14:50	**GNSS START:**	19:46		
TAKEOFF:	15:12	**TOUCHDOWN:**	19:43	**AIR TIME**	04:31

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	15:23:00					Dataset: 20151025_152333
000_FL114	15:23:33	15:25:26	160	62	-	
001_FL115	15:28:41	15:31:23	160	62	-	
002_FL116	15:34:16	15:42:38	160	62	-	
003_FL117	15:45:18	15:54:07	160	62	-	
004_FL118	15:56:40	16:05:54	160	62	-	
005_FL119	16:08:39	16:18:01	160	62	-	
006_FL120	16:20:33	16:30:13	160	62	-	
007_FL121	16:32:50	16:42:43	160	62	-	
008_FL122	16:45:32	16:55:32	160	62	-	
009_FL123	16:58:05	17:07:56	160	62	-	
010_FL124	17:10:57	17:21:04	160	62	-	
011_FL125	17:23:34	17:33:26	160	62	-	
012_FL126	17:36:08	17:46:17	160	62	-	
013_FL127	17:49:20	17:59:23	160	62	-	
014_FL128	18:01:52	18:12:06	160	62	-	
015_FL129	18:14:41	18:24:50	160	62	-	
016_FL130	18:27:13	18:37:32	160	62	-	
017_FL131	18:40:31	18:50:45	160	62	-	
018_FL132	18:53:05	19:03:15	160	62	-	
019_FL133	19:05:43	19:15:59	160	62	-	
020_FL134	19:18:41	19:28:59	160	62	-	
						*5MP Camera not setup

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / RCD30 Cal & Block 12	**DATE:**	25 October 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	Various (see remarks)	**CLOUDS:**	High Clouds
BASE STATION:	RWL1	**WIND:**	15-20kts @ 200°

ENGINE START:	21:20	**ENGINE OFF:**	23:32	**ENGINE TIME:**	02:12
GNSS START:	21:22	**GNSS START:**	23:31		
TAKEOFF:	21:32	**TOUCHDOWN:**	23:31	**AIR TIME**	01:59

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
						RCD30 Camera Calibration
	21:42:00					Mission: CALIBRATION-RWL_1000m
	21:42:00					Dataset: 20151025_214208
000_FL1	21:42:08	21:43:26	250	35	-	
001_FL2	21:46:26	21:47:38	250	35	-	
002_FL3	21:50:54	21:52:16	250	35	-	
003_FL4	21:55:17	21:56:32	250	35	-	
	22:01:00					Mission: CarbonWY_1500m
	22:01:00					Dataset: 20151025_220117
000_FL160	22:01:17	22:11:25	160	62	-	
001_FL159	22:14:23	22:24:44	160	62	-	
002_FL158	22:27:40	22:38:02	160	62	-	
003_FL157	22:40:46	22:51:11	160	62	-	
004_FL156	22:54:01	23:05:02	160	62	-	
005_FL155	23:08:19	23:19:30	160	62	-	
						*5MP Camera not setup

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 12	**DATE:**	27 October 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Cloudy
BASE STATION:	RWL1	**WIND:**	20-25kts @ 280°

ENGINE START:	15:36	**ENGINE OFF:**	17:32	**ENGINE TIME:**	01:56
GNSS START:	15:43	**GNSS START:**	17:32		
TAKEOFF:	15:53	**TOUCHDOWN:**	17:27	**AIR TIME**	01:34

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	15:41:00					5MP Camera setup
	16:09:00					Dataset: 20151027_160938
000_FL154	16:09:38	16:21:13	160	62	-	Low clouds at start of line
001_FL141	16:25:02	16:33:27	160	62	-	
002_FL140	16:36:21	16:44:35	160	62	-	
003_FL139	16:47:32	16:55:40	160	62	-	
004_FL138	16:58:09	17:05:54	160	62	-	
005_FL137	17:08:43	17:16:24	160	62	-	Some clouds at end of line
	17:17:00					Abort mission due to weather

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 12	**DATE:**	28 October 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	RWL1	**WIND:**	30-35kts @ 270°

ENGINE START:	14:31	**ENGINE OFF:**	18:35	**ENGINE TIME:**	04:04
GNSS START:	14:35	**GNSS START:**	18:35		
TAKEOFF:	14:47	**TOUCHDOWN:**	18:32	**AIR TIME**	03:45

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	14:55:00					Laser TEC Temp out of range
	15:06:00					Laser 1&2 TEMP3 reached 15°C
	15:07:00					System ready to start acquisition
	15:08:00					Dataset: 20151028_150810
000_FL154	15:08:10	15:19:35	160	62	-	
001_FL153	15:22:58	15:34:36	160	62	-	
002_FL152	15:37:47	15:49:05	160	62	-	
003_FL151	15:52:22	16:04:31	160	62	-	
004_FL150	16:08:04	16:19:24	160	62	-	
005_FL149	16:22:56	16:35:17	160	62	-	
006_FL148	16:37:58	16:49:41	160	62	-	
007_FL147	16:53:04	17:05:06	160	62	-	
008_FL146	17:08:20	17:20:08	160	62	-	
009_FL145	17:23:22	17:35:28	160	62	-	
010_FL144	17:38:21	17:49:36	160	62	-	
011_FL143	17:52:47	18:04:45	160	62	-	
012_FL142	18:07:44	18:18:42	160	62	-	

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 14, 15 & 16	**DATE:**	28 October 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	AA2125 & RWL1	**WIND:**	30-35kts @ 280°

ENGINE START:	20:40	**ENGINE OFF:**	00:06	**ENGINE TIME:**	03:26
GNSS START:	16:42	**GNSS START:**	00:06		
TAKEOFF:	20:52	**TOUCHDOWN:**	00:04	**AIR TIME**	03:12

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	21:03:00					Initialise GNSS over AA2125
	21:12:00					Dataset: 20151028_211252 (BL16)
000_FL177	21:12:52	21:19:41	160	62	-	
001_FL178	21:23:28	21:29:43	160	62	-	
002_FL179	21:34:58	21:42:23	160	62	-	
003_FL180	21:46:05	21:52:30	160	62	-	
004_FL181	21:56:21	22:03:53	160	62	-	
005_FL182	22:07:10	22:13:47	160	62	-	
FL183	22:14:00					Skip Flightline, not required
	22:19:00					Dataset: 20151028_211252 (BL15)
006_FL171	22:19:09	22:23:31	160	62	-	
007_FL172	22:27:03	22:30:57	160	62	-	
008_FL173	22:35:09	22:40:00	160	62	-	
009_FL174	22:43:11	22:47:38	160	62	-	
010_FL175	22:51:26	22:56:32	160	62	-	
	23:00:00					Dataset: 20151028_211252 (BL14)
011_FL170	23:00:39	23:04:34	160	62	-	
012_FL169	23:07:06	23:11:16	160	62	-	
013_FL168	23:14:09	23:18:43	160	62	-	
014_FL167	23:21:20	23:25:54	160	62	-	
015_FL166	23:28:49	23:33:40	160	62	-	
	23:42:00					Dataset: 20151028_211252 (BL16)
016_FL176	23:42:00	23:46:25	160	62	-	

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 07 & 08	**DATE:**	3 Novenmber 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0573 & RWL1	**WIND:**	40-45kts @ 215°

ENGINE START:	15:46	**ENGINE OFF:**	19:48	**ENGINE TIME:**	04:02
GNSS START:	15:51	**GNSS START:**			
TAKEOFF:	16:02	**TOUCHDOWN:**	19:44	**AIR TIME**	03:42

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	16:17:00					Initialise GNSS over MP0573
	16:25:00					Dataset: 20151003_162523 (BL07)
000_FL50	16:25:23	16:31:20	160	62	-	
001_FL49	16:34:23	16:40:09	160	62	-	
002_FL48	16:44:10	16:50:41	160	62	-	
003_FL47	16:53:37	17:00:01	160	62	-	
004_FL46	17:03:26	17:10:40	160	62	-	
005_FL45	17:13:21	17:20:08	160	62	-	
006_FL44	17:23:18	17:30:47	160	62	-	
007_FL43	17:33:31	17:40:45	160	62	-	
008_FL42	17:44:26	17:53:07	160	62	-	
009_FL41	17:55:48	18:04:01	160	62	-	
	18:12:00					Dataset: 20151003_162523 (BL08)
010_FL51	18:12:55	18:21:38	160	62	-	
011_FL52	18:24:18	18:32:44	160	62	-	
012_FL60	18:35:51	18:45:43	160	62	-	
013_FL61	18:48:23	18:58:26	160	62	-	
014_FL62	19:01:26	19:12:19	160	62	-	
015_FL63	19:15:00	19:25:36	160	62	-	
	19:30:00					Close GNSS over MP0573
						*GNSS RWL1 blown over
						*GNSS MP0573 blown over for a bit

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 10	**DATE:**	3 November 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0214 & RWL1	**WIND:**	30kts @ 195°

ENGINE START:	23:32	**ENGINE OFF:**	01:27	**ENGINE TIME:**	01:59
GNSS START:	23:37	**GNSS START:**	01:20		
TAKEOFF:	23:46	**TOUCHDOWN:**	01:17	**AIR TIME**	01:33

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	00:00:00					Initialise GNSS over MP0214
	00:08:00					Dataset: 20151104_000857 (BL10)
000_FL113	00:08:57	00:17:37	160	62	-	
001_FL112	00:20:26	00:29:16	160	62	-	
002_FL111	00:32:48	00:41:57	160	62	-	
003_FL110	00:44:44	00:53:38	160	62	-	
	01:08:00					Close GNSS over MP0214

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Calibration / Block 10	**DATE:**	7 November 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0214 & RWL1	**WIND:**	10-20kts @ 225°

ENGINE START:	15:14	**ENGINE OFF:**	21:15	**ENGINE TIME:**	06:01
GNSS START:	15:18	**GNSS START:**	21:10		
TAKEOFF:	15:30	**TOUCHDOWN:**	21:08	**AIR TIME**	05:38

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
						Calibration- use RWL1 base
	00:08:00					Begin 500m Calibration
000_FL6	15:37:47	15:38:58	440	13	-	
001_FL5	15:41:20	15:42:27	440	13	-	
002_FL1	15:46:16	15:47:30	440	13	-	
003_FL4	15:50:39	15:51:52	440	13	-	
004_FL2	15:54:27	15:55:42	440	13	-	
005_FL3	15:59:15	16:00:23	440	10	-	
						Begin 1000m Calibration
000_FL1	16:04:27	16:05:50	250	36	-	
001_FL2	16:08:37	16:09:51	250	36	-	
002_FL3	16:12:50	16:14:03	250	36	-	
003_FL4	16:16:56	16:18:16	250	36	-	
004_FL5	16:21:22	16:22:34	250	36	-	
005_FL6	16:26:44	16:28:02	250	36	-	
						Begin 1500m Calibration
000_FL1	16:36:38	16:38:03	160	63	-	
001_FL2	16:41:05	16:42:35	160	63	-	
002_FL3	16:45:16	16:46:41	160	63	-	
003_FL4	16:49:29	16:50:57	160	63	-	
004_FL5	16:53:36	16:55:05	160	63	-	
005_FL6	16:59:50	17:01:16	160	63	-	
	17:03:00					Calibration complete, overfly RWL1
	17:05:00					Transit to Block 10
						Restart AHAB OC - may have logged
						unintended files on Leica OC as well
	17:12:00					Over base MP0214
	17:21:00					Begin Block 10
000_FL109	17:21:13	17:30:22			-	
001_FL108	17:33:47	17:43:04			-	

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Calibration / Block 10	**DATE:**	7 November 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0214 & RWL1	**WIND:**	10-20kts @ 225°

ENGINE START:	15:14	**ENGINE OFF:**	21:15	**ENGINE TIME:**	06:01
GNSS START:	15:18	**GNSS START:**	21:10		
TAKEOFF:	15:30	**TOUCHDOWN:**	21:08	**AIR TIME**	05:38

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
002_FL107	17:46:42	17:56:02			-	
003_FL106	17:59:13	18:08:35			-	
004_FL105	18:11:20	18:20:47			-	
005_FL104	18:23:44	18:33:15			-	
006_FL103	18:36:10	18:45:46			-	
007_FL102	18:48:43	18:58:20			-	
008_FL101	19:01:24	19:11:10			-	
009_FL100	19:14:03	19:23:45			-	
010_FL99	19:26:41	19:36:10			-	
011_FL98	19:39:06	19:48:17			-	
012_FL97	19:51:21	20:00:29			-	
013_FL96	20:03:18	20:12:16			-	
014_FL95	20:15:07	20:23:40			-	
015_FL94	20:26:22	20:34:48			-	
016_FL93	20:37:25	20:45:42			-	
	20:47:00					Finish Block 10
	20:53:00					Over base MP0214
	20:59:00					Out of area to NW

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 8	**DATE:**	7 November 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0573 & RWL1	**WIND:**	10-15kts @ 220°

ENGINE START:	22:44	**ENGINE OFF:**	01:23	**ENGINE TIME:**	02:39
GNSS START:	22:47	**GNSS START:**	01:18		
TAKEOFF:	22:57	**TOUCHDOWN:**	01:16	**AIR TIME**	02:19

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	23:09:00					In air initialization over MP0573
	23:19:00					Begin Block 8
000_FL68	23:19:09	23:31:31	160	62	-	
001_FL67	23:34:20	23:47:02	160	62	-	
002_FL66	23:49:44	00:02:08	160	62	-	Invalid PPS at rollover
003_FL65	00:04:46	00:16:47	160	62	-	
004_FL64	00:19:22	00:31:16	160	62	-	
005_FL59	00:33:44	00:43:42	160	62	-	
006_FL58	00:46:24	00:56:18	160	62	-	
	01:00:00					Over base MP0573
	01:02:00					Returning to RWL

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 8 / Block 7	**DATE:**	8 November 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0573 & RWL1	**WIND:**	10-15kts @ 220°

ENGINE START:	14:19	**ENGINE OFF:**	17:01	**ENGINE TIME:**	02:42
GNSS START:	14:25	**GNSS START:**	16:54		
TAKEOFF:	14:30	**TOUCHDOWN:**	16:52	**AIR TIME**	02:22

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	14:50:00					In air initialization over MP0573
						Begin Block 8
000_FL53	14:58:58	15:08:16	160	62	-	Light dusting of snow on some lines
001_FL54	15:11:06	15:20:21	160	62	-	
002_FL55	15:23:17	15:32:53	160	62	-	
003_FL56	15:35:57	15:45:30	160	62	-	
004_FL57	15:48:30	15:58:08	160	62	-	
						Finished Block 8, move to Block 7
						Block 7 rerun lines due to bad base
005_FL43	16:03:18	16:10:40	160	62	-	Too much snow - Reject
006_FL44	16:12:58	16:20:17	160	62	-	Too much snow - Reject
	16:23:00					Over base MP0573
	16:25:00					Exit area and transit to Dixson (DWX)
						to evaluate snow cover
						Block 1 no snow, remaining blocks
						have thick snow cover
						Return to RWL

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 1	**DATE:**	8 November 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	DWX1	**WIND:**	25-30kts @ 200°

ENGINE START:	21:10	**ENGINE OFF:**	23:20	**ENGINE TIME:**	02:10
GNSS START:	21:12	**GNSS START:**	23:15		
TAKEOFF:	21:23	**TOUCHDOWN:**	23:13	**AIR TIME**	01:50

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
						Prior to start of survey, transit to
						Dixon airfield (DWX).
	20:03:00					Engine start
	20:12:00					Take off
	20:35:00					Land DWX
	20:38:00					Engines off
	20:55:00					Setup base on DWX1
						Start Block 1
000_FL11	21:35:02	21:40:12	160	62	-	Dusting of light snow on NE side
001_FL10	21:43:16	21:48:17	160	62	-	Generally in the shadows
002_FL9	21:51:45	21:56:55	160	62	-	
003_FL8	22:00:00	22:05:09	160	62	-	
004_FL7	22:08:26	22:13:37	160	62	-	
005_FL6	22:16:39	22:21:49	160	62	-	
006_FL5	22:24:57	22:30:12	160	62	-	
007_FL4	22:33:14	22:38:27	160	62	-	
008_FL3	22:41:51	22:47:09	160	62	-	
009_FL2	22:50:13	22:55:23	160	62	-	
010_FL1	22:58:28	23:03:47	160	62	-	
						Finished Block 1
	23:13:00					Land at DWX to recover base station
	23:22:00					Stop base DWX1 logging
	23:30:00					Restart engines
	23:35:00					Take off from DWX
	23:54:00					Land at RWL
	23:56:00					Engines off
						Additional transit engine time = 1:01
						Additional transit air time = 0:42
						Total engine time = 3:11
						Total air time = 2:32

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Block 19 / Block 13	**DATE:**	9 November 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	High clouds, clear
BASE STATION:	RWL1 and AA2125	**WIND:**	20-25kts @ 240°

ENGINE START:	14:59	**ENGINE OFF:**	17:46	**ENGINE TIME:**	02:47
GNSS START:	15:02	**GNSS START:**	17:39		
TAKEOFF:	15:08	**TOUCHDOWN:**	17:36	**AIR TIME**	02:28

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	15:26:00					Over base station AA2125
						Block 17 has too much snow for survey
						South end of Block 19 has some light snov
						Start mid Block 19
000_FL223	15:36:14	15:49:07	160	63	-	Snow dusting mostly at W end
001_FL222	15:52:31	16:05:37	160	63	-	Wind turbines at E end
002_FL221	16:09:02	16:22:03	160	63	-	
003_FL220	16:24:35	16:37:32	160	63	-	
004_FL219	16:41:06	16:53:49	160	63	-	
005_FL218	16:56:41	17:08:47	160	63	-	
						Getting too far from base, end area
	17:18:00					Over AA2125
	17:24:00					Begin Block 13
006_FL161	17:23:26	17:27:34	160	63	-	Too much snow at W end of line
						Return to RWL

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 24, 25, 26, 27, 28	**DATE:**	9 November 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	NR0387 & RWL1	**WIND:**	30-35kts @ 220°

ENGINE START:	19:59	**ENGINE OFF:**	01:04	**ENGINE TIME:**	05:05
GNSS START:	20:02	**GNSS START:**	00:58		
TAKEOFF:	20:11	**TOUCHDOWN:**	00:56	**AIR TIME**	04:45

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	20:22:00					Over base at NR0387 for initialization
						Begin Block 26
000_FL325	20:27:28	20:30:26	160	62	-	
001_FL326	20:38:58	20:41:34	160	62	-	
002_FL327	20:44:48	20:47:24	160	62	-	
						Finished Block 26, Start Block 27
003_FL332	20:51:32	20:53:33	160	62	-	
004_FL331	20:56:39	20:58:49	160	62	-	
005_FL330	21:01:43	21:04:00	160	62	-	
006_FL329	21:06:59	21:09:23	160	62	-	
007_FL328	21:12:55	21:15:24	160	62	-	
						Finished Block 27, Start Block 28
008_FL338	21:20:20	21:22:20	160	62	-	
009_FL337	21:26:23	21:28:39	160	62	-	
010_FL336	21:32:44	21:35:15	160	62	-	
011_FL335	21:38:30	21:41:05	160	62	-	
012_FL334	21:44:27	21:47:32	160	62	-	Flew low at SOL - may be out of spec
013_FL333	21:50:33	21:53:24	160	62	-	Lost altitude - flew low may be out of spec
						Finished Block 28, Start Block 25
014_FL320	21:56:58	21:58:55	160	62	-	
015_FL321	22:01:35	22:04:14	160	62	-	Lost altitude - flew low may be out of spec
016_FL322	22:09:01	22:11:54	160	62	-	
017_FL323	22:14:38	22:17:59	160	62	-	
018_FL324	22:21:59	22:25:28	160	62	-	
						Finished Block 25, Start Block 24
019_FL293	22:30:18	22:34:36	160	62	-	
020_FL294	22:37:07	22:42:34	160	62	-	
021_FL295	22:46:18	22:53:01	160	62	-	
022_FL296	22:56:15	23:03:42	160	62	-	
023_FL297	23:06:31	23:14:26	160	62	-	

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 24, 25, 26, 27, 28	**DATE:**	9 November 2015
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Ben H.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	NR0387 & RWL1	**WIND:**	30-35kts @ 220°

ENGINE START:	19:59	**ENGINE OFF:**	01:04	**ENGINE TIME:**	05:05
GNSS START:	20:02	**GNSS START:**	00:58		
TAKEOFF:	20:11	**TOUCHDOWN:**	00:56	**AIR TIME**	04:45

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
024_FL298	23:17:34	23:26:07	160	62	-	
025_FL299	23:29:11	23:37:55	160	62	-	
026_FL300	23:40:47	23:49:53	160	62	-	
027_FL301	23:52:30	00:01:48	160	62	-	Invalid PPS at rollover
028_FL302	00:04:27	00:13:57	160	62	-	
029_FL303	00:17:41	00:27:09	160	62	-	
030_FL304	00:30:20	00:39:54	160	62	-	
	00:44:00					Over base at NR0387
	00:45:00					Return to RWL

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 19	**DATE:**	17 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	AA2125	**WIND:**	10-15kts @ 200°

ENGINE START:	14:12	**ENGINE OFF:**	18:42	**ENGINE TIME:**	04:30
GNSS START:	14:15	**GNSS START:**	18:41		
TAKEOFF:	14:22	**TOUCHDOWN:**	18:39	**AIR TIME**	04:17

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	14:40:00					Initialize GNSS over AA2125
	14:47:00					Dataset: 20160617_145005 (BL19)
000_FL229	14:47:22	15:00:08	180	55	-	
001_FL228	15:03:09	15:16:25	180	55	-	
002_FL227	15:19:35	15:32:32	180	55	-	
003_FL226	15:35:18	15:48:10	180	55	-	
004_FL225	15:51:26	16:04:11	180	55	-	Back reflection
005_FL224	16:06:59	16:20:18	180	55	-	
006_FL217	16:22:27	16:34:50	180	55	-	
007_FL216	16:37:31	16:49:50	180	55	-	
008_FL215	16:53:03	17:05:50	180	55	-	
009_FL214	17:08:23	17:20:07	180	55	-	
010_FL213	17:23:25	17:35:29	180	55	-	
011_FL212	17:38:22	17:49:39	180	55	-	
012_FL211	17:52:08	18:03:50	180	55	-	
013_FL210	18:06:08	18:18:15	180	55	-	Fifo for sensoe 1 peaks 50% full
	18:25:00					Close GNSS over AA2125

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 21	**DATE:**	18 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0498	**WIND:**	15-20kts @ 230°

ENGINE START:	12:13	**ENGINE OFF:**	17:18	**ENGINE TIME:**	05:05
GNSS START:	12:17	**GNSS START:**	17:18		
TAKEOFF:	12:25	**TOUCHDOWN:**	17:15	**AIR TIME**	04:50

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:40:00					Initialize GNSS over MP0498
	12:48:00					Dataset: 20160618_125118 (BL21)
000_FL258	12:48:35	12:59:47	180	55	-	
001_FL257	13:02:42	13:13:30	180	55	-	
002_FL256	13:17:06	13:26:56	180	55	-	
003_FL255	13:30:15	13:39:03	180	55	-	
004_FL254	13:42:41	13:50:57	180	55	-	
005_FL253	13:54:25	14:01:29	180	55	-	
006_FL252	14:05:06	14:11:33	180	55	-	
007_FL251	14:15:10	14:20:43	180	55	-	
008_FL250	14:24:32	14:29:10	180	55	-	
009_FL249	14:32:49	14:34:55	180	55	-	Force Stop (Scanner Speed High)
010_FL249	14:35:49	14:36:17	180	55	-	BAD: Test
011_FL249	14:36:29	14:36:44	180	55	-	BAD: Test
012_FL249	14:40:37	14:44:29	180	55	-	Refly due to Force Stop
013_FL248	14:48:06	14:51:11	180	55	-	
014_FL247	14:54:37	14:56:41	180	55	-	
015_FL259	15:04:23	15:15:28	180	55	-	
016_FL260	15:18:06	15:29:01	180	55	-	
017_FL261	15:32:13	15:43:06	180	55	-	
018_FL262	15:45:43	15:56:31	180	55	-	
019_FL263	15:59:09	16:09:45	180	55	-	
020_FL264	16:12:40	16:23:40	180	55	-	
021_FL265	16:27:06	16:37:51	180	55	-	
022_FL266	16:40:41	16:51:30	180	55	-	
	16:55:00					Close GNSS over MP0498

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 13, 20	**DATE:**	19 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Cloudy
BASE STATION:	MP0486	**WIND:**	30-40kts @ 250°

ENGINE START:	12:30	**ENGINE OFF:**	16:58	**ENGINE TIME:**	04:28
GNSS START:	12:34	**GNSS START:**	16:57		
TAKEOFF:	12:43	**TOUCHDOWN:**	16:53	**AIR TIME**	04:10

FL #	START TIME	END TIME	TOPO PRF	TOPO PWR	BATHY PWR CHII	REMARKS
	12:50:00					Initialize GNSS over MP0486
	13:01:00					Dataset: 20160619_130347 (BL20)
000_FL246	13:01:04	13:09:03	180	55	-	
001_FL245	13:11:26	13:18:40	180	55	-	
002_FL244	13:22:04	13:29:59	180	55	-	
003_FL243	13:33:00	13:41:16	180	55	-	
004_FL242	13:44:33	13:52:58	180	55	-	
005_FL241	13:55:54	14:04:01	180	55	-	
006_FL240	14:07:29	14:15:31	180	55	-	
007_FL239	14:18:22	14:26:42	180	55	-	
008_FL238	14:29:39	14:37:27	180	55	-	
009_FL237	14:40:13	14:48:00	180	55	-	
010_FL236	14:50:48	14:58:24	180	55	-	
011_FL235	15:00:50	15:08:29	180	55	-	
012_FL234	15:11:17	15:18:30	180	55	-	
013_FL233	15:21:15	15:28:24	180	55	-	
014_FL232	15:31:22	15:38:13	180	55	-	
015_FL231	15:40:45	15:47:29	180	55	-	
016_FL230	15:50:16	15:56:46	180	55	-	
017_FL165	16:01:34	16:05:31	180	55	-	Start BL13
018_FL164	16:09:28	16:13:36	180	55	-	
019_FL163	16:16:52	16:21:08	180	55	-	
020_FL162	16:24:49	16:29:07	180	55	-	
021_FL161	16:32:15	16:36:27	180	55	-	
	16:40:00					Close GNSS over MP0486

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 21	**DATE:**	19 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0498	**WIND:**	25kts @ 250°

ENGINE START:	17:55	**ENGINE OFF:**	19:16	**ENGINE TIME:**	01:21
GNSS START:	17:58	**GNSS START:**	-		
TAKEOFF:	18:06	**TOUCHDOWN:**	19:14	**AIR TIME**	01:08

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	18:22:00					Initialize GNSS over MP0498
	18:30:00					Dataset: 20160619_183301 (BL21)
000_FL267	18:30:18	18:42:01	180	55	-	
001_FL268	18:45:23	18:50:35	180	55	-	
	18:55:00					Close GNSS over MP0498

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 07, 22	**DATE:**	20 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Cloudy
BASE STATION:	MP0498	**WIND:**	

ENGINE START:	12:03	**ENGINE OFF:**	14:48	**ENGINE TIME:**	02:45
GNSS START:	12:06	**GNSS START:**			
TAKEOFF:	12:16	**TOUCHDOWN:**	14:45	**AIR TIME**	02:29

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:32:00					Initialize GNSS over MP0498
	12:40:00					Dataset: 20160620_124303
000_FL279	12:40:20	12:44:36	180	55	-	BL22
001_FL278	12:47:40	12:52:11	180	55	-	Clouds @ East Side
002_FL277	12:55:37	13:00:07	180	55	-	Clouds @ East Side
003_FL276	13:02:49	13:06:57	180	55	-	Clouds @ East Side
	13:07:00					Increasing Clouds, Abort Block
	13:12:00					Close GNSS over MP0498
	13:12:00					Transit to BL07
	13:28:00					Initialize GNSS over RWL1
004_FL41	13:41:01	13:44:55	180	55	-	BL07, Large Snow Drifts
	13:50:00					Land @ Saratoga (Hatch Open)
	14:08:00					Take off from Saratoga
	14:15:00					Check conditions at other sites

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 24	**DATE:**	20 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	NR0387	**WIND:**	

ENGINE START:	22:53	**ENGINE OFF:**	23:35	**ENGINE TIME:**	00:42
GNSS START:	22:58	**GNSS START:**			
TAKEOFF:	23:07	**TOUCHDOWN:**	23:32	**AIR TIME**	00:25

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	23:15:00					Initialize GNSS over NR0387
	23:20:00					Digitizer Temperature Ciritical, Abort

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 12, 24, 25, 26, 27, 28	**DATE:**	21 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	NR0387	**WIND:**	20-25kts @ 250°

ENGINE START:	12:02	**ENGINE OFF:**	16:52	**ENGINE TIME:**	04:50
GNSS START:	12:05	**GNSS START:**	16:52		
TAKEOFF:	12:12	**TOUCHDOWN:**	16:50	**AIR TIME**	04:38

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:20:00					Initialize GNSS over NR0387
	12:32:00					Dataset: 20160621_123444
000_FL321	12:32:01	12:34:25	180	55	-	BL25
001_FL356	12:37:58	12:39:18	180	55	-	Start BL26
002_FL326	12:43:52	12:46:33	180	55	-	
003_FL333	12:49:34	12:52:24	180	55	-	Start BL28
004_FL335	12:54:45	12:57:15	180	55	-	
005_FL337	13:01:03	13:03:28	180	55	-	
006_FL357	13:09:13	13:10:46	180	55	-	
007_FL355	13:16:28	13:17:48	180	55	-	Start BL24
008_FL305	13:24:04	13:33:25	180	55	-	
009_FL306	13:36:34	13:45:42	180	55	-	
010_FL307	13:48:38	13:57:55	180	55	-	
011_FL308	14:00:45	14:09:25	180	55	-	
012_FL309	14:12:21	14:20:57	180	55	-	
013_FL310	14:23:57	14:32:37	180	55	-	
014_FL311	14:35:36	14:43:52	180	55	-	
015_FL312	14:46:42	14:55:01	180	55	-	
016_FL313	14:57:56	15:06:09	180	55	-	
017_FL314	15:08:40	15:16:38	180	55	-	
018_FL315	15:19:34	15:27:15	180	55	-	
019_FL316	15:29:42	15:37:23	180	55	-	
020_FL317	15:39:57	15:47:17	180	55	-	
021_FL318	15:50:13	15:57:36	180	55	-	
022_FL319	16:00:31	16:07:41	180	55	-	
023_FL136	16:11:15	16:18:47	180	55	-	Start BL12
024_FL135	16:21:48	16:29:08	180	55	-	
025_FL350	16:32:40	16:33:59	180	55	-	

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 12, 24, 25, 26, 27, 28	**DATE:**	21 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	NR0387	**WIND:**	20-25kts @ 250°

ENGINE START:	12:02	**ENGINE OFF:**	16:52	**ENGINE TIME:**	04:50
GNSS START:	12:05	**GNSS START:**	16:52		
TAKEOFF:	12:12	**TOUCHDOWN:**	16:50	**AIR TIME**	04:38

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	16:08:00					Close GNSS over NR0387

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 21, 22, 23	**DATE:**	22 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0498	**WIND:**	20-25kts @ 255°

ENGINE START:	12:10	**ENGINE OFF:**	17:37	**ENGINE TIME:**	05:27
GNSS START:	12:17	**GNSS START:**	17:37		
TAKEOFF:	12:27	**TOUCHDOWN:**	17:35	**AIR TIME**	05:08

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:45:00					Initialize GNSS over MP0498
	12:50:00					Dataset: 20160622_125334
000_FL279	12:50:51	12:55:29	180	55	-	Start BL22
001_FL278	12:58:29	13:03:13	180	55	-	
002_FL277	13:08:30	13:13:03	180	55	-	
003_FL276	13:16:01	13:20:08	180	55	-	
004_FL275	13:24:01	13:27:57	180	55	-	
005_FL274	13:31:50	13:35:06	180	55	-	
006_FL273	13:39:45	13:42:53	180	55	-	
007_FL272	13:45:50	13:48:16	180	55	-	
008_FL280	13:54:46	14:03:34	180	55	-	Start BL23
009_FL281	14:06:49	14:14:43	180	55	-	
010_FL282	14:19:45	14:27:51	180	55	-	
011_FL283	14:30:45	14:37:54	180	55	-	
012_FL284	14:41:47	14:49:04	180	55	-	
013_FL285	14:52:03	14:58:40	180	55	-	
014_FL286	15:01:51	15:09:03	180	55	-	
015_FL287	15:12:01	15:21:18	180	55	-	
016_FL288	15:24:58	15:35:04	180	55	-	
017_FL289	15:38:23	15:48:06	180	55	-	
018_FL290	15:51:27	16:01:47	180	55	-	
019_FL291	16:04:46	16:14:51	180	55	-	Force Stop @ end
020_FL292	16:18:21	16:28:32	180	55	-	
021_FL267	16:32:17	16:43:05	180	55	-	Start BL21
022_FL268	16:46:41	16:57:50	180	55	-	
023_FL269	17:00:42	17:11:34	180	55	-	
	17:15:00					Close GNSS over MP0498

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 2, 3, 4, 5, 6	**DATE:**	23 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0498	**WIND:**	25-30kts @ 220°

ENGINE START:	12:13	**ENGINE OFF:**	16:13	**ENGINE TIME:**	04:00
GNSS START:	12:13	**GNSS START:**	16:18		
TAKEOFF:	12:24	**TOUCHDOWN:**	16:11	**AIR TIME**	03:47

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:13:00					Initialize GNSS next to DWX1
	12:38:00					Dataset: 20160623_124134
000_FL40	12:38:51	12:43:38	180	55	-	Start BL06
001_FL39	12:46:23	12:51:07	180	55	-	
002_FL38	12:53:47	12:58:36	180	55	-	
003_FL37	13:01:35	13:06:19	180	55	-	
004_FL36	13:09:06	13:13:49	180	55	-	
005_FL35	13:17:35	13:21:40	180	55	-	
006_FL34	13:24:14	13:27:49	180	55	-	
007_FL33	13:31:00	13:34:11	180	55	-	
008_FL32	13:36:40	13:39:25	180	55	-	
009_FL31	13:42:37	13:44:46	180	55	-	
010_FL30	13:47:44	13:49:24	180	55	-	
011_FL29	13:54:55	14:00:04	180	55	-	Start BL05
012_FL28	14:03:06	14:08:36	180	55	-	
013_FL27	14:11:21	14:16:37	180	55	-	
014_FL22	14:19:24	14:24:03	180	55	-	Start BL03
015_FL21	14:27:05	14:31:41	180	55	-	
016_FL20	14:35:06	14:39:50	180	55	-	
017_FL19	14:42:27	14:46:45	180	55	-	
018_FL18	14:49:54	14:53:54	180	55	-	
019_FL17	14:56:26	14:59:48	180	55	-	
020_FL16	15:03:33	15:06:28	180	55	-	
021_FL15	15:08:57	15:11:16	180	55	-	
022_FL14	15:15:30	15:17:25	180	55	-	
023_FL26	15:21:16	15:24:39	180	55	-	Start BL04
024_FL25	15:28:19	15:31:49	180	55	-	
025_FL24	15:35:01	15:38:30	180	55	-	

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 2, 3, 4, 5, 6	**DATE:**	23 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0498	**WIND:**	25-30kts @ 220°

ENGINE START:	12:13	**ENGINE OFF:**	16:13	**ENGINE TIME:**	04:00
GNSS START:	12:13	**GNSS START:**	16:18		
TAKEOFF:	12:24	**TOUCHDOWN:**	16:11	**AIR TIME**	03:47

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
026_FL23	15:42:18	15:46:00	180	55	-	
027_FL13	15:50:30	15:54:56	180	55	-	Start BL02
028_FL12	15:58:31	16:03:10	180	55	-	
	16:13:00					Close GNSS next to DWX1
	11:20:00					Engine Start RWL:
	11:30:00					Takeoff RWL:
	11:51:00					Touchdown DX:
	11:54:00					Engine Off DX:
						Surveying…
	16:32:00					Engine Start DX:
	16:40:00					Takeoff DX:
	16:58:00					Touchdown RWL:
	17:02:00					Engine Off RWL:

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 8, 9	**DATE:**	24 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Eric L.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0214	**WIND:**	20-23kts @ 230°

ENGINE START:	12:40	**ENGINE OFF:**	17:15	**ENGINE TIME:**	04:35
GNSS START:	12:40	**GNSS START:**	17:20		
TAKEOFF:	13:02	**TOUCHDOWN:**	17:12	**AIR TIME**	04:10

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	13:30:00					Initialize GNSS over MP0214
	13:34:00					Dataset: 20160624_133722
000_FL75	13:34:39	13:41:35	180	55	-	Start BL09
001_FL76	13:44:33	13:51:16	180	55	-	
002_FL77	13:54:14	14:01:11	180	55	-	
003_FL78	14:04:45	14:11:39	180	55	-	
004_FL79	14:15:07	14:22:00	180	55	-	
005_FL80	14:25:20	14:32:16	180	55	-	
006_FL81	14:35:26	14:42:09	180	55	-	
007_FL82	14:45:57	14:52:31	180	55	-	
008_FL83	14:55:48	15:02:08	180	55	-	
009_FL84	15:05:40	15:11:35	180	55	-	
010_FL85	15:14:56	15:14:58	180	55	-	Force stop mid line - Needs Re-run
000_FL86	15:37:55	15:42:41	180	55	-	Force stop - already re-run
001_FL87	15:46:21	15:50:44	180	55	-	
002_FL88	15:53:42	15:57:35	180	55	-	
003_FL89	16:01:06	16:04:29	180	55	-	
004_FL90	16:07:44	16:10:38	180	55	-	
005_FL91	16:14:24	16:16:46	180	55	-	
006_FL92	16:20:01	16:21:45	180	55	-	
007_FL73	16:29:47	16:37:17	180	55	-	Start BL08
008_FL72	16:39:57	16:48:03	180	55	-	
009_FL71	16:50:54	17:02:06	180	55	-	

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blocks 8, 9, 10, 11, 12	**DATE:**	25 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Eric L.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0214	**WIND:**	15-40kts @ 240°

ENGINE START:	12:07	**ENGINE OFF:**	17:22	**ENGINE TIME:**	05:15
GNSS START:	12:07	**GNSS STOP:**	17:28		
TAKEOFF:	12:20	**TOUCHDOWN:**	17:18	**AIR TIME**	04:58

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:31:00					Initialize GNSS over MP0214
	12:35:00					Dataset: 20160625_123803
000_FL85	12:35:20	12:40:42	180	55	-	Start BL09
001_FL70	12:44:54	12:53:26	180	55	-	Start BL08
002_FL69	12:56:06	13:04:46	180	55	-	
003_FL63	13:07:25	13:18:53	180	55	-	
004_FL62	13:21:45	13:32:37	180	55	-	
005_FL61	13:35:42	13:46:51	180	55	-	
006_FL60	13:49:20	13:59:53	180	55	-	
007_FL339	14:03:37	14:05:49	180	55	-	
008_FL52	14:13:27	14:22:40	180	55	-	Some small snow patches - do not proces
009_FL51	14:25:27	14:34:45	180	55	-	Some small snow patches - do not proces
010_FL113	14:40:11	14:49:18	180	55	-	Start BL10
011_FL112	14:52:03	15:01:27	180	55	-	
012_FL111	15:04:09	15:13:34	180	55	-	
013_FL110	15:16:53	15:26:10	180	55	-	
014_FL343	15:33:24	15:34:46	180	55	-	
015_FL340	15:37:48	15:40:46	180	55	-	
016_FL342	15:43:39	15:44:58	180	55	-	
017_FL341	15:52:51	15:54:33	180	55	-	
018_FL347	16:16:38	16:18:10	180	55	-	Start BL12 - do not process
019_FL348	16:18:58	16:21:29	180	55	-	Do not process
020_FL349	16:28:17	16:29:47	180	55	-	Too fast - 160 kts - do not process
021_FL349	16:35:49	16:37:20	180	55	-	Re-run at <130 kts - do not process
022_FL344	16:43:44	16:45:43	180	55	-	Start BL11 - ~45 km to MP0214, and - do
023_FL345	16:50:20	16:51:46	180	55	-	closer to RWL1 Base Station, but - do not
024_FL346	16:55:27	16:56:52	180	55	-	that station ran out of batteries - do not p

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blks 11,12,14,15,16,19,21	**DATE:**	26 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Eric L.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	AA2125 and RWL1	**WIND:**	15-25kts @ 250°

ENGINE START:	14:58	**ENGINE OFF:**	19:19	**ENGINE TIME:**	06:10
GNSS START:	14:50	**GNSS STOP:**	19:25		
TAKEOFF:	15:16	**TOUCHDOWN:**	19:14	**AIR TIME**	05:28

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	15:30:00					Initialize GNSS over AA2125
	15:40:00					Dataset: 20160626_154007
000_FL351	15:40:07	15:42:15	180	55	-	Start BL15
001_FL352	15:45:07	15:47:16	180	55	-	
002_FL353	15:50:17	15:51:39	180	55	-	Start BL16
003_FL363	15:57:11	15:58:48	180	55	-	Start BL14
004_FL172	16:05:07	16:09:37	180	55	-	Start BL15
005_FL174	16:12:37	16:17:17	180	55	-	"Forced Stop" @ EOL
007_FL176	16:21:40	16:26:34	180	55	-	Start BL16
008_FL178	16:29:22	16:35:53	180	55	-	
009_FL180	16:39:04	16:46:08	180	55	-	
010_FL182	16:49:05	16:56:08	180	55	-	
011_FL354	17:02:30	17:04:05	180	55	-	Start BL19
012_FL366	17:08:07	17:10:54	180	55	-	
013_FL365	17:14:09	17:17:38	180	55	-	
014_FL364	17:18:40	17:21:40	180	55	-	
015_FL271	17:26:19	17:37:10	180	55	-	Start BL21
016_FL270	17:41:09	17:52:34	180	55	-	
	17:55:00				-	Close GNSS over AA2125
	18:11:00				-	Initialize GNSS over RWL1
017_FL346	18:21:07	18:22:27	180	55	-	Start BL11
018_FL345	18:27:43	18:29:04	180	55	-	
019_FL344	18:35:45	18:37:33	180	55	-	
020_FL347	18:50:16	18:51:45	180	55	-	Start BL12
021_FL348	18:52:32	18:55:12	180	55	-	
022_FL349	19:00:12	19:01:44	180	55	-	
023_FL358	19:06:07	19:08:38	180	55	-	
	19:25:00					Close GNSS next to RWL1

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / Blks 11,12,14,15,16,19,21	**DATE:**	26 June 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Ray L.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Eric L.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	AA2125 and RWL1	**WIND:**	15-25kts @ 250°

ENGINE START:	14:58	**ENGINE OFF:**	19:19	**ENGINE TIME:**	06:10
GNSS START:	14:50	**GNSS STOP:**	19:25		
TAKEOFF:	15:16	**TOUCHDOWN:**	19:14	**AIR TIME**	05:28

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:00:00					Engine start
	12:16:00					Takeoff
						System Power issues
						and troubleshooting
	13:46:00					Touchdown
	13:49:00					Engines off

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / BL15, 16, 17, 18, 19, 20, 29	**DATE:**	23 July 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Dave S.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	AA2125 and RWL1	**WIND:**	25-30kts @ 270°

ENGINE START:	12:15	**ENGINE OFF:**	17:30	**ENGINE TIME:**	05:15
GNSS START:	12:19	**GNSS STOP:**	17:27		
TAKEOFF:	12:28	**TOUCHDOWN:**	17:24	**AIR TIME**	04:56

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:40:00					Initialize GNSS over AA2125
	12:47:00					Dataset: 20160723_125010
000_FL193	12:47:00	12:52:04	180	55	-	Start BL17
001_FL192	12:54:51	12:59:55	180	55	-	
002_FL191	13:01:53	13:07:09	180	55	-	
003_FL190	13:09:15	13:14:29	180	55	-	
004_FL189	13:16:45	13:22:06	180	55	-	
005_FL188	13:24:41	13:30:05	180	55	-	
006_FL187	13:32:25	13:37:50	180	55	-	
007_FL186	13:40:12	13:45:45	180	55	-	
008_FL185	13:48:23	13:53:54	180	55	-	
009_FL184	13:56:27	14:01:57	180	55	-	
010_FL419	14:04:35	14:10:23	180	55	-	
011_FL204	14:15:09	14:20:17	180	55	-	Start BL18
012_FL205	14:23:40	14:29:04	180	55	-	
013_FL206	14:32:09	14:37:10	180	55	-	
014_FL207	14:40:06	14:45:02	180	55	-	
015_FL208	14:48:12	14:52:38	180	55	-	
016_FL209	14:55:32	14:59:56	180	55	-	
017_FL203	15:02:36	15:07:31	180	55	-	
018_FL202	15:10:08	15:14:55	180	55	-	
019_FL201	15:17:18	15:21:31	180	55	-	
020_FL200	15:24:19	15:28:27	180	55	-	
021_FL199	15:30:37	15:34:14	180	55	-	
022_FL198	15:36:50	15:40:10	180	55	-	
023_FL197	15:42:37	15:45:27	180	55	-	
024_FL196	15:47:54	15:50:27	180	55	-	
025_FL195	15:52:35	15:54:42	180	55	-	

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / BL15, 16, 17, 18, 19, 20, 29	**DATE:**	23 July 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Dave S.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	AA2125 and RWL1	**WIND:**	25-30kts @ 270°

ENGINE START:	12:15	**ENGINE OFF:**	17:30	**ENGINE TIME:**	05:15
GNSS START:	12:19	**GNSS STOP:**	17:27		
TAKEOFF:	12:28	**TOUCHDOWN:**	17:24	**AIR TIME**	04:56

FL #	START TIME	END TIME	TOPO PRF	TOPO PWR	BATHY PWR CHII	REMARKS
026_FL194	15:57:14	15:58:57	180	55	-	
027_FL417	16:03:30	16:05:09	180	55	-	Start BL16
028_FL418	16:07:30	16:09:19	180	55	-	Start BL15
029_FL420	16:11:08	16:14:47	180	55	-	Satrt BL29
030_FL421	16:17:22	16:20:53	180	55	-	
031_FL422	16:22:53	16:25:20	180	55	-	
032_FL423	16:31:02	16:32:34	180	55	-	Satrt BL19
033_FL426	16:34:33	16:40:33	180	55	-	
034_FL430	16:44:29	16:47:49	180	55	-	Start BL20
035_FL431	16:49:54	16:55:23	180	55	-	
036_FL432	16:57:16	17:02:57	180	55	-	
	17:07:00					Close GNSS over AA2125

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / BL07, 08, 10, 30	**DATE:**	24 July 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Dave S.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0573 and RWL1	**WIND:**	15kts @ 250°

ENGINE START:	12:17	**ENGINE OFF:**	17:52	**ENGINE TIME:**	05:35
GNSS START:	12:21	**GNSS STOP:**	17:51		
TAKEOFF:	12:31	**TOUCHDOWN:**	17:47	**AIR TIME**	05:16

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:40:00					Initialize GNSS over MP0573
	12:47:00					Dataset: 20160724_125227
000_FL41	12:49:17	12:57:12	180	55	-	Start BL07
001_FL42	12:59:24	13:07:06	180	55	-	
002_FL43	13:09:32	13:17:06	180	55	-	
003_FL44	13:19:19	13:26:38	180	55	-	
004_FL45	13:29:25	13:36:42	180	55	-	
005_FL46	13:38:47	13:45:32	180	55	-	
006_FL47	13:48:07	13:54:43	180	55	-	
007_FL48	13:57:00	14:03:28	180	55	-	
008_FL49	14:06:09	14:12:19	180	55	-	
009_FL50	14:14:41	14:20:20	180	55	-	
010_FL382	14:25:29	14:34:22	180	55	-	Start BL08
011_FL383	14:37:05	14:46:02	180	55	-	
012_FL384	14:51:27	15:00:21	180	55	-	
013_FL373	15:04:03	15:08:17	180	55	-	
014_FL374	15:10:46	15:14:51	180	55	-	
015_FL375	15:17:44	15:22:42	180	55	-	
016_FL376	15:24:49	15:30:30	180	55	-	
017_FL377	15:32:55	15:38:38	180	55	-	
018_FL378	15:41:03	15:46:48	180	55	-	
019_FL379	15:49:21	15:55:12	180	55	-	
020_FL380	16:00:49	16:03:54	180	55	-	
021_FL381	16:06:25	16:08:09	180	55	-	
022_FL386	16:13:10	16:14:41	180	55	-	
023_FL387	16:15:50	16:17:48	180	55	-	Start BL10
024_FL388	16:20:33	16:22:15	180	55	-	
025_FL389	16:24:18	16:26:18	180	55	-	

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / BL07, 08, 10, 30	**DATE:**	24 July 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Dave S.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0573 and RWL1	**WIND:**	15kts @ 250°

ENGINE START:	12:17	**ENGINE OFF:**	17:52	**ENGINE TIME:**	05:35
GNSS START:	12:21	**GNSS STOP:**	17:51		
TAKEOFF:	12:31	**TOUCHDOWN:**	17:47	**AIR TIME**	05:16

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
026_FL390	16:29:05	16:32:11	180	55	-	Start BL30
027_FL391	16:34:22	16:39:09	180	55	-	
028_FL392	16:43:33	16:49:52	180	55	-	
029_FL393	16:51:51	16:59:57	180	55	-	
030_FL394	17:02:58	17:11:49	180	55	-	
031_FL395	17:14:01	17:23:10	180	55	-	
032_FL385	17:29:08	17:30:40	180	55	-	Start BL08
	17:35:00					Close GNSS over MP0573

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / BL11-13, 20, 24, 25, 28, 30	**DATE:**	25 July 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Dave S.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0479 and RWL1	**WIND:**	15-20kts @ 260°

ENGINE START:	12:08	**ENGINE OFF:**	16:29	**ENGINE TIME:**	04:21
GNSS START:	12:12	**GNSS STOP:**	16:28		
TAKEOFF:	12:23	**TOUCHDOWN:**	16:25	**AIR TIME**	04:02

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:30:00					Initialize GNSS over MP0479
	12:34:00					Dataset: 20160725_123750
000_FL396	12:34:40	12:43:44	180	55	-	Start BL30
001_FL397	12:45:42	12:54:43	180	55	-	
002_FL398	12:57:04	13:06:07	180	55	-	
003_FL399	13:08:09	13:17:10	180	55	-	
004_FL400	13:19:32	13:28:33	180	55	-	
005_FL407	13:38:07	13:40:08	180	55	-	Start BL12
006_FL409	13:41:23	13:43:54	180	55	-	
007_FL414	13:45:53	13:47:51	180	55	-	
008_FL413	13:49:53	13:51:59	180	55	-	
009_FL412	13:54:01	13:55:53	180	55	-	
010_FL408	13:57:59	13:59:32	180	55	-	
011_FL411	14:03:20	14:05:31	180	55	-	
012_FL416	14:08:45	14:10:10	180	55	-	Start BL13
013_FL415	14:13:11	14:15:09	180	55	-	
014_FL410	14:17:29	14:20:27	180	55	-	Start BL12
015_FL450	14:22:41	14:25:29	180	55	-	Start BL24
016_FL449	14:27:38	14:30:31	180	55	-	
017_FL451	14:33:54	14:35:39	180	55	-	
018_FL433	14:39:36	14:43:34	180	55	-	Start BL20
019_FL434	14:46:23	14:47:54	180	55	-	
020_FL435	14:49:35	14:51:17	180	55	-	
021_FL452	15:00:54	15:02:56	180	55	-	Start BL24
022_FL453	15:04:49	15:06:41	180	55	-	
023_FL456	15:09:19	15:11:10	180	55	-	Start BL28
024_FL454	15:13:40	15:16:04	180	55	-	Start BL24
025_FL455	15:18:47	15:21:58	180	55	-	Start BL25

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / BL11-13, 20, 24, 25, 28, 30	**DATE:**	25 July 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Dave S.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0479 and RWL1	**WIND:**	15-20kts @ 260°

ENGINE START:	12:08	**ENGINE OFF:**	16:29	**ENGINE TIME:**	04:21
GNSS START:	12:12	**GNSS STOP:**	16:28		
TAKEOFF:	12:23	**TOUCHDOWN:**	16:25	**AIR TIME**	04:02

FL #	START TIME	END TIME	TOPO PRF	TOPO PWR	BATHY PWR CHII	REMARKS
						Close GNSS over MP0479
						Initialize GNSS over RWL1
026_FL402	15:43:35	15:46:24	180	55	-	Start BL11
027_FL401	15:48:13	15:49:58	180	55	-	
028_FL406	15:53:15	15:56:11	180	55	-	
029_FL405	16:00:17	16:01:59	180	55	-	
030_FL403	16:06:25	16:08:36	180	55	-	
031_FL404	16:16:42	16:18:49	180	55	-	
						Close GNSS over MP0573

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / BL19, 21, 22, 23	**DATE:**	26 July 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Dave S.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	MP0499	**WIND:**	20-25kts @ 260°

ENGINE START:	12:04	**ENGINE OFF:**	15:39	**ENGINE TIME:**	03:35
GNSS START:	-	**GNSS STOP:**	-		
TAKEOFF:	12:11	**TOUCHDOWN:**	15:35	**AIR TIME**	03:24

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	12:28:00					Initialize GNSS over MP0499
	12:34:00					Dataset: 20160726_123748
000_FL437	12:34:38	12:36:32	180	55	-	Start BL21
001_FL442	12:41:02	12:46:49	180	55	-	Start BL23
002_FL443	12:50:37	12:52:24	180	55	-	
003_FL444	12:53:28	12:55:27	180	55	-	
004_FL441	13:00:11	13:02:12	180	55	-	Start BL22
005_FL440	13:05:00	13:08:46	180	55	-	
006_FL439	13:10:49	13:14:25	180	55	-	
007_FL438	13:17:27	13:18:56	180	55	-	
008_FL445	13:20:22	13:21:49	180	55	-	Start BL23
009_FL448	13:24:54	13:27:40	180	55	-	
010_FL447	13:30:37	13:38:44	180	55	-	
011_FL446	13:41:06	13:49:21	180	55	-	
012_FL436	13:55:36	13:57:06	180	55	-	Start BL21
013_FL424	14:01:25	14:04:23	180	55	-	Start BL19
014_FL425	14:09:38	14:11:09	180	55	-	
015_FL427	14:16:52	14:28:23	180	55	-	
016_FL428	14:30:47	14:42:34	180	55	-	
017_FL429	14:44:44	14:56:21	180	55	-	
						Close GNSS over MP0499
						Land at Dixon (DWX) Airport

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / BL01, 03, 04, 06	**DATE:**	26 July 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Dave S.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	DWX1	**WIND:**	10kts @ 270°

ENGINE START:	16:01	**ENGINE OFF:**	17:46	**ENGINE TIME:**	01:45
GNSS START:	16:06	**GNSS STOP:**	-		
TAKEOFF:	16:16	**TOUCHDOWN:**	17:43	**AIR TIME**	01:27

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	16:16:00					Take off from Dixon (DWX) Airport
	16:27:00					Dataset: 20160726_163037
000_FL457	16:27:27	16:30:22	180	55	-	Start BL01
001_FL369	16:36:01	16:37:46	180	55	-	Start BL04
002_FL370	16:39:46	16:41:25	180	55	-	
003_FL367	16:44:33	16:46:07	180	55	-	Start BL03
004_FL368	16:48:04	16:50:15	180	55	-	
005_FL372	16:52:33	16:54:15	180	55	-	Start BL06
006_FL371	16:56:18	16:57:48	180	55	-	
	17:06:00					Land at Dixon (DWX) Airport
	17:09:00					Close GNSS at DWX1
	17:22:00					Take off from Dixon (DWX) Airport
	17:43:00					Land at Rawlins (RWL) Airport

GEOMATICS DATA SOLUTIONS

FLIGHT LOG

PROJECT NAME:	P2015.023 - Carbon County - QL2 Lidar	**BASE AIRPORT:**	Rawlins (RWL)
LOCATION / AREA:	Carbon County, WY / BL07, 09, 17, 18	**DATE:**	27 July 2016
AIRCRAFT:	Cessna 401 - N6255Q	**PILOT:**	Dave S.
SYSTEM:	Dual DragonEye	**OPERATOR:**	Dushan A.
MISSION ID:	P2015-023-CarbonWY_1500m	**CLOUDS:**	Clear
BASE STATION:	AA2125 & RWL1	**WIND:**	20kts @ 270°

ENGINE START:	14:04	**ENGINE OFF:**	16:11	**ENGINE TIME:**	02:07
GNSS START:	14:07	**GNSS STOP:**	16:10		
TAKEOFF:	14:16	**TOUCHDOWN:**	16:07	**AIR TIME**	01:51

FL #	START TIME	END TIME	TOPO PRF | PWR		BATHY PWR CHII	REMARKS
	14:07:00					Initialize GNSS at RWL1
	14:29:00					Dataset: 20160727_143300
000_FL459	14:29:50	14:31:16	180	55	-	Start BL07
	14:41:00					Close GNSS over RWL1
	14:55:00					Initialize GNSS over AA2125
001_FL463	14:59:27	15:01:08	180	55	-	Start BL18
002_FL464	15:04:00	15:05:35	180	55	-	
003_FL465	15:11:26	15:13:18	180	55	-	
004_FL466	15:15:59	15:17:55	180	55	-	
005_FL467	15:20:24	15:22:13	180	55	-	
006_FL458	15:29:05	15:30:48	180	55	-	Start BL09
007_FL460	15:37:54	15:39:31	180	55	-	Start BL17
008_FL461	15:42:05	15:43:42	180	55	-	
009_FL462	15:46:36	15:48:19	180	55	-	
	15:55:00					Close GNSS over AA2125

Section 7: Final Deliverables

The final lidar deliverables are listed below.

- LAS v1.4 classified point cloud
- LAS v1.4 raw unclassified point cloud flight line strips.
- Hydro Breaklines as ESRI shapefile
- Bridge Breaklines as ESRI shapefile
- Digital Elevation Model in ERDAS .IMG format
- 8-bit gray scale intensity images in .TIF format
- Tile Index provided as ESRI shapefile
- Project boundary as ESRI shape file
- Control Points provided as ESRI shapefile
- FGDC compliant metadata per product in XML format
- Lidar processing report in pdf format
- Survey report in pdf format