



# LiDAR Mapping Systems

## Drone Pilot Training

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	2
<b>Legal Notices</b>	<b>4</b>
<b>Disclaimer</b>	<b>4</b>
<b>1. Introduction</b>	<b>5</b>
<b>2. Safety Guidelines</b>	<b>5</b>
2.1 UAV Operational Safety	5
2.2 LiPo Battery Safety	5
2.2.1 General Guidelines and Warnings	5
2.2.2 Pre-Charging Guidelines	6
2.2.3 Charging Process Guidelines	6
2.2.4 Storage/Transportation Guidelines	6
2.2.5 Battery Care Guidelines	6
2.2.6 Battery Life Guidelines	7
<b>3. Training Goals</b>	<b>7</b>
<b>3. Software Overview</b>	<b>7</b>
4.1 DJI GO	7
4.2 Litchi	7
4.3 DJI Assistant 2	7
<b>5. Hardware Overview</b>	<b>7</b>
5.1 Aircrafts	7
5.1.1 DJI Matrice 600 Pro	8
5.1.2 Watts Innovations MFD 5000	8
5.1.3 TerraHawk CW-20	9
5.1.4 TerraHawk CW-30	9
5.1.5 Pulse Aerospace Vapor 55	10
5.3 DJI D-RTK GNSS (optional)	10
5.4 Additional Accessories	11
5.4.1 RunCam HD Camera (optional)	11
<b>6. Getting Started</b>	<b>12</b>
6.1 DJI Matrice 600 Basics	12
6.1.1 DJI Matrice 600 Drone	12
6.1.1.1 Unfolding the Aircraft	12
6.1.2 DJI Matrice 600 Remote Controller	12
6.1.2.1 Power Controller ON/OFF	12
6.2 Updating Firmware	12
<b>7. Checklist</b>	<b>13</b>
7.1 Equipment	13
7.2 Operational Safety	13
7.2.1 DJI Matrice 600 Pro Operational Safety	13
<b>8. DJI D-RTK</b>	<b>14</b>

8.1 Hardware Overview	14
8.1.1 RTK (Real Time Kinematic)	14
8.2 Equipment Setup	14
<b>9. Field Procedures</b>	<b>14</b>
9.1 D-RTK Setup	14
9.1.1 D-RTK Ground Setup	14
9.2 Proper Scanning Procedure	15
9.2.1 DJI GNSS Antenna Offsets	15
9.2.2 IMU Calibration	15
9.2.3 Compass Calibration	15
9.2.2 Figure Eights	16
9.2.3 Mirror Beginning and End Procedures	16
<b>10. Phoenix Flight Planner</b>	<b>16</b>

# Legal Notices

All the features, functionality, and other product specifications are subject to change without prior notice or obligation. Information contained herein is subject to change without notice.

Please read carefully and visit our website, [www.phoenixlidar.com](http://www.phoenixlidar.com) for further information and contact [support@phoenixlidar.com](mailto:support@phoenixlidar.com) for any technical support questions.

**NOTE:** This document provides an overview of the basics of drone Pilot training and relevant components. The product you purchased may not support certain functions dedicated to specific models, upgrades or customizations.

## Disclaimer

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# 1. Introduction

Thank you for choosing Phoenix LiDAR Systems! This document provides a brief overview and instruction of our Drone Pilot training for our LiDAR mapping systems. It briefly addresses the working principles of the underlying components, explains the system architecture, as well as offer a quick tutorial of the required software. This document does not provide a complete overview of our LiDAR acquisition procedures. Please refer to the *Phoenix LiDAR Systems User Manual* which can be found on our homepage, [www.phoenixlidar.com](http://www.phoenixlidar.com), for information on LiDAR acquisition. This document is not intended to replace customer training; instead it should be used as an outline for Drone Pilot acquisition training.

## 2. Safety Guidelines

### 2.1 UAV Operational Safety

The following is a list of basic UAV operational safety tips. Make sure to review and plan for each item before you operate your UAV.

- Do not operate the UAV without an experienced and/or licensed operator present.
- Always complete a pre and post mission inspection of the UAV and the support equipment to determine operational safety. This includes cleaning camera lens, sensor glass and inspecting cables, wifi antennas etc for any damage.
- Never approach or handle the UAV, unless instructed to do so by the operator.
- Remove all obstructions or loose debris (Foreign Object Debris a.k.a FOD) from the operational safety zone and surrounding areas.
- Survey the area for possible operational risks including obstructions (i.e. plants/animals, utilities, and other vehicles) and environmental factors (i.e. water, dust, heat, wind, chemicals).
- If you are a spotter, always maintain a visual Line-of-Sight (LoS) on the UAV or its operator.
- Never operate or attempt to recover the UAV in/on/under/over or near any areas without first obtaining permission and risk analysis from the proper authorities/owners.
- Review all applicable laws and regulations set forth by government and local authorities prior to operating any equipment.
- Establish an agreed upon signaling protocol (verbal/nonverbal) between team members to communicate status and the safety of personnel, equipment, and other potential risks.
- Always understand the risks and dangers of storing, charging, transporting, and the improper usage of large Lithium Polymer (LiPo) batteries.

### 2.2 LiPo Battery Safety

The following is a list of basic LiPo battery safety tips. You must read these safety instructions and warnings before using or charging your batteries. Lithium Polymer batteries are volatile. Failure to read and follow the instructions below may result in fire, personal injury and damage to property if charged or used improperly. Phoenix LiDAR Systems does not assume any liability for failures to comply with these warnings and safety guidelines.

#### 2.2.1 General Guidelines and Warnings

- **Use specific Lithium Polymer chargers only. Do not use a NiCd or NiMh charger.** Failure to do so may result in personal injury and property damage.

- **Never charge batteries unattended.** When charging LiPo batteries you should always remain in constant observation to monitor the charging process and to be able to react to potential problems that may occur.
- **Some LiPo chargers may have technical deficiencies that may cause it to charge the LiPo batteries incorrectly or at an improper rate.**
- **If at any time you witness a battery starting to balloon or swell up, discontinue the charging process immediately.** Disconnect the battery and observe it in a safe place for approximately 15 minutes. Continuing to charge a battery that has begun to swell will result in fire. Never use a battery if you find it swollen or ballooned upon purchase.
- **If you accidentally short the wires, the battery must be placed in a safe area for observation for approximately 15 minutes.** Additionally, if a short occurs and contact is made with metal, severe injuries may occur due to the conductivity of electric current.
- **In the event of a crash, remove the batteries for observation.** Place them in a safe open area away from any combustible material for approximately 15 minutes.
- **If for any reason you need to cut the terminal wires, it will be necessary to cut each wire separately.** Ensure the wires do not touch each other or a short may occur, potentially causing a fire. If you accidentally cause the battery to short, place it in a safe open space and observe the battery for approximately 15 minutes
- **Never store or charge a battery pack inside your car in extreme temperatures.** Extreme temperatures could cause fires.

## 2.2.2 Pre-Charging Guidelines

- **Take the time to visually inspect each LiPo battery.** Look for any damaged leads, connectors, broken shrink wrap, swelling of cells, or other irregularities. Do not use the battery pack if you find any of the issues listed and determine if the battery can be salvaged or will need to be disposed of.
- Do not attempt to charge the pack if any damage is found or if the voltage is significantly less for your pack than specified above.

## 2.2.3 Charging Process Guidelines

- **Never charge batteries unattended.** Charge in an isolated area, away from other flammable materials on a concrete surface outside of buildings.
- Let the battery cool down to ambient temperature before charging.
- **When selecting the cell count or voltage for charging purposes, select the cell count and voltage as it appears on the battery label.** Selecting a cell count or voltage other than the one printed on the label can be dangerous. As a safety precaution, please confirm the information printed on the battery is correct.

## 2.2.4 Storage/Transportation Guidelines

- **Store LiPo batteries at room temperature.** The optimal temperature is between 40 and 80 degrees F for best results.
- Do not expose battery pack to direct sunlight (heat) for extended periods.
- Do not store LiPo batteries at more than 150 degrees F when transporting or temporarily storing in a vehicle.

## 2.2.5 Battery Care Guidelines

- Do not use poor quality LiPo chargers.
- Set charge voltage and current correctly. Failure to do so can result in personal injury.
- 4 cell 5000 mah lipos should be charged at 5amps and 10,000mah 6s lipos at 10amps
- Please check pack voltage after the first charge.
- Do not discharge LiPo batteries to a level below 3V per cell under load. Deep discharge below 3V per cell can deteriorate battery performance.

- Use caution to avoid puncture of the cell. Puncture of cells may result in personal injury and property damage.

## 2.2.6 Battery Life Guidelines

Batteries that lose 20% of their capacity must be removed from service and disposed of properly. Proper disposal includes discharging the battery to 3 volts per cell, making sure the output wires are insulated, then wrapping the battery in a bag for disposal.

# 3. Training Goals

The main goal of Pilot training is to provide an overview of the use of the DJI Matrice 600, M5000 or any other UAV that has been integrated with our LiDAR mapping systems. We will address and explain the working principles of the underlying components, the system architecture, and the required software. Phoenix LiDAR Systems mapping solutions contain multiple hardware sensors that once integrated and controlled by software allow the user to create accurate, high-resolution maps of outdoor environments. Even though the accompanying software makes flying and LiDAR scanning a straightforward task, the user must still understand the basic working principles of the DJI Matrice 600 drone platform in order to obtain accurate data and produce quality results.

# 3. Software Overview

## 4.1 DJI GO

The DJI GO app allows for configuring various parameters on your DJI M600 including programming test flights, performing calibrations, and adjusting video settings. Built for universal DJI compatibility and upgraded usability, simply connect your device, launch the app, and go. The app is available on the [Apple App Store](#) or [Google Play Store](#).

## 4.2 Litchi

Litchi is an iOS/Android app that facilitates planning flight missions. With Litchi, you can plan waypoint missions anywhere. Whether you are a professional or beginner, Litchi offers the most intuitive yet powerful waypoint mission engine. Litchi mission planner is available on all platforms including PC/Mac with seamless mission syncing across all your devices.

## 4.3 DJI Assistant 2

The DJI Assistant2 is a desktop application that allows you to update the firmware on your DJI drone as well as set the GNSS antenna offsets. It is available for Windows and Mac. You must check the DJI product page to determine the version of the software that is compatible with your DJI drone platform.

# 5. Hardware Overview

## 5.1 Aircrafts

The drone's hardware is pre-configured during manufacturing to facilitate the setup procedure for the end user. We offer several types of aircrafts, each designed to meet the specific needs of each client.

### 5.1.1 DJI Matrice 600 Pro

The Matrice 600 Pro (M600 Pro) is built to closely integrate with a host of powerful DJI technologies, including the A3 flight controller, Lightbridge 2 transmission system, Intelligent Batteries and Battery Management system, for maximum performance and quick setup. It inherits everything from the DJI Matrice 600 (M600) with improved flight performance and better loading capacity. Pre-installed arms and antennas reduce time required for setup, and the system's modular design makes it easy to mount additional modules.

Diagonal Wheelbase	1333 mm
Aircraft Dimensions (unfolded)	1668 mm x 1518 mm x 727 mm with propellers, frame arms and GPS mount (including landing gear)
Aircraft Dimensions (folded)	437 mm x 402 mm x 553 mm with propellers, frame arms and GPS mount (excluding landing gear)
Package Dimensions	525 mm x 480 mm x 640 mm
Weight (with six TB47S batteries)	9.5 kg
Max Takeoff Weight (recommended)	15.5 kg
Max Ascent Speed	5 m/s
Max Descent Speed	3 m/s
Max Angular Velocity	Pitch: 300°/s, Yaw: 150°/s
Flight Control System	A3 Pro
Operating Temperature	14° F to 104° F (-10° C to 40° C)

### 5.1.2 Watts Innovations MFD 5000

The M5000 was designed to be an intuitive heavy lifting Lidar drone. This is for pilots who are comfortable and familiar with the DJI workflow and components. Utilizing the A3 Pro flight controller and Lightbridge 2, this drone acts just like a big Inspire 2, or Matrice 600. This aircraft meant to carry serious Sensor packages for the 3d mapping world.

Aircraft Dry Weight (Without Batteries)	23 lbs
Maximum All Up Aircraft Weight	75 lbs
Battery Requirements	4 x 6s 8,000 mAh – 16,000mAh
Flight Time	9 – 30 Minutes (Depending on Camera and Battery Configuration)
Maximum Tested Speed	45 mph
Power System	DJI E5000 Pro Motor / ESC / Propeller / Motor Mount
Aircraft Control	DJI LightBridge 2 (Pilot)



FPV Video	From Lightbridge 2 to Pilot Radio
Guidance	DJI A3 Pro Flight Controller (Triple IMU & GPS Redundancy)

### 5.1.3 TerraHawk CW-20

The TerraHawk is the first fixed-wing UAV aircraft to offer LiDAR with real time point clouds. Ideal for applications that require large scan areas, these systems can be used for ground & airborne mobile mapping. Optional post-processing software can be used to compute forward & reverse solutions, recovering an accurate & smooth trajectory in cases of satellite connection losses.

Features include:

- Map up to 11 sq km in one flight
- Up to 3 hour flight times
- LiDAR sensor solutions: T-32 or miniRANGER
- No runway required with vertical liftoff capability
- Autonomous flight via waypoints
- Modular accessory upgrade options: Photogrammetry Options (RTK) – RGB & NIR Sensors, DSLR, Optional RTK Photogrammetry stand-alone solution available
- Quick and easy aircraft assembly

Maximum Takeoff Weight	25 kg
Empty Weight (excluding fuel and payload)	19 kg
Wingspan	3.2 m
Fuselage	1.8 m
Max Flight Time	~ 180 mins (~ 3 hours)
Cruise Speed	25 m/s
Max Speed	40 m/s

### 5.1.4 TerraHawk CW-30

The TerraHawk CW-30 is a hybrid VTOL / fixed-wing UAV with an integrated Phoenix Ranger-LR-T LiDAR mapping payload. Hybrid VTOL / fixed-wing technology offers an innovative and logistically simple solution to the problem of vertical takeoff and landing: it combines the vertical takeoff and landing (VTOL) capabilities of a multirotor aircraft and the efficiency, speed, and range of a normal fixed-wing aircraft. Combined with the Phoenix Ranger-LR-T payload, the TerraHawk CW-30 provides both ortho-imagery as well as high density LiDAR point clouds.

Features include:

- Map up to 52 sq km in one flight
- Up to 120 min flight times
- LiDAR sensor solution: RANGER-LR-T
- No runway required with vertical liftoff capability
- Autonomous flight via waypoints

- Quick and easy aircraft assembly

Maximum Takeoff Weight	27 kg
Weight (including payload)	33 kg
Wingspan	4 m
Fuselage	2.2 m
Max Flight Time	120 mins
Cruise Speed	28 m/s
Max Speed	36 m/s

### 5.1.5 Pulse Aerospace Vapor 55

The Vapor 55 provides infinite payload flexibility for a variety of sensors (or dual sensor configurations) including infrared, multispectral, and high resolution electro optical camera systems. Pilot Training is NOT provided by Phoenix LiDAR Systems. It is provided by Pulse Aerospace. Refer to Pulse Aerospace for training information.

Gross Weight	55 lbs
Useful Load (battery + payload)	34 lbs
Allowable Payload (with full endurance)	< 11 lbs
Max Cruise Endurance (with full payload)	60 mins
Max Hover Endurance (with full payload)	45 mins

- ★ **As of this writing, this aircraft is no longer sold by Phoenix LiDAR Systems and thus payload integration is no longer supported.**

### 5.3 DJI D-RTK GNSS (optional)

D-RTK is a high precision navigation and positioning system specially designed for DJI A3 series flight controllers. Using dynamic differential technology, it provides ultra-accurate, centimeter level 3D positioning. This enhanced accuracy over typical barometer, compass and GPS systems makes D-RTK essential for commercial, industrial and scientific applications where accuracy is imperative.

Positioning Accuracy	Horizontal: 1 cm + 1 ppm Vertical: 2 cm + 1 ppm
Orientation Accuracy	$(0.2/R)^\circ$ R is the baseline distance (distance between the two Air System antennas) in meters.
Root Mean Square (RMS)	0.03 m/s

Frequency Used	Global version: GPS L1&L2, GLONASS F1&F2 Asia-Pacific version: GPS L1&L2, BEIDOU B1&B
Interface Type	CAN, UART, USB
Input Voltage	3S to 12S (12 to 52 V)
Power Consumption	5.2 Watts
Current	0.45 A (@ 12 V)
D-RTK Processor Dimensions	112.3 mm × 63 mm × 18.6 mm
D-RTK Processor Weight	139.5 g
Operating Temperature	32° to 113°F (0° to 45°C)
Storage Temperature	-40° to 185°F (-40° to 85°C)

## 5.4 Additional Accessories

### 5.4.1 RunCam HD Camera (optional)

Especially designed for FPV hobbyists by RunCam, this mini HD FPV camera provides high image resolution of 1080P@30fps and 720P@60fps.

Angle of Field	F.O.V 120°
Photo Resolution	3 MegaPixels
Video Resolution	1080P 30FPS FULL HD, 720P 60FPS, 720P 30FPS HD
Video/photo Files Format	*.MOV, *.AVI, *.MP4 / *.JPG
Live TV Video Output	NTSC / PAL
Interface	Micro USB
Max TF Card Supported	32 GB (Suggest using Class 6 or above)
Image Flip	180° rotation
Weight	41 g
Dimensions	60 mm (L) x 35 mm (W) x 18mm (H)
Rechargeable LIPO Battery	850 mAh
Continuous Recording Time	~120 minutes
Working Voltage	DC 5 Volts
Working Current	< 500mA

## 6. Getting Started

### 6.1 DJI Matrice 600 Basics

#### 6.1.1 DJI Matrice 600 Drone

The Matrice 600 Pro is a six-rotor flying platform designed for professional aerial photography and industrial applications. It is equipped with a dedicated DJI A3 Pro triple-modular redundancy system and advanced intelligent flight functions, ensuring safe and stable operation at all times. Its mechanical design, with quick-release landing gear and mounted folding arms, make it easy to transport, store, and prepare for flight. With a maximum takeoff weight of 15.5 kg, the Matrice 600 Pro can meet specific needs across a range of industries.

The A3 Pro's three GPS modules and IMUs add triple modular redundancy to greatly reduce the risk of system failure.

##### 6.1.1.1 Unfolding the Aircraft

When the aircraft is folded, you must take care when unfolding the arms. Failure to follow proper procedure may damage the aircraft's arms.

1. Gently lift the frame arm and twist the red knob to lock each arm in place.
2. With the arms locked in place, unfold the propellers on each propeller.
3. Proceed to unfold the GPS-Compass Pro and ensure that all the arrows on the GPS-Compass Pro point toward the front of the aircraft.

When storing the aircraft, make sure to untwist the red knobs before lowering the frame arms.

#### 6.1.2 DJI Matrice 600 Remote Controller

The remote controller integrates video downlink and aircraft control into one system. The combined system operates at 2.4GHz or 5.8GHz with a maximum signal transmission range of 5 km. The device features a number of standard and customizable buttons that allow users to quickly access certain aircraft functions, such as taking and reviewing photos/videos, as well as controlling the landing gear.

##### 6.1.2.1 Power Controller ON/OFF

The battery level is indicated by the Battery Level LEDs on the front panel. To power on your remote controller, press the Power Button once, then hold down the button. The remote controller will beep when it powers on. During this time, the Status LED will blink red rapidly, indicating that the remote controller is linking to the aircraft. Once the remote controller has established a link with the aircraft, the Status LED will show a solid green light.

To power off the remote controller, press the Power Button once, then hold down the button while the remote is powered on.

### 6.2 Updating Firmware

To update the firmware on your DJI Matrice 600 Pro, you'll need to use DJI Assistant 2 software. You have to make sure you download the corresponding version of DJI Assistant 2 that is compatible with the DJI Matrice 600 Pro.

Before upgrading the firmware on your DJI Matrice 600 Pro, ensure that your computer has internet access, or else you cannot get the latest firmware. Additionally, make sure that the Intelligent Flight Batteries have enough power supply. The aircraft settings may be reset after firmware upgrade.

To download the latest version of DJI Assistant 2, visit the [DJI Matrice 600 Pro Downloads page](#). The latest version will be listed under the SOFTWARE section..

## 7. Checklist

Before heading out to the field, it is best to make sure that you have all the necessary equipment required.

### 7.1 Equipment

- Fully Assembled DJI Matrice 600 Pro with RTK and vibration isolator with green dampers
- 3 Sets of fully charged batteries for the M600 Batteries
- Fully Charged Lightbridge 2 Remote Controller
- Fully Charged iPad Pro + with Autoflight Logic installed and flight plan uploaded
- Lighting Cable for iPad Pro
- (Optional) DJI Ground RTK system with Antennas, cables, and adapters to power on with 4S Lipo battery or TB47
- Runcam 2 with 32 GB SD card and FPV cable
- Multi-tool set that includes 1.5 mm, 2.0 mm, 2.5 mm, 3.0 mm hex bits
- Additional tools and accessories such as zip ties, clippers, Loctite, etc.

### 7.2 Operational Safety

#### 7.2.1 DJI Matrice 600 Pro Operational Safety

- Make sure props are extended and arms are securely locked.
- Ensure all batteries are charged and properly latched into place.
- Set the D-RTK ground station on tripod and level it using a bubble indicator.
- Check the D-RTK battery is fully charged before use.
- The D-RTK ground station must be powered on with a solid green LED before powering up DJI Matrice 600 Pro.
- DJI Matrice 600 Pro data link antennas must be properly latched onto the arms.
- All GPS antennas should be connected properly and must be properly secured.
- Ensure the GPS cable, power cable and other accessories are properly connected.
- Complete the compass calibration and a test flight before LiDAR acquisition flight.
- Place the DJI Matrice 600 Pro on level ground and ensure it is powered on.
- Power on the RunCam2 and press the record button.
- When you pack up, have everything neatly organized to prevent damage or unnecessary scuffs.

## 8. DJI D-RTK

### 8.1 Hardware Overview

D-RTK is a high precision navigation and positioning system specially designed for DJI A3 series flight controllers. Using dynamic differential technology, it provides ultra-accurate, centimeter level 3D positioning. This enhanced accuracy over typical barometer, compass and GPS systems makes D-RTK essential for commercial, industrial and scientific applications where accuracy is imperative

#### 8.1.1 RTK (Real Time Kinematic)

Real Time Kinematic (RTK) is a satellite navigation technique used to enhance the precision of position data derived from satellite-based positioning systems (global navigation satellite systems, GNSS) such as GPS, GLONASS, Galileo, and BeiDou. It uses measurements of the phase of the signal's carrier wave, rather than the information content of the signal, and relies on a single reference station or interpolated virtual station to provide real-time corrections, providing up to centimetre-level accuracy. RTK allows the drone to solve its own position in real-time to within centimeter-level accuracy.

### 8.2 Equipment Setup

We recommend mounting the DJI D-RTK with a clear view of the sky, away from buildings and powerlines. **When applying power to the DJI D-RTK, we recommend using a 4 cell Li-Po battery or DJI TB47 battery.**

You must mount the DJI D-RTK onto a tripod. DJI does not include a tripod with the D-RTK system, however if you purchased the DJI D-RTK from Phoenix LiDAR Systems, a tripod is included. You do not need to measure the Antenna Reference Point (ARP) height.

For complete installation and connection instructions, please refer to the official DJI D-RTK User Manual.

## 9. Field Procedures

### 9.1 D-RTK Setup

#### 9.1.1 D-RTK Ground Setup

- The first thing you want to set up in the field is your D-RTK station.
- Provide power to your DJI D-RTK station. Make sure to **ONLY** use a 4 cell Li-Po battery.
- Make sure the D-RTK is positioned under an area with a clear view of the sky.

## 9.2 Proper Scanning Procedure

### 9.2.1 DJI GNSS Antenna Offsets

The antenna offsets for the the DJI Matrice M600 are set through the DJI Assistant 2 software. You can check the offsets of your drone by using the DJI Go app. These offset measurements are different from the IMU to GNSS antenna offsets for rover.

### 9.2.2 IMU Calibration

The IMU should be calibrated only if the drone has experienced a dramatic change in roll, pitch, and yaw during transportation. Before calibrating the IMU, ensure that the firmware on the DJI Matrice 600 Pro is up to date and that you have the latest version of the DJI GO app. Launch DJI GO app to check the condition of the IMU and if needed perform an advanced IMU calibration. Make sure to place the drone in a cool environment and on a flat, stable surface. Do not touch the aircraft during calibration.

### 9.2.3 Compass Calibration

You must calibrate the compass before your initial first flight. After the initial calibration, you must calibrate the compass only if you are flying in a new area that is farther than a radius of about 20 miles or 32 km from your last take-off point.

Before initializing the compass calibration, we recommend following a few guidelines. Do NOT calibrate the compass in an area with strong magnetic interference. Additionally, make sure to remove any ferromagnetic devices/items that you may be carrying such as cell phones, watches, etc. These objects may cause interference during the compass calibration procedure.

When launching the DJI GO app, if you are prompted to calibrate the compass you must do so.

The following steps will guide you through the compass calibration procedure. Open the DJI GO app and tap the System Status bar. Select Calibrate and then follow the on-screen instructions to calibrate the drone:

1. Hold the aircraft horizontally. While holding it, rotate it 360 degrees along the central axis. The Aircraft Status indicator will emit a solid green light.
2. Hold the aircraft vertically with its nose pointing downwards. While holding it, rotate it 360 degrees around its central axis.

The Aircraft Status Indicator will blink red if the compass calibration procedure was unsuccessful. There is a small chance that after a successful compass calibration, the compass may still be experiencing issues. If that is the case, the DJI GO app will prompt you to recalibrate the compass when you place the drone on the ground. We recommend moving the aircraft to another location.

The following are a few instances of when you'll have to recalibrate the compass:

1. The compass data is abnormal and the Aircraft Status Indicator is blinking red and yellow alternatively.
2. If you are flying in a new location or a location that is different from your last flight.
3. The mechanical structure of the Matrice 600 Pro has changed (i.e. the mounting position of the GPS module is changed).
4. If severe drifting occurs in flight (i.e. the Matrice 600 Pro has difficulty flying in a straight line).

## 9.2.2 Figure Eights

Learning how to fly a figure eight pattern is crucial to stabilizing the rover's navigation system during a scan. In order to achieve an INS status of **SolutionGood**, you must conduct two to three sets of figure-eights, either manually or using waypoint mode. This allows the software to process the current IMU drift and noise. We recommend flying a figure eight pattern because it helps lower the covariances (Uncertainty Position and Uncertainty Attitude), which are estimated errors of position and attitude.

When flying figure eights, we recommend manual flying. This will help you become familiar with applying the correct amount of roll, pitch, and yaw necessary for achieving the proper technique.

## 9.2.3 Mirror Beginning and End Procedures

There are several aerial procedures that must be performed to acquire excellent LiDAR data. The end goal is to mirror the same aerial procedures during the beginning and end of a scan to help increase the accuracy of your post-processed trajectory. During trajectory post-processing, the software calculates the best trajectory solution by processing the data in various directions: forward, reverse, or both. When the software's algorithm processes both directions, it helps to have similar procedures at beginning and end of scan to obtain the best solution.

We recommend if possible, beginning and ending the mission from the same place it was initiated. Furthermore, after taking off, if you intend to post-process the trajectory for increased accuracy, travel forward for a period of at least 10 seconds, at a minimum velocity of 5 m/s (18 km/h), moving as straight and as level as possible with an unobstructed clear line of sight. This should be immediately followed by two to three sets of figure eights. Remember to mirror the procedures.

# 10. Phoenix Flight Planner

The Phoenix Flight Planner allows you to optimize your LiDAR mission parameters before you fly. Calculate your flight plan, review estimated LiDAR data quality, and upload a terrain-following KMZ directly to your UAV (using AutoPilot). You can explore the effects that different parameters have on your data before you fly and estimate your data quality and reduce costs by experimenting with various flight paths, altitudes, and other variables.

Phoenix Flight Planner features include:

- Calculate your flight plan based on your area of interest (AOI).
- Estimate your LiDAR swath and point density based on terrain, speed, and more.
- Anticipate MTA zones that may affect data quality, especially in uneven terrain.
- Upload a terrain-following KMZ directly to your UAV.

Because the Phoenix Flight Planner is crunching a lot of data, it can be a challenge for some browsers. For the best experience we recommend Chrome/Safari with few or no other tabs open. If equipped, set your browser to use your NVIDIA graphics card.

Find your area of interest using the search bar or GPS coordinates, then click the map to outline it. The maps feature is based on Google Earth, so you'll feel right at home as you navigate the globe.



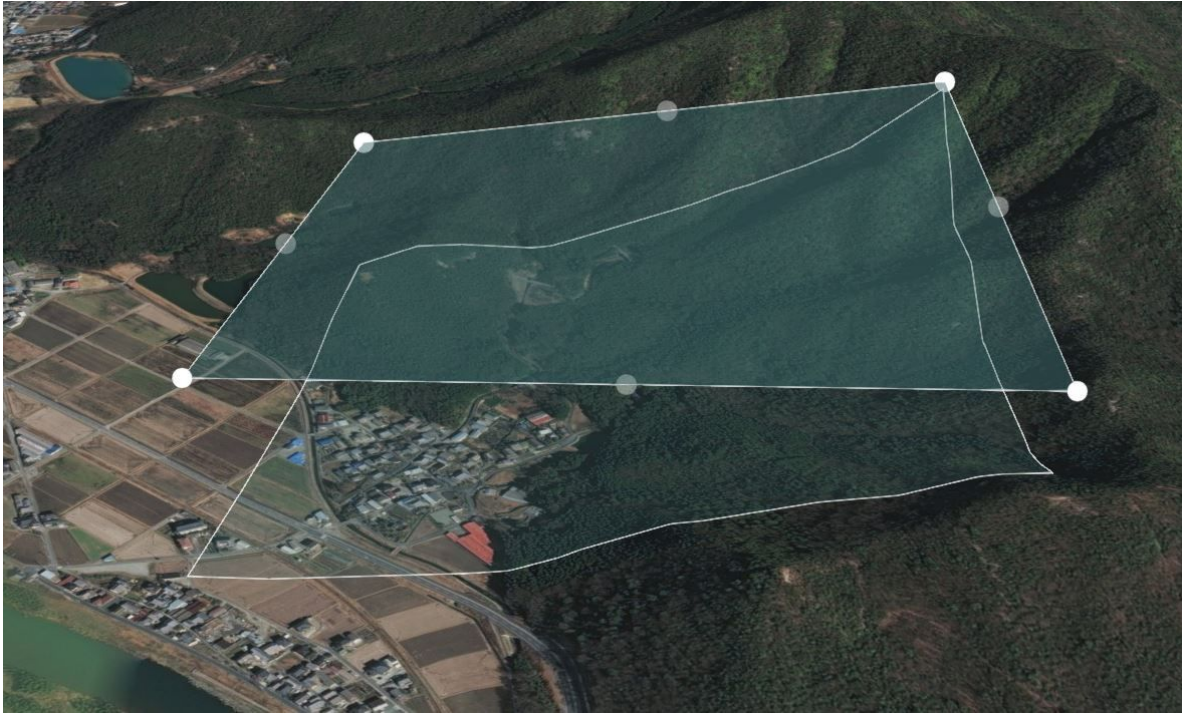


Figure 10.1: Choosing your AOI (area of interest)

Fill out your mission details by inputting system type, altitude, velocity, etc., then click “Calculate Flight Plan.” Try various flight plan adjustments and see how they affect your swath, point density, MTA zones, and more.



Figure 10.2: Inputting Flight Parameters

Download your KMZ file from the Flight Planner tool and upload it to your drone, if it supports this feature. Now that you’ve optimized the mission, enjoy your flight with peace of mind!



Figure 10.3: Export directly to UAV

This content is subject to change.

Download the latest version from [www.phoenixlidar.com](http://www.phoenixlidar.com)

If you have any questions about this document, please contact Phoenix LiDAR Systems by sending a message to [support@phoenixlidar.com](mailto:support@phoenixlidar.com).

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