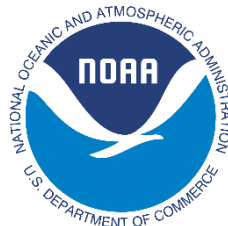




# Quality Assurance Report

CHESAPEAKE BAY SHORELINE MAPPING  
VA2203-TB-C  
TOPO BATHY LIDAR, ORTHO, STEREO COMPILATION

**Prepared For:**



**National Oceanic and Atmospheric Administration**

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# TABLE OF CONTENTS

- 1. INTRODUCTION ..... 4**
  - 1.1 SURVEY AREA .....4
- 2. LIDAR DATA ACQUISITION ..... 5**
  - 2.1 MOBILIZATION .....5
    - 2.1.1 Aircraft Offset Survey .....6
    - 2.1.2 System Calibration Checks .....6
  - 2.2 SURVEY OPERATIONS .....8
    - 2.2.1 The HawkEye 4X .....9
    - 2.2.2 Positioning .....10
- 3. GROUND SURVEY OPERATIONS..... 10**
  - 3.1 LIDAR SURVEY POINTS .....10
  - 3.2 LIDAR GROUND CHECK POINTS (RTK) .....10
- 4. DATA PROCESSING ..... 11**
  - 4.1 POSITION .....11
  - 4.2 IMAGERY .....12
  - 4.3 LIDAR .....12
    - 4.3.1 Raw Data Processing .....12
    - 4.3.2 Lidar Data Classification/Editing .....13
    - 4.3.3 Reflectance .....13
    - 4.3.4 LiDAR Datum Conversions .....14
- 5. QUALITY CONTROL ..... 14**
  - 5.1 CALIBRATION .....14
  - 5.2 ONLINE CHECKS .....14
  - 5.3 POSITIONING .....14
  - 5.4 ACCURACY CHECKS.....14
    - 5.4.1 Comparison to Adjacent Lines (Relative Accuracy) .....14
    - 5.4.2 Cross Line Analyses .....15
    - 5.4.3 Comparison to Topographic Control .....15
- 6. FLIGHT TRAJECTORIES ..... 17**
  - 6.1 VA2203 FLIGHT TRAJECTORIES .....17
- 7. PRODUCTS ..... 18**
  - 7.1 CLASSIFIED LIDAR POINT CLOUD (LAZ FILES) .....18
- 8. RELATED INFORMATION ..... 19**
  - 8.1 FLIGHT LOGS .....19
  - 8.2 TRAJECTORY PROCESSING LOG .....20



# LIST OF FIGURES

Figure 1: Survey Area.....4

Figure 2. Survey Subareas .....5

Figure 3: Mobilized Survey Aircraft N7079F .....6

Figure 4. Schematic of HE4X Calibration Lines .....7

Figure 5. Daily VA2203 QC Control and Check Point Survey .....11

Figure 6. Sample Waveform in Shallow Water .....12

Figure 7. VA2203 Flight Trajectories.....17

# LIST OF TABLES

Table 1. Survey Blocks.....4

Table 2: Aircraft Offsets for October 30, 2022 Calibration (N7079F) .....6

Table 3: Calibration QA Results for October 30, 2022 .....7

Table 4: Calibration Ground Truth Comparisons for October 30, 2022.....8

Table 5: Summary of Daily Operations .....8

Table 6. HE4X Survey Flight Parameters .....9

Table 7. GNSS Base Summary for Calibration .....10

Table 8. Project Spatial Reference Systems .....11

Table 9. Line to Line Relative Accuracy .....15

Table 10. Cross Line Surface to Main Scheme Surface Results .....15

Table 11. Precise Point Positioning Shifts .....15

Table 12. Static Shifts Applied to Align Ellipsoid Heights to Topographic Lidar Control Points .....15

Table 13. Ellipsoid LiDAR Comparison to NVA Check Point Results .....16

Table 14. Ellipsoid LiDAR Comparison to VVA Check Point Results .....16

Table 15. Ellipsoid LiDAR Comparison to BVA Check Point Results.....16

Table 16. Orthometric LiDAR Comparison to NVA Check Point Results .....16

Table 17. Orthometric LiDAR Comparison to VVA Check Point Results.....16

Table 18. Orthometric LiDAR Comparison to BVA Check Point Results.....16

Table 19. Product Deliverable Structure .....18

Table 20. LAZ Classes .....18



# 1. Introduction

Woolpert was contracted by the National Oceanic and Atmospheric Administration’s National Geodetic Survey (NGS) Remote Sensing Division (RSD) Coastal Mapping Program (CMP) to provide airborne topographic and bathymetric lidar data and digital imagery to enable accurate and consistent measurement of the national shoreline for 2145 square kilometers of Tangier Smith (VA2203-TB0C). All data were acquired using Woolpert’s Leica HawkEye 4X system to meet the requirements of the project.

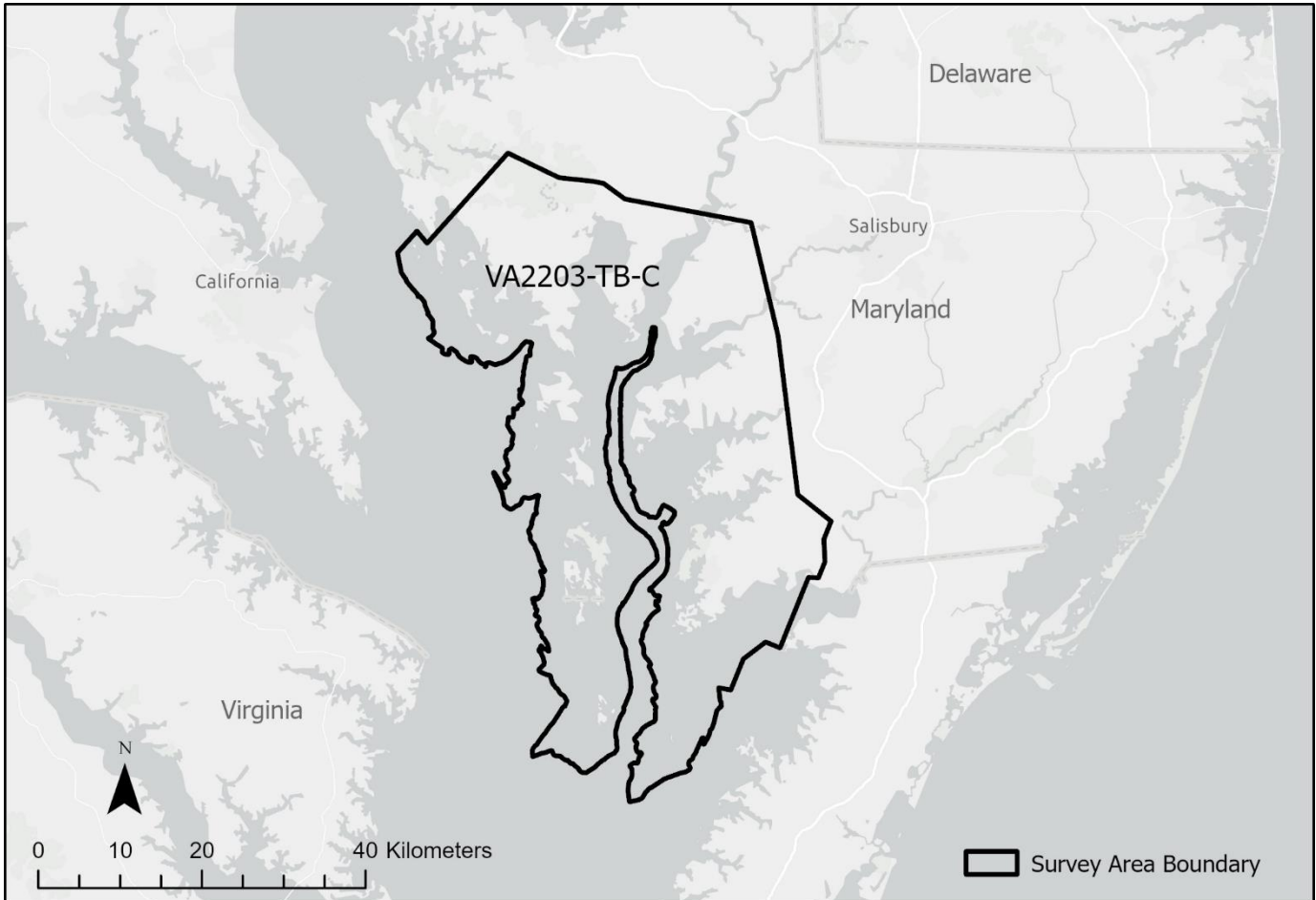


Figure 1: Survey Area

Details of the survey, data processing, quality control (QC), and product creation are provided in detail within this report.

## 1.1 Survey Area

The project areas covers approximately 2145 square kilometers of topographic and bathymetric lidar and digital imagery collection.

The project area was split into survey areas, subareas, and survey blocks, allowing flight lines to be planned in the most efficient manner. Bathymetric lidar data was collected to support 100% coverage and to meet QL2b specifications.

Table 1. Survey Blocks

Survey Area	Survey Subarea	Area (km <sup>2</sup> )	Survey Block(s)
VA2203	VA2203A	484	BL10 – BL18, BL45 – BL50
VA2203	VA2203B	469	BL11 – BL14, BL18, BL49, BL50
VA2203	VA2203C	347	BL11, BL12, BL14, BL17, BL18, BL47, BL50



Survey Area	Survey Subarea	Area (km <sup>2</sup> )	Survey Block(s)
VA2203	VA2203D	507	BL 10 – BL12, BL16, BL17, BL45,
VA2203	VA2203E	399	BL10, BL11, BL15, BL17, BL46

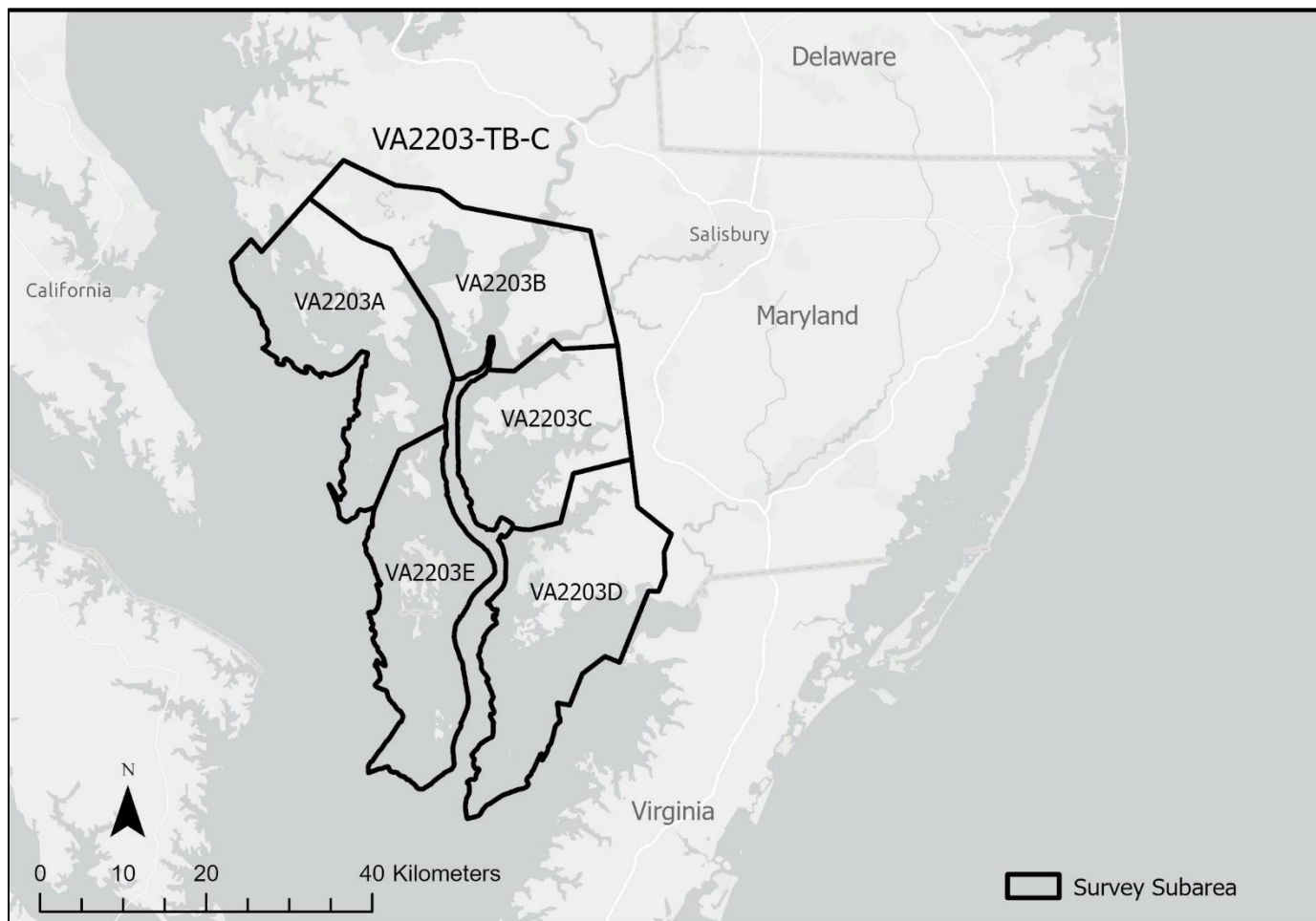


Figure 2. Survey Subareas

## 2. Lidar Data Acquisition

All lidar data were acquired using a Chiroptera 4X (CH4X) sensor, with an additional Leica 40 kHz deep bathymetric channel. The combination of these sensors is referred to as a Leica HawkEye 4X (HE4X) system. The CH4X sensor head, which contains the topographic laser, shallow bathymetric laser and camera, was mounted in a Leica PAV100 gyro-stabilized mount integrated with a NovAtel SPAN GNSS and LCI-100C IMU. The deep channel sensor head was mounted over a second hatch, with an additional IMU. Real-time navigation and GNSS/IMU data logging were provided by Leica FlightPro software. Lidar data was logged on the Airborne Hydrography, AB (AHAB) operator console.

### 2.1 Mobilization

The HE4X sensor was installed in a Cessna 404 (N7079F) and a full calibration flight was collected over Stennis International Airport (HSA) on October 30, 2022 for survey operations.



Figure 3: Mobilized Survey Aircraft N7079F

### 2.1.1 Aircraft Offset Survey

Physical mounting offsets between the GNSS antenna, IMU and gyro-stabilized mount were determined through a combination of manual measurements and iterative processing in NovAtel Inertial Explorer software.

Manual measurements were taken from the GNSS antenna to the reference point on the IMU in the HE4x sensor head. These measurements are added to the known offset between the IMU reference point and the rotation center of the gyro-stabilized mount to calculate the preliminary offset between the GNSS antenna and sensor reference point. This preliminary value was then used to seed the post-processing software which, through an iterative computation, uses the dynamic accelerations and rotations during flight to refine the offsets. Once the solution converges, the final offsets are entered into the flight management software and used in subsequent post-processing of the GNSS/IMU data for final trajectories.

Final offsets, shown in the Leica reference frame, are presented in Table 2.

Table 2: Aircraft Offsets for October 30, 2022 Calibration (N7079F)

Sensor Head	Lever Arm	X (forward)	Y (right)	Z (down)
CHII (Topo and Shallow Channel)	Reference to GNSS Antenna L1 Phase Center	-0.022 m	0.007 m	0.958 m
	Reference to IMU	-0.003 m	-0.006 m	-0.296 m
	Reference to IMU Rotation	0°	180°	0°
Deep Channel	IMU to GNSS Antenna L1 Phase Center	-0.081 m	0.744 m	0.876 m
	Reference to IMU Rotation	-90°	0°	180°

### 2.1.2 System Calibration Checks

Field calibration of the HE4X system was carried out to eliminate systematic errors by calculating corrections for boresight errors, scanner angle errors, remaining IMU angle errors, and any necessary internal timing errors. To verify or compute the field calibration, the lines shown in Figure 4 were flown.

- a. 2 x Line A over mixed terrain with flat or gentle slopes and features such as peaked roof buildings (1 x each direction)
- b. 1 x Line B offset + 50% from Line A in one direction
- c. 1 x Line C offset - 50% from Line A in the same direction as Line B



- d. 2 x Line D orthogonal to previous lines (1 x each direction)

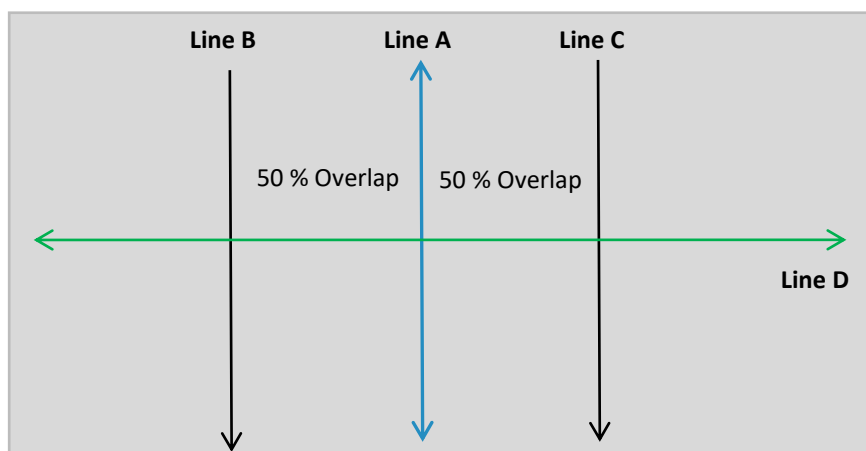


Figure 4. Schematic of HE4X Calibration Lines

A set of calibration lines were acquired at 800m, 500m and 400m altitude over Stennis on October 30<sup>th</sup>.

Calibration values were calculated using the automatic calibration routine within the Leica Lidar Survey Studio (LSS) software. This utility first identified patches or areas of gentle slope within the overlap region of all the lines to use for calibration. Patch selection prevented areas of vegetation, side of cars, or buildings from being used in the calibration process. Next, the utility compared the front side and back side of the elliptical scan within the same line, as well as comparing all lines to each other, to identify suitable calibration parameters such that data within the patches match. The procedure was iterative and continued until the best possible solution is computed.

Calibration for each channel (topographic, shallow, and deep) was done independently. Topographic channel calibration was computed using the 500 m altitude lines. The 400 m lines were then used for verification. Calibration of the shallow channel and deep channel were computed using 500 m altitude data. The lower altitude data was used for verification.

At each step of the calibration process, quality assurance was conducted to ensure values being calculated were valid. This was done using the Leica LSS Quality Control Utility. Two types of checks were performed. First, the front scan was compared to the back scan for every line. Next, a single line was chosen as a baseline and was compared to every other line. As expected, the average errors from both checks were small. Additionally, the data was visually reviewed. In particular, features were studied to ensure lines from different directions show structures in the same position, verifying horizontal accuracy was maintained. These tests all provided assurance of relative accuracy.

Results from the calibration verification checks are provided in [Table 3](#). Results are good and indicate that calibrations were successful. Calibration values computed were used for all project data collected until the date of the next calibration.

Table 3: Calibration QA Results for October 30, 2022

Test		Topo 800m	Topo 500m	Topo 400m	Shallow 500m	Shallow 400m	Deep 500m	Deep 400m
Front to Back Scan Comparison	Average Error (m)	-0.0113	-0.0004	-0.0003	-0.0005	-0.0033	0.0004	0.0107
	Std. Dev. of Error	0.0007	0.0005	0.0003	0.0013	0.0011	0.0054	0.0010
Line to Line Comparison	Average Error (m)	-0.0025	-0.0033	-0.0057	-0.0044	-0.0067	-0.0045	-0.0051
	Std. Dev. of Error	0.0029	0.0008	0.0010	0.0008	0.0018	0.0066	0.0075

Woolpert acquired a detailed set of ground truth data at Stennis International Airport. The ground truth was acquired using Trimble R10 GNSS receivers, Real Time Kinematic (RTK) and Post-Processed Kinematic (PPK) survey techniques.

Ground truth is not used within the automatic calibration routine. However, a comparison to the lidar data was used to verify absolute accuracy. Results presented in [Table 4](#) show data is well within required accuracy specifications.



Table 4: Calibration Ground Truth Comparisons for October 30, 2022

	Topo			Shallow		Deep	
	800m	500m	400m	500m	400m	500m	400m
Average dz (m)	-0.0073	0.0075	0.0092	0.0032	0.0032	0.0203	0.0030
Root Mean Square (m)	0.0082	0.0110	0.0109	0.0096	0.0072	0.0218	0.0069

## 2.2 Survey Operations

For ease of operations and data management, the survey area was split into survey blocks. Actual flight lines flown, including start and end date and unique line ID, are provided in the trajectory database included with the project deliverables in SHP format.

A summary of the daily operations is shown in [Table 5](#). Detailed Flight Logs for each day are provided in section 8.1. Aerial operations were conducted out of four airports: Cambridge-Dorchester (CGE), Ocean City Municipal Airport (OXB), Salisbury Regional (SBY), and Easton Airport (ESN).

Eighteen cross lines were acquired across the areas of interest during the survey for quality purposes. Crosslines were planned perpendicular to main scheme survey lines and used to verify the relative accuracy of the data where bottom coverage allowed.

Table 5: Summary of Daily Operations

Flight	Engine Time	Air Time	Flown km   %		Reflown km   %		Comments
2022-10-30A	2:19:00	1:42:00	123.5	0.5%			400m, 500m, 800m
2022-11-03A	5:07:00	4:32:00	549.8	2.4%			BL10, BL31, BL60
2022-11-03A	5:07:00	4:32:00	549.8	2.4%			BL10, BL31, BL60
2022-11-05A	5:37:00	4:48:00	502.4	2.2%			BL10, BL11, BL14, BL33, BL60
2022-12-08A	6:41:00	6:13:00	658.8	2.8%	26.1	0.1%	BL12, BL32, BL60
2022-12-13A	4:44:00	4:11:00	477.0	2.0%	48.7	0.2%	BL12, BL60
2022-12-18A	5:00:00	4:25:00	621.2	2.7%			BL17, BL60
2022-12-19A	6:21:00	4:45:00	606.8	2.6%	93.7	0.4%	BL11, BL33, BL60
2022-12-20A	5:53:00	5:22:00	859.5	3.7%			BL11, BL60
2022-12-21A	4:46:00	3:42:00	409.7	1.8%	55.4	0.2%	BL11, BL40, BL60
2022-12-20A	5:53:00	5:22:00	859.5	3.7%			BL11, BL60
2022-12-21A	4:46:00	3:42:00	409.7	1.8%	55.4	0.2%	BL11, BL40, BL60
2023-01-07A	4:59:00	3:44:00	504.1	2.2%	57.3	0.2%	BL10, BL13, BL61
2023-01-05A	4:17:00	3:23:00	398.6	1.7%	56.2	0.2%	BL11, BL61
2023-01-06A	5:51:00	5:21:00	852.1	3.7%	60.1	0.3%	BL10, BL11, BL61
2023-01-14A	6:25:00	5:56:00					BL13, BL61
2023-01-14A	6:25:00	5:56:00					BL13, BL61
2023-01-15A	2:52:00	1:27:00	140.4	0.6%			BL13, BL61
2023-01-16A	2:35:00	3:37:00	531.5	2.3%	45.6	0.2%	BL13, BL14, BL61
2023-01-18A	5:46:00	5:12:00	763.1	3.3%	9.1	0.0%	BL14, BL61
2023-02-05A	5:50:00	5:04:00	197.4	0.8%			BL41, BL45, BL61
2023-02-06A	3:28:00	2:27:00	35.2	0.2%	15.7	0.1%	BL45, BL61
2023-02-07A	2:48:00	1:20:00	27.3	0.1%			BL45, BL61
2023-02-09A	4:24:00	3:35:00	95.1	0.4%			BL45, BL46, BL61





2023-02-10A	4:13:00	3:37:00	131.4	0.6%	16.8	0.1%	BL49, BL61
2023-02-11A	4:44:00	4:11:00	238.2	1.0%			BL47, BL49, BL61
2023-02-19A	6:11:00	5:37:00	217.8	0.9%	114.5	0.5%	BL46, BL48, BL61
2023-02-20A	4:21:00	3:52:00	105.9	0.5%	4.9	0.0%	BL46, BL47, BL61
2023-02-23A	1:58:00	1:32:00	41.3	0.2%			BL47, BL61
2023-02-27A	2:08:00	1:40:00	10.6	0.0%	89.7	0.4%	BL45, BL61
2023-03-01A	4:23:00	3:46:00	316.5	1.4%	104.3	0.4%	BL48, BL49, BL50, BL61
2023-03-01A	4:23:00	3:56:00	10.6	0.0%	455.4	2.0%	BL48, BL49, BL50, BL61
2023-03-05A	2:38:00	2:08:00	10.6	0.0%	150.7	0.6%	BL45, BL61

## 2.2.1 The HawkEye 4X

All lidar data was acquired using a HE4X sensor. The system provides denser data than previous traditional bathymetric lidar systems. It is unique in its ability to acquire bathymetric lidar, topographic lidar, and 4-band digital camera imagery simultaneously.

The HE4X provided 500 kHz topographic data, an effective 140 kHz shallow bathymetric data, and 40 kHz deep bathymetric data.

The bathymetric and topographic lasers are independent and do not share an optical chain or receivers, so they are optimized for their specific function. As with any bathymetric lidar, maximum depth penetration is a function of water clarity and seabed reflectivity. The HE4X is designed to penetrate to 3 times the secchi depth. This is also represented as  $D_{max} = 4/K$ , where K is the diffuse attenuation coefficient, and assuming K is between 0.1 and 0.3, a normal sea state and 15% seabed reflectance.

Both the topographic and bathymetric sub-systems use a palmer scanner to produce an elliptical scan pattern of laser points with a degree of incidence ranging from  $\pm 14^\circ$  (front and back) to  $\pm 20^\circ$  (sides), providing a  $40^\circ$  field of view. This has the benefit of providing multiple look angles on a single pass and helps to eliminate shadowing effects. This can be of particular use in urban areas, where all sides of a building are illuminated, or for bathymetric features such as the sides of narrow water channels or features on the seafloor, such as smaller objects and wrecks. It also assists with penetration in the surf zone where the back scan passes the same ground location a couple of seconds after the front scan, allowing the areas of whitewater to shift.

The bathymetric laser is a diode pumped class 4 laser which operates in the green spectrum. Full waveform data is acquired for every pulse. The topographic laser operates in the infra-red spectrum at 1064 nm. Up to 4 returns per pulse are acquired from each lidar.

For this project, the flight parameters shown in [Table 6](#) were used to provide 100% coverage. Flight parameters used exceed the requirements for the survey to meet QL2b.

**Table 6. HE4X Survey Flight Parameters**

	<b>Topo-Bathy Flight Lines</b>
Topographic PRF (kHz)	500
Topographic Points per m <sup>2</sup>	>16.7
Shallow Bathy PRF (kHz)	140
Shallow Bathy Points per m <sup>2</sup>	4.7
Deep Bathy PRF (kHz)	40
Deep Bathy Points per m <sup>2</sup>	1.3
Swath Width (m)	350
Flight Line Sidelap (%)	20
Altitude (m)	480
Survey Speed (knots)	125



During acquisition, flight lines were shown on a pilot's display, and the aircraft was controlled by the pilot at all times. The HE4X system includes a NovAtel SPAN GNSS system with an LCI-100C IMU for aircraft position and orientation. One IMU is in the main Chiroptera sensor head, which includes the topographic channel, shallow channel, and RCD30 camera. Data from this IMU is also used in real-time by the PAV100 gyro-stabilized mount to compensate for deviations in pitch and roll.

A second IMU is contained within the deep channel sensor head, installed over a second hatch in the aircraft. This head does not include a gyro-stabilized mount. Aircraft bank angles were restricted to 25° to avoid any potential GNSS dropouts. No flights were planned if the PDOP was expected to go above 3.0.

Data were monitored for quality during acquisition using the Operators Console running on the AHAB collection computer. The operator monitored the system status of the scanners and receivers, waveforms, camera images, data coverage, flight lines and the health of the navigation system.

All data was recorded to a removable solid-state hard disk. At the end of each flight, the hard disk was removed and taken to the field office, where data was copied onto backup disks for transmission back to the main processing office. Preliminary data was reviewed daily in the field for quality and coverage.

## 2.2.2 Positioning

Position and orientation data was acquired in the aircraft using a NovAtel SPAN with LCI-100C IMU. All data was post-processed using NovAtel Inertial Explorer software to provide a tightly coupled position and orientation trajectory solution.

Calibration data were processed using single-base Post Processed Kinematic (PPK) techniques. A GNSS base station was set up at Stennis International Airport. The data collected from GNSS base station provided the reference station data used to control trajectory processing.

To provide accurate coordinates for comparison, a control point (JX10) was established which served as the base for RTK observations. GNSS observations were used to compute an accurate coordinate for the control point ([Table 7](#)).

**Table 7. GNSS Base Summary for Calibration**

Control Point	Latitude	Longitude	Height (m)	Datum
JX10	30° 22' 23.25998" N	089° 26' 54.19218" W	-22.853	NAD83-2011

All project data were acquired using Precise Point Positioning (PPP) techniques. Logs for the base station and trajectory processing are provided in [Section 8.2](#).

# 3. Ground Survey Operations

Ground control surveys were conducted to assist with final point cloud calibration and to perform quality assurance checks on the final LiDAR point cloud.

## 3.1 LiDAR Survey Points

The purpose of this survey was to establish three-dimensional coordinates for 10 topographic lidar control points, 3 bathymetric lidar check points, 41 vegetated check points, and 40 non-vegetated check points. The points were uniformly dispersed over the project areas. Further discussion of the results is presented in [Section 5.4.3](#).

## 3.2 Lidar Ground Check Points (RTK)

For quality control purposes, a daily QC flight line was acquired over the same location nearly every day near Oxford, MD for VA2203. Topographic control and check point data were collected with a Trimble R-10 GNSS receiver using RTK GNSS techniques over the area covered by the daily lidar QC line. Further discussion of the processing and results is presented in [Section 5.4.3](#).



Figure 5. Daily VA2203 QC Control and Check Point Survey

## 4. Data Processing

Initial data coverage analysis and quality checks to ensure there were no potential system issues were carried out in the field and office prior to final demobilization of the sensor. Final processing was conducted in Woolpert’s offices.

In general, data were initially processed in Leica’s Lidar Survey Studio (LSS) using final processed trajectory information. LAS files from LSS were then imported to a TerraScan project, where spatial algorithms were used to remove gross noise. Manual review and further QC were conducted in TerraScan prior to product creation.

### 4.1 Position

Final trajectory data were post processed in NovAtel Inertial Explorer. Lever arms, shown in the NovAtel reference frame, are presented in [Table 2](#). 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. Trajectory processing logs are provided in [Section 8.2](#). Average Forward and Reverse Separation RMS for the project was 0.027 m in Easting and Northing, and 0.041 m in Height.

Project Datum are provided in [Table 8](#). Data were delivered in UTM Zone 18N NAD83(2011) epoch 2010.0 with elevations in NAVD88 GEOID18 except for the classified lidar point cloud which was delivered with ellipsoid heights.

Table 8. Project Spatial Reference Systems

Name	Processing and Deliverable Datum
Horizontal Datum	NAD83(2011) epoch 2010

<b>Horizontal Projection</b>	UTM 18N
<b>Horizontal Units</b>	Meters
<b>Vertical Datum</b>	Ellipsoid or NAVD88 GEOID18
<b>Vertical Units</b>	Meters

## 4.2 Imagery

For more details about the imagery acquisition and processing see the following reports:

VA2203:

Airborne Positioning and Orientation Report (APOR): Submitted April 6, 2023

Acquisition Summary: Submitted on April 6, 2023

A/T Report: Submitted on June 8, 2023

## 4.3 Lidar

### 4.3.1 Raw Data Processing

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 v1.4 format. All points from the topographic and bathymetric laser include 16-bit intensity values.

During the LSS processing stage, an automatic land/water discrimination was made for the bathymetric waveforms. This allowed the bathymetric (green) pulses over water to be automatically refracted for the pulse hitting the water surface and travelling through the water column, producing the correct depth. Another advantage of the automatic land/water discrimination was that it permitted calculation of an accurate water surface over smaller areas, allowing simple bathymetric processing of smaller, narrower streams and drainage channels. Sloping water surfaces were also handled correctly.

Prior to processing, the hydrographer adjusted waveform sensitivity settings dependent on the environment encountered and entered a value for the refraction index to be used for bathymetry. The index of refraction was an indication of the water type. Values used for sensitivity settings and the index of refraction are included in the LSS processing settings files. A value of 1.3423 was used for the index of refraction, indicating salt water.

To determine the optimal waveform sensitivity settings for final processing, sample areas were selected and processed with multiple different settings, to iteratively converge on the best possible settings. This was done by reviewing the processed point cloud and waveforms within sample areas. A sample waveform is provided in [Figure 6](#). Settings affected which waveform peaks were classified as valid seabed, and which peaks were classified as noise.

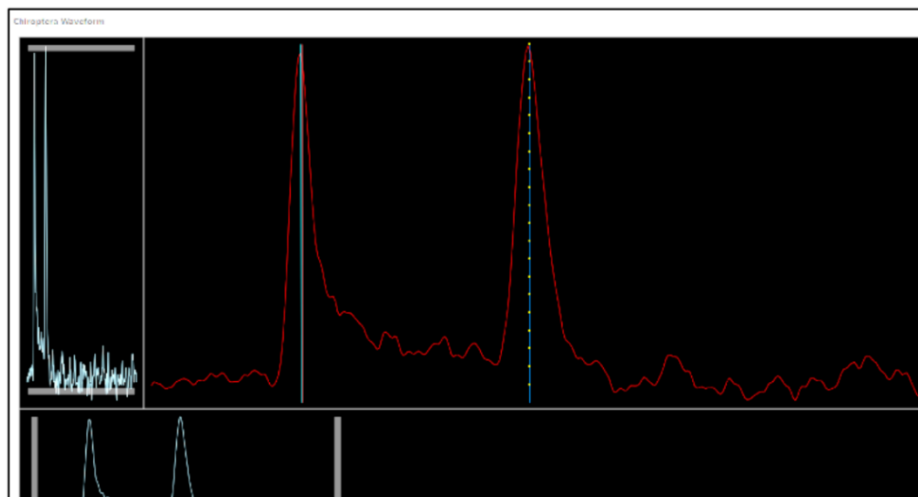


Figure 6. Sample Waveform in Shallow Water



Optimal settings struck a balance between the amount of valid data that was classified as seabed bottom, and the amount of noise that was incorrectly classified due to peaks in the waveforms. All valid data was selected, while only a small amount of noise remained to be edited out. Once optimal threshold settings were chosen, they were used for the entire project.

It is important to note that all digitized waveform peaks were available to be reviewed by the hydrographer; both valid seabed bottom and peaks classed as noise. This allowed the hydrographer to review data during TerraScan editing for valid data such as objects that may have been misclassified as noise.

Woolpert developed proprietary routines implemented in our in-house GTools software to run further checks on the lidar data prior to import to Terrascan project tiles. These checks automatically identified areas where Multiple Pulse in Air (MPIA) errors occurred, as well as invalid derived water surface data, and deleted the erroneous data from the dataset. In addition, GTools merged the multiple small files per flight line generated by LSS into a single LAS file per flight line. Data in each LAS file was also classed into a standard LAS class structure in preparation for data editing.

### 4.3.2 Lidar Data Classification/Editing

After data were processed through LSS and the data integrity reviewed, data were organized into tiles within a TerraScan project. Data classification and spatial algorithms were applied in Terrasolid's TerraScan software. Customized spatial algorithms, such as isolated points and low point filters, were run to remove gross fliers in the bathymetric and topographic data.

All data were reviewed manually to reclassify any valid bathy points incorrectly identified by the automated routines in LSS as invalid, and vice versa. In addition, any topographic points remaining over the water were reclassified to a Topographic Water class to correct the ground representation. Manual editing was conducted in TerraScan. Product grids and TIN models were used at the required product resolution to assist in data editing and QC results. Steps conducted during the manual editing phase included:

- Removing noise from the unclassified topographic class to leave only valid data (e.g., vegetation, buildings, real temporary objects in the environment such as cars, people, etc.);
- Removing any topographic unclassified, topographic ground, and valid seabed class data from the water surface to a water surface class, including along the shoreline;
- Filling gaps in the topographic ground and seabed classes, including potential objects such as rocks on the coast; and
- Removing any remaining noise from the topographic ground and seabed classes.

### 4.3.3 Reflectance

Once all lidar data were edited, final seabed class data were used to compute project specific correction parameters and normalize the raw intensity data for depth. Corrected values were then written back into the LAS files.

Although the bathymetric data includes intensity values, these are raw values. For intensity (reflectance) to correctly represent the reflectance of the seabed, the intensities must be normalized for any losses in signal as the light travels through the water column, so that the intensity value better reflects the intensity of the seabed itself.

One of the fundamental issues that exists with reflectance imagery is the variance in return due to water clarity differences occurring spatially along line, and temporally from day to day. This is challenging for any bathymetric lidar sensor.

If water clarity is relatively consistent along a line, then it is possible to achieve an overall homogenous reflectance image for an area. To a certain extent, variation in reflectivity intensity can be minimized by limiting the size of flight blocks and trying to ensure similar environmental parameters exist within a single flight block. In other words, where changes in water clarity or environment may be expected, flight blocks should be split to allow different normalization parameters to be used per block for the reflectance processing. Where this is not possible and water clarity varies significantly along a line, variation in reflective intensity will be seen in the output imagery. While this imagery can still be analyzed and used for manual seabed classification, it prohibits the use of unsupervised, or semiautomated classification.

Woolpert used proprietary in-house scripts to compute project specific correction parameters and normalize the raw intensity data for depth. This provided intensities that more closely represent the reflectance of the actual seabed. Corrected values were used to create reflectance images per flight line using LASTools. Individual flight line reflectance images were then used in Trimble's OrthoVista software to create a final reflectance image for the entire area.



OrthoVista was used to improve radiometric balancing between lines and the seamline editor was used to improve the joins between lines to remove as much line-to-line edge matching and cloud artifact issues as possible. As well as delivering the reflectance raster mosaics themselves, the processed reflectance data was used to correct the intensity values within the LAS files for delivery.

### 4.3.4 LiDAR Datum Conversions

All editing was conducted with the LiDAR data elevations on the ellipsoid. Once editing was completed, data were transformed from ITRF2014 (Current Epoch) to NAD83(2011) epoch:2010 with ellipsoid heights using TerraScan.

Terrascan was then used to compare the LiDAR data to known ground control points. For each known location a small TIN was created from the surrounding LiDAR points and the elevation difference from the TIN plane to the point computed.

## 5. Quality Control

Quality control was carried out through every phase of the project. Several checks were used to ensure data integrity and quality was maintained. Specific statistics were generated during cross line analysis and from direct comparison to topographic control.

### 5.1 Calibration

Calibration, which is fundamental to ensuring good data accuracy, is discussed in detail in [Section 2.1.2](#).

### 5.2 Online Checks

The airborne operator monitored the system status of the scanners and receivers, waveforms, data coverage, flight lines, and navigation system during data acquisition. Flight logs were maintained during data acquisition. Logs not only tracked lines acquired, but also any relevant information on weather or water clarity, instances when sensor issues occurred, and so on. These logs were a valuable resource during processing. Flight logs are provided in [Section 8.1](#).

### 5.3 Positioning

During acquisition, aircraft bank angles were restricted to 25 degrees to avoid any potential GNSS dropouts. No flights were planned if the PDOP was expected to go above 3.0. Position processing and results are discussed in [Section 2.2.2](#).

### 5.4 Accuracy Checks

#### 5.4.1 Comparison to Adjacent Lines (Relative Accuracy)

Throughout data editing, adjacent survey lines of data were compared to ensure there were no data busts or system artifacts. During processing, TerraSolid's TMatch software was run to examine the Delta Z differences between overlapping lines, then a simple Z correction was applied per flight line to remove any vertical differences between flight lines. Using TMatch to move all the lines into the same relative plane reduced any remaining small differences caused by the limitations of the trajectory accuracy.

Woolpert's in-house software, GTools, was used to generate dZ grids representing flight line to flight line differences in areas of overlap. Any results within areas of slope greater than 10 degrees were removed, and final dZ statistics generated for the project. This provided a measure of inter-swath accuracy.

Interswath or overlap consistency for the topographic laser was assessed in all areas of overlap with slopes of less than 10 degrees. The topographic RMSDz average for the project is 0.031 m. This meets the required accuracy of  $\pm 8$  cm.

Interswath or overlap consistency for the bathymetric laser was assessed in all areas of overlap with slopes of less than 10 degrees. The bathymetric RMSDz average for the project lines is 0.060 m. This meets the required QL2b accuracy.

Results for each survey area are presented in [Table 9](#).



Table 9. Line to Line Relative Accuracy

Survey Area	Topographic Laser RMSDz (m)	Bathymetric Laser RMSDz (m)
VA2203	0.031	0.060

## 5.4.2 Cross Line Analyses

Cross lines were run in a direction perpendicular to main scheme lines across the entire survey area, providing a good representation for analysis of consistency. All cross lines were used for cross line comparisons. Only bathymetric point returns were used for the analysis. Cross line analysis was performed using ArcGIS Pro. A 2m mean gridded surface of cross line point data were compared to a 2m gridded surface of the main scheme survey lines and statistics generated. A summary of the results is provided in [Table 10](#). The result of the analysis meets the required QL2b depth accuracy requirements.

Table 10. Cross Line Surface to Main Scheme Surface Results

	VA2203
No. of Nodes Compared	5225308
Mean Difference (m)	0.005
Standard Deviation (Std. Dev)	0.090
Mean + 2*Std. Dev	0.185

## 5.4.3 Comparison to Topographic Control

Topographic control data were acquired near Oxford, MD using RTK GNSS techniques. ([Section 3.1](#)). This area was covered by the daily lidar QC line used to account for any potential trajectory shifts between each acquisition survey day. In addition, survey control and check points were acquired throughout the survey area to shift the lidar data to the project datum and to assess absolute accuracy.

### 5.4.3.1 Precise Point Positioning Shifts

Due to the remote location of the project areas, Precise Point Positioning (PPP) was used for survey acquisition. To account for any potential trajectory shift between each acquisition survey day a daily QC line was acquired and compared to topographic control data and a shift computed.

To ensure the highest accuracy possible in this scenario, the daily QC line was established on near Oxford, MD for VA2203 and this same line was collected on every survey flight. Control points were acquired for this daily QC line. The control was compared to each lidar daily QC line, and a mean shift computed. During lidar calibration, any line-to-line vertical mismatches were removed. Thus, an average PPP shift per project area was computed and applied to remove any remaining errors in the ellipsoid height due to the use of PPP processing of the trajectories.

A static shift was determined to be appropriate to account for PPP trajectory shift for both survey areas. Results of calculated data shifts comparing the QC lines and RTK control points are provided in [Table 11](#).

Table 11. Precise Point Positioning Shifts

	Static Shift Applied (m)
VA2203	0.149

### 5.4.3.2 Primary Ellipsoid Height Control

A ground survey was collected by Woolpert throughout the survey area. The consisted of 10 topographic lidar control points, 3 bathymetric lidar check points, 41 vegetated check points, and 40 non-vegetated check points. The points were uniformly dispersed over the project area. Once all manual classification was completed and the PPP shift applied, data were compared to topographic lidar control to compute an average vertical shift to be applied. Results are noted in [Table 12](#).

Table 12. Static Shifts Applied to Align Ellipsoid Heights to Topographic Lidar Control Points

	Static Shift Applied (m)
VA2203	-0.038



Absolute vertical accuracy for the lidar points was then calculated using the acquired check points. A summary of results is provided in [Table 13](#), [Table 14](#), and [Table 15](#). The check points were observed in three different land cover types to assess absolute vertical accuracy: non-vegetated (NVA), vegetated (VVA), and bathymetric (BVA). The results indicate that the project meets the required vertical accuracy of 10cm RMSE or 19.6cm at a 95% confidence level for NVA.

This data set tested 0.077 meters fundamental vertical accuracy at the 95<sup>th</sup> percent confidence level in open terrain using  $RMSE(z) \times 1.96$ .

**Table 13. Ellipsoid LiDAR Comparison to NVA Check Point Results**

Area	Count	Average dZ (m)	Std. Deviation	RMSE (m)	Accuracy (95% Confidence)
VA2203	39	0.032	0.042	0.041	0.080

**Table 14. Ellipsoid LiDAR Comparison to VVA Check Point Results**

Area	Count	Average dZ (m)	Std. Deviation	95 <sup>th</sup> Percentile
VA2203	39	0.159	0.106	0.351

**Table 15. Ellipsoid LiDAR Comparison to BVA Check Point Results**

Area	Count	Average dZ (m)	Std. Deviation	RMSE (m)
VA2203	1	0.045	--	0.045

### 5.4.3.3 Ellipsoid to Orthometric Corrections Applied

Once the data were vertically shifted and checked using the Woolpert acquired ground survey the GEOID18 geoid model was applied in SAFE's FME software to convert the ellipsoid elevation data to the final orthometric datum for product creation and delivery.

Terrascan was used to compare the LiDAR data to known ground control points after the transformation. For each location a small TIN was created from the surrounding LiDAR points and elevation difference from the TIN plane to the known point computed. Results are provided in [Table 16](#) and indicate the transformation was applied correctly.

**Table 16. Orthometric LiDAR Comparison to NVA Check Point Results**

Area	Count	Average dZ (m)	Std. Deviation	RMSE (m)	Accuracy (95% Confidence)
VA2203	39	0.000	0.042	0.041	0.080

**Table 17. Orthometric LiDAR Comparison to VVA Check Point Results**

Area	Count	Average dZ (m)	Std. Deviation	95 <sup>th</sup> Percentile
VA2203	39	0.158	0.106	0.351

**Table 18. Orthometric LiDAR Comparison to BVA Check Point Results**

Area	Count	Average dZ (m)	Std. Deviation	RMSE (m)
VA2203	1	0.045	--	0.045

### 5.4.3.4 Imagery Accuracy

For a detailed discussion of imagery accuracy see the Aerotriangulation Report VA2203-TB-C.pdf submitted on June 1, 2023.



# 6. Flight Trajectories

The flight trajectories used for the survey collection are provided in ESRI Shapefile format. The Shapefile contains the attributes, date of capture, local start time, local end time, reference station, and flight line number.

## 6.1 VA2203 Flight Trajectories

The VA2203-TB-C project area was surveyed between November 3, 2022 and March 5, 2023. A total of 588 flight lines were collected.

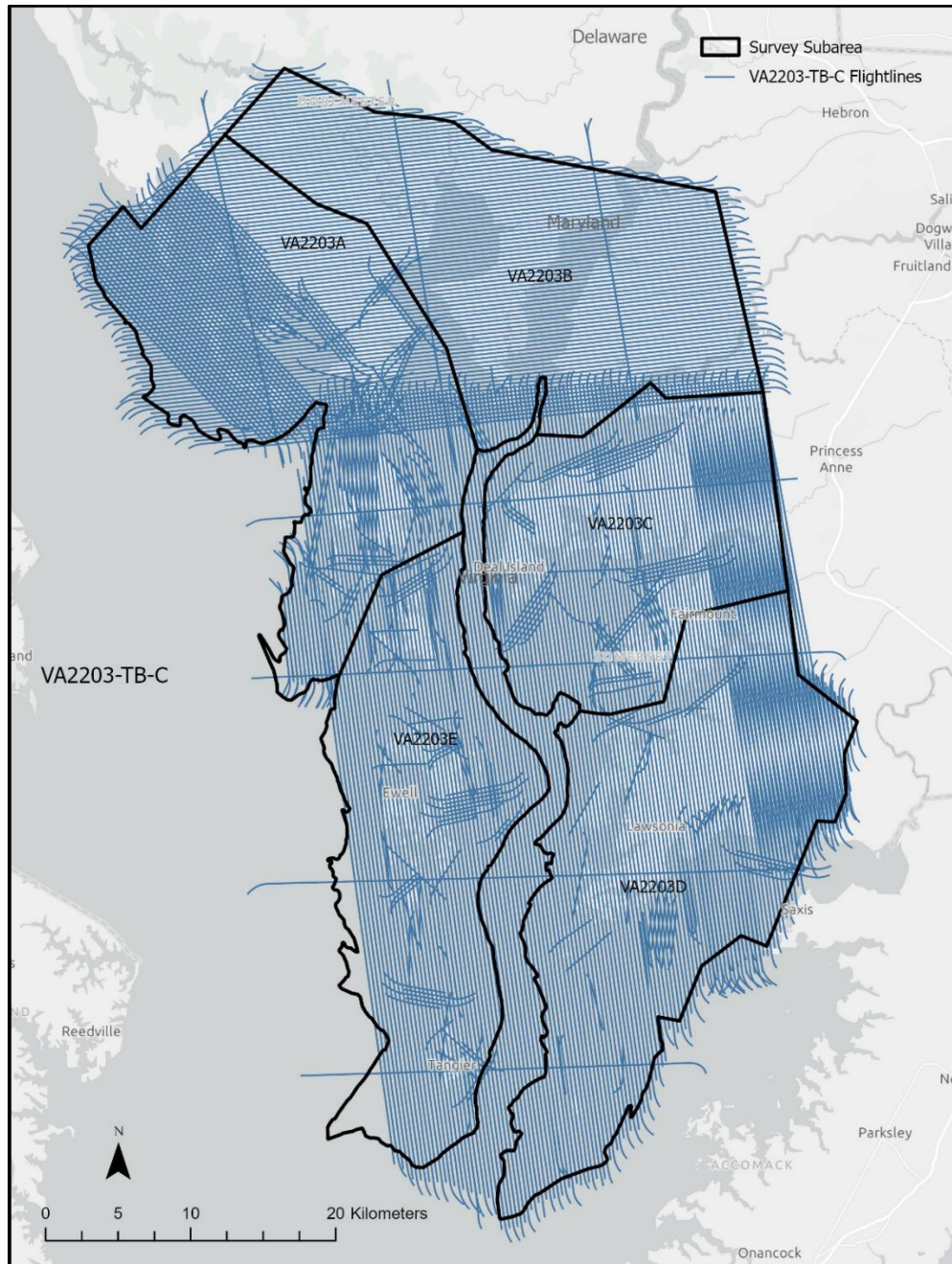


Figure 7. VA2203 Flight Trajectories



## 7. Products

Deliverables required for the project are listed in [Table 19](#).

**Table 19. Product Deliverable Structure**

ID	Type	Item	Deliverable	Resolution (m)	Tiled	Note
1		Classified Lidar Point Cloud	LAS 1.4	--	✓	Vertical NAD83 (2011) epoch 2010.0
2		Topographic/Bathymetric DEM	GeoTIFF	1	✓	Classes 2 and 40. Vertical NAVD88 GEOID18
3		Bathymetric Void Layer	SHP	--		
4		Tile Index	SHP	1000 x 1000	✓	
5		TopoBathy DEM Tile Index	SHP	5000 x 5000	✓	
6		Normalized Seabed Intensity	GeoTIFF	1	✓	
7		Final Trajectory	ASCII	--	--	
8		TPU	GeoTIFF	1	✓	
9		Dz Orthos	GeoTIFF	1	✓	
10		Metadata Per Product	XML	--	--	
16		Flightline Index	SHP	--	--	

### 7.1 Classified Lidar Point Cloud (LAZ Files)

The LAZ data coordinate reference system applied is:

- Horizontal: UTM Zone 18N, NAD83(PA11) epoch:2010, meters
- Vertical: NAD83(2011) epoch:2010 Ellipsoid, meters

Delivered LAZ data are provided in Point Record Format 6 and include Adjusted GPS Time and 16-bit intensity values. LAZ file classes delivered are shown in [Table 20](#). Classes 2 and 40 provide the ground model for the project.

**Table 20. LAZ Classes**

NUMBER	POINT CLASS	DESCRIPTION
1	Unclassified	Valid unclassified data from the topographic laser
2	Ground	Bare earth ground
W7	Low Noise	Spurious high/low point returns (unusable)
9	Water	Water (topographic sensor)
W18	High Noise	Spurious high/low noise points from the bathymetric laser.
40	Bathymetric Point	Submerged topography
41	Water Surface	Water surface, distinct from Point Class 9, which is used in topographic-only lidar and only designates "water," not "water surface"
S42	Derived Water Surface	Synthetic water surface location used in computing refraction at water surface
43	Submerged object	Submerged Object, not otherwise specified (e.g., wreck, rock, submerged piling)



## 8. Related Information

### 8.1 Flight Logs

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Stennis (KHSA)
<b>LOCATION / AREA:</b>	Stennis / 400m, 500m, 800m	<b>DATE:</b>	30 October 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Ryan C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Richard C.
<b>MISSION ID:</b>	Stennis-Cal	<b>CLOUDS:</b>	Clouds @ 3000ft
<b>BASE STATION:</b>	JX10	<b>WIND:</b>	5-10 kts @ 280
<b>ENGINE START:</b>		<b>ENGINE OFF:</b>	
<b>ENGINE TIME:</b>			
<b>GNSS START:</b>	19:07	<b>GNSS START:</b>	2:19
<b>TAKEOFF:</b>	19:32	<b>TOUCHDOWN:</b>	<b>AIR TIME</b> 01:42

FL #	LINE #	START TIME	END TIME	TOPO PRF   PWR	CHII PWR	REMARKS
		19:32:00				Takeoff
		19:39:27				DS: 800m_20221030_193927
000_FL1	6381	19:39:27	19:41:34	800 330	10	
001_FL1	6381	19:44:21	19:46:21	800 330	10	
002_FL3	6383	19:49:56	19:52:02	800 330	10	
003_FL4	6384	19:54:29	19:56:27	800 330	10	
004_FL5	6385	19:59:12	20:01:09	800 330	10	
005_FL6	6386	20:06:06	20:08:08	800 330	10	
		20:11:49				DS: 500m_20221030_201149
000_FL1	6351	20:11:50	20:13:27	490 500	4	<b>BAD:</b> Wrong settings at start of line
001_FL2	6352	20:18:31	20:20:08	490 500	4	
002_FL1	6351	20:22:20	20:23:56	490 500	4	
003_FL3	6353	20:26:52	20:28:25	490 500	4	
004_FL4	6354	20:30:49	20:32:24	490 500	4	
005_FL5	6355	20:34:33	20:36:04	490 500	4	
006_FL6	6356	20:40:16	20:41:51	490 500	4	
		20:48:15				DS: 400m_20221030_204815
000_FL1	6341	20:48:15	20:49:51	400 300	3	
001_FL2	6342	20:52:06	20:53:37	400 300	3	
002_FL3	6343	20:56:24	20:57:48	400 300	3	
003_FL4	6344	20:59:41	21:01:04	400 300	3	
004_FL5	6345	21:03:34	21:04:56	400 300	3	
005_FL6	6346	21:08:48	21:10:08	400 300	3	
		21:10:00				End survey
		21:14:00				Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Ocean City(KOXB)
<b>LOCATION / AREA:</b>	Chesapeake / BL10, BL31, BL60	<b>DATE:</b>	3 November 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Theron C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Richard C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeMD, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	10 kts @ 100

<b>ENGINE START:</b>		<b>ENGINE OFF:</b>		<b>ENGINE TIME:</b>	
<b>GNSS START:</b>	13:41	<b>GNSS START:</b>			5:07
<b>TAKEOFF:</b>	14:04	<b>TOUCHDOWN:</b>		<b>AIR TIME</b>	04:32

FL #	LINE #	START TIME	END TIME	TOPO PRF   PWR	CHII PWR	REMARKS
		14:04:00				Takeoff
		14:11:39				DS: BL60_20221103_141139
000_FL1	6001	14:11:39	14:14:06	480	500	10
		14:35:45				DS: BL10_20221103_143545
000_FL35	1035	14:35:45	14:49:55	480	500	10
		15:26:52				DS: BL31_20221103_152652
000_FL56	3156	15:26:52	15:30:55	480	500	10
001_FL55	3155	15:33:28	15:38:05	480	500	10
002_FL54	3154	15:40:25	15:45:28	480	500	10
003_FL53	3153	15:48:01	15:53:39	480	500	10
004_FL52	3152	15:55:51	16:01:45	480	500	10
005_FL51	3151	16:04:17	16:10:25	480	500	10
006_FL50	3150	16:12:44	16:19:17	480	500	10
007_FL49	3149	16:21:21	16:28:39	480	500	10
008_FL48	3148	16:31:07	16:38:43	480	500	10
009_FL47	3147	16:41:15	16:48:53	480	500	10
010_FL46	3146	16:51:02	16:58:26	480	500	10
011_FL45	3145	17:00:50	17:08:19	480	500	10
012_FL44	3144	17:10:18	17:17:43	480	500	10
013_FL43	3143	17:20:06	17:27:34	480	500	10
014_FL42	3142	17:29:54	17:37:24	480	500	10
015_FL41	3141	17:39:38	17:47:06	480	500	10
016_FL40	3140	17:49:27	17:56:52	480	500	10
017_FL39	3139	17:59:07	18:06:33	480	500	10
018_FL38	3138	18:08:52	18:16:23	480	500	10
019_FL37	3137	18:18:29	18:25:55	480	500	10
		18:36:00				Landing
		18:46:00				End survey

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Salisbury(KSBY)
<b>LOCATION / AREA:</b>	Chesapeake / BL10, BL11, BL14, BL33, BL60	<b>DATE:</b>	5 November 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Theron C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Richard C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeMD, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 3000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	20-25 kts @ 200
<b>LIDAR DRIVE:</b>	HE4X-04	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	13:16	<b>ENGINE OFF:</b>	18:53	<b>ENGINE TIME:</b>	05:37
<b>TAKEOFF:</b>	13:49	<b>LANDING:</b>	18:37	<b>AIR TIME</b>	04:48

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		13:49:00					Takeoff
		14:10:30					DS: BL10_20221105_141030
000_FL54	1098	14:10:30	14:20:23	480	500	10	
001_FL53	1097	14:25:25	14:35:49	480	500	10	
002_FL52	1096	14:41:35	14:51:39	480	500	10	
003_FL51	1095	14:56:56	15:03:54	480	500	10	
		15:09:40					DS: BL11_20221105_150940
000_FL17	1117	15:09:40	15:23:10	480	500	10	
001_FL50	1150	15:27:05	15:38:25	480	500	10	
		15:51:11					DS: BL14_20221105_155111
000_FL47	1497	15:51:11	15:57:33	480	500	10	
001_FL46	1496	16:01:45	16:08:55	480	500	10	
002_FL45	1495	16:15:58	16:21:00	480	500	10	
003_FL1	1401	16:29:51	16:41:16	480	500	10	
		17:07:34					DS: BL60_20221105_170734
000_FL1	6001	17:07:34	17:09:51	480	500	10	
		17:15:31					DS: BL33_20221105_171531
000_FL31	3331	17:15:31	17:18:28	480	500	10	
001_FL30	3330	17:21:57	17:26:20	480	500	10	
002_FL29	3329	17:28:54	17:33:41	480	500	10	
003_FL28	3328	17:36:42	17:42:26	480	500	10	
004_FL27	3327	17:44:54	17:51:08	480	500	10	
005_FL26	3326	17:53:40	18:00:22	480	500	10	
006_FL25	3325	18:02:49	18:09:04	480	500	10	
007_FL24	3324	18:11:43	18:18:28	480	500	10	
		18:19:00					End survey
		18:37:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Salisbury(KSBY)
<b>LOCATION / AREA:</b>	Chesapeake / BL12, BL32, BL60	<b>DATE:</b>	8 December 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Richard C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeMD, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 3000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	25-30kts @ 20
<b>LIDAR DRIVE:</b>	HE4X-01	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	14:47	<b>ENGINE OFF:</b>	21:28	<b>ENGINE TIME:</b>	06:41
<b>TAKEOFF:</b>	15:01	<b>LANDING:</b>	21:14	<b>AIR TIME</b>	06:13

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		15:01:00					Takeoff
		15:14:11					DS: BL60_20221208_151411
000_FL1	6001	15:14:11	15:16:27	480	500	4	
		15:21:24					DS: BL32_20221208_152124
000_FL26	3226	15:21:24	15:28:52	480	500	4	
001_FL25	3225	15:32:28	15:38:57	480	500	4	
002_FL24	3224	15:42:05	15:48:58	480	500	4	
003_FL23	3223	15:51:33	15:57:40	480	500	4	
004_FL22	3222	16:00:29	16:07:03	480	500	4	
005_FL21	3221	16:09:36	16:15:35	480	500	4	
006_FL20	3220	16:18:21	16:24:38	480	500	4	
007_FL19	3219	16:26:37	16:32:12	480	500	4	
008_FL18	3218	16:34:49	16:40:53	480	500	4	
009_FL17	3217	16:43:12	16:48:35	480	500	4	
010_FL16	3216	16:51:21	16:56:58	480	500	4	
011_FL15	3215	16:59:34	17:04:40	480	500	4	
012_FL14	3214	17:07:16	17:12:24	480	500	4	
013_FL13	3213	17:14:48	17:19:36	480	500	4	
014_FL12	3212	17:22:44	17:25:49	480	500	4	
015_FL11	3211	17:28:19	17:31:01	480	500	4	
016_FL10	3210	17:34:08	17:36:54	480	500	4	
017_FL9	3209	17:39:18	17:41:47	480	500	4	
018_FL8	3208	17:44:19	17:46:39	480	500	4	
019_FL7	3207	17:49:15	17:51:22	480	500	4	
020_FL6	3206	17:54:23	17:56:25	480	500	4	
021_FL5	3205	17:58:54	18:00:47	480	500	4	
022_FL4	3204	18:03:36	18:05:21	480	500	4	
023_FL3	3203	18:07:33	18:09:03	480	500	4	
024_FL2	3202	18:12:05	18:13:18	480	500	4	

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Salisbury(KSBY)
<b>LOCATION / AREA:</b>	Chesapeake / BL12, BL32, BL60	<b>DATE:</b>	8 December 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Richard C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeMD, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 3000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	25-30kts @ 20
<b>LIDAR DRIVE:</b>	HE4X-01	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	14:47	<b>ENGINE OFF:</b>	21:28	<b>ENGINE TIME:</b>	06:41
<b>TAKEOFF:</b>	15:01	<b>LANDING:</b>	21:14	<b>AIR TIME</b>	06:13

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
025_FL1	3201	18:15:31	18:16:28	480	500	4	
026_FL57	3295	18:19:45	18:23:41	480	500	4	
027_FL58	3296	18:27:36	18:31:54	480	500	4	
		18:50:42					DS: BL12_20221208_185042
000_FL45	1245	18:50:42	18:51:34	480	500	4	
001_FL44	1244	18:54:13	18:55:18	480	500	4	
002_FL43	1243	18:57:34	18:58:52	480	500	4	
003_FL42	1242	19:01:56	19:03:32	480	500	4	
004_FL41	1241	19:06:14	19:08:35	480	500	4	
005_FL40	1240	19:11:08	19:13:38	480	500	4	
006_FL39	1239	19:16:26	19:18:59	480	500	4	
007_FL38	1238	19:21:08	19:24:02	480	500	4	
008_FL37	1237	19:26:15	19:29:14	480	500	4	
009_FL36	1236	19:31:36	19:34:41	480	500	4	
010_FL35	1235	19:37:17	19:40:20	480	500	4	
011_FL34	1234	19:43:32	19:51:53	480	500	4	
012_FL33	1233	19:54:24	20:02:16	480	500	4	
013_FL32	1232	20:04:50	20:13:08	480	500	4	
014_FL31	1231	20:15:26	20:23:41	480	500	4	
015_FL30	1230	20:26:17	20:34:55	480	500	4	
016_FL29	1229	20:37:19	20:45:46	480	500	4	
017_FL28	1228	20:48:14	20:57:11	480	500	4	
		20:58:00					End survey
		21:14:00					Landing



<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Salisbury(KSBY)
<b>LOCATION / AREA:</b>	Chesapeake / BL12, BL60	<b>DATE:</b>	13 December 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	RICHARD C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	5-10 kts @ 334
<b>LIDAR DRIVE:</b>	HE4X-02	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	14:22	<b>ENGINE OFF:</b>	19:06	<b>ENGINE TIME:</b>	04:44
<b>TAKEOFF:</b>	14:49	<b>LANDING:</b>	19:00	<b>AIR TIME</b>	04:11

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		14:49:00					Takeoff
		15:12:13					DS: BL60_20221213_151213
000_FL1	6001	15:12:13	15:14:26	480	500	4	
		15:31:06					DS: BL12_20221213_153106
000_FL27	1227	15:31:06	15:40:11	480	500	4	
001_FL26	1226	15:43:28	15:52:13	480	500	4	
002_FL25	1225	15:54:47	16:03:56	480	500	4	
003_FL24	1224	16:07:34	16:16:31	480	500	4	
004_FL23	1223	16:19:10	16:28:26	480	500	4	
005_FL22	1222	16:31:11	16:39:53	480	500	4	
006_FL21	1221	16:42:43	16:52:11	480	500	4	
007_FL20	1220	16:54:51	17:03:59	480	500	4	
008_FL19	1219	17:07:01	17:16:57	480	500	4	
009_FL18	1218	17:19:56	17:29:24	480	500	4	
010_FL17	1217	17:32:09	17:42:14	480	500	4	
011_FL16	1216	17:45:29	17:55:26	480	500	4	
012_FL15	1215	17:58:07	18:08:24	480	500	4	
013_FL14	1214	18:11:07	18:13:47	480	500	4	<b>BAD:</b> System fault
		18:39:06					DS: BL12_20221213_183906
000_FL14	1214	18:39:06	18:49:52	480	500	4	<b>BAD:</b> System fault
		18:50:00					End survey
		19:00:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Salisbury(KSBY)
<b>LOCATION / AREA:</b>	Chesapeake / BL12, BL17, BL60	<b>DATE:</b>	17 December 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	RICHARD C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	10-15 kts @ 290
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	16:40	<b>ENGINE OFF:</b>	21:38	<b>ENGINE TIME:</b>	04:58
<b>TAKEOFF:</b>	17:05	<b>LANDING:</b>	21:26	<b>AIR TIME</b>	04:21

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		17:05:00					Takeoff
		17:19:40					DS: BL60_20221217_171940
000_FL1	6001	17:19:40	17:21:52	480	500	4	
		17:39:49					DS: BL12_20221217_173949
000_FL14	1214	17:39:49	17:49:57	480	500	4	
001_FL13	1213	17:52:43	18:02:27	480	500	4	
002_FL12	1212	18:05:23	18:15:25	480	500	4	
003_FL11	1211	18:18:10	18:27:47	480	500	4	
004_FL10	1210	18:30:25	18:40:43	480	500	4	
005_FL9	1209	18:43:20	18:52:54	480	500	4	
006_FL8	1208	18:55:54	19:05:51	480	500	4	
007_FL7	1207	19:08:34	19:18:10	480	500	4	
008_FL6	1206	19:21:10	19:31:05	480	500	4	
009_FL5	1205	19:33:38	19:43:32	480	500	4	
010_FL4	1204	19:46:01	19:56:22	480	500	4	
011_FL3	1203	19:59:01	20:09:00	480	500	4	
012_FL2	1202	20:11:25	20:21:53	480	500	4	
013_FL1	1201	20:24:33	20:34:29	480	500	4	
		20:40:35					DS: BL17_20221217_204035
000_FL81	1781	20:40:35	20:41:20	480	500	4	
001_FL80	1780	20:44:00	20:45:16	480	500	4	
002_FL79	1779	20:48:21	20:50:20	480	500	4	
003_FL78	1778	20:52:56	20:55:10	480	500	4	
004_FL77	1777	20:58:18	21:00:53	480	500	4	
005_FL76	1776	21:03:17	21:05:55	480	500	4	
006_FL75	1775	21:08:23	21:15:53	480	500	4	
		21:16:00					End survey
		21:26:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Salisbury(KSBY)
<b>LOCATION / AREA:</b>	Chesapeake / BL17, BL60	<b>DATE:</b>	18 December 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	RICHARD C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	5-10 kts @ 310
<b>LIDAR DRIVE:</b>	HE4X-02	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	16:40	<b>ENGINE OFF:</b>	21:40	<b>ENGINE TIME:</b>	05:00
<b>TAKEOFF:</b>	17:04	<b>LANDING:</b>	21:29	<b>AIR TIME</b>	04:25

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		17:04:00					Takeoff
		17:18:30					DS: BL60_20221218_171830
000_FL1	6001	17:18:30	17:20:27	480	500	4	
		17:36:34					DS: BL17_20221218_173634
000_FL74	1774	17:36:34	17:44:10	480	500	4	
001_FL73	1773	17:47:31	17:54:33	480	500	4	
002_FL72	1772	17:57:48	18:05:29	480	500	4	
003_FL71	1771	18:08:19	18:15:13	480	500	4	
004_FL70	1770	18:19:25	18:27:10	480	500	4	
005_FL69	1769	18:30:00	18:37:16	480	500	4	
006_FL68	1768	18:40:47	18:48:51	480	500	4	
007_FL67	1767	18:51:29	18:58:43	480	500	4	
008_FL66	1766	19:01:51	19:10:13	480	500	4	
009_FL65	1765	19:12:43	19:19:43	480	500	4	
010_FL64	1764	19:22:51	19:31:09	480	500	4	
011_FL63	1763	19:33:37	19:40:56	480	500	4	
012_FL62	1762	19:44:07	19:52:27	480	500	4	
013_FL61	1761	19:55:02	20:02:25	480	500	4	
014_FL60	1760	20:05:49	20:14:19	480	500	4	
015_FL59	1759	20:16:34	20:24:07	480	500	4	
016_FL58	1758	20:27:12	20:35:33	480	500	4	
017_FL57	1757	20:37:34	20:45:05	480	500	4	
018_FL56	1756	20:48:25	20:56:46	480	500	4	
019_FL55	1755	20:59:18	21:06:39	480	500	4	
020_FL54	1754	21:09:41	21:17:49	480	500	4	
		21:18:00					End survey
		21:29:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Salisbury(KSBY)
<b>LOCATION / AREA:</b>	Chesapeake / BL11, BL33, BL60	<b>DATE:</b>	19 December 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	RICHARD C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeMD, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	10-15 kts @ 320
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	15:16	<b>ENGINE OFF:</b>	21:37	<b>ENGINE TIME:</b>	06:21
<b>TAKEOFF:</b>	16:40	<b>LANDING:</b>	21:25	<b>AIR TIME</b>	04:45

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		21:12:00					End survey
		16:40:00					Takeoff
		16:52:44					DS: BL60_20221219_165244
000_FL1	6001	16:52:44	16:54:51	480	500	4	
		16:59:48					DS: BL33_20221219_165948
000_FL13	3313	16:59:48	17:01:19	480	500	4	
		17:23:17					DS: BL11_20221219_172317
000_FL50	1150	17:23:17	17:33:58	480	500	4	
001_FL49	1149	17:36:31	17:46:22	480	500	4	
002_FL48	1148	17:49:22	18:00:08	480	500	4	
003_FL47	1147	18:02:42	18:12:49	480	500	4	
004_FL46	1146	18:16:32	18:27:52	480	500	4	
005_FL45	1145	18:30:20	18:40:46	480	500	4	
006_FL44	1144	18:43:50	18:55:20	480	500	4	
007_FL43	1143	18:57:42	19:08:24	480	500	4	
008_FL42	1142	19:11:48	19:23:31	480	500	4	
009_FL41	1141	19:25:50	19:27:11	480	500	4	<b>BAD:</b>
010_FL41	1141	19:52:19	20:03:24	480	500	4	
011_FL40	1140	20:06:16	20:18:00	480	500	4	
012_FL39	1139	20:20:05	20:31:04	480	500	4	
013_FL38	1138	20:34:18	20:45:47	480	500	4	
014_FL37	1137	20:47:43	20:58:31	480	500	4	
015_FL36	1136	21:01:04	21:13:22	480	500	4	
		21:25:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Salisbury(KSBY)
<b>LOCATION / AREA:</b>	Chesapeake / BL11, BL60	<b>DATE:</b>	20 December 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	RICHARD C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	5-10 kts @ 300
<b>LIDAR DRIVE:</b>	HE4X-04	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	15:22	<b>ENGINE OFF:</b>	21:15	<b>ENGINE TIME:</b>	05:53
<b>TAKEOFF:</b>	15:43	<b>LANDING:</b>	21:05	<b>AIR TIME</b>	05:22

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		15:43:00					Takeoff
		15:58:14					DS: BL60_20221220_155814
000_FL1	6001	15:58:14	16:00:26	480	500	4	
		16:07:46					DS: BL60_20221220_160746
000_FL1	6001	16:07:46	16:10:03	480	500	4	
		16:28:44					DS: BL11_20221220_162844
000_FL35	1135	16:28:44	16:40:53	480	500	4	
001_FL34	1134	16:43:36	16:55:12	480	500	4	
002_FL33	1133	16:58:07	17:10:26	480	500	4	
003_FL32	1132	17:13:21	17:24:54	480	500	4	
004_FL31	1131	17:27:43	17:40:56	480	500	4	
005_FL30	1130	17:43:22	17:55:19	480	500	4	
006_FL29	1129	17:58:52	18:11:49	480	500	4	
007_FL28	1128	18:14:19	18:26:40	480	500	4	
008_FL27	1127	18:29:29	18:42:56	480	500	4	
009_FL26	1126	18:45:21	18:57:55	480	500	4	
010_FL25	1125	19:00:57	19:14:02	480	500	4	
011_FL24	1124	19:16:39	19:29:10	480	500	4	
012_FL23	1123	19:31:54	19:45:19	480	500	4	
013_FL22	1122	19:47:17	19:59:35	480	500	4	
014_FL21	1121	20:02:21	20:16:03	480	500	4	
015_FL20	1120	20:18:19	20:31:12	480	500	4	
016_FL19	1119	20:33:51	20:48:30	480	500	4	
		20:49:00					End survey
		21:05:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Salisbury(KSBY)
<b>LOCATION / AREA:</b>	Chesapeake / BL11, BL40, BL60	<b>DATE:</b>	21 December 2022
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	RICHARD C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeMD, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	5-10 kts @ 70
<b>LIDAR DRIVE:</b>	HE4X-04	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	15:37	<b>ENGINE OFF:</b>	20:23	<b>ENGINE TIME:</b>	04:46
<b>TAKEOFF:</b>	16:30	<b>LANDING:</b>	20:12	<b>AIR TIME</b>	03:42

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		16:30:00					Takeoff
		16:42:32					DS: BL60_20221221_164232
000_FL1	6001	16:42:32	16:44:42	480	500	4	
		16:50:37					DS: BL40_20221221_165037
000_FL1	4001	16:50:37	16:51:50	480	500	4	
001_FL2	4002	16:54:59	16:56:21	480	500	4	
002_FL3	4003	16:59:08	17:00:32	480	500	4	
003_FL4	4004	17:03:43	17:04:31	480	500	4	
004_FL5	4005	17:07:32	17:08:50	480	500	4	
005_FL6	4006	17:11:27	17:12:45	480	500	4	
006_FL7	4007	17:15:28	17:16:49	480	500	4	
007_FL8	4008	17:19:47	17:21:06	480	500	4	
008_FL9	4009	17:23:03	17:23:54	480	500	4	
		17:41:11					DS: BL11_20221221_174111
000_FL18	1118	17:41:11	17:54:47	480	500	4	
001_FL17	1117	17:57:28	18:11:02	480	500	4	
002_FL16	1116	18:13:47	18:27:29	480	500	4	
003_FL15	1115	18:30:17	18:43:51	480	500	4	
004_FL14	1114	18:46:56	19:00:34	480	500	4	
005_FL13	1113	19:03:13	19:16:58	480	500	4	
006_FL12	1112	19:23:40	19:37:13	480	500	4	
007_FL11	1111	19:39:43	19:53:32	480	500	4	
		19:54:00					End survey
		20:12:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL10, BL11, BL61	<b>DATE:</b>	6 January 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Richard C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	20-25 kts @ 310
<b>LIDAR DRIVE:</b>	HE4X-02	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	15:51	<b>ENGINE OFF:</b>	21:42	<b>ENGINE TIME:</b>	05:51
<b>TAKEOFF:</b>	16:11	<b>LANDING:</b>	21:32	<b>AIR TIME</b>	05:21

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		16:11:00					Takeoff
		16:27:25					DS: BL61_20230106_162725
000_FL1	6101	16:27:25	16:30:10	480	500	4	
		16:44:52					DS: BL11_20230106_164452
000_FL3	1103	16:44:52	16:45:37	480	500	4	
001_FL3	1103	16:48:27	17:01:28	480	500	4	
002_FL2	1102	17:04:35	17:18:36	480	500	4	
003_FL1	1101	17:21:21	17:34:41	480	500	4	
		17:39:43					DS: BL10_20230106_173943
000_FL50	1050	17:39:44	17:53:41	480	500	4	
001_FL49	1049	17:56:45	18:10:27	480	500	4	
002_FL48	1048	18:13:06	18:27:26	480	500	4	
003_FL47	1047	18:29:57	18:43:34	480	500	4	
004_FL46	1046	18:46:51	19:01:04	480	500	4	
005_FL45	1045	19:03:54	19:17:47	480	500	4	
006_FL44	1044	19:20:49	19:34:58	480	500	4	
007_FL43	1043	19:37:24	19:51:11	480	500	4	
008_FL42	1042	19:54:05	20:08:08	480	500	4	
009_FL41	1041	20:10:38	20:24:35	480	500	4	
010_FL40	1040	20:27:11	20:41:15	480	500	4	
011_FL39	1039	20:43:37	20:57:04	480	500	4	
012_FL38	1038	20:59:58	21:13:30	480	500	4	
		21:14:00					End survey
		21:32:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL10, BL13, BL61	<b>DATE:</b>	7 January 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Richard C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	20-25 kts @ 330
<b>LIDAR DRIVE:</b>	HE4X-04	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	14:46	<b>ENGINE OFF:</b>	19:45	<b>ENGINE TIME:</b>	04:59
<b>TAKEOFF:</b>	15:52	<b>LANDING:</b>	19:36	<b>AIR TIME</b>	03:44

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		15:52:00					Takeoff
		16:09:06					DS: BL61_20230107_160906
000_FL1	6101	16:09:06	16:11:46	480	500	4	
		16:23:42					DS: BL10_20230107_162342
000_FL37	1037	16:23:42	16:37:04	480	500	4	
001_FL36	1036	16:40:30	16:54:04	480	500	4	
002_FL35	1035	16:56:47	17:10:26	480	500	4	
003_FL34	1034	17:14:07	17:27:42	480	500	4	
004_FL33	1033	17:30:26	17:43:50	480	500	4	
005_FL32	1032	17:46:43	18:00:02	480	500	4	
006_FL31	1031	18:02:52	18:16:35	480	500	4	
007_FL30	1030	18:19:47	18:33:11	480	500	4	
008_FL29	1029	18:35:44	18:49:39	480	500	4	
009_FL28	1028	18:52:17	19:05:36	480	500	4	
		19:11:38					DS: BL13_20230107_191138
000_FL1	1301	19:11:38	19:12:36	480	500	4	
001_FL2	1302	19:14:56	19:15:58	480	500	4	
002_FL3	1303	19:18:36	19:19:53	480	500	4	
		19:19:00					End survey
		19:36:00					Landing



<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL10, BL61	<b>DATE:</b>	8 January 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Richard C.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @5000ft+
<b>BASE STATION:</b>	NA	<b>WIND:</b>	5-10 kts @ 130
<b>LIDAR DRIVE:</b>	HE4X-06	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	14:15	<b>ENGINE OFF:</b>	18:39	<b>ENGINE TIME:</b>	04:24
<b>TAKEOFF:</b>	14:42	<b>LANDING:</b>	18:30	<b>AIR TIME</b>	03:48

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		14:42:00					Takeoff
		14:54:15					DS: BL61_20230108_145415
000_FL1	6101	14:54:15	14:56:57	480	500	4	
		15:06:29					DS: BL10_20230108_150629
000_FL27	1027	15:06:29	15:20:20	480	500	4	
001_FL26	1026	15:23:28	15:36:49	480	500	4	
002_FL25	1025	15:39:29	15:53:18	480	500	4	
003_FL24	1024	15:55:53	16:09:04	480	500	4	
004_FL23	1023	16:11:56	16:25:18	480	500	4	
005_FL22	1022	16:28:15	16:41:00	480	500	4	
006_FL21	1021	16:44:12	16:57:23	480	500	4	
007_FL20	1020	17:00:29	17:12:43	480	500	4	
008_FL19	1019	17:16:24	17:29:20	480	500	4	
009_FL18	1018	17:31:59	17:43:29	480	500	4	
010_FL17	1017	17:46:37	17:58:29	480	500	4	
011_FL16	1016	18:00:52	18:12:10	480	500	4	
		18:14:00					End survey
		18:30:00					Landing

<b>PROJECT NAME:</b> 2022-10010368 Chesapeake	<b>BASE AIRPORT:</b> Easton(KESN)
<b>LOCATION / AREA:</b> Chesapeake / BL13, BL61	<b>DATE:</b> 14 January 2023
<b>AIRCRAFT:</b> Cessna 404 (N70790F)	<b>PILOT:</b> Dennis C.
<b>SYSTEM:</b> HawkEye 4X	<b>OPERATOR:</b> Paul R.

<b>MISSION ID:</b> ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b> Clouds @ 2000ft
<b>BASE STATION:</b> NA	<b>WIND:</b> 30+ kts @ 0
<b>LIDAR DRIVE:</b> HE4X-02	<b>RCD DRIVE:</b> RCD-02

<b>ENGINE START:</b> 13:45	<b>ENGINE OFF:</b> 20:10	<b>ENGINE TIME:</b> 06:25
<b>TAKEOFF:</b> 14:08	<b>LANDING:</b> 20:04	<b>AIR TIME:</b> 05:56

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		14:08:00					Takeoff
		14:21:27					DS: BL61_20230114_142127
000_FL1	6101	14:21:27	14:24:10	480	500	4	
		14:31:35					DS: BL13_20230114_143135
000_FL4	1304	14:31:35	14:32:59	480	500	4	
001_FL5	1305	14:35:43	14:37:21	480	500	4	
002_FL6	1306	14:40:10	14:42:01	480	500	4	
003_FL7	1307	14:44:51	14:46:54	480	500	4	
004_FL8	1308	14:49:31	14:50:17	480	500	4	BAD: Eye Safe
005_FL8	1308	14:54:39	14:56:40	480	500	4	
006_FL9	1309	14:59:33	15:01:57	480	500	4	
007_FL10	1310	15:04:12	15:06:46	480	500	4	
008_FL11	1311	15:09:47	15:12:34	480	500	4	
009_FL12	1312	15:15:03	15:17:55	480	500	4	
010_FL13	1313	15:21:07	15:24:16	480	500	4	
011_FL14	1314	15:26:58	15:30:24	480	500	4	
012_FL15	1315	15:33:10	15:37:12	480	500	4	
013_FL16	1316	15:39:37	15:43:45	480	500	4	
014_FL17	1317	15:47:12	15:51:44	480	500	4	
015_FL18	1318	15:54:25	15:59:06	480	500	4	
016_FL19	1319	16:01:54	16:07:03	480	500	4	
017_FL20	1320	16:09:41	16:14:36	480	500	4	
018_FL21	1321	16:17:43	16:23:01	480	500	4	
019_FL22	1322	16:25:28	16:30:45	480	500	4	
020_FL23	1323	16:33:55	16:39:28	480	500	4	
021_FL24	1324	16:41:55	16:47:23	480	500	4	
022_FL25	1325	16:50:25	16:56:22	480	500	4	
023_FL26	1326	16:58:33	17:04:34	480	500	4	
024_FL27	1327	17:07:40	17:14:12	480	500	4	

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL13, BL61	<b>DATE:</b>	14 January 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Paul R.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 2000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	30+ kts @ 0
<b>LIDAR DRIVE:</b>	HE4X-02	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	13:45	<b>ENGINE OFF:</b>	20:10	<b>ENGINE TIME:</b>	06:25
<b>TAKEOFF:</b>	14:08	<b>LANDING:</b>	20:04	<b>AIR TIME</b>	05:56

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
025_FL28	1328	17:16:29	17:22:53	480	500	4	
026_FL29	1329	17:25:54	17:33:06	480	500	4	
027_FL30	1330	17:35:52	17:43:05	480	500	4	
028_FL31	1331	17:46:09	17:54:46	480	500	4	
029_FL32	1332	17:57:02	18:05:26	480	500	4	
030_FL33	1333	18:08:14	18:17:21	480	500	4	
031_FL34	1334	18:19:30	18:28:29	480	500	4	
032_FL35	1335	18:31:05	18:40:39	480	500	4	
033_FL36	1336	18:42:41	18:52:21	480	500	4	
034_FL37	1337	18:54:57	19:05:04	480	500	4	
035_FL38	1338	19:07:11	19:17:24	480	500	4	
036_FL39	1339	19:19:46	19:30:25	480	500	4	
037_FL40	1340	19:32:44	19:43:26	480	500	4	
		19:43:00					End survey
		20:04:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL13, BL14, BL61	<b>DATE:</b>	16 January 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Paul R.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	15 kts @ 310
<b>LIDAR DRIVE:</b>	HE4X-02	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	17:51	<b>ENGINE OFF:</b>	20:26	<b>ENGINE TIME:</b>	02:35
<b>TAKEOFF:</b>	18:39	<b>LANDING:</b>	22:16	<b>AIR TIME</b>	03:37

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		18:39:00					Takeoff
		18:50:46					DS: BL61_20230116_185046
000_FL1	6101	18:50:46	18:53:21	480	500	4	
		19:05:47					DS: BL13_20230116_190547
000_FL44	1344	19:05:47	19:17:24	480	500	4	
001_FL45	1345	19:19:32	19:30:45	480	500	4	
002_FL46	1346	19:33:05	19:44:32	480	500	4	
003_FL47	1347	19:46:41	19:57:22	480	500	4	
004_FL48	1348	20:00:08	20:12:02	480	500	4	
005_FL49	1349	20:14:07	20:24:40	480	500	4	
006_FL50	1350	20:27:17	20:39:14	480	500	4	
		20:40:00					Move to BL14
		20:41:50					DS: BL14_20230116_204150
000_FL1	1401	20:41:50	20:52:04	480	500	4	
001_FL2	1402	20:54:41	21:05:46	480	500	4	
002_FL3	1403	21:07:59	21:18:25	480	500	4	
003_FL4	1404	21:20:59	21:31:52	480	500	4	
004_FL5	1405	21:34:24	21:45:05	480	500	4	
005_FL6	1406	21:47:47	21:58:28	480	500	4	
		21:59:00					End survey
		22:16:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL14, BL61	<b>DATE:</b>	18 January 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Paul R.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	30+ kts @ 300
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	13:21	<b>ENGINE OFF:</b>	19:07	<b>ENGINE TIME:</b>	05:46
<b>TAKEOFF:</b>	13:38	<b>LANDING:</b>	18:50	<b>AIR TIME</b>	05:12

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		18:33:00					End survey
		13:38:00					Takeoff
		13:53:00					DS: BL61_20230118_135300
000_FL1	6101	13:53:00	13:55:50	480	500	4	
		14:07:31					DS: BL14_20230118_140731
000_FL7	1407	14:07:31	14:18:30	480	500	4	
001_FL8	1408	14:21:09	14:31:21	480	500	4	
002_FL9	1409	14:35:27	14:46:09	480	500	4	
003_FL10	1410	14:48:33	14:58:51	480	500	4	
004_FL11	1411	15:02:19	15:13:06	480	500	4	
005_FL12	1412	15:15:33	15:25:33	480	500	4	
006_FL13	1413	15:28:10	15:38:50	480	500	4	
007_FL14	1414	15:41:28	15:51:47	480	500	4	
		16:20:01					DS: BL14_20230118_162001
000_FL15	1415	16:20:01	16:30:43	480	500	4	
001_FL16	1416	16:33:00	16:43:14	480	500	4	
002_FL17	1417	16:46:09	16:56:40	480	500	4	
003_FL18	1418	16:59:12	17:09:18	480	500	4	
004_FL19	1419	17:12:28	17:22:48	480	500	4	
005_FL20	1420	17:25:05	17:35:17	480	500	4	
006_FL21	1421	17:37:56	17:48:09	480	500	4	
007_FL22	1422	17:50:46	18:00:46	480	500	4	
008_FL23	1423	18:03:57	18:14:13	480	500	4	
009_FL24	1424	18:16:34	18:26:57	480	500	4	
010_FL25	1425	18:29:53	18:32:05	480	500	4	<b>BAD:</b> Abort due to Airspace
		18:50:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL14, BL61	<b>DATE:</b>	20 January 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Paul R.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 4500ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	20-25 kts @ 300
<b>LIDAR DRIVE:</b>	HE4X-04	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	15:16	<b>ENGINE OFF:</b>	18:59	<b>ENGINE TIME:</b>	03:43
<b>TAKEOFF:</b>	15:36	<b>LANDING:</b>	18:55	<b>AIR TIME</b>	03:19

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		15:36:00					Takeoff
		16:13:13					DS: BL61_20230120_161313
000_FL1	6101	16:13:13	16:16:07	480	500	4	
		16:29:07					DS: BL14_20230120_162907
000_FL25	1425	16:29:07	16:40:37	480	500	4	
001_FL26	1426	16:42:58	16:52:37	480	500	4	
002_FL27	1427	16:55:53	17:06:59	480	500	4	
003_FL28	1428	17:09:18	17:19:21	480	500	4	
004_FL29	1429	17:22:03	17:33:13	480	500	4	
005_FL30	1430	17:35:25	17:45:45	480	500	4	
006_FL31	1431	17:48:53	17:59:47	480	500	4	
007_FL32	1432	18:01:54	18:03:50	480	500	4	BAD: System Issues
008_FL32	1432	18:06:54	18:07:13	480	500	4	BAD: System Issues
009_FL32	1432	18:13:58	18:14:28	480	500	4	BAD:
		18:40:00					End survey
		18:55:00					Landing

**PROJECT NAME:** 2022-10010368 Chesapeake  
**LOCATION / AREA:** Chesapeake / BL14  
**AIRCRAFT:** Cessna 404 (N70790F)  
**SYSTEM:** HawkEye 4X

**BASE AIRPORT:** Easton(KESN)  
**DATE:** 21 January 2023  
**PILOT:** Dennis C.  
**OPERATOR:** Paul R.

**MISSION ID:** ChesapeakeVA  
**BASE STATION:** NA  
**LIDAR DRIVE:** HE4X-03

**CLOUDS:** Clouds @ 2500ft  
**WIND:** 20 kts @ 300  
**RCD DRIVE:** RCD-02

**ENGINE START:** 13:44      **ENGINE OFF:** 18:40      **ENGINE TIME:** 04:56  
**TAKEOFF:** 14:18      **LANDING:** 18:25      **AIR TIME:** 04:07

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		14:18:00					Takeoff
		14:46:54					DS: BL14_20230121_144654
000_FL32	1432	14:46:54	14:57:43	480	500	4	
001_FL33	1433	15:00:09	15:10:21	480	500	4	
002_FL34	1434	15:13:36	15:23:45	480	500	4	
003_FL35	1435	15:26:24	15:36:31	480	500	4	
004_FL36	1436	15:39:33	15:49:25	480	500	4	
005_FL37	1437	15:52:18	16:02:36	480	500	4	
006_FL38	1438	16:05:18	16:14:53	480	500	4	
007_FL39	1439	16:17:24	16:27:14	480	500	4	
008_FL40	1440	16:30:17	16:40:03	480	500	4	
009_FL41	1441	16:42:32	16:52:32	480	500	4	
010_FL42	1442	16:54:56	17:04:12	480	500	4	
011_FL43	1443	17:06:54	17:16:10	480	500	4	
012_FL44	1444	17:18:43	17:27:37	480	500	4	
013_FL47	1497	17:32:00	17:38:16	480	500	4	
014_FL46	1496	17:42:59	17:49:10	480	500	4	
015_FL45	1495	17:53:56	17:58:58	480	500	4	
		18:00:00					End survey
		18:25:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL41, BL45, BL61	<b>DATE:</b>	5 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeMD, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @5000ft+
<b>BASE STATION:</b>	NA	<b>WIND:</b>	30+ kts @ 240
<b>LIDAR DRIVE:</b>	HE4X-02	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	16:14	<b>ENGINE OFF:</b>	22:04	<b>ENGINE TIME:</b>	05:50
<b>TAKEOFF:</b>	16:46	<b>LANDING:</b>	21:50	<b>AIR TIME</b>	05:04

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		16:46:00					Takeoff
		17:03:25					DS: BL61_20230205_170325
000_FL1	6101	17:03:25	17:06:23	480	500	4	
		17:32:51					DS: BL41_20230205_173251
000_FL49	4149	17:32:51	17:34:39	480	500	4	
001_FL50	4150	17:38:54	17:40:02	480	500	4	
002_FL51	4151	17:43:46	17:44:53	480	500	4	
003_FL52	4152	17:49:08	17:50:24	480	500	4	
004_FL53	4153	17:54:59	17:56:11	480	500	4	
005_FL54	4154	17:59:52	18:00:59	480	500	4	
006_FL55	4155	18:05:25	18:06:12	480	500	4	
007_FL56	4156	18:10:51	18:11:41	480	500	4	
008_FL57	4157	18:15:28	18:16:21	480	500	4	
009_FL58	4158	18:20:30	18:21:30	480	500	4	
010_FL59	4159	18:23:40	18:24:30	480	500	4	
011_FL60	4160	18:29:33	18:30:29	480	500	4	
012_FL61	4161	18:34:31	18:35:21	480	500	4	
013_FL62	4162	18:39:43	18:40:36	480	500	4	
014_FL63	4163	18:44:02	18:44:55	480	500	4	
015_FL64	4164	18:48:38	18:49:25	480	500	4	
016_FL65	4165	18:59:19	19:00:07	480	500	4	
017_FL66	4166	19:03:16	19:04:07	480	500	4	
018_FL67	4167	19:08:10	19:09:11	480	500	4	
		19:10:00					Completed BL41.
		19:17:39					DS: BL45_20230205_191739
000_FL1	4501	19:17:39	19:18:35	480	500	4	
001_FL2	4502	19:24:37	19:27:18	480	500	4	
002_FL3	4503	19:31:53	19:34:50	480	500	4	
003_FL4	4504	19:37:20	19:40:02	480	500	4	



<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL41, BL45, BL61	<b>DATE:</b>	5 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeMD, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @5000ft+
<b>BASE STATION:</b>	NA	<b>WIND:</b>	30+ kts @ 240
<b>LIDAR DRIVE:</b>	HE4X-02	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	16:14	<b>ENGINE OFF:</b>	22:04	<b>ENGINE TIME:</b>	05:50
<b>TAKEOFF:</b>	16:46	<b>LANDING:</b>	21:50	<b>AIR TIME</b>	05:04

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
004_FL5	4505	19:43:38	19:46:40	480	500	4	
005_FL6	4506	19:48:48	19:51:32	480	500	4	
006_FL7	4507	19:55:03	19:58:09	480	500	4	
007_FL8	4508	20:00:31	20:03:22	480	500	4	
008_FL9	4509	20:06:19	20:09:26	480	500	4	
009_FL10	4510	20:11:45	20:14:42	480	500	4	
010_FL11	4511	20:17:26	20:20:34	480	500	4	
011_FL12	4512	20:22:44	20:25:31	480	500	4	
012_FL13	4513	20:27:54	20:30:56	480	500	4	
013_FL14	4514	20:33:03	20:35:55	480	500	4	
014_FL15	4515	20:38:27	20:40:32	480	500	4	
015_FL16	4516	20:42:50	20:44:51	480	500	4	
016_FL17	4517	20:47:37	20:49:39	480	500	4	
017_FL18	4518	20:53:18	20:54:57	480	500	4	
018_FL19	4519	20:58:18	21:00:03	480	500	4	
019_FL20	4520	21:02:21	21:03:33	480	500	4	
020_FL21	4521	21:07:21	21:08:09	480	500	4	
021_FL22	4522	21:10:24	21:11:15	480	500	4	
022_FL23	4523	21:16:14	21:17:23	480	500	4	
023_FL24	4524	21:20:02	21:21:09	480	500	4	
024_FL25	4525	21:24:27	21:25:42	480	500	4	
025_FL26	4526	21:28:12	21:29:22	480	500	4	
		21:50:00					Landing
		22:04:00					Ended survey

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL45, BL61	<b>DATE:</b>	6 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 4000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	30+ kts @ 0
<b>LIDAR DRIVE:</b>	HE4X-02	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	17:06	<b>ENGINE OFF:</b>	20:34	<b>ENGINE TIME:</b>	03:28
<b>TAKEOFF:</b>	17:54	<b>LANDING:</b>	20:21	<b>AIR TIME</b>	02:27

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		17:54:00					Takeoff
		18:23:01					DS: BL61_20230206_182301
000_FL1	6101	18:23:01	18:25:26	480	500	4	
		18:44:02					DS: BL45_20230206_184402
000_FL27	4527	18:44:02	18:45:06	480	500	4	
001_FL28	4528	18:50:09	18:51:17	480	500	4	
002_FL29	4529	18:54:17	18:55:16	480	500	4	
003_FL30	4530	18:56:48	18:57:32	480	500	4	<b>BAD:</b> Aircraft speed too fast
004_FL31	4531	19:02:33	19:03:50	480	500	4	
005_FL32	4532	19:07:12	19:08:24	480	500	4	
006_FL33	4533	19:11:02	19:11:52	480	500	4	
007_FL34	4534	19:15:24	19:16:23	480	500	4	
008_FL35	4535	19:19:44	19:21:08	480	500	4	<b>BAD:</b> Aircraft speed too fast
009_FL36	4536	19:24:21	19:25:37	480	500	4	
010_FL37	4537	19:30:44	19:32:19	480	500	4	
011_FL38	4538	19:36:05	19:37:08	480	500	4	
012_FL39	4539	19:41:31	19:42:39	480	500	4	
013_FL40	4540	19:46:39	19:48:01	480	500	4	<b>BAD:</b> Aircraft speed too fast
		19:49:00					Ended survey due to high winds
		20:21:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL45, BL61	<b>DATE:</b>	7 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Dennis C.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 3000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	10 kts @ 230
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	16:33	<b>ENGINE OFF:</b>	19:21	<b>ENGINE TIME:</b>	02:48
<b>TAKEOFF:</b>	17:30	<b>LANDING:</b>	18:50	<b>AIR TIME</b>	01:20

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		17:30:00					Takeoff
		17:33:35					DS: BL61_20230207_173335
000_FL1	6101	17:33:35	17:36:28	480	500	4	
		17:58:36					DS: BL45_20230207_175836
000_FL30	4530	17:58:36	17:59:35	480	500	4	
001_FL40	4540	18:03:14	18:04:48	480	500	4	
002_FL35	4535	18:10:05	18:11:33	480	500	4	
003_FL41	4541	18:17:02	18:18:35	480	500	4	
004_FL42	4542	18:20:35	18:21:32	480	500	4	
005_FL43	4543	18:27:36	18:28:54	480	500	4	
		18:50:00					Landing
		19:49:00					Ended survey, restricted area activated

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL45, BL46, BL61	<b>DATE:</b>	9 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 3000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	25-30kts @ 220
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	17:50	<b>ENGINE OFF:</b>	22:14	<b>ENGINE TIME:</b>	04:24
<b>TAKEOFF:</b>	18:24	<b>LANDING:</b>	21:59	<b>AIR TIME</b>	03:35

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		18:24:00					Takeoff
		18:30:41					DS: BL61_20230209_183041
000_FL1	6101	18:30:41	18:33:35	480	500		
		18:56:27					DS: BL45_20230209_185627
000_FL44	4544	18:56:27	18:57:50	480	500		
001_FL45	4545	19:01:14	19:02:14	480	500		
002_FL46	4546	19:04:53	19:05:56	480	500		
003_FL47	4547	19:08:09	19:09:29	480	500		
004_FL48	4548	19:11:55	19:12:41	480	500		
005_FL49	4549	19:15:17	19:16:14	480	500		
006_FL50	4550	19:19:20	19:20:16	480	500		
		19:26:47					DS: BL46_20230209_192647
000_FL1	4601	19:26:47	19:27:51	480	500		
001_FL2	4602	19:30:44	19:31:54	480	500		
002_FL3	4603	19:35:19	19:36:10	480	500		
003_FL4	4604	19:39:12	19:40:10	480	500		
004_FL5	4605	19:42:38	19:43:35	480	500		
005_FL6	4606	19:46:11	19:47:05	480	500		
006_FL7	4607	19:49:45	19:51:17	480	500		
007_FL8	4608	19:53:50	19:54:40	480	500		
008_FL9	4609	19:56:22	19:57:22	480	500		
009_FL10	4610	20:00:28	20:01:27	480	500		
010_FL11	4611	20:04:35	20:05:47	480	500		
011_FL12	4612	20:08:20	20:09:30	480	500		
012_FL13	4613	20:13:03	20:14:13	480	500		
013_FL14	4614	20:16:39	20:17:46	480	500		
014_FL15	4615	20:20:30	20:21:29	480	500		
015_FL67	4667	20:25:55	20:26:57	480	500		
016_FL68	4668	20:29:16	20:30:17	480	500		

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL45, BL46, BL61	<b>DATE:</b>	9 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 3000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	25-30kts @ 220
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	17:50	<b>ENGINE OFF:</b>	22:14	<b>ENGINE TIME:</b>	04:24
<b>TAKEOFF:</b>	18:24	<b>LANDING:</b>	21:59	<b>AIR TIME</b>	03:35

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
017_FL46	4646	20:33:06	20:34:23	480	500		
018_FL47	4647	20:38:03	20:39:14	480	500		
019_FL62	4662	20:41:58	20:43:06	480	500		
020_FL64	4664	20:47:25	20:48:39	480	500		
021_FL63	4663	20:52:11	20:53:52	480	500		
022_FL18	4618	20:55:16	20:56:44	480	500		
023_FL19	4619	20:59:49	21:01:09	480	500		
024_FL20	4620	21:03:29	21:05:00	480	500		
025_FL21	4621	21:07:13	21:08:32	480	500		
026_FL22	4622	21:10:49	21:12:15	480	500		
027_FL23	4623	21:15:19	21:16:17	480	500		
028_FL24	4624	21:18:29	21:19:39	480	500		
029_FL65	4665	21:22:24	21:23:12	480	500		
030_FL66	4666	21:25:06	21:25:58	480	500		
031_FL25	4625	21:28:56	21:29:57	480	500		
032_FL16	4616	21:32:22	21:33:50	480	500		
033_FL17	4617	21:36:34	21:37:53	480	500		
		21:39:00					Ended survey, losing daylight
		21:59:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL49, BL61	<b>DATE:</b>	10 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @5000ft+
<b>BASE STATION:</b>	NA	<b>WIND:</b>	25-30kts @ 320
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	16:53	<b>ENGINE OFF:</b>	21:06	<b>ENGINE TIME:</b>	04:13
<b>TAKEOFF:</b>	17:12	<b>LANDING:</b>	20:49	<b>AIR TIME</b>	03:37

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		17:12:00					Takeoff
		18:29:27					DS: BL61_20230210_182927
000_FL1	6101	18:29:27	18:32:14	480	500	4	
		18:41:41					DS: BL49_20230210_184141
000_FL61	4961	18:41:41	18:43:11	480	500	4	
001_FL60	4960	18:46:03	18:48:14	480	500	4	
002_FL59	4959	18:50:33	18:53:25	480	500	4	
003_FL58	4958	18:56:02	18:59:21	480	500	4	
004_FL57	4957	19:02:05	19:05:31	480	500	4	
005_FL56	4956	19:08:08	19:09:04	480	500	4	<b>BAD:</b> Too high
006_FL56	4956	19:12:33	19:15:57	480	500	4	
007_FL55	4955	19:18:13	19:21:35	480	500	4	
008_FL54	4954	19:24:09	19:27:26	480	500	4	
009_FL53	4953	19:29:39	19:32:56	480	500	4	
010_FL22	4922	19:36:20	19:37:59	480	500	4	
011_FL21	4921	19:40:19	19:42:04	480	500	4	
012_FL20	4920	19:44:35	19:46:15	480	500	4	
013_FL19	4919	19:48:31	19:50:14	480	500	4	
014_FL18	4918	19:53:07	19:54:47	480	500	4	
015_FL23	4923	19:57:09	19:58:19	480	500	4	
016_FL17	4917	19:58:24	19:59:45	480	500	4	
017_FL16	4916	20:02:20	20:03:40	480	500	4	
018_FL15	4915	20:05:58	20:07:22	480	500	4	
019_FL14	4914	20:09:20	20:10:56	480	500	4	
020_FL13	4913	20:13:59	20:15:36	480	500	4	
021_FL12	4912	20:18:16	20:19:25	480	500	4	
022_FL11	4911	20:22:00	20:23:04	480	500	4	
023_FL10	4910	20:25:43	20:26:55	480	500	4	
		20:49:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL49, BL61	<b>DATE:</b>	10 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @5000ft+
<b>BASE STATION:</b>	NA	<b>WIND:</b>	25-30kts @ 320
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-01

<b>ENGINE START:</b>	16:53	<b>ENGINE OFF:</b>	21:06	<b>ENGINE TIME:</b>	04:13
<b>TAKEOFF:</b>	17:12	<b>LANDING:</b>	20:49	<b>AIR TIME</b>	03:37

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR	REMARKS
		21:39:00				Ended survey, restricted areas active

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL47, BL49, BL61	<b>DATE:</b>	11 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 3000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	15-20 kts @ 350
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	17:10	<b>ENGINE OFF:</b>	21:54	<b>ENGINE TIME:</b>	04:44
<b>TAKEOFF:</b>	17:33	<b>LANDING:</b>	21:44	<b>AIR TIME</b>	04:11

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		17:33:00					Takeoff
		17:40:12					DS: BL61_20230211_174012
000_FL1	6101	17:40:12	17:43:00	480	500	6	
		17:51:50					DS: BL49_20230211_175150
000_FL26	4926	17:51:50	17:55:40	480	500	6	
001_FL52	4952	17:58:12	18:01:43	480	500	6	
002_FL51	4951	18:04:06	18:07:17	480	500	6	
003_FL50	4950	18:09:55	18:13:19	480	500	6	
004_FL49	4949	18:15:25	18:18:42	480	500	6	
005_FL48	4948	18:21:11	18:24:44	480	500	6	
006_FL47	4947	18:27:01	18:30:27	480	500	6	
007_FL46	4946	18:33:16	18:36:13	480	500	6	
008_FL45	4945	18:38:17	18:43:09	480	500	6	
009_FL44	4944	18:46:11	18:51:20	480	500	6	
010_FL43	4943	18:54:04	18:59:51	480	500	6	
011_FL25	4925	19:01:49	19:02:43	480	500	6	
012_FL24	4924	19:05:21	19:06:18	480	500	6	
013_FL9	4909	19:10:03	19:11:09	480	500	6	
014_FL1	4901	19:15:01	19:16:12	480	500	6	
015_FL2	4902	19:19:25	19:20:37	480	500	6	
016_FL3	4903	19:24:25	19:25:19	480	500	6	
017_FL4	4904	19:27:47	19:29:11	480	500	6	
018_FL5	4905	19:32:21	19:33:47	480	500	6	
019_FL6	4906	19:35:48	19:37:07	480	500	6	
020_FL7	4907	19:41:37	19:43:11	480	500	6	
021_FL8	4908	19:48:27	19:50:01	480	500	6	
		20:01:38					DS: BL47_20230211_200138
000_FL23	4723	20:01:38	20:03:11	480	500	6	
001_FL24	4724	20:05:32	20:07:24	480	500	6	



<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL47, BL49, BL61	<b>DATE:</b>	11 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 3000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	15-20 kts @ 350
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	17:10	<b>ENGINE OFF:</b>	21:54	<b>ENGINE TIME:</b>	04:44
<b>TAKEOFF:</b>	17:33	<b>LANDING:</b>	21:44	<b>AIR TIME</b>	04:11

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
002_FL25	4725	20:09:47	20:11:30	480	500	6	
003_FL26	4726	20:13:51	20:15:04	480	500	6	
004_FL27	4727	20:17:43	20:18:56	480	500	6	
005_FL28	4728	20:21:28	20:22:48	480	500	6	
006_FL29	4729	20:26:00	20:27:27	480	500	6	
007_FL30	4730	20:30:29	20:32:25	480	500	6	
008_FL31	4731	20:35:10	20:36:59	480	500	6	
009_FL32	4732	20:39:29	20:41:17	480	500	6	
010_FL33	4733	20:44:01	20:45:33	480	500	6	
011_FL34	4734	20:48:26	20:49:44	480	500	6	
012_FL35	4735	20:52:28	20:53:20	480	500	6	
013_FL49	4749	20:56:48	20:58:03	480	500	6	
014_FL38	4738	21:00:36	21:01:50	480	500	6	
015_FL37	4737	21:04:49	21:05:55	480	500	6	
016_FL36	4736	21:08:31	21:09:37	480	500	6	
017_FL39	4739	21:13:18	21:14:30	480	500	6	
018_FL40	4740	21:17:13	21:18:24	480	500	6	
019_FL41	4741	21:21:35	21:22:45	480	500	6	
		21:27:00					Ended survey
		21:44:00					Landing

<b>PROJECT NAME:</b> 2022-10010368 Chesapeake	<b>BASE AIRPORT:</b> Easton(KESN)
<b>LOCATION / AREA:</b> Chesapeake / BL46, BL48, BL61	<b>DATE:</b> 19 February 2023
<b>AIRCRAFT:</b> Cessna 404 (N70790F)	<b>PILOT:</b> Nevo D.
<b>SYSTEM:</b> HawkEye 4X	<b>OPERATOR:</b> Andrew B.

<b>MISSION ID:</b> ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b> Clear
<b>BASE STATION:</b> NA	<b>WIND:</b> 25-30kts @ 210
<b>LIDAR DRIVE:</b> HE4X-03	<b>RCD DRIVE:</b> RCD-02

<b>ENGINE START:</b> 14:23	<b>ENGINE OFF:</b> 20:34	<b>ENGINE TIME:</b> 06:11
<b>TAKEOFF:</b> 14:41	<b>LANDING:</b> 20:18	<b>AIR TIME:</b> 05:37

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		14:41:00					Takeoff
		14:45:51					DS: BL61_20230219_144551
000_FL1	6101	14:45:51	14:48:32	480	500	4	
		15:05:28					DS: BL48_20230219_150528
000_FL1	4801	15:05:28	15:06:54	480	500	4	
001_FL2	4802	15:09:25	15:11:19	480	500	4	
002_FL3	4803	15:14:09	15:16:11	480	500	4	
003_FL4	4804	15:18:29	15:20:46	480	500	4	
004_FL5	4805	15:23:46	15:26:15	480	500	4	
005_FL6	4806	15:28:44	15:31:18	480	500	4	
006_FL7	4807	15:34:20	15:36:52	480	500	4	
007_FL8	4808	15:39:20	15:41:54	480	500	4	
008_FL9	4809	15:44:54	15:47:37	480	500	4	
009_FL10	4810	15:49:58	15:52:30	480	500	4	
010_FL11	4811	15:56:09	15:57:47	480	500	4	
011_FL12	4812	16:00:04	16:01:46	480	500	4	
012_FL13	4813	16:04:56	16:05:49	480	500	4	
013_FL14	4814	16:08:02	16:09:01	480	500	4	
014_FL15	4815	16:12:34	16:13:30	480	500	4	
015_FL16	4816	16:15:11	16:16:17	480	500	4	
016_FL17	4817	16:18:55	16:19:52	480	500	4	
017_FL18	4818	16:23:16	16:24:53	480	500	4	
018_FL19	4819	16:29:01	16:29:58	480	500	4	
019_FL31	4831	16:32:27	16:35:19	480	500	4	
020_FL30	4830	16:38:27	16:41:26	480	500	4	
021_FL22	4822	16:46:25	16:47:39	480	500	4	
022_FL21	4821	16:50:27	16:51:39	480	500	4	
023_FL20	4820	16:54:20	16:55:34	480	500	4	
024_FL23	4823	16:58:00	16:59:05	480	500	4	

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL46, BL48, BL61	<b>DATE:</b>	19 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	25-30kts @ 210
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	14:23	<b>ENGINE OFF:</b>	20:34	<b>ENGINE TIME:</b>	06:11
<b>TAKEOFF:</b>	14:41	<b>LANDING:</b>	20:18	<b>AIR TIME</b>	05:37

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
025_FL41	4841	17:03:39	17:06:28	480	500	4	
026_FL40	4840	17:09:09	17:12:02	480	500	4	
027_FL39	4839	17:14:26	17:17:14	480	500	4	
028_FL38	4838	17:20:19	17:23:08	480	500	4	
029_FL37	4837	17:26:10	17:28:51	480	500	4	
030_FL36	4836	17:31:34	17:33:16	480	500	4	
031_FL35	4835	17:35:48	17:37:36	480	500	4	
032_FL34	4834	17:40:13	17:41:59	480	500	4	
033_FL33	4833	17:44:19	17:45:52	480	500	4	
034_FL32	4832	17:48:20	17:49:24	480	500	4	
035_FL24	4824	17:55:52	17:56:49	480	500	4	
036_FL25	4825	17:59:49	18:01:02	480	500	4	
037_FL26	4826	18:03:32	18:04:48	480	500	4	
038_FL27	4827	18:07:20	18:08:37	480	500	4	
039_FL28	4828	18:11:08	18:12:24	480	500	4	
040_FL29	4829	18:15:03	18:16:05	480	500	4	
041_FL42	4842	18:19:04	18:20:08	480	500	4	
042_FL43	4843	18:22:56	18:23:59	480	500	4	
043_FL44	4844	18:26:28	18:27:31	480	500	4	
044_FL45	4845	18:30:00	18:31:03	480	500	4	
045_FL46	4846	18:33:45	18:34:48	480	500	4	
046_FL47	4847	18:37:27	18:38:29	480	500	4	
		18:39:00					Completed BL48
		18:43:45					DS: BL46_20230219_184345
000_FL73	4673	18:43:45	18:45:22	480	500	4	
001_FL33	4633	18:45:49	18:46:44	480	500	4	
002_FL35	4635	18:49:02	18:49:57	480	500	4	
003_FL34	4634	18:52:20	18:53:33	480	500	4	
004_FL32	4632	18:55:13	18:56:12	480	500	4	
005_FL31	4631	18:58:46	18:59:45	480	500	4	

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL46, BL48, BL61	<b>DATE:</b>	19 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	25-30kts @ 210
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	14:23	<b>ENGINE OFF:</b>	20:34	<b>ENGINE TIME:</b>	06:11
<b>TAKEOFF:</b>	14:41	<b>LANDING:</b>	20:18	<b>AIR TIME</b>	05:37

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
006_FL30	4630	19:02:31	19:04:30	480	500	4	
007_FL69	4669	19:07:19	19:10:42	480	500	4	
008_FL38	4638	19:12:14	19:14:52	480	500	4	
009_FL70	4670	19:18:29	19:19:27	480	500	4	
010_FL71	4671	19:22:24	19:24:03	480	500	4	
011_FL72	4672	19:26:30	19:27:32	480	500	4	
012_FL42	4642	19:29:12	19:30:14	480	500	4	
013_FL43	4643	19:33:04	19:34:07	480	500	4	
014_FL44	4644	19:36:23	19:37:33	480	500	4	
015_FL45	4645	19:39:59	19:41:02	480	500	4	
016_FL36	4636	19:44:17	19:45:06	480	500	4	
017_FL37	4637	19:47:47	19:48:58	480	500	4	
018_FL39	4639	19:51:16	19:52:31	480	500	4	
019_FL40	4640	19:55:15	19:56:34	480	500	4	
020_FL41	4641	19:58:47	20:00:07	480	500	4	
		20:01:00					Ended survey
		20:18:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL46, BL47, BL61	<b>DATE:</b>	20 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @5000ft+
<b>BASE STATION:</b>	NA	<b>WIND:</b>	30+ kts @ 280
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	15:22	<b>ENGINE OFF:</b>	19:43	<b>ENGINE TIME:</b>	04:21
<b>TAKEOFF:</b>	15:41	<b>LANDING:</b>	19:33	<b>AIR TIME</b>	03:52

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		15:41:00					Takeoff
		15:45:32					DS: BL61_20230220_154532
000_FL1	6101	15:45:32	15:48:20	480	500	4	
		16:05:53					DS: BL46_20230220_160553
000_FL26	4626	16:05:53	16:07:26	480	500	4	
001_FL27	4627	16:10:16	16:11:45	480	500	4	
002_FL28	4628	16:15:00	16:15:52	480	500	4	
003_FL29	4629	16:18:37	16:19:33	480	500	4	
004_FL48	4648	16:22:41	16:23:19	480	500	4	
005_FL49	4649	16:25:58	16:26:40	480	500	4	
006_FL50	4650	16:29:37	16:30:24	480	500	4	
007_FL51	4651	16:33:08	16:33:55	480	500	4	
008_FL52	4652	16:36:40	16:37:23	480	500	4	
009_FL56	4656	16:39:49	16:40:33	480	500	4	
010_FL57	4657	16:43:44	16:44:39	480	500	4	
011_FL58	4658	16:47:44	16:49:38	480	500	4	
012_FL59	4659	16:52:43	16:53:32	480	500	4	
013_FL60	4660	16:56:44	16:57:36	480	500	4	
014_FL61	4661	17:01:11	17:01:59	480	500	4	
015_FL54	4654	17:07:36	17:08:21	480	500	4	
016_FL53	4653	17:12:03	17:12:49	480	500	4	
017_FL55	4655	17:15:59	17:17:03	480	500	4	
		17:20:00					Completed BL46
		17:21:14					DS: BL47_20230220_172114
000_FL1	4701	17:21:14	17:22:25	480	500	4	
001_FL2	4702	17:25:33	17:26:21	480	500	4	
002_FL11	4711	17:30:13	17:31:33	480	500	4	
003_FL10	4710	17:35:59	17:37:11	480	500	4	
004_FL9	4709	17:40:41	17:41:53	480	500	4	

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL46, BL47, BL61	<b>DATE:</b>	20 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Nevo D.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @5000ft+
<b>BASE STATION:</b>	NA	<b>WIND:</b>	30+ kts @ 280
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	15:22	<b>ENGINE OFF:</b>	19:43	<b>ENGINE TIME:</b>	04:21
<b>TAKEOFF:</b>	15:41	<b>LANDING:</b>	19:33	<b>AIR TIME</b>	03:52

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
005_FL8	4708	17:44:33	17:45:41	480	500	4	
006_FL7	4707	17:49:45	17:50:59	480	500	4	
007_FL6	4706	17:54:45	17:55:52	480	500	4	
008_FL5	4705	17:58:49	18:00:41	480	500	4	
009_FL4	4704	18:03:46	18:05:37	480	500	4	
010_FL3	4703	18:08:06	18:09:53	480	500	4	
011_FL12	4712	18:12:30	18:13:18	480	500	4	
012_FL13	4713	18:16:17	18:17:10	480	500	4	
013_FL14	4714	18:20:08	18:21:08	480	500	4	
014_FL15	4715	18:23:57	18:24:52	480	500	4	
015_FL16	4716	18:27:23	18:28:23	480	500	4	
016_FL42	4742	18:33:56	18:35:27	480	500	4	
017_FL18	4718	18:36:28	18:37:16	480	500	4	
018_FL19	4719	18:41:38	18:42:24	480	500	4	
019_FL20	4720	18:46:59	18:47:49	480	500	4	
020_FL43	4743	18:50:53	18:52:35	480	500	4	
021_FL44	4744	18:55:05	18:56:33	480	500	4	
022_FL45	4745	19:00:25	19:01:40	480	500	4	
023_FL46	4746	19:04:24	19:05:20	480	500	4	
024_FL47	4747	19:09:05	19:09:45	480	500	4	BAD: Rain
025_FL17	4717	19:13:25	19:14:03	480	500	4	BAD: Rain
		19:15:00					Ended survey due to rain
		19:33:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL47, BL61	<b>DATE:</b>	23 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Russ G.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 4000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	20-25 kts @ 270
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	17:26	<b>ENGINE OFF:</b>	19:24	<b>ENGINE TIME:</b>	01:58
<b>TAKEOFF:</b>	17:40	<b>LANDING:</b>	19:12	<b>AIR TIME</b>	01:32

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		17:40:00					Takeoff
		18:01:27					DS: BL47_20230223_180127
000_FL17	4717	18:01:27	18:02:14	480	500	4	
001_FL21	4721	18:05:10	18:05:57	480	500	4	
002_FL22	4722	18:07:58	18:08:50	480	500	4	
003_FL47	4747	18:10:12	18:11:02	480	500	4	
004_FL48	4748	18:13:23	18:15:06	480	500	4	
005_FL50	4750	18:18:44	18:20:00	480	500	4	
006_FL51	4751	18:22:53	18:25:11	480	500	4	
007_FL52	4752	18:27:06	18:29:03	480	500	4	
008_FL53	4753	18:31:48	18:34:16	480	500	4	
009_FL54	4754	18:35:56	18:37:51	480	500	4	
		18:39:00					Completed BL47
		18:58:00					Ended survey, restricted areas active
		18:59:10					DS: BL61_20230223_185910
000_FL1	6101	18:59:10	19:02:12	480	500	4	
		19:12:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL45, BL61	<b>DATE:</b>	27 February 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Russ G.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 4000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	10-15 kts @ 100
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	16:25	<b>ENGINE OFF:</b>	18:33	<b>ENGINE TIME:</b>	02:08
<b>TAKEOFF:</b>	16:42	<b>LANDING:</b>	18:22	<b>AIR TIME</b>	01:40

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		16:42:00					Takeoff
		17:09:36					DS: BL45_20230227_170936
000_FL2	4502	17:09:36	17:12:33	480	500	4	
001_FL3	4503	17:14:27	17:17:32	480	500	4	
002_FL4	4504	17:19:53	17:22:59	480	500	4	
003_FL5	4505	17:25:39	17:28:49	480	500	4	
004_FL6	4506	17:31:07	17:34:21	480	500	4	
005_FL7	4507	17:36:30	17:39:37	480	500	4	
006_FL8	4508	17:42:09	17:45:27	480	500	4	Light rain
007_FL9	4509	17:47:43	17:50:50	480	500	4	<b>BAD:</b> Rain
		18:12:59					DS: BL61_20230227_181259
000_FL1	6101	18:12:59	18:16:01	480	500	4	<b>BAD:</b> Rain
		18:17:00					Ended survey, due to rain
		18:22:00					Landing



<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL48, BL49, BL50, BL61	<b>DATE:</b>	1 March 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Ray L.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 2000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	20-25 kts @ 200
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	17:35	<b>ENGINE OFF:</b>	21:58	<b>ENGINE TIME:</b>	04:23
<b>TAKEOFF:</b>	17:56	<b>LANDING:</b>	21:52	<b>AIR TIME</b>	03:56

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO PRF   PWR		REMARKS
		17:56:00					Takeoff
		18:02:44					DS: BL61_20230301_180244
000_FL1	6101	18:02:44	18:05:28	480	500	4	
		18:15:06					DS: BL49_20230301_181506
000_FL27	4927	18:15:06	18:19:29	480	500	4	
001_FL28	4928	18:21:53	18:26:28	480	500	4	
002_FL29	4929	18:29:07	18:34:06	480	500	4	
003_FL30	4930	18:36:27	18:41:39	480	500	4	
004_FL31	4931	18:43:55	18:49:13	480	500	4	
005_FL32	4932	18:51:44	18:56:57	480	500	4	
006_FL33	4933	18:59:08	19:04:28	480	500	4	
007_FL34	4934	19:06:56	19:12:21	480	500	4	
008_FL35	4935	19:14:19	19:19:45	480	500	4	
009_FL36	4936	19:21:56	19:27:26	480	500	4	
010_FL37	4937	19:29:59	19:35:28	480	500	4	
011_FL38	4938	19:37:58	19:43:24	480	500	4	
012_FL39	4939	19:45:49	19:51:15	480	500	4	
013_FL40	4940	19:53:16	19:58:48	480	500	4	
014_FL41	4941	20:00:54	20:06:23	480	500	4	
015_FL42	4942	20:08:42	20:14:14	480	500	4	
		20:15:00					Completed BL49
		20:24:48					DS: BL48_20230301_202448
000_FL1	4801	20:24:48	20:26:16	480	500	4	
001_FL2	4802	20:28:44	20:30:34	480	500	4	
002_FL3	4803	20:33:00	20:35:07	480	500	4	
003_FL4	4804	20:37:29	20:39:49	480	500	4	
004_FL5	4805	20:42:22	20:44:55	480	500	4	
005_FL6	4806	20:47:21	20:49:57	480	500	4	
006_FL7	4807	20:52:12	20:54:51	480	500	4	

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL48, BL49, BL50, BL61	<b>DATE:</b>	1 March 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Ray L.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clouds @ 2000ft
<b>BASE STATION:</b>	NA	<b>WIND:</b>	20-25 kts @ 200
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	17:35	<b>ENGINE OFF:</b>	21:58	<b>ENGINE TIME:</b>	04:23
<b>TAKEOFF:</b>	17:56	<b>LANDING:</b>	21:52	<b>AIR TIME</b>	03:56

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
007_FL8	4808	20:57:05	20:59:44	480	500	4	
008_FL9	4809	21:02:13	21:05:05	480	500	4	
009_FL10	4810	21:07:18	21:09:46	480	500	4	
010_FL11	4811	21:12:44	21:14:29	480	500	4	
011_FL12	4812	21:16:34	21:18:11	480	500	4	
		21:29:16					DS: BL50_20230301_212916
000_FL1	5001	21:29:16	21:30:32	480	500	4	
001_FL2	5002	21:32:50	21:34:12	480	500	4	
002_FL3	5003	21:36:29	21:37:47	480	500	4	
003_FL4	5004	21:40:06	21:41:31	480	500	4	
		21:42:00					Ended survey, due to poor visibility
		21:52:00					Landing

<b>PROJECT NAME:</b>	2022-10010368 Chesapeake	<b>BASE AIRPORT:</b>	Easton(KESN)
<b>LOCATION / AREA:</b>	Chesapeake / BL45, BL61	<b>DATE:</b>	5 March 2023
<b>AIRCRAFT:</b>	Cessna 404 (N70790F)	<b>PILOT:</b>	Ray L.
<b>SYSTEM:</b>	HawkEye 4X	<b>OPERATOR:</b>	Andrew B.

<b>MISSION ID:</b>	ChesapeakeMain, ChesapeakeVA	<b>CLOUDS:</b>	Clear
<b>BASE STATION:</b>	NA	<b>WIND:</b>	15-20 kts @ 310
<b>LIDAR DRIVE:</b>	HE4X-03	<b>RCD DRIVE:</b>	RCD-02

<b>ENGINE START:</b>	13:50	<b>ENGINE OFF:</b>	16:28	<b>ENGINE TIME:</b>	02:38
<b>TAKEOFF:</b>	14:08	<b>LANDING:</b>	16:16	<b>AIR TIME</b>	02:08

FL #	LINE #	START TIME	END TIME	ALTITUDE	TOPO		REMARKS
					PRF	PWR	
		14:08:00					Takeoff
		14:12:26					DS: BL61_20230305_141226
000_FL1	6101	14:12:26	14:15:16	480	500	4	
		14:32:17					DS: BL45_20230305_143217
000_FL14	4514	14:32:17	14:35:12	480	500	4	
001_FL13	4513	14:37:56	14:40:58	480	500	4	
002_FL12	4512	14:43:31	14:46:33	480	500	4	
003_FL11	4511	14:49:19	14:52:22	480	500	4	
004_FL10	4510	14:55:01	14:58:03	480	500	4	
005_FL9	4509	15:00:46	15:03:50	480	500	4	
006_FL8	4508	15:06:33	15:09:33	480	500	4	
007_FL7	4507	15:12:15	15:15:14	480	500	4	
008_FL6	4506	15:17:42	15:20:39	480	500	4	
009_FL5	4505	15:23:14	15:26:07	480	500	4	
010_FL4	4504	15:28:29	15:31:23	480	500	4	
011_FL3	4503	15:33:56	15:36:47	480	500	4	
012_FL2	4502	15:39:12	15:42:03	480	500	4	
		15:43:00					Completed BL45
		16:16:00					Landing



## 8.2 Trajectory Processing Log

Project Name	Download Airborne Data	Create IE Project Directory	Copy Data to IE Project /Raw	Run Project Wizard	Base Station			Check Base Coordinate & Datum	Check Lever Arms	Process Time Window		Process TC	Review QC Plots	Separation			Solution Status	Comments
					Station ID	Receiver Type	Antenna (ARP) Height (m)			Start Time (GPS Week Time)	End Time (GPS Week Time)			East RMS (m)	North RMS (m)	Up RMS (m)		
2022-10-30A_CH4X	RC	RC	RC	RC	jx10	R10	GT	GT	GT	70124	76516	GT	GT	0.004	0.002	0.010	FINAL	CAL
2022-10-30A_HE4X	RC	RC	RC	RC	jx10	R10	RC	RC	RC	70102	76661	RC	RC	0.005	0.003	0.010	FINAL	CAL
2022-11-03A_CH4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.011	0.011	0.044	FINAL	
2022-11-03A_HE4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.043	0.059	0.089	FINAL	
2022-11-05A_CH4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.007	0.014	0.034	FINAL	
2022-11-05A_HE4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.072	0.055	0.109	FINAL	
2022-12-08A_CH4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			GT	GT	0.024	0.024	0.058	FINAL	
2022-12-08A_HE4X	GT	GT	GT	GT	NA	PPP	NA	GT	GT			GT	GT	0.024	0.024	0.059	FINAL	
2022-12-13A_CH4X	GT	GT	GT	GT	NA	PPP	NA	GT	GT			GT	GT	0.006	0.005	0.011	FINAL	
2022-12-13A_HE4X	GT	GT	GT	GT	NA	PPP	NA	GT	GT			GT	GT	0.122	0.053	0.060	FINAL	
2022-12-17A_CH4X	JS	JS	JS	JS	NA	PPP	NA	JS	JS			RC	RC	0.026	0.021	0.055	FINAL	
2022-12-17A_HE4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.026	0.021	0.057	FINAL	
2022-12-18A_CH4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.015	0.006	0.031	FINAL	
2022-12-18A_HE4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.090	0.020	0.093	FINAL	
2022-12-19A_CH4X	JS	JS	JS	JS	NA	PPP	NA	JS	JS			JS	RC	0.016	0.015	0.043	FINAL	
2022-12-19A_HE4X	JS	JS	JS	JS	NA	PPP	NA	JS	JS			RC	RC	0.121	0.061	0.135	FINAL	
2022-12-20A_CH4X	JS	JS	JS	RC	NA	PPP	NA	RC	RC			RC	RC	0.017	0.010	0.040	FINAL	
2022-12-20A_HE4X	JS	JS	JS	RC	NA	PPP	NA	RC	RC			RC	RC	0.124	0.031	0.091	FINAL	
2022-12-21A_CH4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.008	0.009	0.015	FINAL	
2022-12-21A_HE4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.107	0.069	0.102	FINAL	
2023-01-05A_CH4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.009	0.005	0.022	FINAL	
2023-01-05A_HE4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.007	0.005	0.022	FINAL	
2023-01-06A_CH4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.009	0.010	0.030	FINAL	
2023-01-06A_HE4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.007	0.010	0.032	FINAL	
2023-01-07A_CH4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.006	0.006	0.019	FINAL	
2023-01-07A_HE4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.003	0.006	0.017	FINAL	
2023-01-08A_CH4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.011	0.005	0.031	FINAL	
2023-01-08A_HE4X	RC	RC	RC	RC	NA	PPP	NA	RC	RC			RC	RC	0.011	0.007	0.032	FINAL	
2023-01-14A_CH4X	PR	PR	PR	PR	NA	PPP	NA	PR	PR			PR	PR	0.018	0.011	0.034	FINAL	



2023-01-14A_HE4X	PR	PR	PR	PR	NA	PPP	NA	PR	PR			PR	PR	0.017	0.011	0.034	FINAL	
2023-01-15A_CH4X	PR	PR	PR	PR	NA	PPP	NA	PR	PR			PR	PR	0.009	0.009	0.038	FINAL	
2023-01-15A_HE4X	PR	PR	PR	PR	NA	PPP	NA	PR	PR			PR	PR	0.009	0.009	0.036	FINAL	
2023-01-16A_CH4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.017	0.005	0.017	FINAL	
2023-01-16A_HE4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.017	0.006	0.027	FINAL	
2023-01-18A_CH4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.013	0.013	0.024	FINAL	
2023-01-18A_HE4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.013	0.012	0.026	FINAL	
2023-01-20A_CH4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.006	0.009	0.038	FINAL	
2023-01-20A_HE4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.005	0.012	0.051	FINAL	
2023-01-21A_CH4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.004	0.013	0.045	FINAL	
2023-01-21A_HE4X	AS	AS	AS	AS	NA	PPP	NA	AS	AS			AS	AS	0.004	0.013	0.045	FINAL	
2023-02-05A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.013	0.014	0.050	FINAL	
2023-02-05A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.012	0.016	0.043	FINAL	
2023-02-06A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.009	0.010	0.037	FINAL	
2023-02-06A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.011	0.010	0.029	FINAL	
2023-02-07A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.008	0.013	0.027	FINAL	
2023-02-07A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.009	0.010	0.034	FINAL	
2023-02-09A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.016	0.022	0.040	FINAL	
2023-02-09A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.011	0.018	0.046	FINAL	
2023-02-10A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.010	0.023	0.050	FINAL	
2023-02-10A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.009	0.010	0.026	FINAL	
2023-02-11A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.032	0.016	0.056	FINAL	
2023-02-11A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.018	0.011	0.042	FINAL	
2023-02-19A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.018	0.012	0.029	FINAL	
2023-02-19A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.012	0.011	0.036	FINAL	
2023-02-20A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.014	0.014	0.030	FINAL	
2023-02-20A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.013	0.013	0.029	FINAL	
2023-02-23A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.025	0.010	0.028	FINAL	15 Degree Elevation Mask
2023-02-23A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB	414907		AB	AB	0.010	0.010	0.028	FINAL	20 Degree Elevation Mask
2023-02-27A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.014	0.011	0.023	FINAL	
2023-02-27A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB	150590		AB	AB	0.009	0.007	0.023	FINAL	
2023-03-01A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB	337511		AB	AB	0.014	0.019	0.043	FINAL	
2023-03-01A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.013	0.017	0.036	FINAL	
2023-03-05A_CH4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.011	0.019	0.045	FINAL	
2023-03-05A_HE4X	AB	AB	AB	AB	NA	PPP	NA	AB	AB			AB	AB	0.013	0.013	0.054	FINAL	