EchoONE User Manual

Teledyne Optech
https://www.teledyneoptech.com/

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1 EchoONE Product Overview

1.1 Product description

The EchoONE is a lightweight airborne LiDAR scanner that is integrated into an UAV (Unmanned Aerial Vehicle). Accessories and custom packages are available for installation on specific UAVs. The EchoONE has an internal 5-megapixel (MP) camera, with an optional 61-MP camera for high-resolution survey projects.

Global Navigation Satellite Systems (GNSS) and inertial systems are provided by Inertial Labs, which also provides the RESEPI (remote sensing payload instrument) graphical user interface (GUI) and the PCMasterPro processing application.

The EchoONE delivers secure, colorized, engineering-grade LiDAR point clouds. It is suitable for applications such as land surveying, electric utility vegetation management, asset management, and transportation projects.

1.1.1 Laser safety classification

The EchoONE is designed as a Class 1 laser product that is eye-safe in normal operations. It emits invisible laser radiation.

Never open the EchoONE scanner. While closed, the EchoONE is classified as a Class 1 laser product despite containing a Class 4 laser. Opening the scanner therefore gives access to emission levels in excess of Class 1 eye-safe limits, especially when the scanner is not rotating, and may increase the eye hazard.

1.1.2 FCC Supplier's Declaration of Conformity

47 CFR 2.1077 Compliance Information

Unique Identifier: EchoONE

Responsible Party – U.S. Contact Information
Teledyne Optech
7225 Stennis Airport Road
Kiln, MS 39556
Tel: +1-228-252-1004

FCC Compliance Statement
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Contains Transmitter Module FCC ID: TFB-1004

1.2 Specifications

For the latest EchoONE specifications, refer to the datasheet available here:
https://defense.flir.com/defense-products/echoone/

1.3 Use cases

1.3.1 Surveying

Providing high-accuracy topographic mapping, cadastral/engineering surveys, earthworks monitoring, and site documentation.

Typical deliverables:

- Classified (e.g., ground, vegetation, buildings), colorized engineering-grade point clouds—LiDAR Aerial Survey (LAS)/LASzip (LAZ)
- Digital Surface Models (DSMs)/Digital Terrain Models (DTMs)
- Contours and spot elevations
- Breaklines and feature extractions (curbs, ridges, drainages)
- Orthophotos (from internal 5-MP camera or optional 61-MP camera)
- Quality report (coverage map, density statistics, trajectory residuals, alignment checks)

1.3.2 Corridor

Mapping linear assets such as powerlines, railways, roads, and pipelines. EchoONE supports vegetation encroachment analysis, sag/clearance measurement, cross-sections, asset inventory, change detection, and construction/as-built verification.

Typical deliverables:

- Classified, colorized corridor point cloud (LAS/LAZ)
- Centerline and right-of-way (ROW) coverage map and statistics
- Feature classes:
  - Power – conductor catenaries, poles/towers, insulators, attachments
  - Rail/Road – rails, ties, ballast, pavement edges, barriers, signage, drainage
  - Pipelines – right-of-way, access roads, markers, exposed fittings
- Vegetation encroachment metrics (distances, volumes within buffer zones)
- Clearance/sag reports and cross-sections at specified intervals (e.g., every x meters)
- Asset inventory and condition snapshots (photo points with 61-MP optional camera)
- Change-detection and construction progress comparisons (multi-date datasets)

1.4 Additional requirements

In addition to the EchoONE scanner, there are several other hardware devices required to conduct a UAV LiDAR survey, as outlined in this section.

1.4.1 UAV

In theory, the EchoONE can be used on any UAV that has the payload weight capability to carry the EchoONE and can provide the required power to the EchoONE.

Teledyne provides turnkey kits and instructions for installing the EchoONE on the following UAVs:

- Freefly Astro Max
- Inspired Flight IF800
- DJI M350

If you would like to operate the EchoONE on a different UAV, we recommend that you speak to the manufacturer or dealer of the UAV about possible integration.

1.4.2 GNSS base station

A GNSS base station and tripod are required for PPK (post-process kinematic) processing of the GNSS (GPS) and IMU data onboard the EchoONE to create an accurate trajectory of the sensor. The GNSS base station must output in RINEX (receiver independent exchange) format and collect at least L1 and L2 data from GPS and Galileo constellations.

The following GNSS base stations have been tested with EchoONE:

- Trimble R12
- Emlid Reach RS3

1.4.3 Mobile device

A mobile device (e.g., cell phone, tablet) is required to connect to the EchoONE via Wi-Fi in the field to configure the system and start and stop collection using the RESEPI GUI.

1.4.4 Processing computer

A Windows PC is required to operate PCMasterPro and LMS Professional (optional). As of the release date of this document, the minimum recommended computer specifications are as follows:

- 10th Gen Intel® Core™ i7 processor
- 32 GB DDR4 RAM
- NVIDIA GeForce GTX 1050 Ti
- Windows 10 x64 or Windows 11

For the most up to date specifications, refer to the PCMasterPro documentation here: https://lidarpayload.com/docs/introduction-to-pcmasterpro/introduction-to-pcmasterpro/#system-requirements-and-limitations

2 GETTING STARTED

2.1 Unboxing the EchoONE

To unbox the EchoONE:

1. Place the hard case on a flat surface with the case logo facing up.
2. Press and hold the gray release button while rotating the latch upward on each side of the case.

Figure 2-1: EchoONE case

3. Grasp the EchoONE sensor firmly on both sides and gently lift it straight up and out of the foam cutout. If an external camera is included with the sensor (as shown below), it will come already assembled on the back of the sensor.

Figure 2-2: EchoONE sensor and accessories

4. Place the sensor on a flat surface and, if the payload adapter is not already installed, remove the red connector cap.

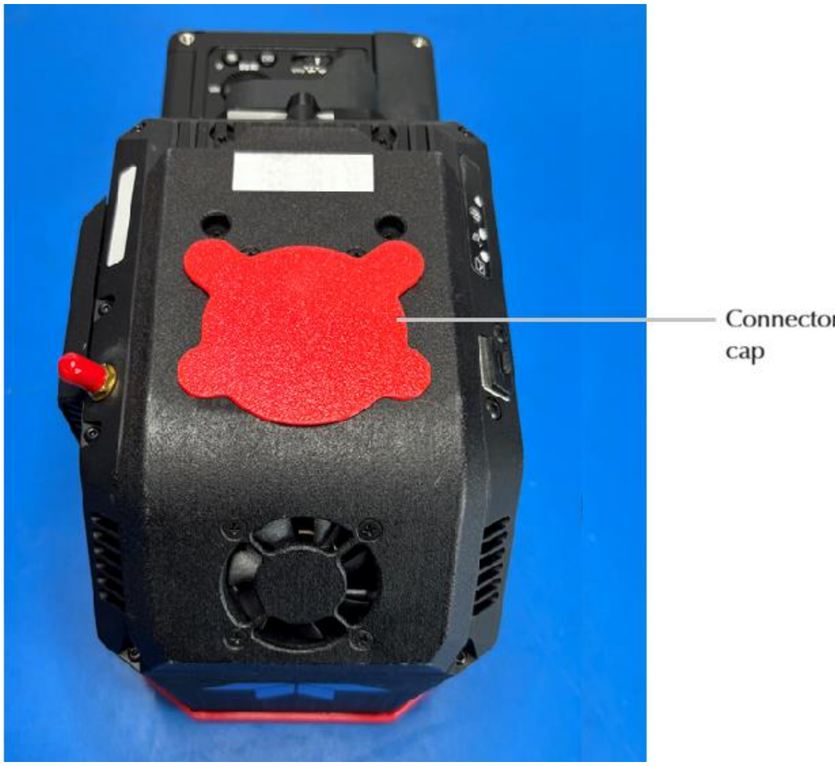

Figure 2-3: Dovetail connector cap

5. Place the sensor on its side and remove the red antenna connector cap and red sensor cover.

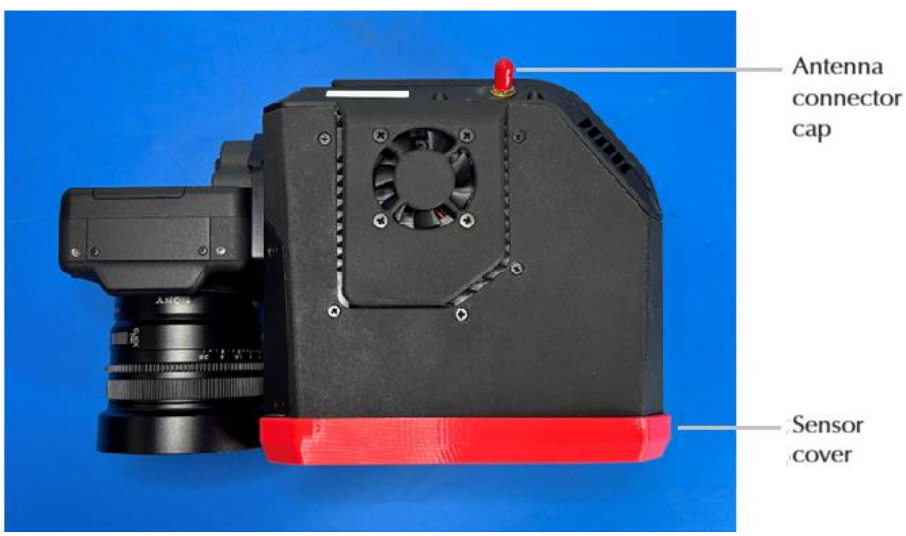

Figure 2-4: Antenna connector cap and sensor cover

6. The EchoONE is ready for the accessories to be installed.

Figure 2-5: EchoONE sensor with covers removed

2.2 Installation instructions

2.2.1 Installing the payload adapter

If the EchoONE does not come with the payload adapter already installed, you will need to install the payload adapter before operating the EchoONE on any UAV that uses the Freefly Smart Dovetail or DJI Skyport adapters.

To install the payload adapter:

1. If the red connector cap has not already been removed from the top of the EchoONE sensor (see Section 2.1, step 4), remove the cap to expose the payload adapter interface.

Figure 2-6: Payload adapter interface

2. Remove the payload adapter from its packaging and align it over the pins.

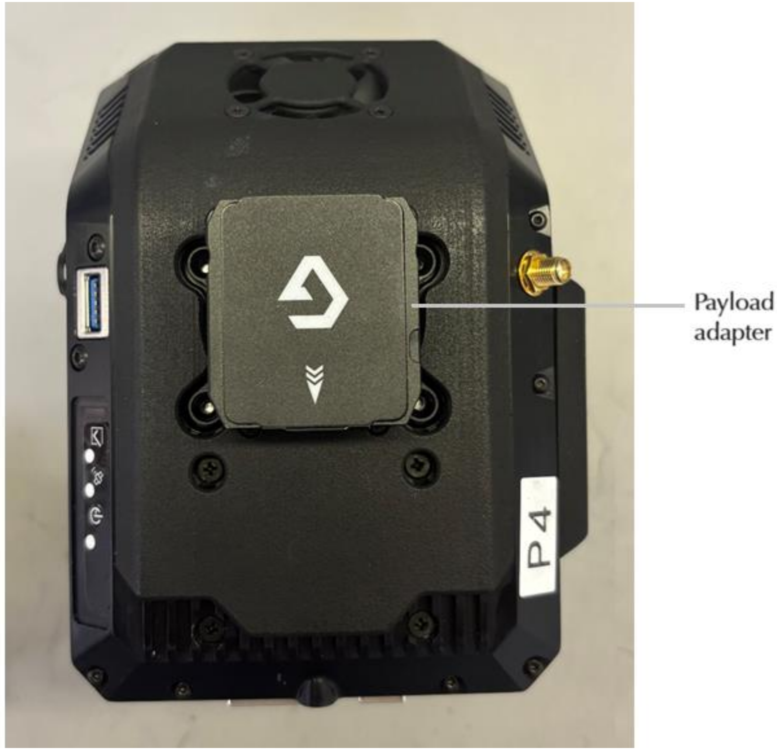

Figure 2-7: Payload adapter

3. Insert the 4 fasteners with gaskets and tighten.

Figure 2-8: Payload adapter fasteners

2.2.2 Installing the external camera

If the EchoONE was not shipped with the external camera installed, you will need to install it.

To install the external camera:

1. On the back of the EchoONE, unscrew the 3 fasteners on the plastic cover, and remove the cover to expose the camera pin connectors.

Figure 2-9: Connectors on back of EchoONE sensor

2. Press the external camera onto the pin connectors so that it is held in place by the connectors.

Figure 2-10: External camera on back of EchoONE sensor

3. Insert the 3 fasteners with gaskets and tighten.

Figure 2-11: External camera fasteners

2.2.3 Setting up the UAV

In most cases, the UAV will need to be set up to operate the EchoONE. Instructions for setting up the following UAVs are provided in Appendix A:

- Freefly Astro Max – Refer to Appendix A.1.
- Inspired Flight IF800 – Refer to Appendix A.2.
- DJI M350 – Refer to Appendix A.3.

2.2.4 Installing PCMasterPro

PCMasterPro is used for post-processing the EchoONE data. EchoONE is supported in PCMasterPro GL version 1.14.2 and later. This section describes how to install PCMasterPro and activate the license. A license is not required to install PCMasterPro.

To install PCMasterPro:

1. Download and install the executable for PCMasterPro.

2. Open PCMasterPro. The PCMasterPro main window has the following features:
    - Menu bar – Contains the menus that provide access to the tools required to process and edit the LiDAR survey. The File menu provides options for creating, opening, saving, and exporting projects. The Settings menu includes options for activating the PCMasterPro license.
    - Status bar – Displays the current steps in the processing workflow and any errors encountered during processing.
    - 3D view window – Displays the trajectory and LiDAR point cloud after the survey has been processed.

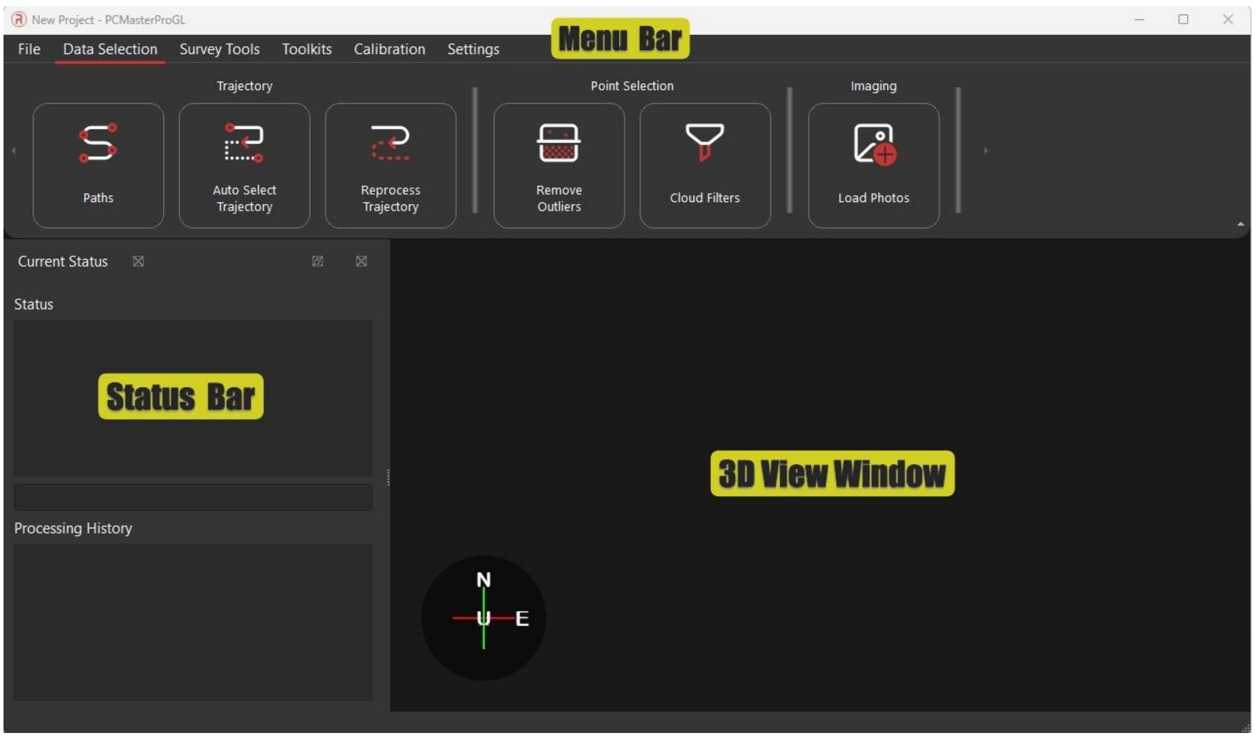

Figure 2-12: RESEPI GUI

3. Activate the license:

   a. Go to **Settings**, and select **Local License Manager**.

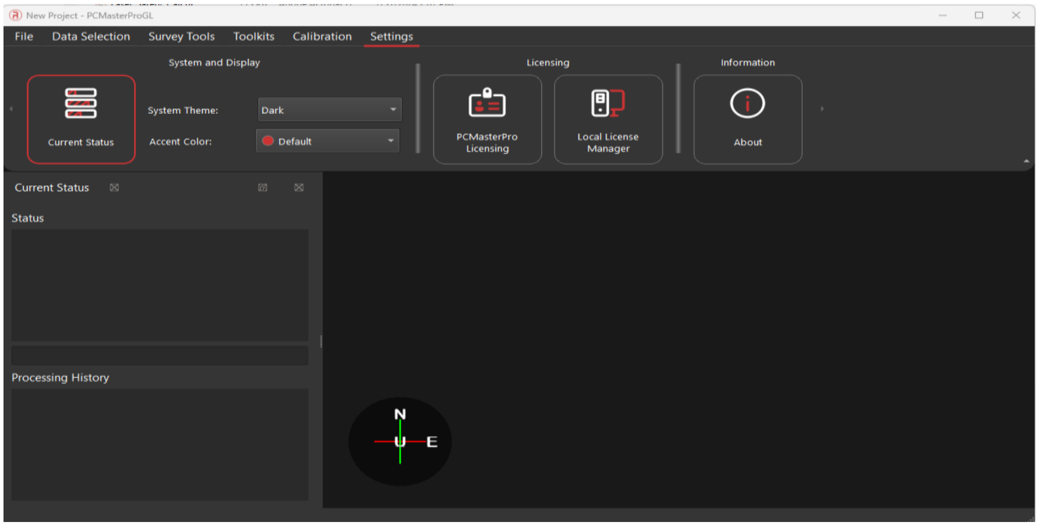

Figure 2-13: Selecting the Local License Manager

   b. In the NovAtel Local License Manager dialog, in the left list box, select **Activate License**.

   c. In the Activate License field, enter the license number, and select **Activate**.

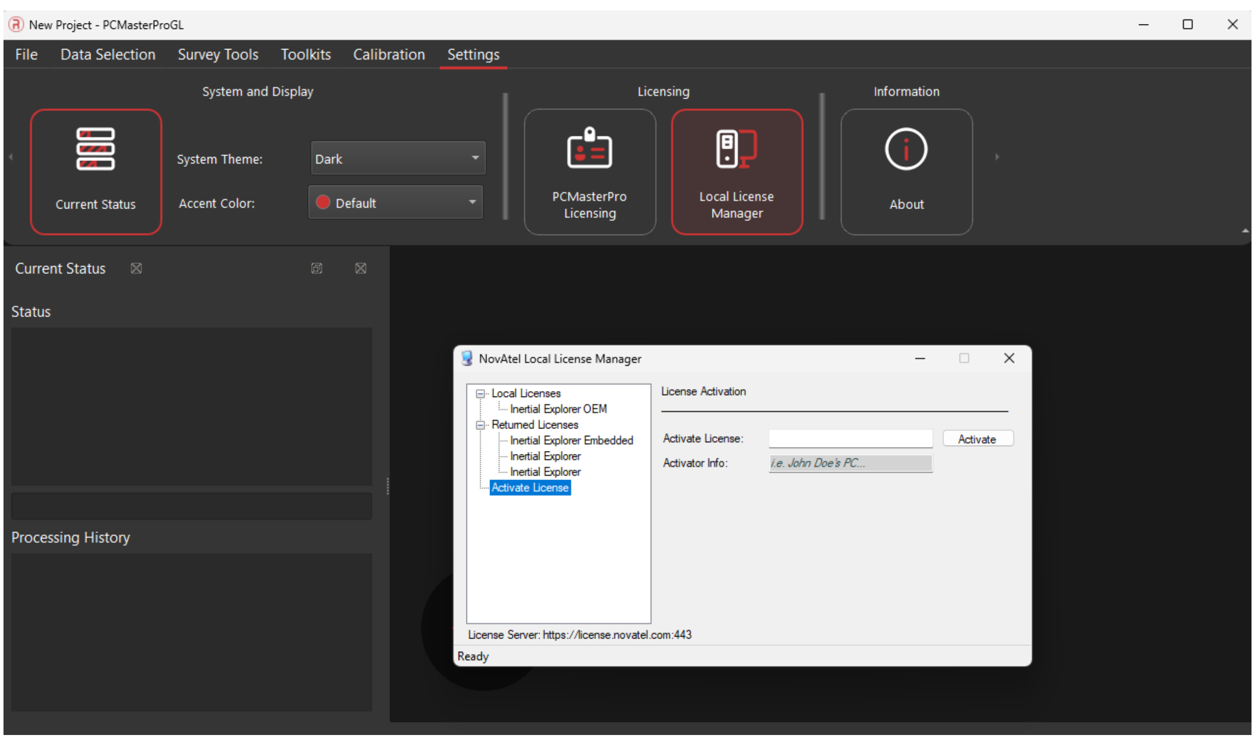

Figure 2-14: Local License Manager

   d. In the left list box, select **Local Licenses**. If the activation was successful, you will see the newly activated license in the list.

4. For a step-by-step overview of how to process data using PCMasterPro, see Section 3.4.

2.3 Configuring the settings

<TBD –Show the different RESEPI GUI screens and what can be configured on each.>

This section describes how to use the RESEPI GUI to view and config ure the following EchoONE settings:

- Geometry
- Connectivity
- Boresight
- Camera
- Firmware
- INS Service
- LiDAR Service
- Hardware

The controls provided under **Status**, such as starting and stopping data recording, and **Storage**, such as downloading the survey data, are discussed in Section 3.3.

2.3.1 Accessing the RESEPI GUI

The RESEPI GUI is the web application used to manage EchoONE status, data storage, firmware updates, and various system settings.

To access the RESEPI GUI:

1. Power on the EchoONE sensor.
2. On a mobile device, connect to the EchoONE Wi-Fi network:
   a. Open the Wi-Fi settings.
   b. Join the Wi-Fi network named **RESEPI - ######.**
   c. Enter the password **LidarAndINS**.
3. Open a web browser and enter the IP address **192.168.12.1**.

2.3.2 Configuring the lever arm settings

The lever arm settings should be configured before the first flight to allow the real-time .las file to be generated correctly.

To configure the lever arm settings:

1. If not already connected, connect to the EchoONE Wi-Fi network as per Section 2.3.1.
2. On a mobile device, open a web browser and enter IP address **192.168.12.1**.
3. In the RESEPI GUI, go to **Settings**, and select **Geometry**.

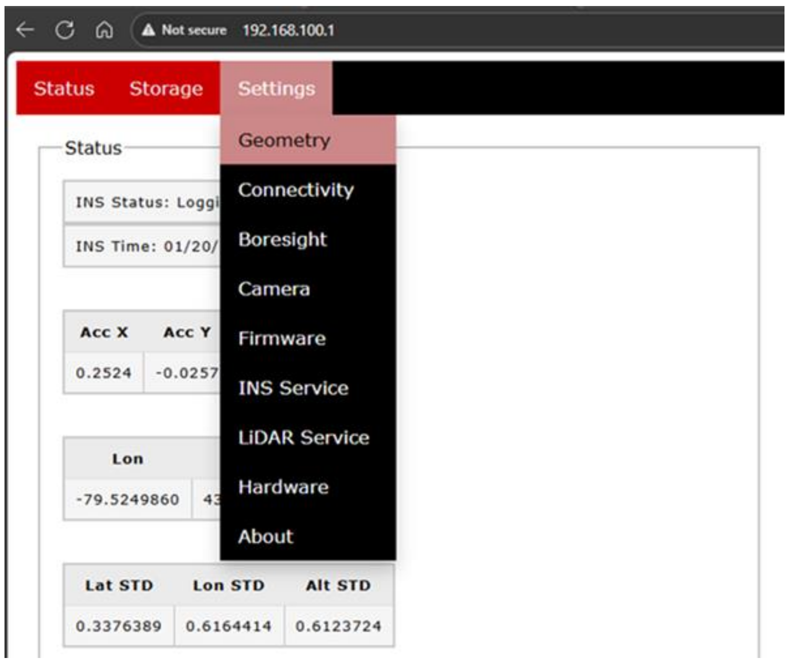

Figure 2-15: Selecting the Geometry settings

4. Under **IMU to Antenna Offset**, enter the appropriate Right, Forward, and Up lever arm values (in meters), and select **Save**. Refresh the page to make sure the values have been applied correctly.

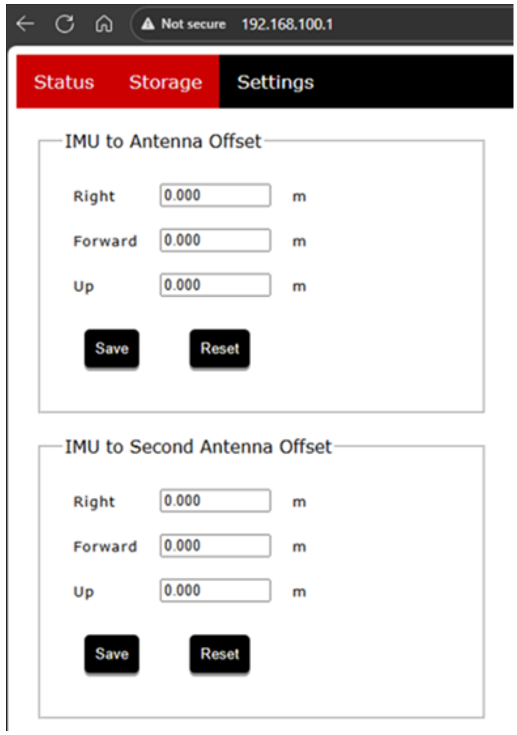

Figure 2-16: Lever arm IMU to Antenna Offset settings

5. If the EchoONE sensor is installed in a different orientation, such as facing backward relative to the flight direction, under **Vehicle to IMU Rotation**, enter the appropriate Yaw, Pitch and Roll rotation angles (in degrees), and select **Save**. Refresh the page to make sure the values have been applied correctly.

3 Survey Workflow

3.1 Planning a survey

Planning a LiDAR survey involves several steps to ensure that an accurate LiDAR point cloud is collected, which achieves the project goals. In this section, the boundary of the project, the collection parameters, and project control will be discussed.

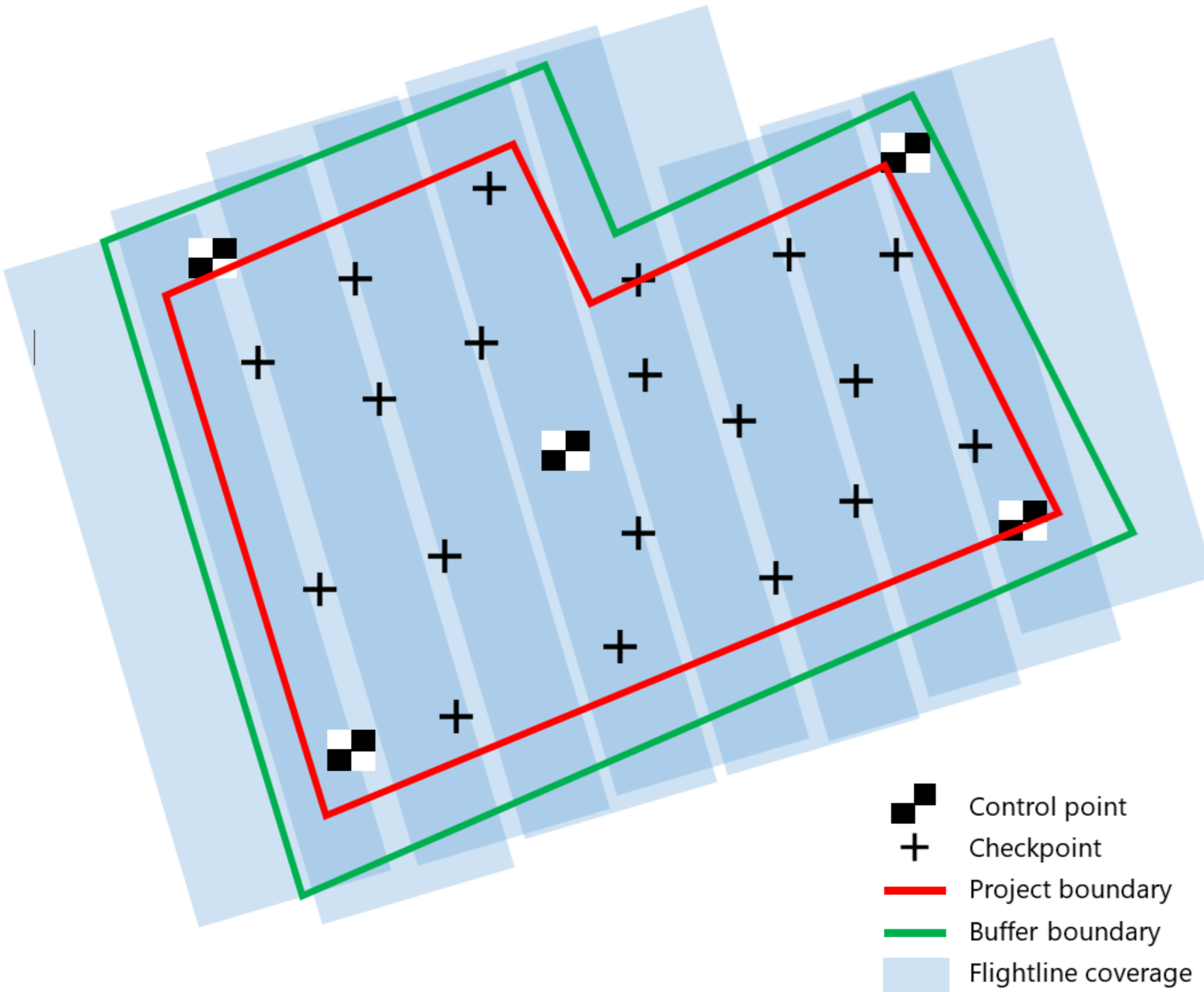

Figure 3-1: LiDAR survey planning

Project boundary

Each project will typically start with a required boundary area or area of interest (AOI). This is the area that is required as a deliverable for the project.

Buffer boundary

It is recommended to add a buffer to the project boundary of between 50 and 200 ft, and it is this buffer boundary that is used for project planning. The buffer boundary ensures that there are no gaps or voids at the edge of the project boundary, provides more flexibility in locating control and checkpoints, and allows UAV turns to be outside the project boundary and easily removed in post-processing.

Flightline coverage

It is recommended to plan flightlines with a 50% side overlap to allow strip alignment tools to correct for trajectory errors.

Control points

Control points have a critical role in UAV LiDAR surveys because they provide a ground-truth reference for ensuring the accuracy and reliability of the LiDAR data. Control points act as a fixed reference position to align the LiDAR point cloud to the correct real-world coordinate system.

For control points, it is recommended to use targets, such as a standard checkerboard target, of sufficient size as to be see in the LiDAR data so that both horizontal and vertical control can be obtained. Position 4 control points at the corners of the boundary area and one roughly in the middle of the area. Using a high quality GNSS base station together with a high quality reference (such as CORS network), observe each control point for at least 120 epochs, and then repeat the observation at least 4 hours later.

Perform a network adjustment of the control point data by processing the baselines to compute the vectors between the control points and base, and check the Chi-Square test result to ensure that the results are statistically sound. Export the control and use this for the checkpoint locations.

Checkpoints

Checkpoints are collected similar to control points. For VVA (Vegetated Vertical Accuracy) checkpoints, collect the points for a minimum of 30 epochs in grass or under foliage. For NVA (Non-Vegetated Vertical Accuracy) checkpoints, collect the points for a minimum of 30 epochs on hard surfaces such as pavement or dirt.

Sensor parameter selection

Selection of sensor parameters is key to achieving project requirements. Listed below are considerations for sensor selection for land surveys and asset inspection projects.

Land surveys (recommend 400 kHz pulse rate):

In land surveys, the key deliverable is typically to generate contour plots of the ground below vegetation such as trees. Vegetation penetration is typically achieved through a combination of high laser power, multiple laser shots to find gaps in vegetation, and multiple fields of view to find gaps from different angles. The highest laser power setting of the EchoONE is 400 kHz, which gives more energy to the laser pulse to get returns off dark forest floors from higher altitudes. Even at 400 kHz, the point density is enough to achieve the 20 to 50 pts/m^2 that is required to generate contour plots.

Asset inspection (recommend 600 kHz pulse rate):

For asset inspection projects or vegetation encroachment, a high point density to capture small objects such as wires or poles is required. The 600 kHz pulse rate of the EchoONE is recommended in this case, as these projects typically do not require the high operating altitude of vegetation penetration capabilities at the 400 kHz pulse rate.

The last key sensor parameter is vehicle speed. It is recommended to fly with a forward velocity of at least 5 m/s to ensure accurate trajectory information.

The curves below give the average point density generated by the EchoONE in a single pass at various altitudes and speeds for the different pulse rates.

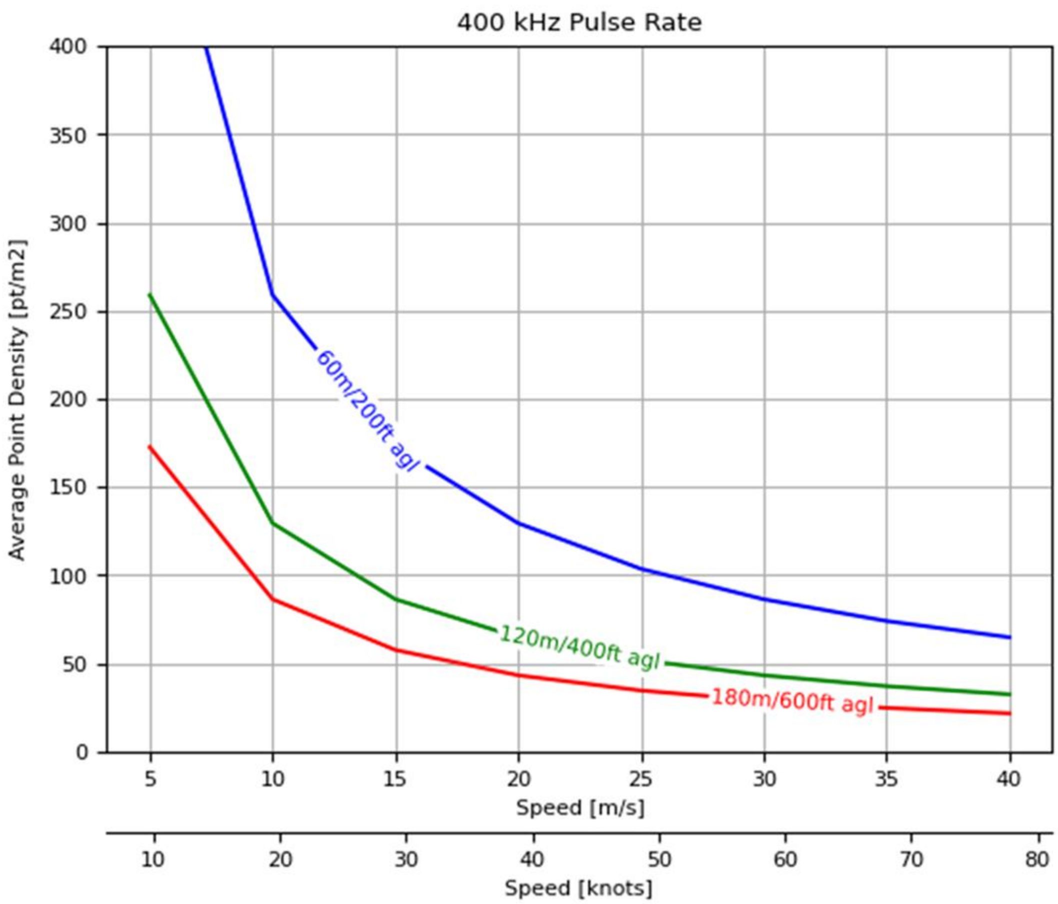

Figure 3-2: EchoONE average point density vs. speed @ 400 kHz pulse rate

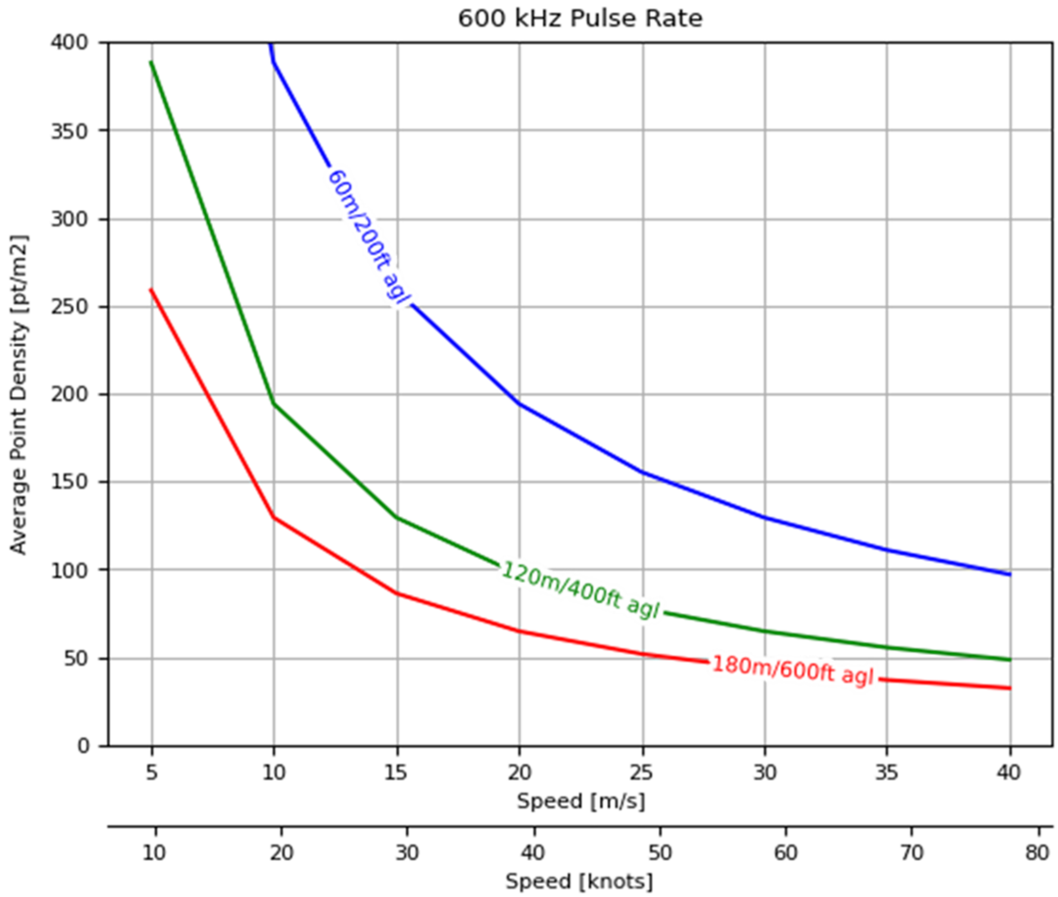

Figure 3-3: EchoONE average point density vs. speed @ 600 kHz pulse rate

3.2 Designing the flight plan

How the UAV flies with the EchoONE is a key requirement to processing the IMU and GNSS data into an accurate trajectory, and in turn an accurate LiDAR point cloud. This section discusses the key steps to a flight plan. At all times during the flight, the UAV should be flying in a forward direction. If the UAV flies sideways, or backwards at any point, the trajectory will be degraded.

The following key steps are recommended.

1. Turn on the UAV and EchoONE and start data collection. Collect for at least 2 minutes with no movement (static) on the ground, and then take off.
2. Fly in a forward direction at a speed of least 5 m/s for a minimum of 3 seconds.
3. Fly a minimum of one figure-8 pattern to align the IMU, preferably outside your survey area so that it can be easily extracted from the data.
4. Fly the flightlines of your survey. At the turns, ensure that the UAV is always flying in a forward direction.
5. Fly at least one tie-line across the survey flight lines at a different altitude. The tie-line should ideally be in the middle of the survey flight lines.

6. Optionally fly a minimum of one figure-8 pattern.
7. Fly forward for at least 3 seconds at a minimum speed of 3 m/s.
8. Land and continue to collect data for at least 2 minutes on the ground.

A sample flight plan is shown below.

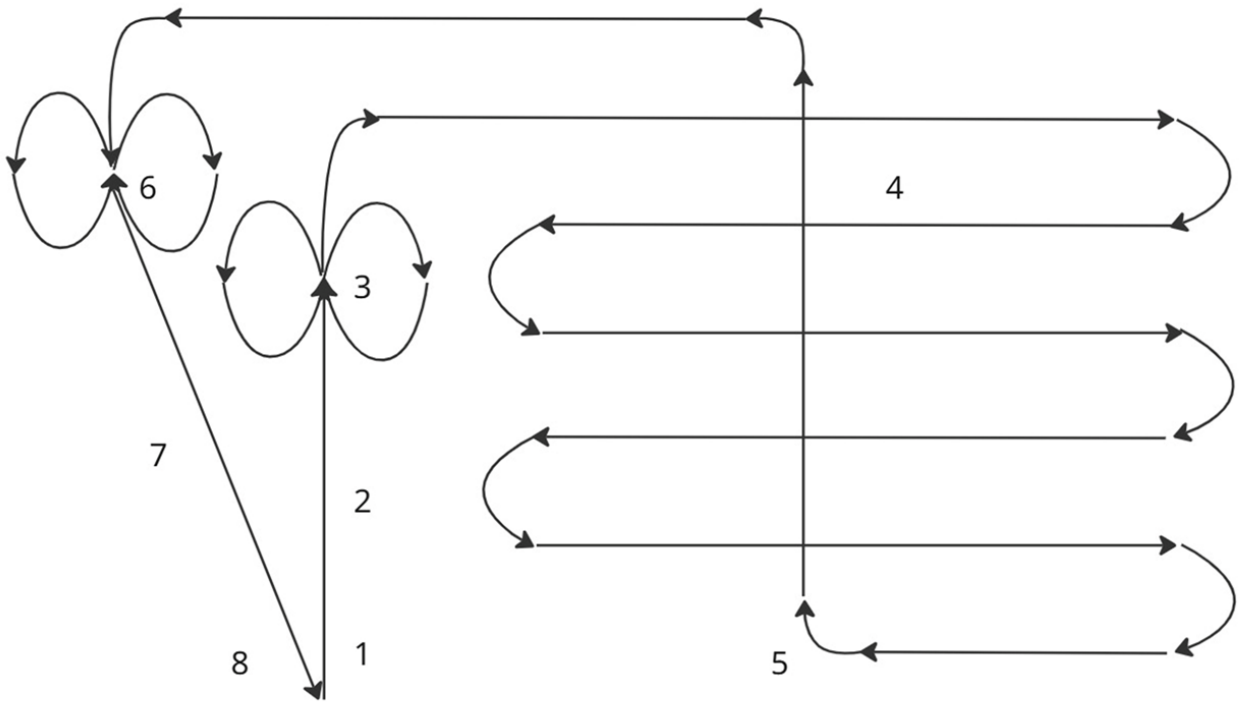

Figure 3-4: Sample flight plan

3.3 Conducting the LiDAR survey

This section describes the standard operating procedures for safely and effectively conducting a UAV LiDAR survey in the field. Proper execution of these steps is critical for achieving high-accuracy results and ensuring all downstream processing aligns with ASPRS and industry best practices.

3.3.1 Setting up the GNSS base station

A stable, well-configured GNSS base station is essential for generating accurate PPK trajectories.

Follow these guidelines for selecting the setup location:

- Choose a known survey control point whenever possible.
- Ensure the site has an unobstructed sky view (≥ 15° mask angle recommended).
- Verify that the tripod or mast is placed on stable, vibration-free ground.

To assemble and level the antenna:

1. Set up the tripod and center it precisely over the mark using an optical or laser plummet.

2. Level the tripod head and secure all clamps.
3. Mount the GNSS antenna securely and record:
   - Antenna height (ARH or vertical height to phase center)
   - Antenna model type
   - Setup time and point ID

To start base station logging:

1. Start raw GNSS observation recording in 1 Hz or 2 Hz measurement mode (depending on system requirements).
2. Maintain continuous logging for at least 10 to 15 minutes before takeoff to ensure robust satellite geometry and stable PPK alignment.
3. Confirm:
   - Adequate satellite count (at least 8 to 10 satellites)
   - Healthy PDOP (< 3 preferred)
   - Sufficient storage and battery life for full mission duration

3.3.2 Pre-flight: Preparing the UAV and LiDAR

The EchoONE must be installed on the UAV, and the LiDAR settings configured before starting the survey.

To prepare the UAV and LiDAR:

1. Set up the UAV and install the EchoONE on the UAV. For details, see Appendix A.
2. Perform any pre-flight inspection required on the UAV.
3. Power on the UAV and the EchoONE.
4. If not already connected, connect to the EchoONE Wi-Fi network as per Section 2.3.1.
5. On a mobile device, open a web browser and enter IP address **192.168.12.1**.

6. In the RESEPI GUI, change the pulse rate to the desired value for the survey:
   a. Go to **Settings**, and select **LiDAR Service**.

Figure 3-5: Selecting the LiDAR Service options

   b. Under **Configure EchoONE**, select the desired **Laser Pulse Repetition Frequency**. If in doubt, select 400 kHz. Select **Save**.

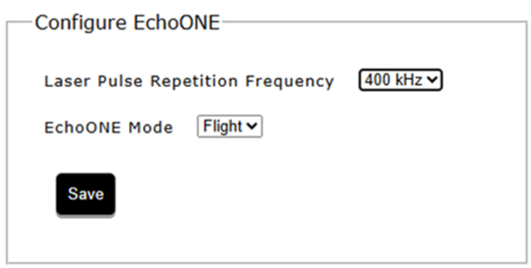

Figure 3-6: Laser Pulse Repetition Frequency setting

7. Select **Status**, scroll down to **Data recording**, and select **Start**.

8. Confirm that the EchoONE is operating normally and collecting data:
    a. Select **Status** and ensure that:
        - **INS Status** transitions to **Logging data**.
        - **GNSS Solution** shows more than 8 Satellites.
    b. Select **Camera** and ensure that:
        - The number of camera **Images Taken** is increasing.

INS Status: Logging data

INS Time: 01/07/2026 19:47:12

...

GNSS Solution	Satellites
single point position	11

...

Camera Model	Serial Number	Images Taken
Blackfly S BFS-U3-50S4C-BD	01804305	3

Figure 3-7: Confirming normal operation and data collection

9. The EchoONE is now collecting data and you are ready to execute the flight plan as designed in Section 3.2.

3.3.3 Post-flight: Downloading UAV data

When the survey is complete and the UAV has landed, do not turn off the UAV power. Leave the UAV turned on and download the UAV data to the EchoONE.

To download the UAV data:

1. Reconnect the EchoONE payload.
2. Select **Status**, scroll down to **Data recording**, and select **Stop**.

3. Insert a USB drive into the EchoONE and download the data. This step can also be done later by powering on the EchoONE again.
    a. Go to **Storage**, and under **Internal Data**, find the project you want to save, and select the download button.

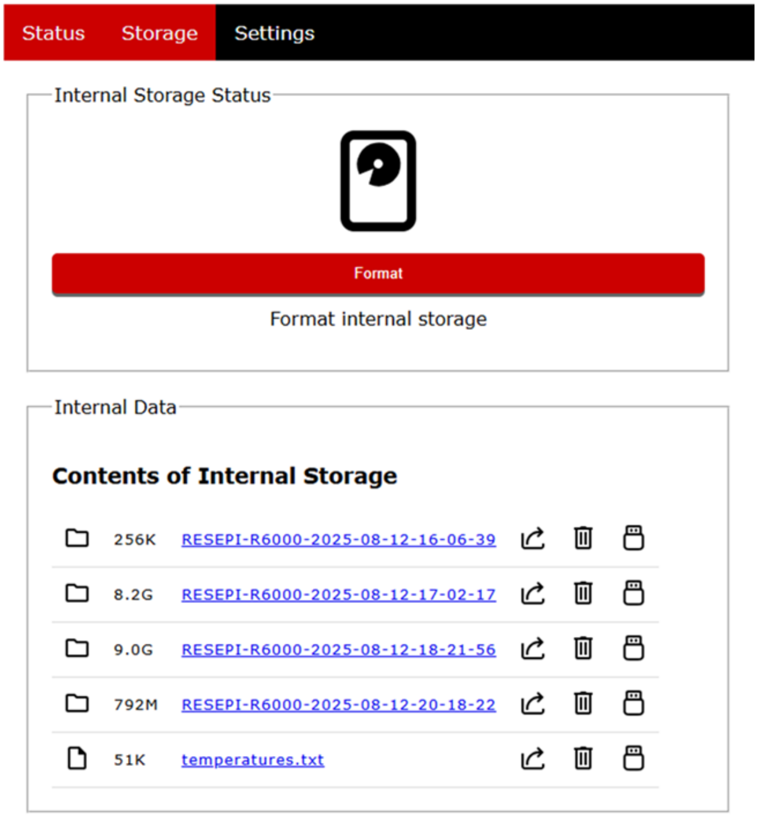

Figure 3-8: Internal project data files

    b. The system begins downloading the project and displays the download progress.

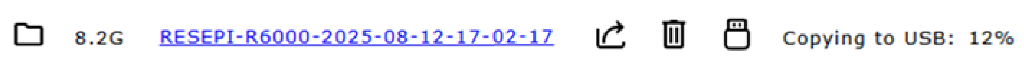

Figure 3-9: Download progress

4. When the data is finished downloading to the USB drive, leave the UAV turned on and shut down the EchoONE—go to **Status**, scroll down to the bottom of the screen, and select **Shutdown**.
5. Wait until the LED on the outside of the EchoONE turns off, and then turn off the UAV power.
6. Continue logging GNSS data from the base station for 10 to 15 minutes after the end of the UAV flight. Do not move or disassemble the tripod until logging stops.

3.4 Processing data in PCMasterPro

This section provides a quick step-by-step overview of how to process data in PCMasterPro. For more detailed instructions, refer to the documents provided at https://lidarpayload.com/docs.

To process data in PCMasterPro:

1. Copy the survey from the EchoONE sensor to your computer. The survey will have the following structure before post-processing in PCMasterPro.

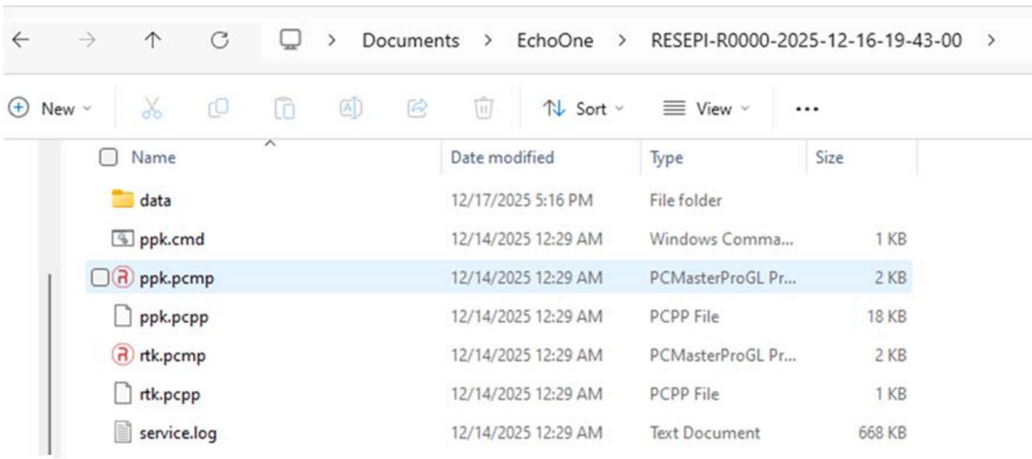

Figure 3-10: EchoONE survey structure

2. Copy the RINEX files from the base station to the **data** folder on your computer.

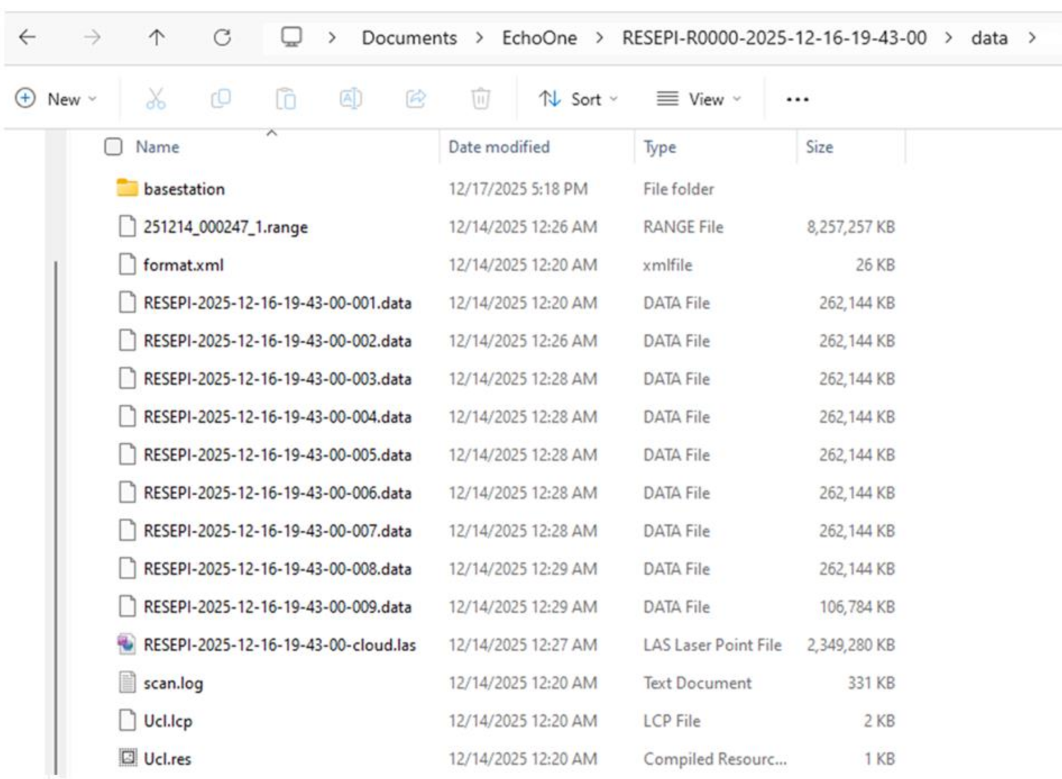

Figure 3-11: RINEX files

3. Open PCMasterPro, go to **File**, and select **New Project**.
4. Navigate to the **data** folder, select all the .data files, and select **Open**.

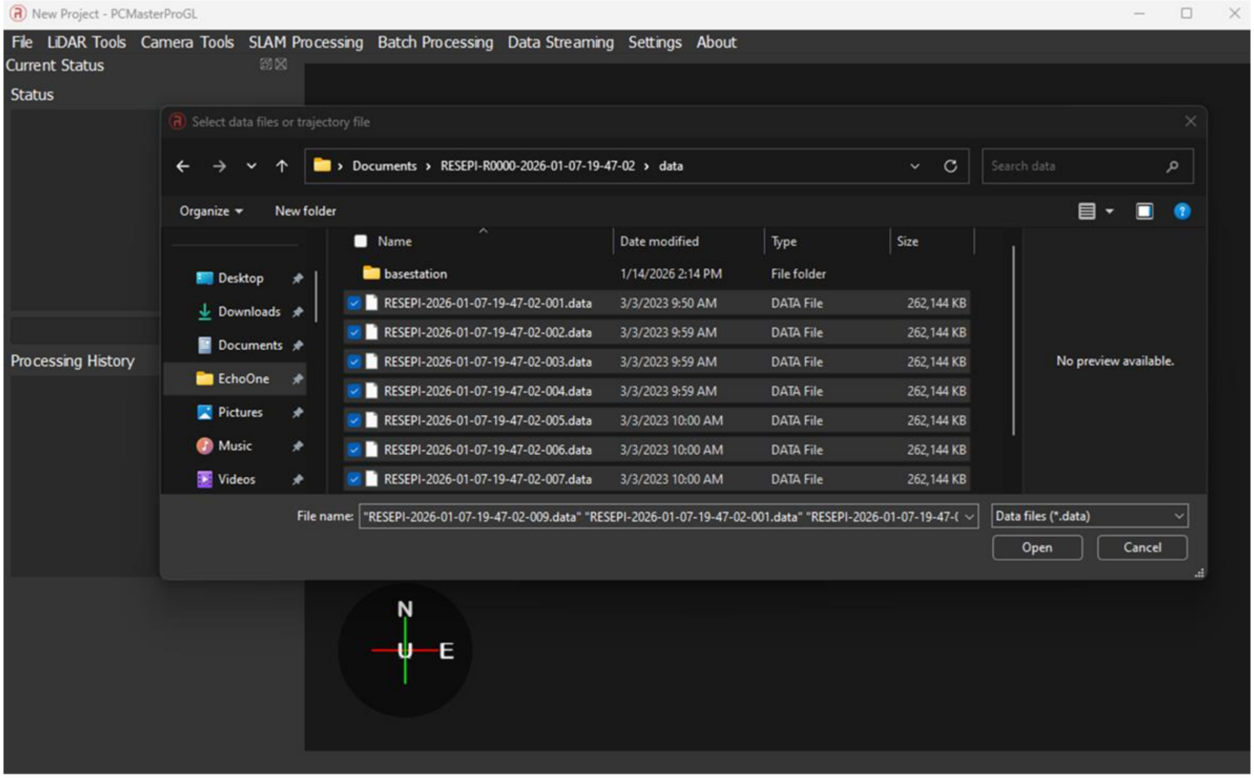

Figure 3-12: Survey .data files

5. When the **Select photos (if available)** dialog appears, select **Cancel** to proceed.
6. Wait for PCMasterPro to unpack, process, and resample the base file in the **data/base station** folder. The progress will be displayed in the Status bar.

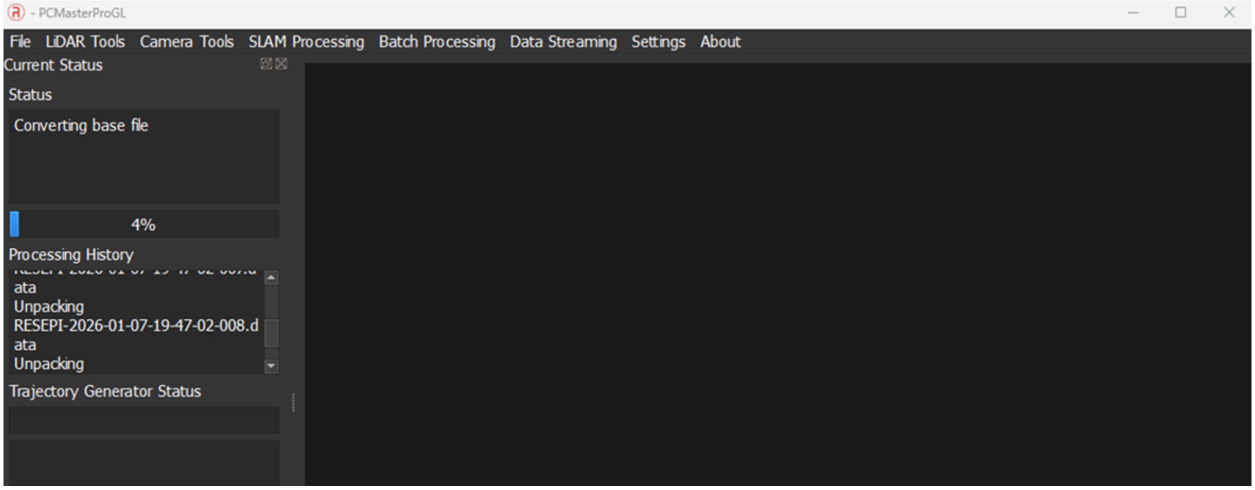

Figure 3-13: Base file processing status

7. If the base station coordinates need to be adjusted (due to post-processing), enter the refined **Latitude** and **Longitude** coordinates and **Ellipsoid height**. If necessary, select a **Sampling rate** of 1 Hz and adjust the **Lever Offset**. Otherwise, leave the Lever Arm Refinement set to **Auto**.

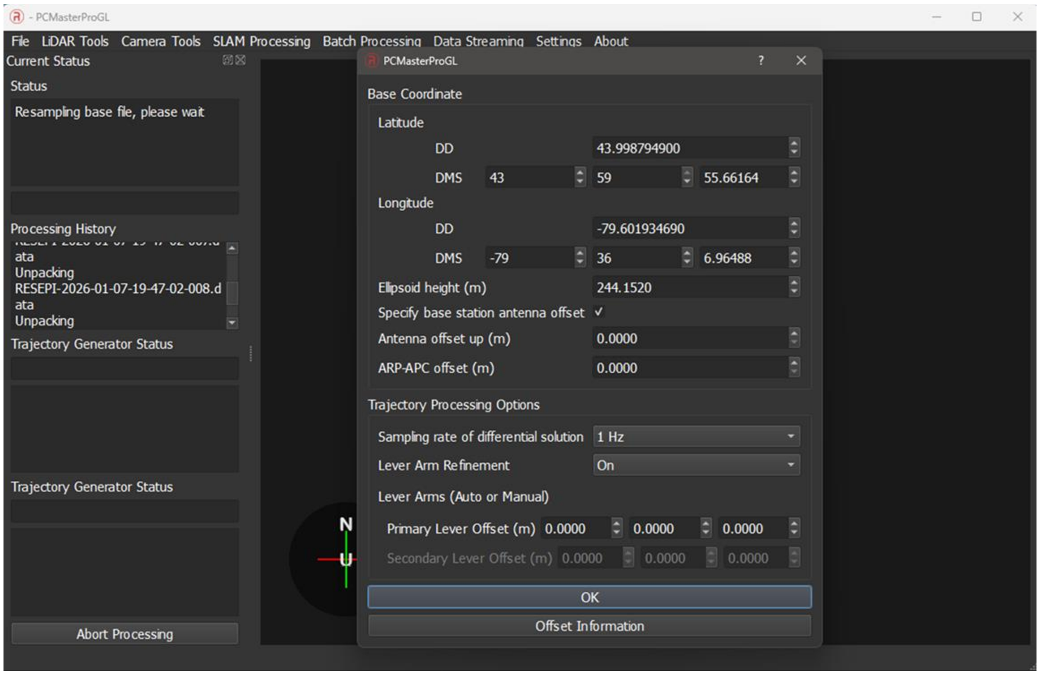

Figure 3-14: Base Coordinate settings

8. When you are done making adjustments, select **OK**. PCMasterPro will run the Trajectory Processor. Wait until all iterations are complete.

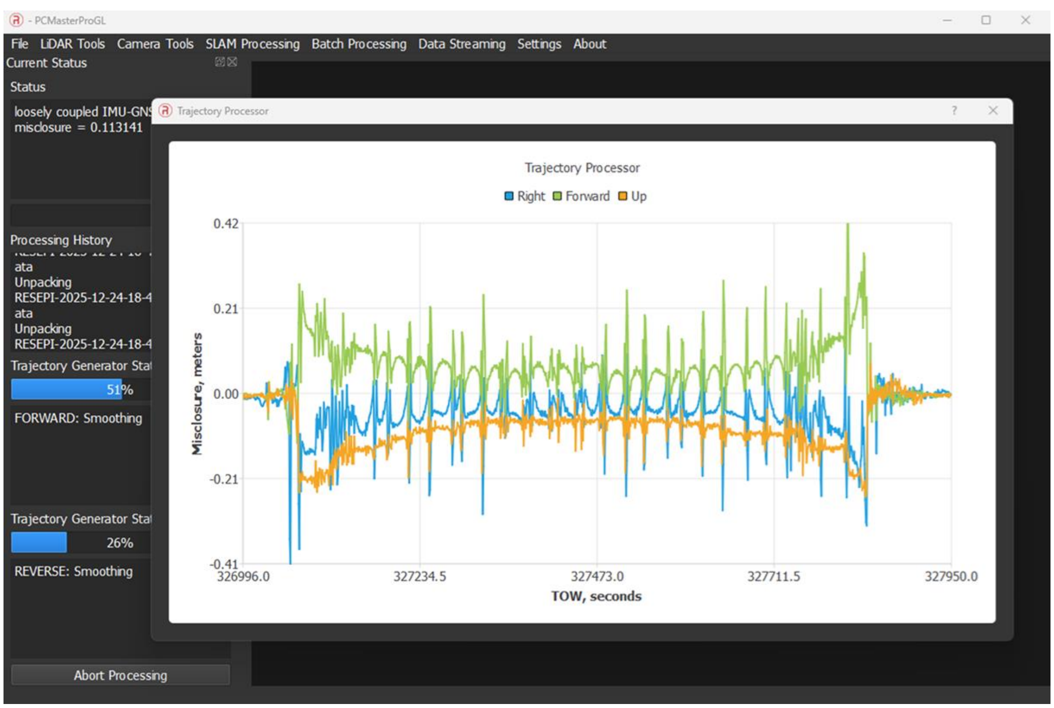

Figure 3-15: Trajectory Processor

9. To add the LiDAR data to the trajectory, in the data folder, select the .range file and select **Open**.

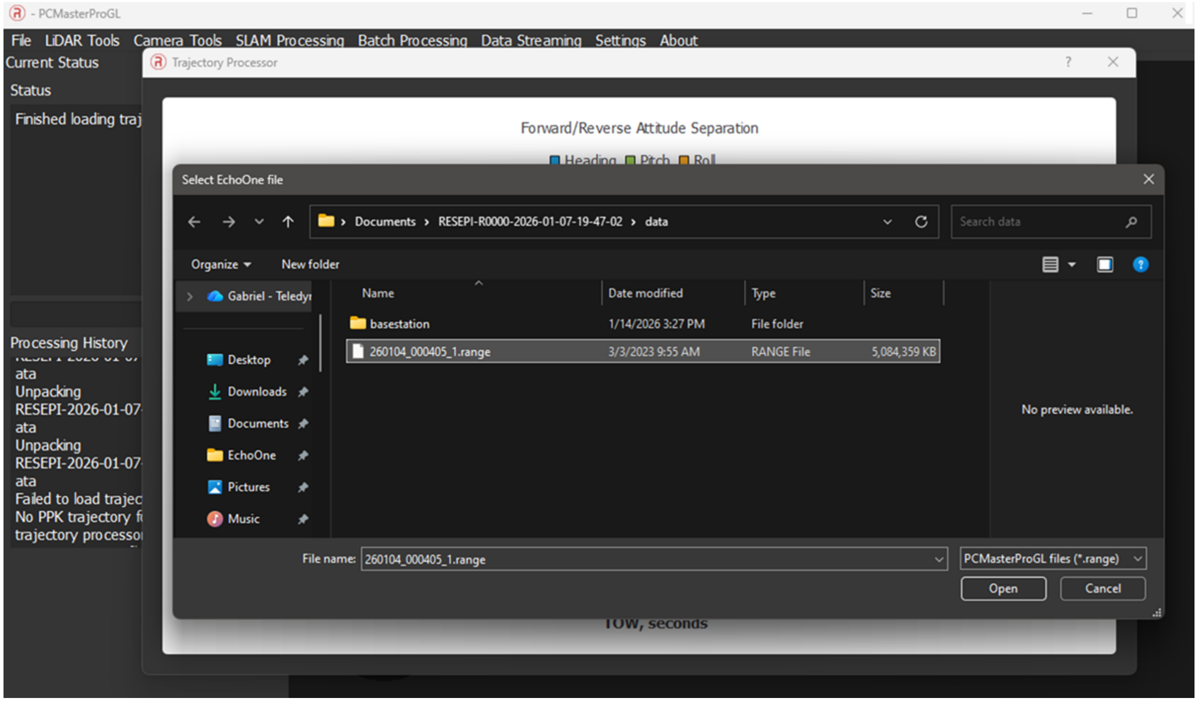

Figure 3-16: EchoONE .range file

10. On the main 3D window, the survey will be visualized.

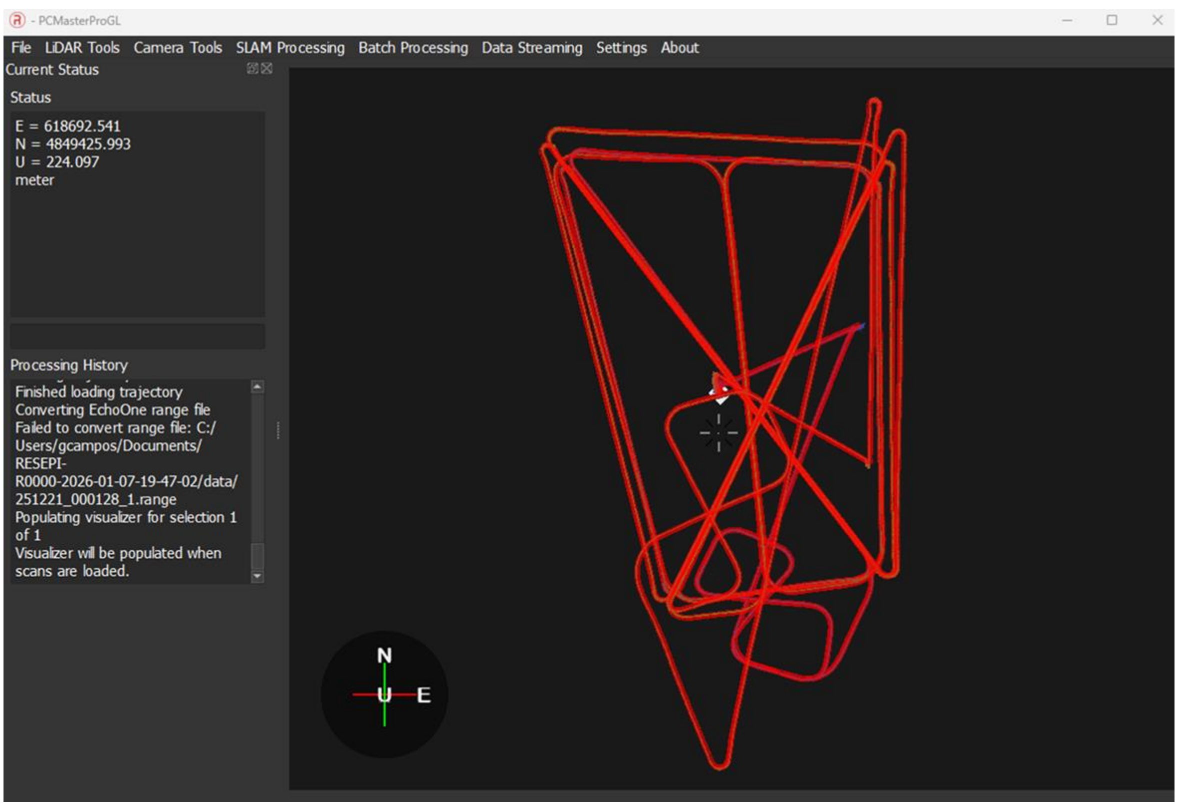

Figure 3-17: 3D survey visualization

4 TROUBLESHOOTING

4.1 Common issues and fixes

The RESEPI GUI is showing no satellites, and I cannot start a data collection.

Ensure that the system is outside and the GNSS antenna is properly connected to the EchoONE. Unscrew the SMA connector at both the antenna and the EchoONE sensor, and check to see if there are any broken pins. Reconnect and make sure you have securely tightened the connector.

4.2 Contacting support

Users who have a valid warranty or service plan can contact Teledyne Optech Technical Solutions 24 hours a day, 7 days a week (except December 25, December 26, and January 1).

Users without coverage can contact Teledyne Optech Technical Solutions during standard office hours (9 a.m. to 5 p.m. EST) at VAU_technical_solutions@Teledyne.com.

Standard warranty

This product is covered by a standard one-year warranty from date of shipment from the factory. Following this period, optional warranty/service contracts are available.

You can refer to the Teledyne General Terms and Conditions at the following link:
https://www.teledyne.com/en-us/terms-and-conditions/Documents/teledyne-general-terms-and-conditions-of-sale.pdf?v=20240418

5 UPDATES AND MAINTENANCE

5.1 Updating the firmware/software

You should perform regular updates of the firmware and software in the EchoONE to ensure the system is running the latest version.

Updating is performed via the customer portal. Access the customer portal using your registered credentials, download the latest firmware and software packages, and follow the provided installation guidelines.

To update the firmware/software:

1. Copy the RESEPI and LiDAR firmware files and LiDAR instrument files that need to be updated to a USB drive.
2. Power up the EchoONE payload and wait until power up is complete.
3. Insert the USB drive into the EchoONE payload.
4. If not already connected, connect to the EchoONE Wi-Fi network as per Section 2.3.1.
5. On a mobile device, open a web browser and enter IP address **192.168.12.1**.
6. In the RESEPI GUI, go to **Storage**, and under **USB Storage Status**, make sure all the copied files are displayed.

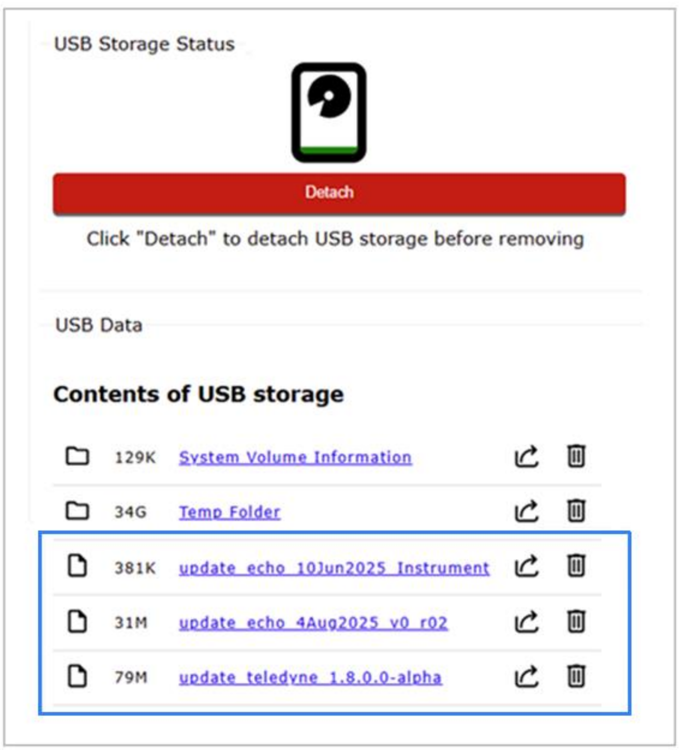

Figure 5-1: USB drive firmware files

7. Go to **Settings**, and select **Firmware**. The uploaded packages on the USB drive will be displayed in the following order:
   - RESEPI firmware
   - LiDAR firmware
   - LiDAR instrument files

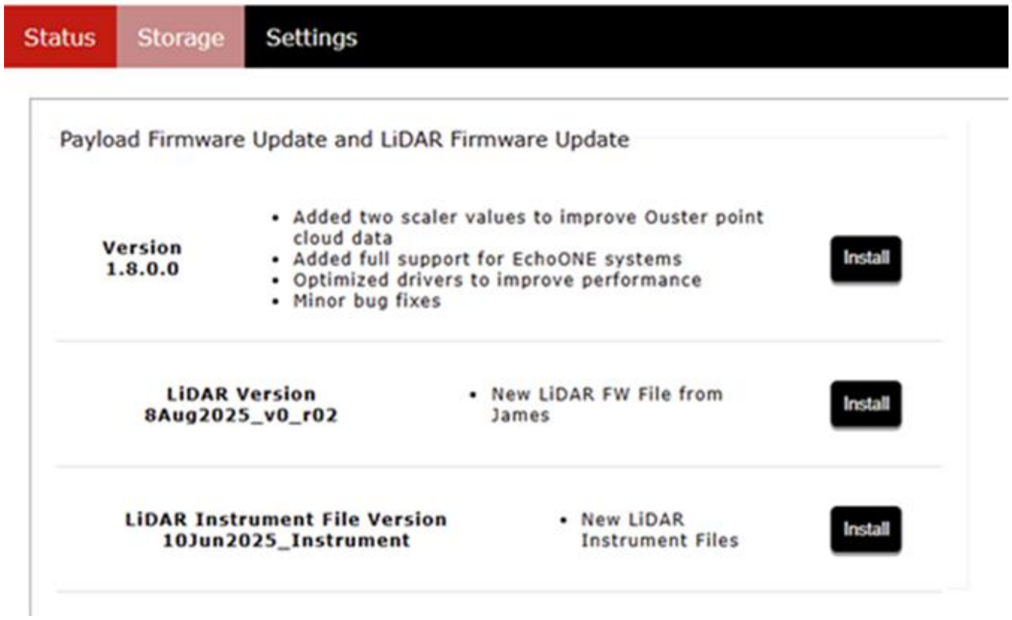

Figure 5-2: Firmware packages for installation

8. If all three packages need to be updated, install the packages in the displayed order: the RESEPI firmware first, followed by the LiDAR firmware, and then the LiDAR instrument files. If only the LiDAR firmware and instrument files need to be updated, install the LiDAR firmware first. The system will not reboot after the LiDAR instrument files update.
   a. For each package, select **Install** and wait for the system to fully reboot.
   b. After each reboot, ensure that the Wi-Fi is reconnected.
   c. After you install the LiDAR instrument files update, the system will not reboot.
9. To confirm that the firmware has been updated, go to **Settings**, and select **Firmware**. The updated LiDAR and RESEPI firmware versions should be displayed.

INS Firmware Version
A2IMU v3.5.5.3 26.07.24

LiDAR	PPS	GPRMC	Firmware Version
EchoONE	Present	Present	v_0_r_03_svn_$WCREV$_$WCMODS?Debug:Trus

Figure 5-3: Firmware update confirmation

5.2 Maintenance schedule

Scanner window: We recommend you check the scanner window before every flight and clean it, when necessary.

5.2.1 Cleaning the scanner window and camera lens

Dirt, grease or scratch marks on the window reduce the data quality. For this reason, always check the sensor window before and after each survey, and clean it as needed.

Never scratch or rub the sensor window.

Cleaning supplies:

- 1 bottle of Fisher Scientific (A 454-4) methanol or equivalent
- 1 pair of latex gloves
- 1 box of lens-cleaning tissue
- 1 can of Airjet spray or equivalent

To clean the scanner window:

1. Blow off large particles with Airjet spray.
2. Place a lens-cleaning tissue on the window.
3. Saturate the issue with methanol.
4. Wipe in one smooth motion, starting and ending on the same side. Avoid stopping mid-window to prevent residue.

Appendix A UAV Integration

A.1 Integrating with a Freefly Astro Max

To operate the EchoONE on a Freefly Astro Max UAV, the following Teledyne parts are required:

- EchoONE
- Smart Dovetail Payload Adapter
- Astro Antenna Kit

The following Freefly parts are also required:

- Astro Max UAV
- 50A Astro Max Vibration Isolator Cartridge

To integrate the Freefly Astro Max with the EchoONE:

1. Install the Astro Max Isolator according to the Freefly instructions provided here: https://freefly.gitbook.io/astro-public/other-user-manuals/ecosystem/components/vibration-isolators#astro-max-isolator
2. Install the Astro Antenna Kit to the right/starboard side of the Astro Max using the 4 fasteners shown below. The Astro Max is now ready to mount the EchoONE.

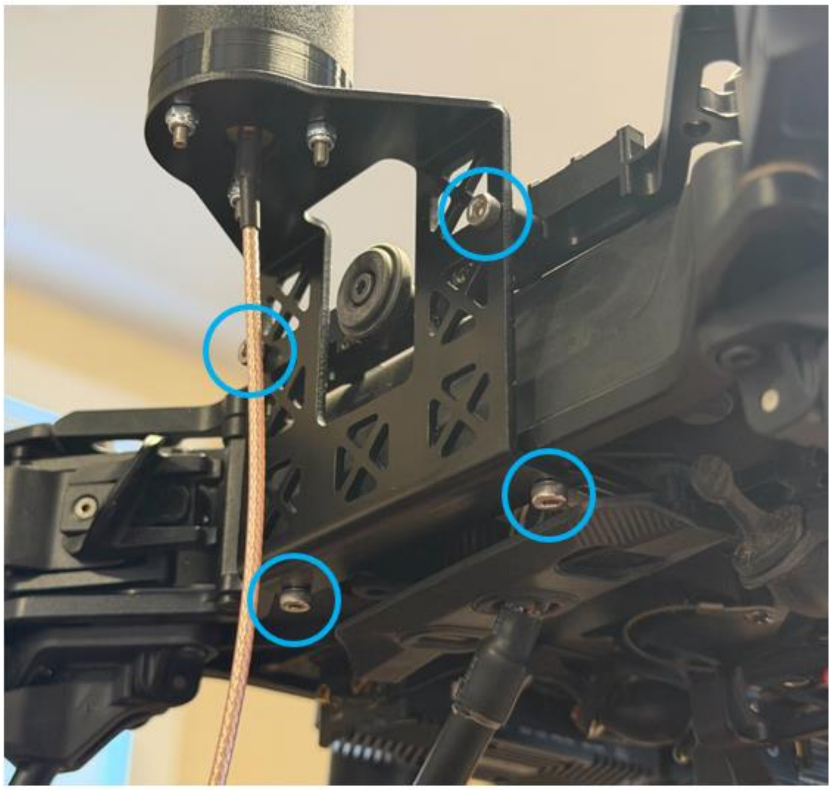

Figure 5-4: Astro Antenna Kit fasteners

3. If not already installed, install the smart dovetail payload adapter on the EchoONE as per Section 2.2.1.
4. Align the EchoONE payload adapter with the dovetail cage. Ensure that the red dovetail clamp is rotated into the release position.
5. Slide the EchoONE sensor into the dovetail cage until it clicks into place.

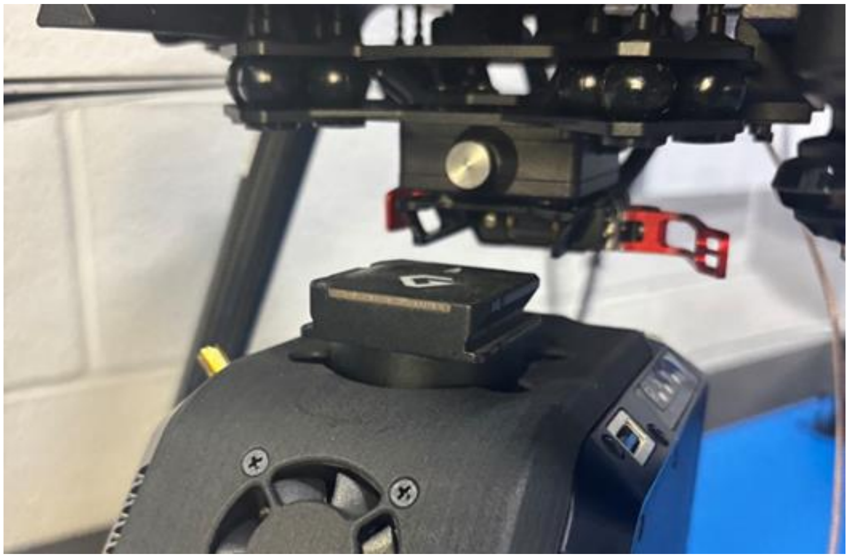

Figure 5-5: EchoONE and the dovetail cage

6. Rotate the red dovetail clamp towards the head of the UAV to lock the EchoONE payload in place.

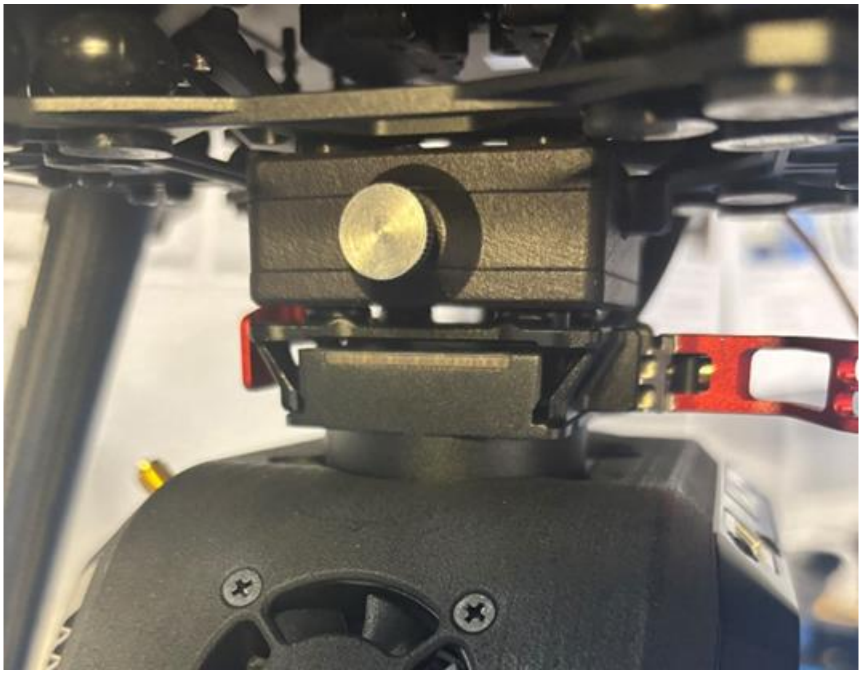

Figure 5-6: Payload adapter locking clamp

7. Thread the loose end of the GNSS cable onto the SMA connector on the side of the EchoONE.

Figure 5-7: GNSS cable connected to the EchoONE

8. Inspect the setup to ensure that the EchoONE payload is secure. The Astro Max and EchoONE are now ready to collect a LiDAR survey.

Figure 5-8: EchoONE and Astro Max final setup

9. In this configuration, the antenna lever arm on the EchoONE should be set as follows as per Section 2.3.2:

IMU to Antenna Offset	
Right (x)	TBD
Forward (y)	TBD
Up (z)	TBD

A.2 Integrating with an Inspired Flight IF800

To operate the EchoONE on an IF800 UAV, the following Teledyne parts are required:

- EchoONE
- Smart Dovetail Payload Adapter

The following Inspired Flight parts are also required:

- IF800 UAV
- IF800 Midweight Pro Damping Kit
- Inertial Labs RESEPI Gen 2 Kit

To integrate the IF800 with the EchoONE:

1. If the Midweight Pro Damping Kit is not already installed, install the kit as per the Inspired Flight instructions provided here: https://docs.inspiredflight.com/inspired-documentation/products/aircraft/if800-tomcat/if800-tomcat-overview/payload-mounting/if800-pro-damping-kits/if800-midweight-pro-damping-kit
2. Move the damping plate to position 4.

Figure 5-9: Damping plate on the IF800

3. Attach the GNSS mount to the IF800 according to the Inspired Flight instructions provided here: (https://docs.inspiredflight.com/inspired-documentation/products/payloads/lidar-kits/inertial-labs-resepi-gen-2-kit). Use the GNSS antenna from the Freefly Astro Antenna Kit.

Figure 5-10: GNSS mount on the IF800

4. Attach the GNSS cable to the SMA connector on the bottom of the IF800. The IF800 is now ready to mount the EchoONE.

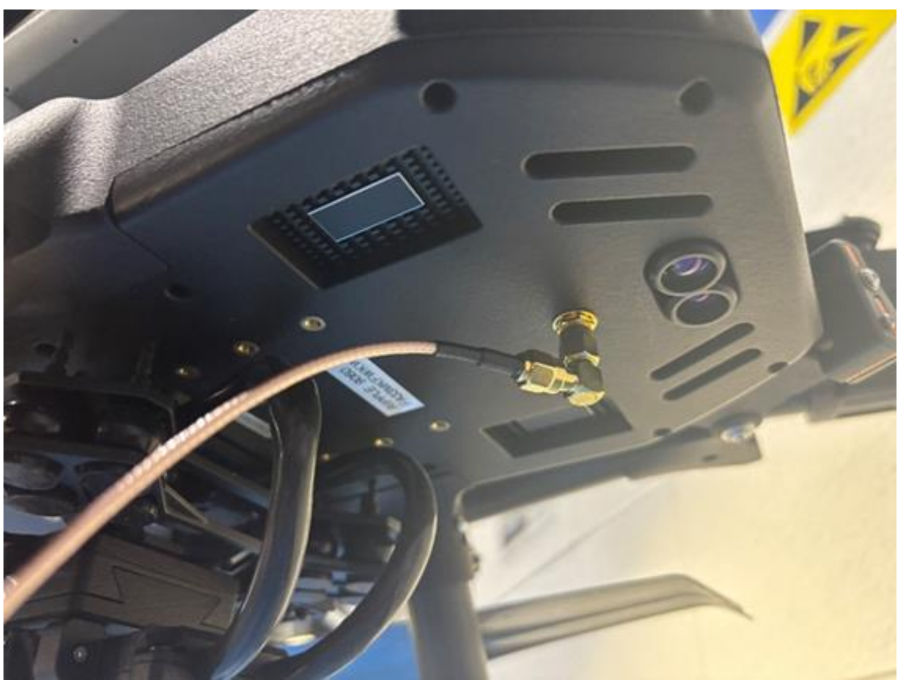

Figure 5-11: GNSS cable connected to the IF800

5. If not already installed, install the smart dovetail payload adapter on the EchoONE as per Section 2.2.1.
6. Align the EchoONE payload adapter with the dovetail cage. Ensure that the red dovetail clamp is rotated into the release position.
7. Slide the EchoONE into the dovetail cage until it clicks into place.

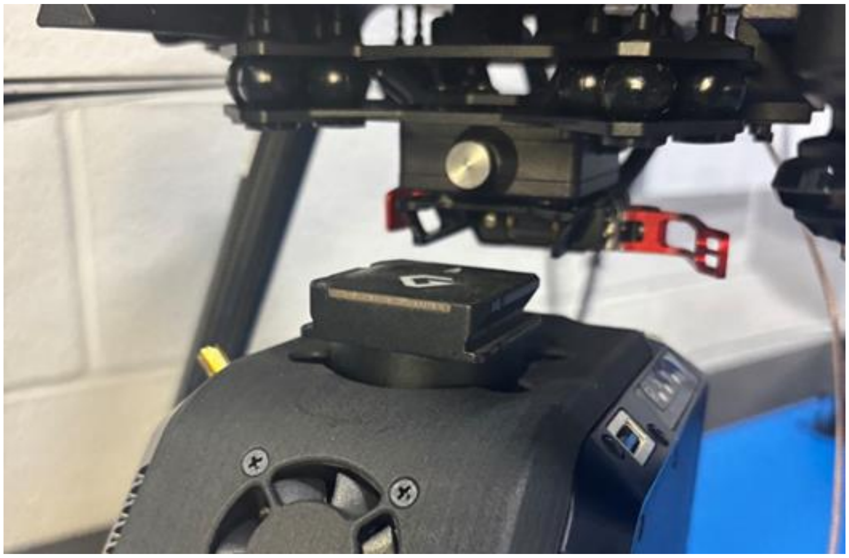

Figure 5-12: EchoONE and the dovetail cage

8. Rotate the red dovetail clamp towards the head of the UAV to lock the EchoONE payload in place.

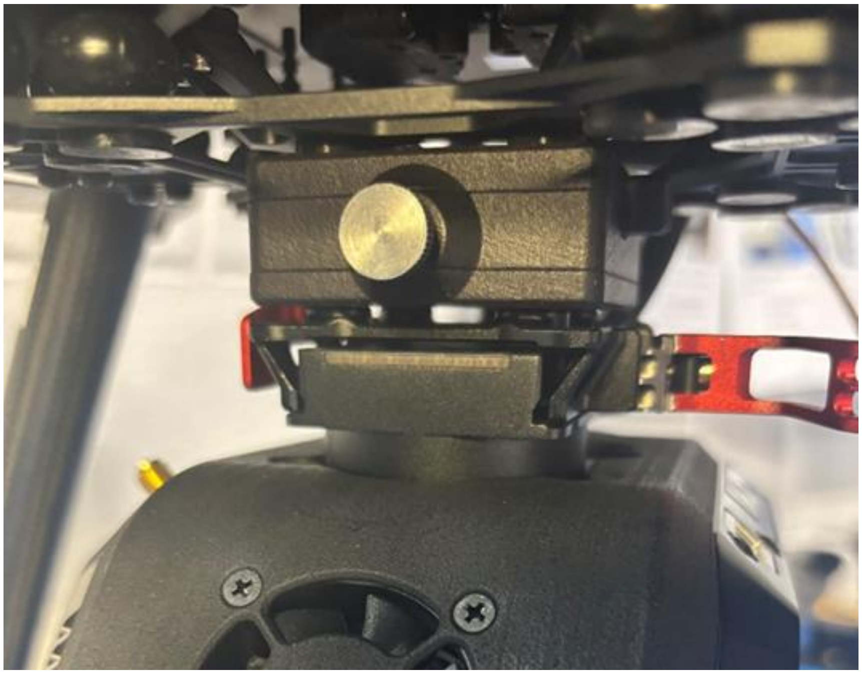

Figure 5-13: Payload adapter locking clamp

9. Thread the loose end of the GNSS cable onto the SMA connector on the side of the EchoONE.

Figure 5-14: GNSS cable connected to the EchoONE

10. Inspect the setup to ensure that the EchoONE payload is secure. The Astro Max and EchoONE are now ready to collect a LiDAR survey.

Figure 5-15: EchoONE and IF800 final setup

11. In this configuration, the antenna lever arm on the EchoONE should be set as follows as per Section 2.3.2:

IMU to Antenna Offset	
Right (x)	0.03 m
Forward (y)	-0.04 m
Up (z)	-0.14 m

A.3 Integrating with a DJI M350

To operate the EchoONE on a DJI M350 RTK (Real-Time Kinematic) UAV, the following Teledyne parts are required:

- EchoONE
- Teledyne e-port power cable
- Inertial Labs antenna kit

The following Inspired Flight parts are also required:

- DJI SkyPort

In this configuration, the antenna lever arm on the EchoONE should be set as follows as per Section 2.3.2:

IMU to Antenna Offset	
Right (x)	0.165 m
Forward (y)	-0.270 m
Up (z)	0.296 m