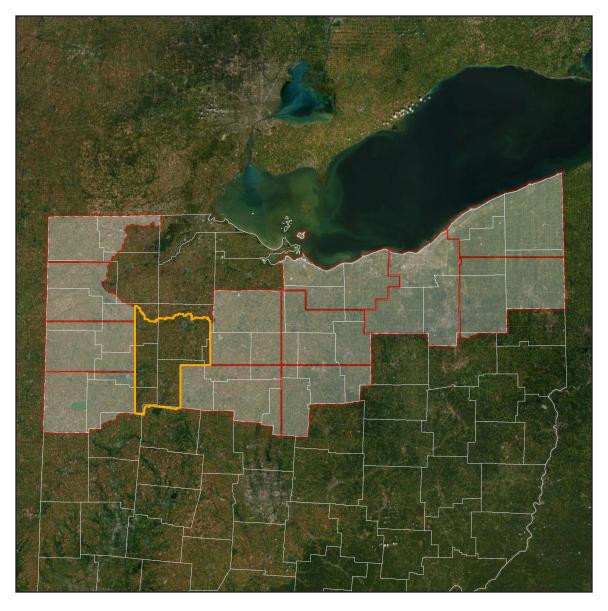
OH Statewide Phase 1 2019 B19

Lot 10 Block 9 Airborne Lidar Report

December 2020





Contract # G16PC00022

Task Order # 140G0219F0279



Contractor Woolpert Project # 79574

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1. Overview

About

This project contains a comprehensive outline of the 140G0219F0279 OH Statewide Phase 1 2019 B19 task order issued by the United States Geological Survey's National Geospatial Technical Operations Center (USGS-NGTOC). This task order called for the acquisition and processing of QL1 data over 13 blocks that total approximately 12,808.6 square miles in northern Ohio.

This report encompasses the Lot 10 Block 9 area of interest. This AOI totals approximately 1,047 square miles and includes the following counties:

- Allen
- Auglaize
- Hancock
- Hardin
- Logan
- Putnam
- Wyandot

Purpose

This project will support the 3DEP mission, the Natural Resources Conservation Service (NRCS) high resolution elevation enterprise program and the Federal Emergency Management Agency (FEMA) Risk Mapping, Assessment and Planning (MAP) program.

Specifications

Data for this task order was acquired and produced to meet USGS Lidar Base Specification 1.3 standards and the American Society of Photogrammetry and Remote Sensing (ASPRS) Positional Accuracy Standards for Digital Geospatial Data (Edition 1, Version 1.0).

Spatial Reference

Geospatial data products were produced using the following horizontal and vertical spatial data reference system.

Table 1-1. Spatial Reference System

Horizontal	EPSG Code	6549
	Datum	NAD83 (2011)
	Projection	State Plane Ohio North (FIPS 3401)
	Units	US Survey Feet
Vertical	Datum	NAVD88
	Geoid	GEOID12B
	Units	US Survey Feet
	Height Type	Orthometric

Task Order Deliverables

All data products produced as part of this task order are listed below. All tiled deliverables had a tile size of 1,250-feet x 1,250 feet. Tile names are derived from the Ohio (OGRIP) naming schema.

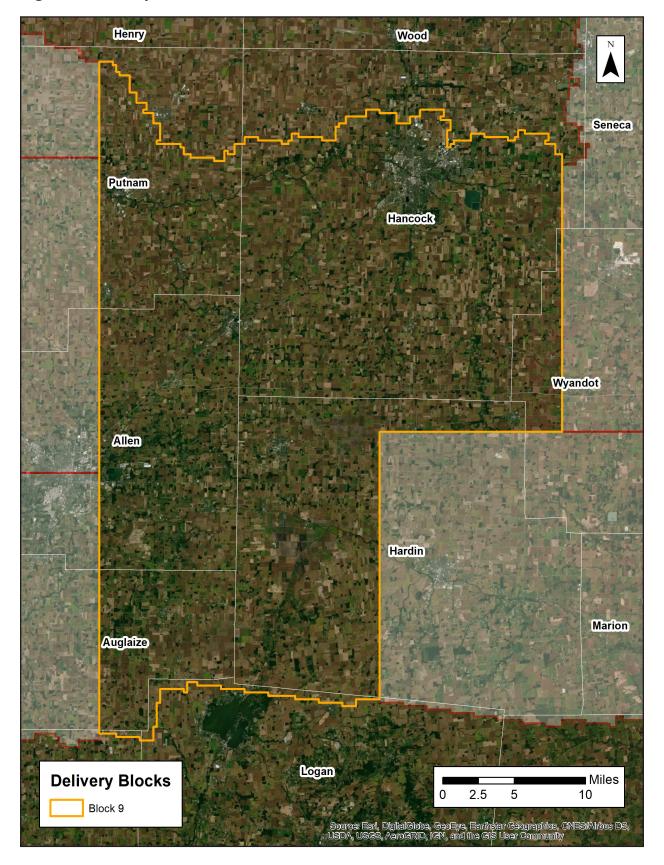
Table 1-2. Project Deliverables

Lidar Data	
Classified lidar point cloud	Tiles in .las v1.4 format
data	Classes
	• 1 – Processed, not Classified
	• 2 – Ground
	• 7 – Noise
	• 9 – Water
	• 17 – Bridge Decks
	• 18 – High Noise • 20 – Ignored Ground
Breaklines used for hydro- flattening	Lake and River features as feature classes in an Esri file geodatabase Water bodies greater than 2 acres as polygon features Rivers 30.5 meters / 100 feet and greater in width as polyline features Bridges used in DEM generation as point features in Esri shapefile format
Hydro-flattened bare	1.25-foot pixel size, 32-bit floating-point; no bridges or overpass structures
earth digital elevation	GeoTIFF format
model (DEM)	
Intensity Imagery	1.25-foot pixel size, 8-bit gray-scale (linear rescaling from 16-bit intensity) GeoTIFF format
Flight Line Index	Polygon features in an Esri file geodatabase
Control Data	
Lidar calibration points	Esri shapefile format
Lidar NVA checkpoints	Esri shapefile format
Lidar VVA checkpoints	Esri shapefile format
Other Data	
Tile Index	Esri shapefile format
Inter-Swath and Intra- Swath Test Results	Esri shapefile format
Metadata and Reports	
Metadata	Deliverable-level FGDC CSDGM/USGS MetaParser Compliant metadata in .xml format
Lidar Project Report	Project report with flight logs in .pdf format
Survey Report	Survey report in .pdf format

Figure 1-1. Project Area



Figure 1-2. Project Area - Lot 10 Block 9



2. Acquisition

Flight Planning

Aerial lidar data for this project was collected using the specifications listed below.

Table 2-1. Acquisition Requirements

Specification	Target
Resolution	8 points per square meter 0.35-meter nominal point spacing
Overlap	At contractor's discretion, but enough to ensure there are no data gaps between usable portions of the swath and nominal point density is achieved
Acquisition Window	Fall 2019 / Winter 2020 leaf-off window (through April 2020)
Data Voids	Not allowed except • Where caused by water bodies • Where caused by areas of low near infra-red (NIR) reflectivity (i.e. asphalt or composition roofing) • Where caused by lidar shadowing from buildings or other features • Where appropriately filled-in by another swath
Acquisition Conditions	 Cloud and fog-free between the aircraft and ground Ground is snow free Ground has no unusual flooding or inundation, except in cases where the goal of the collection is to map the inundation Preference of vegetation is leaf-off Time of day is not of concern
Control	Airborne Global Positioning System (ABGPS) and Inertial Measurement Unit (IMU) data to be used along with differentially-corrected GPS ground control points.

Lidar Sensor Information

Aerial lidar data was acquired for this project using the Leica Terrain Mapper lidar sensor system. A total of 136 flight lines were collected for this project.

Table 2-2. Leica Terrain Mapper Sensor Info

Sensor Specifications	
Operating Altitude (m AGL)	300 - 5,500 at 10% reflective target
Maximum Measurement Rate (kHz)	2,000
Scan Angle	20 - 40
Scan Width	Up to 70% of flight altitude
Scan Frequency	Programmable up to 125 Hz (7,500 RPM), 250 scan lines per second
Number of Returns	15
Number of intensity measurements	15
Pulse Mode(s)	Up to 35 pulses in air
Laser Specifications	
Laser Beam Divergence	0.25 mrad (1/e)
Laser Classification	Class 4 laser product
Accuracy	
Range Resolution	< 1 cm RMS
Elevation Accuracy	< 5 cm 1 σ
Horizontal Accuracy	< 13 cm 1 σ
Physical Specifications	
Size (cm), Weight (kg) • Scanner • Control Electronics	• 37 W x 68 L x 26 H cm, 47 kg • 45 W x 47 D x 25 H cm, 33 kg
Operating Temperature • Scanner • Control Electronics	• 0 - 40°C cabin-side temperature • 0 - 40°C
Flight Management	Leica FlightPro
Power Consumption	922 W @ 22.0 – 30.3 VDC

Source: Leica TerrainMapper Data Sheet

https://leica-geosystems.com/en-US/products/airborne-systems/topographic-lidar-sensors/leica-terrainmapper and the products of the product of the product of the products of the product of

GNSS and IMU Equipment

Prior to mobilizing to the project site, flight crews coordinated with the necessary air traffic control personnel to ensure airspace access. Crews were on-site, operating a Global Navigation Satellite System (GNSS) Base Station for the airborne GPS support.

Flight navigation during acquisition was 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.

Base stations were set by acquisition staff and was used to support the aerial data acquisition. See the table below for stations operated during acquisition.

Table 2-3. GNSS Base Stations

Station Name	Latitude (DMS)	Longitude (DMS)	Ellipsoid Height L1 Phase Center (Meters)
GARF_CORS	41° 24' 56.78161"	81° 36' 53.60423"	354.314
GUST_CORS	41° 27' 45.87329"	80° 42' 58.24972"	283.272
KNTN_CORS	40° 37' 49.64021"	83° 36' 53.28035"	266.056
MTVR_CORS	40° 22' 56.57516"	82° 30' 38.38039"	286.605
OHAL_CORS	40° 46' 09.73944"	84° 06' 25.04574"	235.117
OHAS_CORS	41° 55' 30.22146"	80° 33' 03.84441"	181.661
OHDT_CORS	39° 45' 53.06211	84° 10' 50.33473"	196.642
OHHA_CORS	41° 02' 27.93405"	83° 40' 33.46888"	210.082
OHHU_CORS	41° 10' 36.35195"	82° 33' 40.91087°	254.565
OHLA_CORS	41° 43' 35.53476"	81° 17' 11.05630"	163.494
OHLC_CORS	41° 43' 16.40562"	83° 31' 34.58723"	151.929
OHMA_CORS	40° 36' 49.73829"	83° 04' 55.32889"	257.026
OHMN_CORS	41° 01' 24.70500"	80° 46' 21.63976"	328.747
OHMR_CORS	40° 32' 45.58334"	84° 37' 50.63693"	236.812
OHRI_CORS	40° 46' 05.33418"	82° 33' 38.35490"	365.49
OHSB_CORS	41° 38' 11.21597"	82° 49' 47.18063"	148.449
TIFF_CORS	41° 04' 29.89642"	84° 09' 01.41466"	211.729

Timeline

Lidar data for Lot 10 Block 9 was collected from November 4, 2019 through April 27, 2020. Acquisition specifications are listed in the table below. An initial quality control process was immediately performed on to review the data coverage, airborne GPS data, and trajectory solution.

For more information, see the Flight Logs in Appendix 1.

Table 2-4. Project Acquisition Specifications

Settings	Leica TerrainMapper QL1
Max. Number of Returns	15
Nominal Point Spacing	0.35 m
Nominal Point Density	8 ppsm
Flying Height Above Ground Level	2,000 m
Flight Speed	160 knots
Scan Angle	40°
Scan Rate Used	150 Hz
Pulse Rate Used	1,600 kHz
Multi-Pulse in Air	Enabled
Swath Width	1,456 m
Swath Overlap	25%

Acquisition Quality Assurance

Woolpert developed a quality assurance and validation plan to ensure the acquired lidar data meets the USGS Base Specification Version 1.3. For quality assurance purposes, the lidar data was processed immediately following acquisition to verify the coverage has appropriate density, distribution, and no unacceptable data voids. Accompanying GPS data was post processed using differential and Kalman filter algorithms to derive a best estimate of trajectory. The quality of the solution was verified to be consistent with the accuracy requirements of the task order. Any required re-flights were scheduled at the earliest opportunity.

The spatial distribution of the geometrically usable first return lidar points was reviewed for density requirements as well as regular and uniform point distribution - verifying the lidar data is spaced so that 90% of the cells in a 2*NPS grid placed over the data contain at least one lidar point. The NPS assessment is made against single swath, first return data located within the geometrically usable center portion (typically ~90%) of each swath. Additionally, the data was reviewed for unacceptable data voids – verifying no area greater than or equal to $(4 \times ANPS)^2$ exhibited data coverage gaps.

3. Processing

Processing Summary

Once the lidar data passed initial QC, the dataset was corrected for aircraft orientation and movement. This process used airborne inertial, orientation, and GPS data collected during acquisition along with ground-based GPS data. The data went through a geometric calibration that further corrected each laser point. This calibrated data set was used to create the LAS point cloud. The LAS point data was initially classified into "ground" and "non-ground", then further refined using the classes specified in this task order. Breaklines were drawn to denote hydrological features. After the hydro-flattening process, the final deliverables products were created.

GNSS-IMU Trajectory Processing

Kinematic corrections for the aircraft position were resolved using aircraft GPS and static ground GPS (1-Hz) for each geodetic control (base station) for three subsystems: inertial measurement unit (IMU), sensor orientation information, and airborne GPS data.

Post-processing of the IMU system data and aircraft position with attitude data was completed to compute an optimally accurate, blended navigation solution based on Kalman filtering technology, or the smoothed best estimate of trajectory (SBET).

Software: POSPac Software v. 5.3, IPAS Pro v.1.35., Novatel Inertial Explorer v8.60.6129

Trajectory Quality

The GNSS trajectory and high-quality IMU data are key factors in determining the overall positional accuracy of the final sensor data. Within the trajectory processing, there are many factors that affect the overall quality, but the most indicative are the combined separation, the estimated positional accuracy, and the positional dilution of precision (PDOP).

Combination Separation

Combined separation is a measure of the difference between the forward-run and the backward-run solution of the trajectory. The Kalman filter was processed in both directions to remove the combined directional anomalies. In general, when these two solutions match closely, an optimally accurate and reliable solution is achieved.

The data for this task order was processed with a goal to maintain a combined separation difference of less than ten (10) centimeters.

Estimated Positional Accuracy

Estimated positional accuracy plots the standard deviations of the east, north, and vertical directions along a time scale of the trajectory. It illustrates loss of satellite lock issues, as well as issues arising from long baselines, noise, and/or other atmospheric interference.

PDOP

The PDOP measures the precision of the GPS solution in regard to the geometry of the satellites acquired and used for the solution.

The data for this task order was processed with a goal to maintain an average PDOP value below 3.0. Brief periods of PDOP over 3.0 are acceptable due to the calibration and control process if other metrics are within specification.

Geometric Calibration

After the initial phase was complete, a formal reduction process was performed on the data. Laser point position was calculated by associating the SBET position to each laser point return time, scan angle, intensity, etc. Raw laser point cloud data was created for the whole project area in LAS format. Automated line-to-line calibrations were then performed for system attitude parameters (pitch, roll, heading), mirror flex (scale) and GPS/IMU drift. Statistical reports were generated for comparison and used to make the necessary adjustments to remove any residual systematic error.

Software: Proprietary Software, TerraMatch v20, Leica CloudPro 1.2.4

Lidar Data Classification

LAS data was classified as ground and non-ground points with additional filters created to meet the task order classification specifications. Statistical absolute accuracy was assessed via direct comparisons of ground classified points to ground RTK survey data. Based on the statistical analysis, the lidar data was then adjusted to reduce the vertical bias when compared to the survey ground control of higher accuracy.

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 the following client-specified classes:

- Class 1 Default / Processed, but not Classified
- Class 2 Bare Earth Ground
- Class 7 Low Noise
- Class 9 Water
- Class 17 Bridge Decks
- Class 18 High Noise
- Class 20 Ignored Ground

Classified LAS files were evaluated through a series of manual QA/QC steps as well as a peer-based review to eliminate remaining artifacts from the ground class. This included a review of the DEM surface to remove artifacts and ensure topographic quality.

Software: Proprietary Software, TerraScan v20

Hydrologic Flattening

The lidar task order required compilation of breaklines defining the following types of water body features:

Lakes, reservoirs, ponds	Minimum of 2-acres or greater
	Compiled as closed polygons, collected at a constant elevation
Rivers, streams	Nominal width of 30.5 meters / 100 feet
	Compiled in direction of flow, with both sides maintaining an equal elevation gradient
Bridge breaklines	Breaklines used to enforce a logical terrain surface below a bridge

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. The newly acquired lidar data was utilized to manually compile 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. An integrated software approach was applied 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. All classified ground points from inside the hydrologic feature polygons were reclassified to water, class nine (9).
- 4. All classified ground points were reclassified from within a buffer along the hydrologic feature breaklines to buffered ground, class twenty (20). The buffer distance was approximately the task order designed nominal pulse spacing distance.
- 5. Breaklines used for bridge removal during the hydrologic flattening were included with the hydrologic breakline geodatabase deliverable. The purpose of these breaklines is for a more aesthetically pleasing DEM appearance.
- 6. The lidar ground points and breaklines were used to generate a digital elevation model (DEM).
- 7. QA/QC for this task was performed by reviewing the hydrologically flattened DEM and hydrologic breakline features. Additionally, a combined approach utilizing commercial off the shelf software and proprietary methods were used to review the overall connectivity of the hydrologic breaklines.

TerraScan was used to add the hydrologic breakline vertices and export the lattice models.

Breaklines defining the water bodies greater than 2-acres were provided as polygon features. Rivers and streams with a nominal minimum width of 30.5 meters (100 feet) were provided as polyline features. All lake and river breaklines compiled as part of the flattening process were provided in an Esri file geodatabase.

Breaklines used for DEM generation were provided as point features in Esri shapefile format.

Software: TerraScan v20, TerraModeler v20, Esri ArcMap v10.7, LP360 v2019.1.30.4

Digital Elevation Model

TerraScan was used to add the hydrologic breakline vertices and export the lattice models. Class 2 (ground) lidar points in conjunction with the hydro breaklines and bridge breaklines were used to create 1.25-foot hydro-flattened bare-earth raster DEM files. Using automated scripting routines within ArcMap, an 32-bit floating point raster GeoTIFF file was created for each tile. Files were produced to the full extent of the tile boundaries. Each surface is reviewed using Global Mapper to check for any surface anomalies or incorrect elevations found within the surface.

Software: TerraScan v20, Esri ArcMap v10.7, Global Mapper v20.0

Intensity Imagery

Lidar intensity data derived from the acquired lidar data was linearly rescaled from 16-bit intensity and provided as 1.25-foot pixel, 8-bit, 256 gray scale GeoTIFF format intensity imagery files. Files were produced to the full extent of the tile boundaries.

Software: TerraScan v20, Esri ArcMap v10.7

Metadata

FGDC CSDGM/USGS MetaParser-compliant metadata was produced in XML format. The metadata includes a complete description of the task order client information, contractor information, project purpose, lidar acquisition and ground survey collection parameters, lidar acquisition and ground survey collection dates, spatial reference system information, data processing including acquisition quality assurance procedures, GPS and base station processing, geometric calibration, lidar classification, hydrologic flattening, intensity imagery development, and final product development.

Other metadata deliverables included Esri shapefiles of the ground control and QA/QC points, data extent, and delivery tile index. A georeferenced, polygonal representation of the detailed extents of each acquired lidar swath was produced as a polygon feature class in an Esri file geodatabase.

4. Accuracy Assessment

Horizontal Accuracy

The data sets was produced to meet ASPRS "Positional Accuracy Standards for Digital Geospatial Data" (2014) for a Positional Horizontal Accuracy = +/- 36.4 cm at a 95% confidence level.

Raw Lidar Swath Testing

This project required the lidar point cloud swath to be produced to meet a Non-Vegetated Vertical Accuracy (NVA) value of 19.6 cm at a 95% confidence level using an RMSEz target value of 10 cm x 1.9600.

Digital Elevation Model Testing

This project required DEM data to be produced to meet a Non-Vegetated Vertical Accuracy (NVA) value of 19.6 cm at a 95% confidence level using an RMSEz target value of 10 cm x 1.9600 and a Vegetated Vertical Accuracy (VVA) value of 0.30 cm at the 95th percentile error.

Appendix 1: Flight Logs

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Project #			Project		U	nique ID	Flight Date (UTC) Day of Year Fli										
79574								ı	Day310	019_SN513_:	1	11,	3	10	1		
Crew Equipmen												Time				Ai	rports
Pi	lot		Ai	rcraft Ma			el / Tai	il#		Hobbs St	art	Local	Start	UTC	Start		parting
	hart			Cessna 4						2426.4			3:00		3:00		day
	rator			nsor Mak						Hobbs E		Loca		UTC			riving
•	ith			ica Terra						2432.8		05:0			6:00		day
311	11(11		LC	ica reira	3111 IV	iappei		Condit	ione	2432.0)	03.0	0.00	22.0	0.00		uay
14" LD:	(0)	\^*			ı., <i>(</i>	• • •				1.0	I -	(0.0)			(0.0)	_	/!! \
Wind Dir	(*)	Wind	Speed (kts)	Visibi		mı)	Ceilir	ng (ft)		ud Cover		p. (°C)	Dew	/ Point	(°C)		ure ("Hg)
140			7		10					cattered		6		-1			3044
Air Spe		;)	Altitude			Al		MSL (ft)	Airfield Ele		n (ft)					
1	50		6,8	390			7,9	920		1,0	009						
								Setti	ngs								
Point Spacia	ng (m)	Poir	nt Density (pp	osm)	Sca	n Angl	e/FO\	/ (°)	Sca	n Frequency	(Hz)	Pulse	Rate	(kHz)	Las	er Pov	ver (%)
0.35			8			4	0			150			1700			100)
											Ve	rify S-	Turns l	Before	Missi	on	Yes
			Start Time	End Tir	ne	Tin	ne					_					
Line #	Direc	ction	(UTC)	(UTC		On-l		Sate	llite	PDOP			Line N	otes/0	Comm	ents	
47	V	V	18:11:00			00:2	0:00	1	8	1.2							
48	ε	š	18:33:00	18:50:	00	00:1	7:00	1	9	1.2							
49	v	V	18:55:00	19:13:00		00:1		3:00 2		1.1							
50	е		19:16:00	19:31:00					1	1.1							
51	٧		19:34:00	19:52:00			00:18:00		1	1.3							
52		e 19:55:00		20:10:00		00:15:00		2		1.1							
53	٧		20:14:00	20:31:00		00:17:00		2		1.3							
54	€		20:34:00	20:47:00		00:13:00		2		1.2							
55	V		20:50:00		21:04:00		00:14:00		4	1.1							
56 57	€		21:07:00	21:18:				2	2	1.2							
58	ν ε					00:1 00:1		2		1.1							
50			21.30.00	21:49:	55	50.1	±.00		-1	<u> </u>							
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								Page	1		٧	erify S	- i urns	Atter	IVIISSIO	n	Yes
Additional (comme	nts															

			1	Vo	olp	ert	Lid	ar <i>i</i>	Acq	uisitic	n L	.og					
				Pro	ject I	nfo								[Date		
Project #			Project	Name)				U	nique ID		Flight	Date	(UTC)	Day o	f Year	Flight #
79574		Ohio	Statewide P	hase 1	2019	B19		[Day313	319_SN513_	1	11,	/09/20	19	3	13	1
Cre	ew				Equip	ment						Time				Ai	rports
Pil	ot		Air	rcraft N			el / Tai	il #		Hobbs St	tart	Local	Start	UTC	Start		parting
Geb				Cessna						2439.2		10:3		15:3			day
Opei				sor M						Hobbs E		Local		UTC			riving
Sm				ica Ter						2445.3		04:4		21:4			day
3111	IUII		Le	ica i ei	Talli IV	таррет		Condit	ions	2443.)	04.4	3.00	21.4	3.00		uay
Min d Din	/ 9 \	\A/: al	Conned (late)	\ /:-:	L : 1:4 /	:\				d Carran	T	- (%C)	D	. Daint	. (°C)	Dunna	(!!!!=\
Wind Dir	()	wina	Speed (kts)	VISI	bility (mı)	Cellir	ng (ft)		ud Cover		p. (°C)	Dew	Point	(C)		ure ("Hg)
190			12		10					cattered		0		-6		3	3016
Air Spe)	Altitude		t)	Al		MSL (rt)	Airfield El		n (ft)					
16	50		6,8	90			7,3	359		1,0	009						
								Setti									
Point Spacir	ıg (m)	Poin	t Density (pp	osm)	Sca	n Angl	e/FO\	/ (°)	Scar	ո Frequency	(Hz)	Pulse	Rate	(kHz)	Las	ser Pov	ver (%)
0.35			8			4	0			150			1700			100)
											Ve	erify S-1	Turns l	3efore	Missi	on	Yes
12	D:		Start Time	End 1	Гime	Tir	ne	C-1-	1124 -	2200			1 N	10			
Line #	Direc	tion	(UTC)	(UT	ГС)	On-	Line	Sate	ilite	PDOP			Line N	otes/0	Jomm	ents	
59	W	,	17:37:00	17:4	8:00	00:1	1:00	1	8	1.2		(lds e.e	end, ma	aybe w	end end	
60	e	:	17:51:00	18:0	0:00	00:0	9:00	1	7	1.5							
61	W	/	18:03:00	18:1	4:00	00:1	1:00	2	1	1.1				clds w	p 21		
62	e	<u>:</u>	18:17:00	18:2		00:0	9:00	2	1	1.2			cl	ouds v	vp 6,5		
63	W	/	18:29:00	18:3		00:1		2		1.2							
64	e	:	18:42:00	18:5		00:0		2		1.2							
65	V		18:53:00	19:0		00:0			2	1.1							
66	e		19:05:00	19:1		00:0		2		1.1							
39 38	W		19:22:00 19:44:00	19:4 20:0		00:1 00:1		2		1.4							
37	v	_	20:03:00	20:0		00:1		2		1.1							
36	e		20:24:00	20:4		00:1		2		1.3	_						
35	W		20:43:00	21:0		00:1			4	1.1							
34	E		21:04:00	21:2		00:1			2	1.2							
					-		-										
											-						
											-						
								Page	1		V	erify S-	Turns	After	Missio	n	Yes
Additional C	omme	nts						0,				, -					

Project # Project Name					Wo	olp	ert	Lid	ar /	A cq	uisitic	n L	.og					
Type					Pro	ject l	nfo								[Date		
Pilot	Project #			Project	Name	<u> </u>				U	nique ID		Flight	Date	(UTC)	Day o	f Year	Flight #
Pilot Cessina 404 Tail # Hobbs Start Local Start UTC Start day Gebhart Cessina 404 Titan Na Na Na Na Na Na Na	79574		Ohio	Statewide F	hase 1	2019	B19		[Day32:	L19_SN511_:	1	11,	/17/20	19	3:	21	1
Pilot Cessina 404 Tail # Hobbs Start Local Start UTC Start day Gebhart Cessina 404 Titan Na Na Na Na Na Na Na	Cr	ew				Equip	ment						Time				Aiı	rports
Gebhart Cessna 404 Titan - N404CP 7435.6 11:20:00 16:20:00 day				Aiı				el / Tai	il #		Hobbs St	art	Local	Start	UTC	Start		•
Sensor Make / Model / Serial # Hobbs End Local End UTC End Arriving																		
Smith																		
Wind Dir (*)																		
Wind Dir (*) Wind Speed (kts) Visibility (mi) Ceiling (ft) Cloud Cover Temp. (*C) Dew Point (*C) Pressure (*Hg)	311	IILII		Le	ica rei	I all I IV	паррег			ions	7440.0	,	04.1	7.00	21.1	7.00		uay
Air Speed (kts)	Mind Dir	/º\	\A/:d	Coood (Ista)	Vici	h:1:4., /	·:\				ud Causa	Tom	- (°C\	Davi	. Daint	/°C\	Dunna	("115\
Air Speed (kts)		()	wina		VISI		,mı)	Cellir	ig (It)					Dew		(C)		
Settings															-4		3	3010
Point Spacing (m)																		
Point Spacing (m) Point Density (ppsm) Scan Angle/FOV (*) Scan Frequency (Hz) Pulse Rate (kHz) Laser Power (%)	10	50		6,8	390			7,3			1,0	009						
Start Time									Setti	ngs								
Characteristics Characteri	Point Spacin	ng (m)	Poin	t Density (pp	osm)	Sca	n Angl	e/FO\	/ (°)	Sca	n Frequency	(Hz)	Pulse	Rate	(kHz)	Las	ser Pov	ver (%)
Line # Direction Start Time (UTC) CITC) Time (UTC) Time (U	0.35			8			4	0			150			1700			100)
Company												Ve	rify S-1	Turns l	3efore	Missi	on	Yes
62 w 17:00:00 17:02:00 00:02:00 17 1.4 refit 61 w 17:09:00 17:13:00 00:05:00 17 1.5 refit 60 w 17:18:00 17:23:00 00:05:00 17 1.5 refit 59 e 17:26:00 17:36:00 00:10:00 17 1.6 refit 46 w 17:40:00 17:52:00 00:12:00 22 1.1 refit 43 e 17:55:00 18:12:00 00:17:00 22 1.1 refit 45 w 18:16:00 18:23:00 00:07:00 22 1.1 refit 44 w 18:28:00 18:34:00 00:06:00 21 1.1 refit 42 e 18:38:00 18:34:00 00:16:00 19 1.1 refit 39 w 18:56:00 19:13:00 00:17:00 19 1.4 38 e 19:16:00 19:33:00 00:17:00 25 1.1 37 w 19:35:00 19:53:00 00:18:00 23 1.3 36 e 19:56:00 20:12:00 00:16:00 25 1.2 35 w 20:15:00 20:32:00 00:16:00 25 1.2 35 w 20:15:00 20:32:00 00:16:00 23 1 34 e 20:35:00 20:51:00 00:16:00 23 1				Start Time	End 1	ime	Tir	ne										
61 w 17:09:00 17:13:00 00:04:00 19 1.2 reflt 60 w 17:18:00 17:23:00 00:05:00 17 1.5 reflt 59 e 17:26:00 17:36:00 00:10:00 17 1.6 reflt 46 w 17:40:00 17:52:00 00:12:00 22 1.1 reflt 43 e 17:55:00 18:12:00 00:7:00 21 1.2 reflt 45 w 18:16:00 18:23:00 00:07:00 22 1.1 reflt 44 w 18:28:00 18:34:00 00:06:00 21 1.1 reflt 42 e 18:38:00 18:54:00 00:16:00 19 1.1 reflt 39 w 18:56:00 19:13:00 00:17:00 19 1.1 reflt 38 e 19:16:00 19:33:00 00:17:00 25 1.1 37 w 19:35:00 19:53:00 00:18:00 23 1.3 36 e 19:56:00 20:12:00 00:16:00 25 1.2 35 w 20:15:00 20:32:00 00:17:00 22 1.3 34 e 20:35:00 20:51:00 00:16:00 23 1	Line #	Direc	tion	(UTC)	(UT	·C)	On-	Line	Sate	llite	PDOP			Line N	otes/C	Comm	ents	
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46 w 17:40:00 17:52:00 00:12:00 22 1.1 refit 43 e 17:55:00 18:12:00 00:17:00 21 1.2 refit 45 w 18:16:00 18:23:00 00:07:00 22 1.1 refit 44 w 18:28:00 18:34:00 00:06:00 21 1.1 refit 42 e 18:38:00 18:54:00 00:16:00 19 1.1 refit 39 w 18:56:00 19:13:00 00:17:00 19 1.4 38 e 19:16:00 19:33:00 00:17:00 25 1.1 37 w 19:35:00 19:53:00 00:16:00 25 1.2 35 w 20:15:00 20:32:00 00:17:00 22 1.3 34 e 20:35:00 20:51:00 00:16:00 23 1 Page 1 Verify S-Turns After Mission Yes	60	W	/	17:18:00	17:2	3:00	00:0	5:00	1	7	1.5				refl	t		
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Mathematical Page 1 Mathematical Page 1	46	W	/	17:40:00	17:5	2:00	00:1	2:00	2	2	1.1							
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				Pro	oject I	nfo								[Date		
Project #			Project	Name	e				U	nique ID		Flight	Date	(UTC)	Day o	f Year	Flight #
79574		Ohio	o Statewide F	hase :	1 2019	B19		[Day32:	219_SN511_	1	11,	/18/20	19	32	22	1
Cr	ew				Equip	ment						Time				Ai	rports
Pi	ot		Aiı	rcraft I	Make	/ Mod	el / Tai	il #		Hobbs S	tart	Local	Start	UTC	Start		parting
Geb	hart		(Cessna	404 T	itan - N	1404CI	<u> </u>		7441		10:4	1:00	15:4	1:00		day
Ope	rator		Ser	sor M	lake /	Model	/ Seri	al#		Hobbs E	nd	Loca	l End	UTC	End		riving
	ith					Ларреі				7447		04:3	4:00		4:00		day
								Condit	ions			V 1.10					,
Wind Dir	(°)	Wind	Speed (kts)	Vis	ibility ((mi)		ng (ft)		oud Cover	Temi	p. (°C)	Dew	/ Point	(°C)	Press	ure ("Hg)
270	•		4		10	,		.6 ()		cattered	_	6		-1	, ()		2980
Air Spe	ed (htc	:)	Altitude	VCI (Λ1	tituda	MSL (Airfield El		_		1			
	60 (KIS	''	6,8		,	H		1 VISL (1	,		009	(11)					
1	,0		0,0	50			7,5	Setti	arc .	Ι,	009						
Point Spacii	ng (m)	Doi	t Doneity /	ocm)	Sec	n Ana	lo/FO			n Eroguana	/U-\	Dulca	Rate	(LU-)	Loc	or Do	ver (%)
	ig (m)	Poin	nt Density (pr	osm)	Sca	n Ang		()	Sca	n Frequency	(HZ)	Puise		(KHZ)	Las		
0.35			8			4	.0			150			1700			100	
				T -	_			<u> </u>			Ve	erify S-1	i urns i	Before	IVIISSI	on	Yes
Line #	Direc	ction	Start Time (UTC)		Time TC)		ne Line	Sate	llite	PDOP			Line N	otes/0	Comm	ents	
31	V	V	16:06:00	16:2	3:00	00:1	7:00	2	1	1.2				blk	2		
30	€	9	16:26:00		3:00	00:1		2		1.1							
29	V		16:46:00		3:00		7:00	1		1.3	-						
28	€		17:06:00		2:00		6:00	2		1.2	-						
27 26	V		17:25:00 17:45:00		2:00		7:00 6:00	2		1.4	-						
25	V		18:04:00		1:00		7:00	2		1.4							
24	•		18:24:00		0:00		6:00	2		1.3							
23	v		18:43:00		1:00		8:00	1		1.6							
22	E	<u>. </u>	19:04:00		0:00		6:00	2	2	1.1							
21	٧	v	19:23:00	19:4	0:00	00:1	7:00	2	0	1.1			С	lds wp	1-18		
58	E	9	19:55:00		9:00		4:00	2	1	1				, clds v		19	
57	V	V	20:12:00		4:00		2:00	1		1.1				clds w			
56	€		20:26:00		9:00		3:00	1		1.2				clds w			
55	V	V	20:41:00	20:5	3:00	00:1	2:00	2	1	1	-		С	lds wp	1-13		
											-						
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								Page	1		V	erify S-	Turns	After	Missio	n	Yes
Additional C	omme	nts															

Blocks 2, 1

				Wo	olp	ert	Lid	ar <i>i</i>	Acq	uisitic	n L	.og					
				Pro	oject I	nfo								[Date		
Project #			Project	Name	2				U	nique ID		Flight	Date	(UTC)	Day o	f Year	Flight #
79574		Ohio	o Statewide F	hase 1	1 2019	B19		[Day329	919_SN515_	1	11,	/25/20	19	3:	29	1
	ew					ment						Time					rports
	lot					/ Mode				Hobbs St			Start	UTC		De	parting
	Perl					itan - N				2068.6		_	2:00	15:5			day
-	rator					Model				Hobbs E		_	l End	UTC			rriving
Sm	nith		Le	ica Te	rrain N	/lapper		15 Condit	:	2073.8	3	04:0	2:00	21:0	2:00		day
Wind Dir	· (°)	\\/ind	Speed (kts)	Vici	ibility ((mi)		rg (ft)		ud Cover	Tomi	p. (°C)	Dov	/ Point	(°C)	Drocc	ure ("Hg)
210	()	vviiiu	14	VISI	10	(1111)	Ceiiii	ig (it)		cattered		6 6	Dew	3	()		2997
Air Spe	ed (kts	١	Altitude	AGI (ΔΙ	titude	MSL (Airfield Ele		_		<u>, </u>		<u> </u>	2991
	60	,	6,8					118	,		009	()					
			-,-				-,	Setti	ngs								
Point Spaci	ng (m)	Poin	it Density (pr	osm)	Sca	n Ang	le/FO\			n Frequency	(Hz)	Pulse	Rate	(kHz)	Las	er Pov	wer (%)
0.35	<u> </u>		8				.0			150			1700			100	
											Ve	erify S-	Turns l	Before	Missi	on	Yes
Line #	Direc	tion	Start Time (UTC)		Time TC)	Tir On-	ne Line	Sate	ellite	PDOP			Line N	otes/0	Comm	ents	
20	W	/	19:38:00	19:5	5:00	00:1	7:00	1	3	1.5							
19	e		19:59:00		5:00		6:00		3	1.5							
18	W	/	20:19:00	20:3	6:00	00:1	7:00	1	6	1.3							
								Page	1		1/	erify S	Turns	After	Missio	n	Yes
Additional (`omme	nts						age	<u> </u>		v	city 3.	1 41113	AILEI	4113310		163
Disal: 2	.5.1111116																

			1	Wo	olp	ert	Lid	ar <i>i</i>	Acq	uisitio	n L	.og					
				Pro	ject I	nfo								[Date		
Project #			Project	Name	2				U	nique ID		Flight	Date	(UTC)	Day o	f Year	Flight #
79574		Ohio	Statewide P	hase :	1 2019	B19		ı	Day339	919_SN513_:	1	12,	/05/20)19	33	39	1
Cr	ew				fy	/2						Time				Aiı	ports
Pi	lot		Aiı	rcraft	Make /	/ Mode	el / Tai	il#		Hobbs St	art	Local	Start	UTC	Start	De	parting
Geb	hart		(Cessna	404 T	itan - N	170791	=		2452		10:1	5:00	15:1	5:00		day
Ope	rator		Ser	nsor M	ake /	Model	/ Seri	al#		Hobbs E	nd	Loca	l End	UTC	End	Ar	riving
Sm	ith		Le	ica Te	rrain N	1apper	- 905	13		2455		01:1	0:00	18:1	0:00		day
		-					(Condit	ions			•					
Wind Dir	(°)	Wind	Speed (kts)	Vis	ibility (mi)	Ceilir	ng (ft)	Clo	ud Cover	Tem	o. (°C)	Dew	/ Point	(°C)	Press	ure ("Hg)
240			5		10				So	cattered		0		-2		3	3007
Air Spe	ed (kts))	Altitude	AGL (ft)	Al	titude	MSL (ft)	Airfield Ele	evatio	n (ft)					
1	50		6,8	90			7,9	920		1,0	009						
								Setti	ngs								
Point Spacia	ng (m)	Poin	t Density (pp	osm)	Sca	n Angl	e/FO\	/ (°)	Scar	n Frequency	(Hz)	Pulse	Rate	(kHz)	Las	ser Pov	ver (%)
0.35			8			4	0			150			1700			100)
											Ve	rify S-	Turns l	Before	Missi	on	Yes
Line #	Direct	tion	Start Time (UTC)		Time TC)	Tir On-l	_	Sate	ellite	PDOP			Line N	lotes/C	Comm	ents	
14	W		15:49:00		7:00	00:1	8:00	2	0	1.2							
15	е		16:10:00		7:00	00:1			0	1.2							
16	W		16:30:00		9:00	00:1			2	1.1							
17 13	e		16:51:00 17:21:00		7:00 9:00	00:1 00:0			2	1.2				uds wr eflt wp		<u> </u>	
21	e w		17:40:00		8:00	00:0			0	1.4			- 11	reflt 1			
											-						
								Daca	1		.,	orif. c	T	∧ € ± ~ !	Missir		Vos
A al al al a	\	-4-						Page	1		V	erify S	urns	Arter	VIISSIO	rı	Yes
Additional (.ommer	πtS															

Project ## Project Name					Woo	olp	ert	Lid	ar A	\cq	uisitio	n Lo	og					
Type					Pro	ject Ir	nfo									Date		
Crew Equipment Hobbs Start Local Start UTC Start Departing Gebhart Cessna 404 PTain - N7079F 2488.6 11:08:00 DAY Day Day Doy	Project #			Project	Name					U	nique ID		Flight	Date	(UTC)	Day o	f Year	Flight #
Pilot Cebhart Cessna 404 Titan - N7079F 2468.6 11.08.00 16.08.00 DAY	79574		Ohi	o Statewide P	hase 1	2019	B19			Day3	47_90513_1		12,	/13/20)19	34	47	1
Gebhart Cessna 404 Titan - N7079F 2468.6 11.08:00 16.08:00 DAY	Cr	ew				Equip	ment						Time				Ai	rports
Operator Condition Cond	Pi	lot		Ai	rcraft N	∕lake /	Mode	l / Tai	l #		Hobbs St	tart	Local	Start	UTC	Start	De	parting
Note	Gek	hart			Cessna	404 Ti	tan - N	17079F	:		2468.0	5	11:0	8:00	16:0	8:00		DAY
Wind Dir (**)	Ope	rator		Sei	nsor Ma	ake / I	Model	/ Seria	al#		Hobbs E	nd	Loca	l End	UTC	End	Aı	riving
Wind Dir (*) Wind Speed (kts) Visibility (mi) 10	Ken	nedy		Le	eica Ter	rain N	lapper	- 9051	L3		2472.	2	14:4	3:00	19:4	3:00		DAY
190								C	onditi	ons								
Air Speed kits Air Air	Wind Dir	· (°)	Wind	Speed (kts)	Visil	bility (mi)	Ceilir	ng (ft)	Clo	ud Cover	Tem	o. (°C)	Dew	/ Point	(°C)	Press	ure ("Hg)
Settings	190			10		10		4,5	500		Broken		7		2		3	30.06
Point Spacing (m)	Air Spe	ed (kts)	Altitude	AGL (ft	t)	Al	titude	MSL (ft)	Airfield El	evatio	ı (ft)					
Point Spacing (m) Point Density (ppsm) Scan Angle/FOV (*) Scan Frequency (Hz) Pulse Rate (kHz) Laser Power (%)	1	60		6,5	62			7,1	L49		1,0	009						
B									Settin	gs								
Verify S-Turns Before Mission Yes	Point Spaci	ng (m)	Poir	nt Density (pp	sm)	Sca	n Angl	e/FOV	/ (°)	Sca	n Frequency	(Hz)	Pulse	Rate	(kHz)	Las	er Pov	ver (%)
Line # Direction Start Time (UTC) Con-Line Satellite PDOP Line Notes/Comments				8			4	0			150			1600			100)
Company												Ve	rify S-1	Turns l	Before	Missi	on	Yes
4 E 17:11:00 17:29:00 00:18:00 21 1.2 3 W 17:32:00 17:49:00 00:17:00 26 1.1 2 E 17:52:00 18:09:00 00:17:00 26 1 1 W 18:12:00 18:29:00 00:17:00 26 1 50 E 18:42:00 18:44:00 00:02:00 21 1.2 partial patch flight 18 E 19:09:00 09:03:00 23 1 partial patch flight 20 W 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight 20 W 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight	Line #	Direc	ction						Sate	ellite	PDOP			Line N	otes/C	Comm	ents	
3	5	V	V	16:50:00	17:08	3:00	00:1	8:00	2	3	1				Block	1		
2 E 17:52:00 18:09:00 00:17:00 23 1.2 1 W 18:12:00 18:29:00 00:17:00 26 1 50 E 18:42:00 18:44:00 00:02:00 21 1.2 partial patch flight 17 W 19:01:00 19:04:00 00:03:00 23 1 partial patch flight 18 E 19:09:00 19:12:00 00:03:00 20 1.2 partial patch flight 20 W 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight																		
1 W 18:12:00 18:29:00 00:17:00 26 1 50 E 18:42:00 18:44:00 00:02:00 21 1.2 partial patch flight 17 W 19:01:00 19:04:00 00:03:00 23 1 partial patch flight 18 E 19:09:00 19:12:00 00:03:00 20 1.2 partial patch flight 20 W 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight 3 1 19:19:00 00:03:00 20 1.2 partial patch flight 4 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight																		
50 E 18:42:00 18:44:00 00:02:00 21 1.2 partial patch flight Block 2						_												
Block 2 17 W 19:01:00 19:04:00 00:03:00 23 1 partial patch flight 18 E 19:09:00 19:12:00 00:03:00 20 1.2 partial patch flight 20 W 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight	1	V	V	10.12.00	10.25	9.00	00.1	7.00		0	1							
Block 2 17 W 19:01:00 19:04:00 00:03:00 23 1 partial patch flight 18 E 19:09:00 19:12:00 00:03:00 20 1.2 partial patch flight 20 W 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight	50	E	<u> </u>	18:42:00	18:44	4:00	00:0	2:00	2	1	1.2			part	ial pate	ch flig	ht	
17 W 19:01:00 19:04:00 00:03:00 23 1 partial patch flight 18 E 19:09:00 19:12:00 00:03:00 20 1.2 partial patch flight 20 W 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight																		
18 E 19:09:00 19:12:00 00:03:00 20 1.2 partial patch flight 20 W 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight																		
20 W 19:16:00 19:19:00 00:03:00 20 1.2 partial patch flight															-			
Page 1 Verify S-Turns After Mission Yes																		
	20	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	V	15.10.00	19.15	9.00	00:0	3.00		U	1.2			part	iai þatí	cii iiigi	ii.	
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	۸ ما ما:ه: ا . C	`a wa : : :	-+-						rage	1		V	епту 5-	urns	Aiter i	viiSSIO	11	res

Blocks 1, 2

79574 Ohio Statewide Crew Pilot A Swain Operator Se Nardone L Wind Dir (°) Wind Speed (kts) 280 4		B19 ment / Model / Titan - N404 Model / Se Mapper - 90	ICP erial # 0511		nique ID 50_90511_1 Hobbs St 7556.4 Hobbs E	art	02, Time Local	/19/20	(UTC)	05	50	Flight #
79574 Ohio Statewide Crew Pilot A Swain Operator Se Nardone L Wind Dir (°) Wind Speed (kts) 280 4	Equipircraft Make Accessing 404 Tensor Make Accessing 100 Tensor Make	oment / Model / 1 itan - N404 Model / Se Mapper - 90	ICP erial # 0511		Hobbs St 7556.4	art	02, Time Local	/19/20	20	05	50	1
Crew Pilot A Swain Operator Se Nardone L Wind Dir (°) Wind Speed (kts) 280 4	Equipircraft Make , Cessna 404 Tensor Make / eica Terrain N	oment / Model / 1 itan - N404 Model / Se Mapper - 90	ICP erial # 0511	Day0	Hobbs St 7556.4	art	Time Local				_	1
Pilot A Swain Operator Se Nardone L Wind Dir (°) Wind Speed (kts) 280 4	ircraft Make , Cessna 404 T insor Make / eica Terrain N	/ Model / 1 itan - N404 Model / Se //apper - 90	ICP erial # 0511		7556.4	art	Local	Start	UTC S	`L1	Aiı	ports
Swain Operator Nardone Wind Dir (°) Wind Speed (kts) 280 4	ircraft Make , Cessna 404 T insor Make / eica Terrain N	/ Model / 1 itan - N404 Model / Se //apper - 90	ICP erial # 0511		7556.4			Start	UTC S	·44		
Swain Operator Nardone Wind Dir (°) Wind Speed (kts) 280 4	Cessna 404 Tensor Make / eica Terrain N	itan - N404 Model / Se Aapper - 90	ICP erial # 0511			l .				otart	Der	arting
Operator Se Nardone L Wind Dir (°) Wind Speed (kts) 280 4	eica Terrain N	Model / Se Napper - 90	erial # 0511				10:5	6:00	15:56			DAY
Nardone L Wind Dir (°) Wind Speed (kts) 280 4	eica Terrain N	/lapper - 90	0511			nd	Local		UTC			riving
Wind Dir (°) Wind Speed (kts) 280 4	Visibility (7562		04:2		21:26			DAY
280 4			Condit	ions	7302		04.2	0.00	21.20	J.00	1	DAI
280 4		lmi\ Ca	iling (ft)	1	oud Cover	Temp	(°C)	Dov	Point	(°C)	Drocc	ure ("Hg)
					cattered	Temp		Dew	-4	()		0.04
			1,500						-4		3	0.04
	AGL (ft)		de MSL (TT)	Airfield Ele		(Tt)					
160 6,5	562		7,149		98	37						
	, , , ,		Settir	_	_	.		_				44.53
Point Spacing (m) Point Density (p	psm) Sca	an Angle/F	ov (°)	Sca	n Frequency	(Hz)	Pulse	Rate	(kHz)	Las		/er (%)
8		40			150			1600			100	
						Ve	rify S-T	Turns E	Before	Missio	on	
Line # Direction Start Time	End Time	Time	Sate	ellite	PDOP			line N	otes/C	omma	ntc	
(UTC)	(UTC)	On-Line	Jack	cinte	rbor			Line iv	otes, c	01111111		
55 W 16:35:00	16:48:00	00:13:00		19	1.7							
56 E 16:51:00	17:03:00	00:12:00		22	1.4							
57 W 17:06:00	17:20:00	00:14:00	_	25	1							
59 E 17:23:00	17:36:00	00:13:00		23	1							
60 W 17:39:00	17:54:00	00:15:00		22	1.1							
61 E 17:57:00 62 W 18:13:00	18:10:00 18:28:00	00:13:00 00:15:00		22 23	1.1							
63 E 18:30:00	18:44:00	00:13:00		23 23	1.2							
64 W 18:48:00	19:03:00	00:14:00		23	1.2							
65 E 19:05:00	19:20:00	00:15:00	_	24	1.1							
66 W 19:23:00	19:39:00	00:16:00		24	1.5							
67 E 19:41:00	19:56:00	00:15:00) 2	24	1.1							
68 W 20:00:00	20:19:00	00:19:00		23	1.2							
69 E 20:21:00	20:37:00	00:16:00		21	1.5							
70 W 20:40:00	20:56:00	00:16:00) 2	24	1.2							
			_									
			-									
			+									
			+									
			+									
			\top									
			Page	1		Ve	erify S-	Turns	After N	∕lissio	n	
Additional Comments												

			1	Wo	olp	ert	Lid	ar A	\cq	uisi	tio	n Lo	og					
				Pro	ject l	nfo										Date		
Project #			Project	Name	:				U	nique I	D		Flight	Date	(UTC)	Day o	f Year	Flight #
79574		Ohi	o Statewide P	hase 1	2019	B19			Day0!	52_905	11_1		02,	/21/20	20	0!	52	1
Cre	ew				Equip	ment							Time				Ai	rports
Pil	ot		Ai	rcraft I	Make ,	/ Mode	el / Tai	l #		Ho	bbs St	art	Local	Start	UTC :	Start	De	parting
Fir	nn			Cessna	404 T	itan - N	1404CF)			7562		10:4	5:00	15:4	5:00	ŀ	CDAY
Opei	rator		Sei	nsor M	ake /	Model	/ Seria	al#		Но	bbs E	nd	Loca	l End	UTC	End	Aı	riving
Naro	done		Le	eica Te	rrain N	/lapper	· - 9051	1		7	7566.2)	02:1	0:00	19:1	0:00	K	MGY
							C	onditi	ions									
Wind Dir	(°)	Wind	Speed (kts)	Visi	bility (mi)	Ceilir	ng (ft)	Clo	ud Cov	/er	Tem	o. (°C)	Dew	Point	(°C)	Press	ure ("Hg)
3			4		10					Clear		-	6		-1			30.6
Air Spe	ed (kts)	Altitude	AGL (f	t)	Α	ltitude	MSL (ft)	Airfi	eld Ele	vation	ı (ft)					
-	50		6,5		-			L49	-			37						
								Settin	gs									
Point Spacin	ıg (m)	Poir	nt Density (pp	sm)	Sca	ın Ang	le/FOV			n Frequ	iency	(Hz)	Pulse	Rate	(kHz)	Las	er Pov	ver (%)
-	<u> </u>		8				.0			15		· ·		1600			100)
												Ve	rify S-1	Turns E	Before	Missi	on	
Line #	Direc	tion	Start Time	End 1			me	Sate	ellite	PD	OP			Line N				
74			(UTC)	(U1	-		Line		2		2							
71 72	W		16:09:00 16:30:00	16:2 16:4			8:00		3	1.								
73	W		16:51:00	17:0			8:00		4	1.								
74	E		17:12:00	17:3			8:00		5	1								
75	V	/	17:32:00	17:5	0:00	00:1	8:00	2	5	1.	1							
32	E		17:58:00	18:1			7:00		4	1.								
33	W	/	18:18:00	18:3	6:00	00:1	8:00	2	4	1.	2							
								Page	2			V	erify S-	Turns	After I	Missin	n	
Additional Co	ommer	nts						0-					,,,					
Block 1																		

			Woo	lpe	rt Lic	lar A	Acq	uisitio	n Lo	og					
			Proj	ect Info)							[Date		
Project #		Projec	t Name				U	nique ID		Flight	t Date	(UTC)	Day o	f Year	Flight #
79574	(Ohio Statewide	Phase 1 2	019 B19	9		Day0	53_90511_1		02,	/22/20)20	0!	53	1
Cre	ew		E	quipm	ent					Time				Aiı	rports
Pil	ot	Δ.		•	lodel / Ta	 nil #		Hobbs St	art	Local	Start	UTC	Start	Dei	parting
Fir	nn			-	า - N404C			7566.2	2		0:00	14:2			CDAY
Oper		S			del / Ser			Hobbs E		Loca		UTC			riving
Naro					per - 905			7572.4			0:00	20:2			CDAY
IValu	ione		Leica Terr	aiii iviap		Condit	iona	7372.2	+	03.2	.0.00	20.2	0.00	, r	DAT
Mind Dir	/0\ \\	:d C	\/:-ib	:1:4/:				d C	T	- (%C)	Davi	. Daimt	/°C\	Dunna	(!!!!=\
Wind Dir	() W	ind Speed (kts)	VISID	ility (mi) Celli	ing (ft)	CIC	oud Cover	-	o. (°C)	Dew	/ Point	()		ure ("Hg)
210		8		10				Clear		4		-12	_	3	0.39
Air Spe		_	e AGL (ft)		Altitud		ft)	Airfield El		າ (ft)					
16	50	6,	562		7,	,149		5	87						
						Settir									
Point Spacin	g (m) F	oint Density (p	psm)	Scan A	Angle/FO	V (°)	Sca	n Frequency	(Hz)	Pulse	Rate	(kHz)	Las	ser Pov	ver (%)
		8			40			150			1600			100)
									Ve	rify S-	Turns l	Before	Missi	on	
12	D:	Start Time	End Ti	me	Time	C-4	. 1124 -	DDOD			1 N	10			
Line #	Directio	n (UTC)	(UTC	c) (On-Line	Sate	ellite	PDOP			Line N	otes/C	.ommo	ents	
86	Е	14:50:00	14:53	:00	00:03:00	1	.8	1.3							
85	W	14:56:00	14:59	:00	00:03:00	1	.8	1.4							
84	Е	15:02:00	15:05	:00	00:03:00	1	.8	1.4	C	Couldn't	slow d	own pla	ane, fle	w 84 ba	ick W
84	W	15:09:00	15:12		00:03:00		.7	1.4							
83	E	15:17:00	15:20		00:03:00		.8	1.1							
82	W	15:23:00	15:27		00:04:00	_	22	1							
81	E	15:30:00	15:34		00:04:00	_	21	1.1							
80	W	15:37:00	15:44		00:07:00	_	21	1.1							
79	E	15:49:00	15:57		00:88:00	_	21	1.1							
78		16:00:00	16:11		00:11:00		20	1.3							
77 76	E W	16:16:00 16:32:00	16:29 16:47		00:13:00	_	20 20	1.3							
75	E VV	16:32:00	17:05		00:15:00	_	24	1.3							
74	W	17:08:00	17:23		00:15:00	_	2 4 26	1.1							
73	E	17:26:00	17:40		00:13:00		25	1.1							
72	W	17:42:00	17:59		00:17:00		26	1							
71	E	18:02:00	18:16		00:14:00	_	28	1							
70	W	18:21:00	18:36		00:15:00	_	23	1.2							
69	E	18:40:00	18:54		00:14:00	2	23	1.1							
68	W	18:57:00	19:12	:00 0	00:15:00	2	22	1.3							
67	Е	19:16:00	19:30		00:14:00	_	21	1.2							
66	W	19:34:00	19:49	:00 0	00:15:00	2	23	1.2							
						1									
			-	\perp		_									
						1								-	
Additional Co						Page	1		V	erify S	-Turns	After I	Viissio	n	

				Woolp	ert	Lida	<u>ar <i>P</i></u>	(cq	uisitio	<u>n Lo</u>	og					
				Project I	nfo								C	ate		
Project #			Project	Name				Uı	nique ID		Flight	Date ((UTC)	Day o	f Year	Flight
79574		Ohi	o Statewide P	hase 1 2019	B19			Day08	36_90515_1		03,	/26/20	20	08	86	1
Cre	ew			Equi	oment				_		Time				Aiı	ports
	lot		Ai	rcraft Make			#		Hobbs St		Local	Start	UTC	Start		parting
	over	\rightarrow		Reims 406	-				5669.6		10:2		14:22			DAY
	rator	-	Sei	nsor Make /					Hobbs E		Loca		UTC			riving
•	nedy	\rightarrow		eica Terrain N		•			5675.8		16:3	-	20:3			DAY
KEIII	leuy		LC	ilca Terrami	viappei		onditio		3073.0	5	10.5	7.00	20.5	7.00		DAT
I Di-	(0)	2000 - 4	- 1/1-4-1		, .\	_			1.6	T	(0.0)	-		10.01		/11.1
Wind Dir	(°)	Wind	Speed (kts)	Visibility	(mi)	Ceilin			ud Cover	Temp	-	Dew	Point	(°C)	_	ure ("H
220			10	10	_	25,0			Broken		.2		6		2	9.91
Air Spe	ed (kts)		Altitude	AGL (ft)	A	ltitude	MSL (f	t)	Airfield Ele	evation	1 (ft)					
16	60		6,5	62	Γ	7,1	.65		1,0	009						
							Setting	gs								
Point Spacin	ng (m)	Poin	nt Density (pp	sm) Sc	an Ang	le/FOV			n Frequency	(Hz)	Pulse	Rate ((kHz)	Las	ser Pov	ver (%)
0.7	**		2			10	`		150	•		1600	<u>, , , , , , , , , , , , , , , , , , , </u>		100	
J.,									155	Ve	rify S-1		2 afore	Missi		Yes
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65	E		14:45:00	15:00:00	00:1	5:00	25	5	0.9		Block				west ei	nd
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106	Е		15:29:00	15:37:00	_	00:8	24		1.1		S	tart Blo	ock 7 @	9 711s	9MSL	
105	W		15:40:00	15:48:00		00:80	25		1.2							
104	E		15:51:00	15:59:00	_	00:80	24		1.1							
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102	Е		16:14:00	16:22:00	_	00:80	22		1.3	<u> </u>						
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Blocks 3, 7

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Project #			Project	Name	:				U	nique ID		Flight	t Date	(UTC)	Day o	f Year	Flight #			
79574		Ohio	o Statewide P	hase 1	2019	B19			Day1	10_90511_:	1	04	/19/20	020	1:	10	1			
Cro	ew				Equip	ment						Time				Ai	rports			
Pil	ot		Ai	rcraft I	Make /	/ Mode	l / Tai	l #		Hobbs	Start	Local	Start	UTC	Start		parting			
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			8			4	0			150			1600			100)			
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64	E		14:19:00	14:3	3:00	00:1	4:00	2	3	1.1										
63	W		14:36:00	14:5	2:00	00:1	6:00	2	1	1.2										
62	Е		14:55:00	15:1	0:00	00:1	5:00	2	3	1.2										
61	W		15:12:00	15:2	8:00	00:1	6:00	2	1	1.6										
60	E		15:31:00	15:4		00:1		2		1.3										
59	W		15:48:00	16:0		00:1			4	1.2										
58	E		16:07:00	16:2		00:1		2		1.3	+									
57	W		16:24:00	16:4		00:1			9	1.5	+									
56	E		16:44:00	16:5		00:1		2		1.2										
55	W	\rightarrow	17:01:00	17:1		00:1		2		1.1										
54	E		17:21:00	17:3		00:1		2		1.1	+									
53 52	W E		17:37:00 17:57:00	17:5 18:1		00:1 00:1		2		1.1										
51	W		18:14:00		1:00	00:1			9	1.1										
50	E	\dashv	18:34:00		7:00	00:1		1		1.5	+									
49	W		18:50:00		7:00	00:1		1		1.3	+									
48	E	\dashv	19:09:00		3:00	00:1		1		1.1										
47	W		19:26:00		0:00	00:1		1		1.3										
46	Е		19:43:00	19:5		00:1		1		1.2										
45	W		20:00:00	20:1		00:1		1	8	1.3										
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				Projec	t Info								[Date		
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79574		Ohio	Statewide P	hase 1 20	19 B19			Day11	120_SN511_:	1	04	/20/20)20	1	11	1
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Air Spe	ed (kts))	Altitude	AGL (ft)	Α	ltitude	MSL (ft)	Airfield Ele	evatio	n (ft)					
16	50		6,5	62		7,1	L65		1,0	009						
							Setti	ngs								
Point Spacir	ng (m)	Poin	t Density (pp	osm) S	can Ang	le/FO\	/ (°)	Sca	n Frequency	(Hz)	Pulse	Rate	(kHz)	Las	ser Pov	wer (%)
					4	10			150			1600			100)
										Ve	erify S-	Turns I	Before	Missi	on	Yes
			Start Time	End Time	Ti	me										
Line #	Direc	tion	(UTC)	(UTC)		Line	Sate	ellite	PDOP			Line N	lotes/C	comm	ents	
16	е		15:33:00	15:45:00		2:00	2	:0	1.3							
17	w		15:47:00	15:59:00		2:00		2	1.1							
18	e		16:03:00	16:15:00		2:00		1	1.3							
19	w		16:18:00	16:32:00		4:00		1	1.5							
20	е	:	16:35:00	16:49:00	00:1	4:00	2	2	1.2							
21	w	,	16:51:00	17:06:00	00:1	L5:00	2	4	1.1							
22	е	!	17:08:00	17:22:00	00:1	4:00	2	:3	1.1							
23	W	<i>i</i>	17:25:00	17:40:00		15:00	2	4	1							
24	е	!	17:42:00	17:56:00		4:00	2	.3	1.2							
25	w	1	17:58:00	18:13:00		15:00		1	1.2							
26	е		18:16:00	18:30:00		4:00		2	1.2							
27	W		18:32:00	18:47:00	_	15:00		.7	1.6	<u> </u>						
28	e		18:49:00	19:03:00		4:00		0	1.3	<u> </u>			cld wr	. 22		
29 30	e w		19:05:00 19:23:00	19:21:00 19:37:00	_	L6:00 L4:00		.9 .9	1.2	_			ciu wp) 3 3		
31	w		19:39:00	19:53:00		4:00		.9 .9	1.1							
32	e		19:56:00	20:10:00	_	4:00		.9 .9	1.2	\vdash						
33	w		20:12:00	20:27:00		5:00	_	.9	1.2				cld w	16		
34	e		20:30:00	20:43:00		13:00		.7	1.2							
35	w		20:46:00	21:01:00		5:00		.6	1.3							
36	е		21:04:00	21:17:00	_	3:00		.0	1							
							Page	1		V	erify S	-Turns	After	Missio	n	Yes
Additional C	comme	nts												-		

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				Pro	ject lı	nfo						Date					
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79574		Ohi	o Statewide Phase 1 2019 B19					Day118_90513_1				04/27/2020			1:	118 1	
Cre	ew		Equipment						-			Time			Ai	rports	
Pil	ot		Aircraft Make / Model / Tai					#		Hobbs Start				UTC	Start	•	
Costanzo			Reims 406 - N4065								318.4		10:21:00 14:2		1:00		
Operator			Sensor Make / Mod				odel / Serial #			Hobbs End			cal End UTC			Arriving	
Kennedy					 lapper - 90513			322.2			3:00	00 17:33:00		DAY			
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Wind Dir (°) Wind			Speed (kts) Visibility (m							oud Cover Temp		o. (°C)	(°C) Dew Point			Press	ure ("Hg)
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Air Speed (kts)			Altitude AGL (f				ltitude	MSL (ft)		Airfield El						,	70.22
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		-	O				Satellite			Ve	rity 5-	iurns	setore	IVIISSI	on	Yes	
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44	E		14:51:00	15:06:00		00:15:00		22		1.3			main	t hobb	s 5293	3.0	
43			15:09:00	15:23:00		00:14:00		24		1.3	-						
42	E		15:29:00	15:43:00 16:00:00		00:14:00 00:14:00		25		1.1							
41	W E		15:46:00 16:03:00	16:00:00		00:14:00		21		1.5 1.2							
39			16:20:00	16:34:00		00:14:00		24		1.1							
38	E		16:36:00	16:50:00		00:14:00		23		1.1							
37	W		16:52:00	17:06:00		00:14:00		22		1.1							
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Additional Co	omment	:s									-						_

Blocks 3, 7