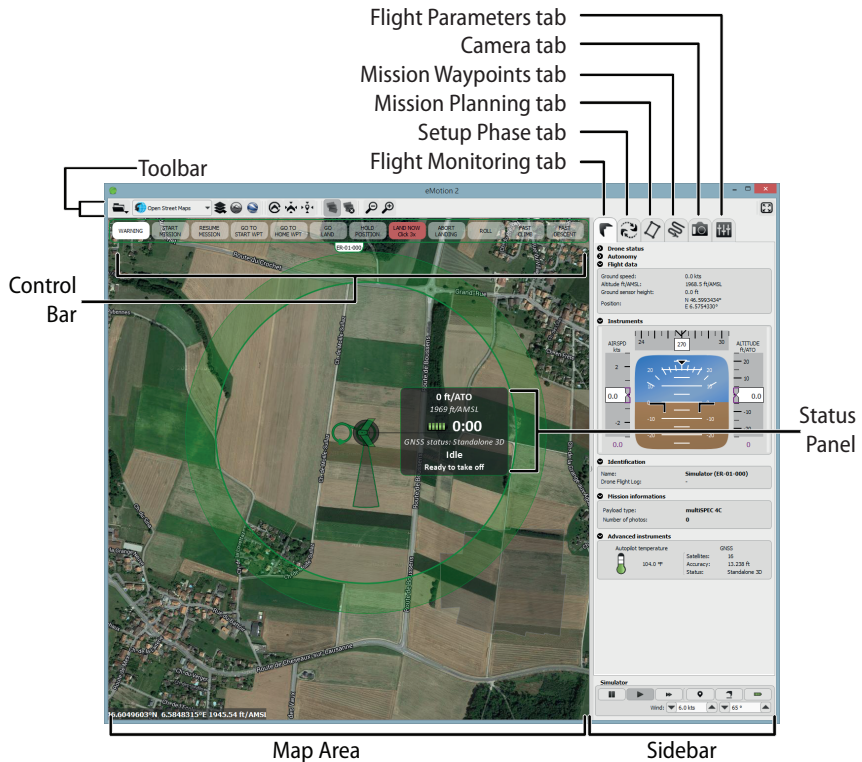


Planning and simulating a flight



current altitude (both Above the Take-off Altitude, marked as ATO, and Above Mean Sea Level, marked as AMSL), battery level, flight time, and status. The Status Panel can be hidden by clicking on the drone. Moving around the map is done by clicking and dragging at any place not occupied by a symbol (such as a waypoint or the drone symbol).

- **Control Bar:** The Control Bar is used to issue various commands to the eBee while it is in flight, such as starting the mission phase or holding position.

It is also used to display and acknowledge warnings that may occur either before or during a flight.

- **Toolbar:** The Toolbar contains buttons to control the layers, sources or map information and other display options related to the Map Area. *eMotion* can use many sources of mapping information.
- **Sidebar:** The Sidebar is split into several tabs, each with a particular function. The Flight Monitoring tab is used for monitoring the drone while in flight. The Setup Phase tab controls the take-off and landing portions of a flight plan (referred to as the 'setup phase') whereas the Mission Planning tab defines the image acquisition portion of the flight plan (referred to as the 'mission phase'). The last three tabs are used for advanced waypoint planning and parameter setting. You can hide the Sidebar by clicking on its left edge. The Sidebar also contains controls for the simulator when connected to a simulated drone.

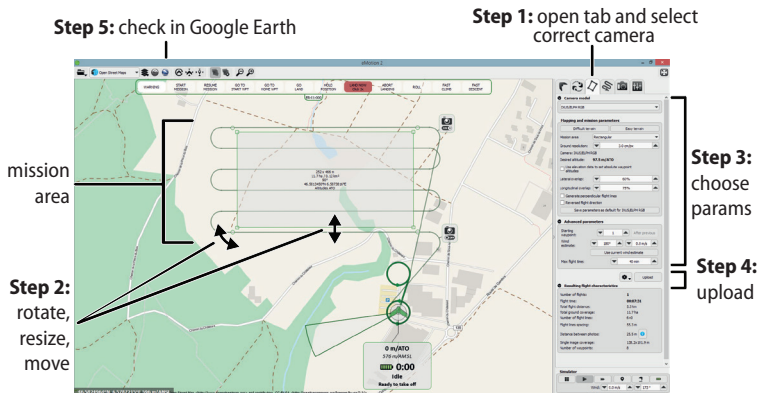
1.3 Creating a new flight plan

Every mapping flight requires a flight plan, which is a path defined by a set of waypoints, or points in 3D space, and a set of actions that can be performed at or in between waypoints, such as taking images, proceeding to the next waypoint or landing. A flight plan is shown in the Map Area using circles to represent waypoints, lines to represent the flight path and arrows to show the direction of flight. The large circle with a thick border illustrates the working area boundaries within which the *eBee* will always remain. See the *eBee* Extended User Manual for more information on waypoints and the various symbols presented in the Map Area.

A complete flight plan for an *eBee* is divided into two separate phases: the setup phase and the mission phase. The mission phase includes waypoints and actions related to mapping and capturing images. The setup phase includes waypoints and actions related to take-off and landing. This phase is usually planned directly in the field and is explained in detail in section 'The setup phase of a flight' on page 38.

1.4 The mission phase of a flight

The easiest way to create a mapping flight for the systematic coverage of an area is to use the automatic mission planning feature of *eMotion*. By simply positioning a rectangle around the area you would like to cover, *eMotion* will generate a mission plan optimised for the ground resolution that you desire.



Note: For more complex terrain and missions, *eMotion* has the ability to set polygonal mission areas of any size and shape, and to automatically adjust waypoint altitudes based on elevation data. These powerful features are described in more detail in the *eBee* Extended User Manual.

Follow these steps to automatically setup waypoints for a mapping mission:

1. Select the Mission Planning tab from the Sidebar. A grey zone will appear in the Map Area to designate the mission area to cover. Information such as size and position is overlaid on the area. A mission plan, including the required waypoints, is automatically calculated and displayed to preview the mission plan that will be created.

2. Adjust the location, size, and shape of the mission area. The area can be relocated by dragging the gray zone. The four square handles on the edges of the area can be used to resize it and the round handles on the corners of the area can be used to rotate it. As you adjust the area the mission plan preview is continuously updated.
3. Adjust the mapping and mission parameters in the Mission Planning tab to suit your terrain and quality requirements². As a first step, *eMotion* provides two predefined set of parameters; 'Easy terrain' are the default parameters designed for simpler terrain, such as mines or agriculture, whereas 'Difficult terrain' is designed for complex areas, such as forests, and provides higher image overlap at the cost of a lower resolution. Be sure to include an estimated wind speed and direction, as this has an effect on the area that can be covered in a single flight. Once again, the mission plan preview will be continuously updated as you modify the parameters.
4. Check the resulting flight characteristics in the tab. Once you are satisfied, upload the mission plan to the simulated drone by clicking the 'Upload' button.
5. Click the  button in the Toolbar to open the flight plan in *Google Earth*^{TM3}. Review the flight plan to ensure that there is sufficient clearance between the flight plan and the ground. Any updates to the flight plan that you make within *eMotion* will be reflected directly in *Google Earth*TM.

² see the *eBee* Extended User Manual for a complete description of available parameters

³ see the *eBee* Extended User Manual

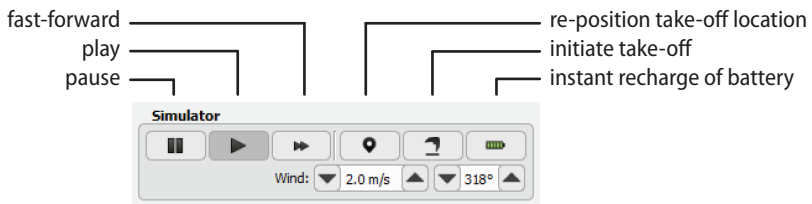


Caution: *eMotion* as well as the automatic mission planning tool are not aware of any obstacles that may exist in the area. In addition, when not using elevation data, the mission planning tool assumes that the mission area is flat and at the same altitude than the take-off location. It is also not aware of any legal restriction (such as minimum or maximum altitude) that may exist in your region. The resulting flight plan should be carefully reviewed in order to avoid any collision with uneven terrain or tall objects such as buildings, and to comply with local regulations.

The final step after you have prepared a flight plan is to save it to a file that you can load into the *eBee* when you are in the field. Select the Setup Phase tab from the Sidebar, click on 'Save flight plan to file...'; choose a filename and location and click 'Save'.

1.5 Simulating your flight

Simulating your flight gives you an idea of the position and size of images that will be taken during the flight. In addition, it allows you to learn to use advanced functions, such as in-flight waypoint editing and camera control, without putting your *eBee* at risk⁴. When *eMotion* is connected to a simulated drone an extra set of buttons appear in the Sidebar:



You can set the take-off location of the *eBee* by clicking on the 📍 icon and placing the point on the map. This simulates the action of switching on the real drone

⁴ see the *eBee* Extended User Manual for a complete description of the simulator

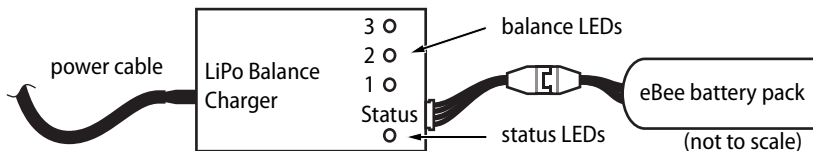
and letting it acquire GPS signals. You can test your flight plan by clicking the  icon, simulating a take-off manoeuvre. The *eBee* will then go through its flight plan in the same way it would in the field. You can pause, play or speed up the simulation by clicking the corresponding buttons in the Toolbar. You can monitor the state of the drone while in flight using the Flight Monitoring tab and the Status Panel⁵. You may also monitor the flight in 3D in *Google Earth*TM by clicking on the  button in the Toolbar.



Caution: The simulator is a tool designed to aid with flight planning and to familiarise you with the advanced functions of your *eBee*. The simulated physics, however, are basic and do not always accurately reflect the true behaviour of the drone in flight. In particular, estimates of battery level and reactions to wind are difficult to simulate with high accuracy. You should in no case depend on behaviours seen with a simulated drone to be reproduced exactly in real flight.

1.6 Getting ready for a mission

Before leaving for the field to perform a flight, be sure to fully charge all your *eBee* batteries⁶. When delivered, the *eBee* battery may not be fully charged.



To charge an *eBee* battery pack, connect it to the battery charger as illustrated above. During charge, the status LED on the charger is solid red. Charging is complete when the status LED turns green.

The charger provided independently balances the voltage of each of the 3 cells contained in the battery pack to ensure optimal performance and battery life.

⁵ see the *eBee* Extended User Manual

⁶ Consult your payload user manual to know if the payload battery is necessary for the flight

If any of the cells is unbalanced, its associated LED will flash red during charging until it is re-balanced. Charging can take up to an hour, depending on the charge level of the battery and the required cell balancing work. See the *eBee* Extended User Manual for more information on maintaining your drone's batteries.

If you plan on performing a flight away from an Internet connection it is useful to preload map tiles by selecting 'Download maps...' from the  File menu. More details on how to take advantage of the various map sources available in *eMotion* can be found in the *eBee* Extended User Manual.

2 Executing a flight



Goal of this section: This section describes how to prepare your *eBee* for flight, launch, monitor and control from the air, and initiate an autonomous landing.



Note: We recommend that you perform your first flight in a large obstacle-free area and limit the length of the mission in order to familiarise yourself with the *eBee* in flight.

2.1 Weather check

Before each flight, you should be aware of the weather conditions. The *eBee* is a small drone that cannot fly in heavy rain or strong wind conditions. In case of doubt, make sure to check a weather bulletin including wind estimations in the flight area. Note that wind is often stronger at higher altitudes and that the wind perceived at the surface is not always a good reference to estimate the wind at flight altitude. Cloud velocity or tall tree movements can help you to estimate the wind speed once you are out in the field.

Weather forecasts may use various units to measure wind speed. As a reference,

$$1 \text{ m/s} = 3.6 \text{ km/h} = 2.24 \text{ mph} = 1.94 \text{ kts.}$$



Caution: The *eBee* should not be launched if the wind speed exceeds 12 m/s (in other units: 43.2 km/h, 26.8 mph, 23.3 kts).



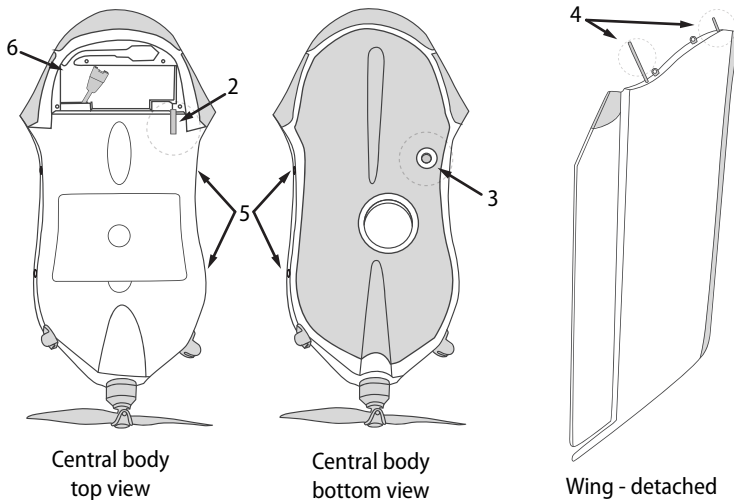
Caution: The *eBee* is not designed to fly in temperatures above 35° C. Avoid exposing the drone to high temperature for prolonged periods of time. In particular, leaving the drone exposed to the sun or in a car should be avoided.

2.2 Preparing the *eBee* for flight

The *eBee*'s simple design means it can go from the box to being ready for flight in minutes. We recommend that you perform the following 6 steps before every flight to ensure that the platform is best prepared for flight.



Note: Remove the red warning sticker from the motor before your first flight.



Step 1: Perform a general inspection

Visually inspect the drone for damage or wear using the following steps:

1. Check the foam central body and wings for cracks or other damage.
2. Verify that the pitot probe is properly attached to the airframe and that the holes in the probe are free of obstructions.
3. Verify that the ground sensor is free of obstructions and that the sensor's lens is clean.
4. Verify that the wing struts are not split or damaged in any way.
5. Verify that the tubes within the Central Body that hold the wing struts are not cracked or damaged in any way.

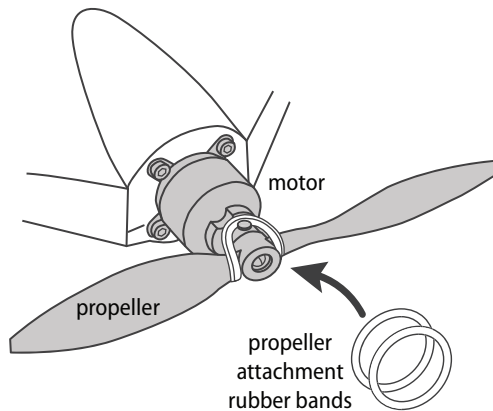


Caution: It is vital to carefully inspect the wing struts and tubes within the Central Body before every flight, as they may cause a crash if they are damaged in any way. This is particularly important if the wings were found separated from the Central Body after a previous flight.

6. Verify that the power cables within the battery compartment are well insulated and not damaged.



Note: A general inspection should be performed before every flight. It is also good practice to perform a full airframe check regularly to keep your *eBee* in good shape. See the *eBee* Extended User Manual for more details.



Step 2: Install the propeller

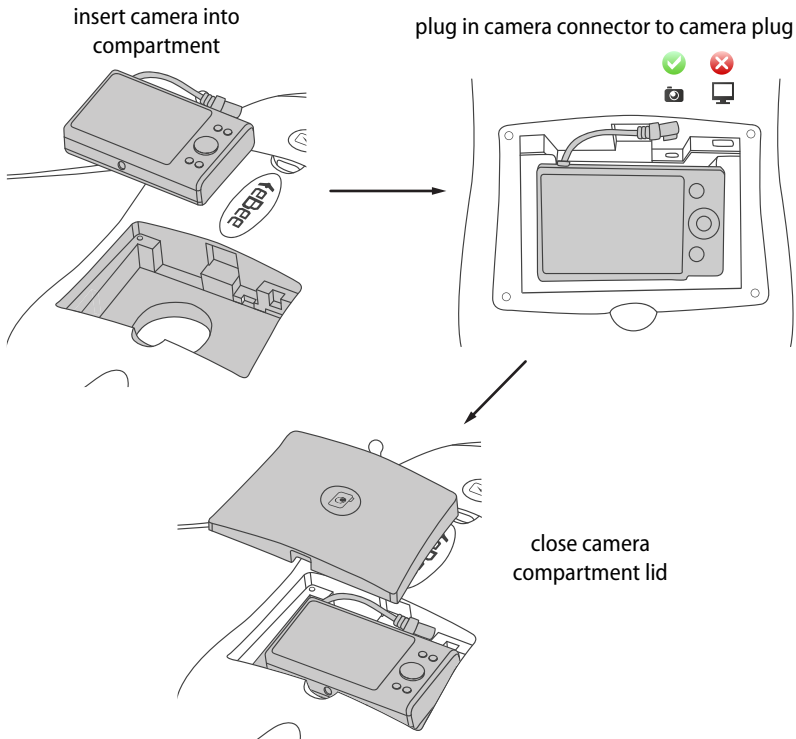
Mount the propeller on the motor axis. Secure the propeller using two attachment rubber bands as illustrated above. Ensure that the propeller is lying flat against the motor mount, and that the rubber bands do not show cracks or any other sign of aging.



Caution: Failure to use two rubber bands may result in the loss of the propeller in flight!



Note: After extensive use, the rubber bands may develop cracks. This is normal and is caused by the ageing of the rubber material. For maximum security, inspect the rubber bands regularly and discard them if they show cracks. 10 spare rubber bands are included in the package.



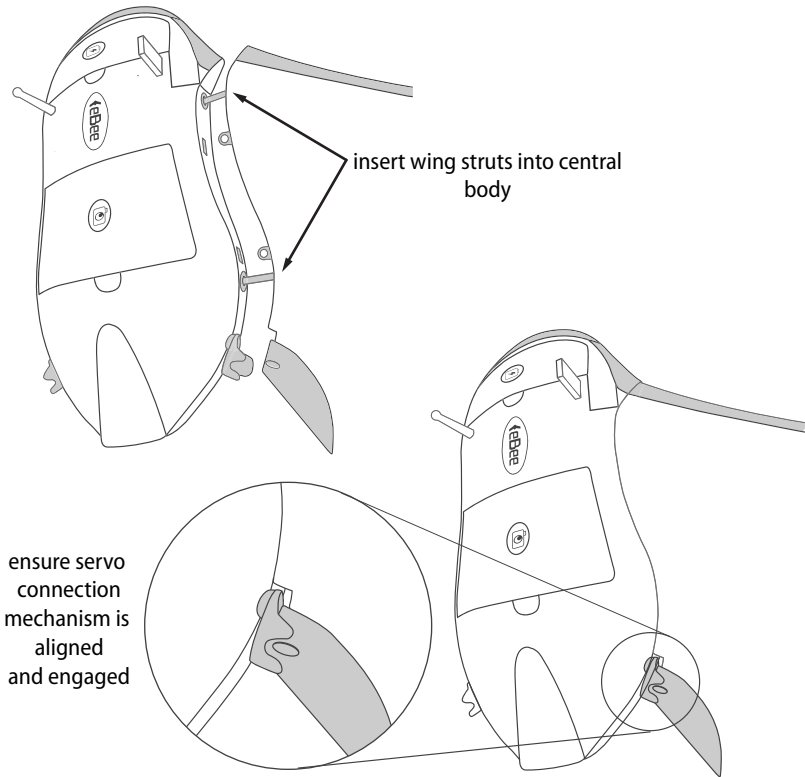
Step 3: Install the camera

Install the camera into the payload bay⁷ within the *eBee* and close the camera compartment lid. If the camera connector is not already connected, plug it into the connector with the  icon on the *eBee*.



Caution: The *eBee* has not been designed to fly without the camera. Attempting to fly without the camera may render the drone unstable, which may eventually lead to a crash.

⁷ Some payloads may require a separate battery or SD card to operate properly. Please refer to the User Manual of the camera or other payload for proper installation instructions.

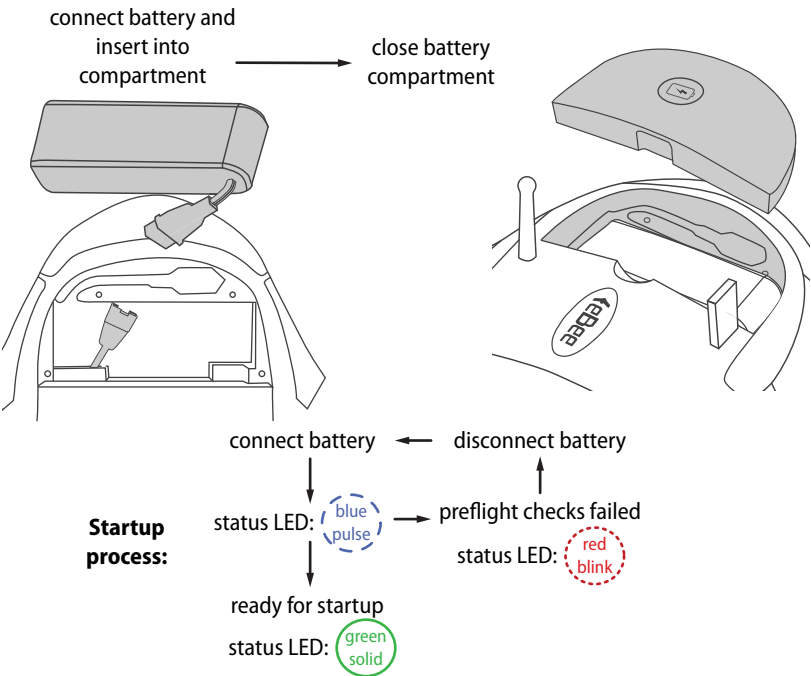


Step 4: Attach the wings

Attach the wings to the central body by inserting the wing struts into the receptacles in the central body. Ensure that the ailerons are properly aligned with the servo connection mechanism before pushing the wings fully into the central body.



Caution: Flying with damaged wing struts or a badly engaged servo connection mechanism may cause erratic flight and ultimately a crash. Be sure to properly inspect and attach the wings before flight.



Step 5: Install and connect the battery

Lay the eBee horizontally on the ground outside in the vicinity of the take-off location, with the top face up. To install the battery, begin by connecting the power cables to the battery. Insert the connectors firmly to the end in order to avoid undesired disconnection when in flight. Once connected, insert the battery into its compartment and close the compartment lid.



Caution: Take care to keep the propeller area clear, in case it suddenly starts spinning.



Note: Only connect the battery cables to the drone when you are ready for start-up. Do not leave the battery connected for extended periods of time when the drone is on the ground, as this may discharge the batteries and cause irreparable damage. When connected and not in flight, the *eBee* will briefly move its ailerons up and down every minute as a reminder that it is switched on.

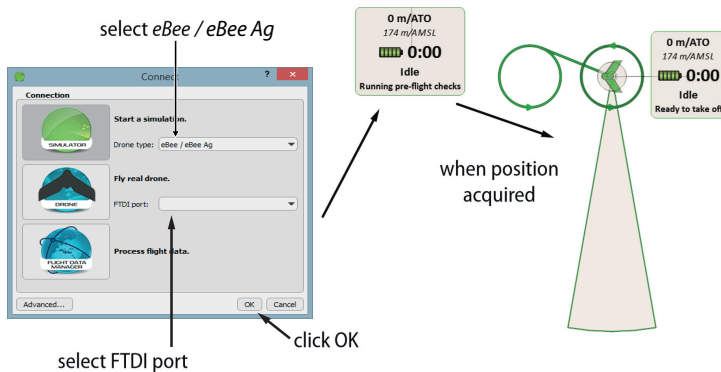
As soon as the battery is connected the *eBee* will perform an automatic self-check of its sensors and acquire GPS signals. Be sure not to move the drone during these tests. It is important that the drone is not inclined more than 10 degrees in order to start up properly. Pre-flight checks may last from a few seconds to several minutes in the case of poor GPS signal reception. As these satellite signals are required for the checks to complete, be sure to place the *eBee* outside with a clear view of the sky.

During the pre-flight checks the status LED will pulse blue. Once the pre-flight checks are complete the *eBee* will flip its ailerons up and down and the status LED will turn solid green to indicate it is ready. You may already connect the drone to *eMotion* (Step 6) before pre-flight checks are complete to get a better idea of the status of the checks.



Note: If there was any problem during the pre-flight checks performed by the drone this will be indicated by a Pre-flight error in *eMotion* as well as by the status LED blinking red. See the *eBee* Extended User Manual for a description of possible Pre-flight errors and how to handle them.

Quick start guide



Step 6: Connect to *eMotion*

Start by connecting the USB ground modem to your computer. Then launch *eMotion*, which will display the Connection window. Select the *eBee* connection profile, choose the corresponding FTDI port and click 'OK'.



Note: Every *eBee* is paired with the ground modem it is delivered with, and will only work with that particular modem. The name of the FTDI port corresponding to the ground modem is labelled as '*eBee*-SERIAL', where SERIAL is the serial number of the drone it is paired with.

When a connection is established *eMotion* will display a map and the Status Panel indicating the current state of the drone. If the *eBee* has not yet detected its location the Status Panel will appear in the top right corner of the Map Area with the text 'GPS: Waiting for signals...'. During this time the status LED on the drone will pulse blue.

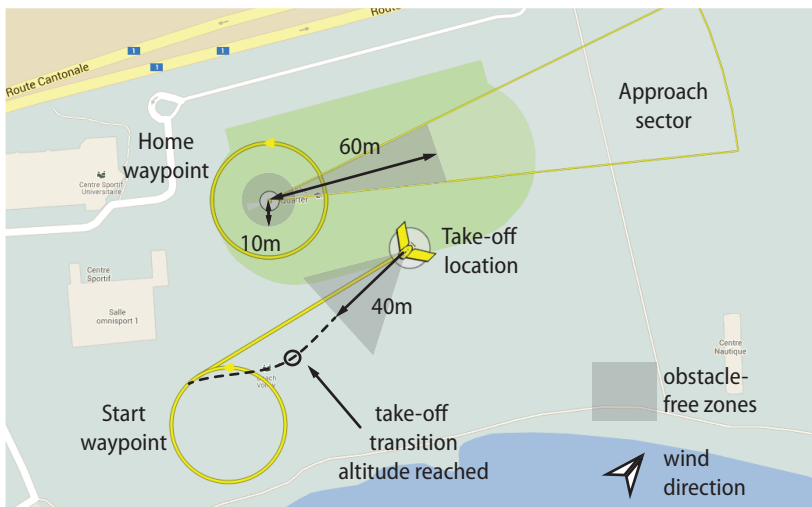
Once your drone has set its position using GPS signals, an icon of the drone will appear at its location on the map. If the drone's location is not on the map you can click the 📍 button from the Toolbar to centre the map on the drone. The drone's status on *eMotion* will be displayed as 'Idle, Ready to take-off' and the status LED will become solid green.

You can now load a flight plan you prepared earlier by selecting the Setup Phase tab from the Sidebar, clicking on 'Load flight plan from file...' and selecting your flight plan file. Alternatively, you can plan the entire mission in the field, following the same process outlined in section 'Planning and simulating a flight' on page 19.

2.3 The setup phase of a flight

The setup phase of a flight includes the waypoints and actions related to the take-off and landing of the *eBee* and includes the following locations:

- **Take-off location:** The point from which the drone is launched, automatically set to the location calculated from GPS signals by the drone when it is launched. This location defines the altitude of 0 m/ATO (ATO stands for above take-off); the altitudes of all other waypoints, when defined in m/ATO, are referenced to the altitude of this location.
- **Start waypoint:** The first point that the drone flies towards when launched (once it reaches the take-off transition altitude).
- **Home waypoint:** The safe point for the drone to circle in case of emergency, as well as its landing position at the end of a flight for both Linear and Circular landings.



It is important to carefully select the take-off location, the Start waypoint and the Home waypoint to ensure your drone remains at a safe distance from obstacles.

The *eBee* should always be launched against the wind. Select a take-off location clear of obstacles (buildings, rocks, power lines, hills, trees, etc.) within a distance of at least 40 m in the upwind direction. Immediately after takeoff it will keep its wings level and climb in the general direction it was launched until it reaches the take-off transition altitude⁸, at which point it will start flying towards the Start waypoint.

By default, the Start waypoint is set to a distance of 80 m West of the initial position of the drone and an altitude of 75 m/ATO. It is good practice to move the Start waypoint close to and upwind from the take-off location to allow a smooth transition between take-off and waypoint-directed flight. You can move waypoints by clicking on them and dragging them within the Map Area⁹.

The Home waypoint is used both as the landing location and as a safety position in case of an In-flight warning. The *eBee* can perform either a Linear or a Circular landing. Linear landing is the default and recommended landing type, especially in high winds. To prepare a Linear landing, place the Home waypoint centre at a location that is at the same altitude as the take-off location and is clear of obstacles in a 10 m radius. Choose one or several approach sectors that are free of obstacles for at least 60 m from the Home waypoint centre. You can drag the approach sector around the Home waypoint and change its width directly in the Map Area or from within the Setup Phase tab. Make the approach sector(s) as wide as possible to maximize the chance that the drone can subsequently land against the direction of the wind. Ensure that the terrain within the approach sector is flat and contains visual contrast to allow the ground sensor to function properly during landing.

When a Linear landing is initiated (either automatically or by pressing the 'Go Land' button in the control bar) the drone will fly towards the Home waypoint, circle the waypoint (at 75 m/ATO by default) to measure the direction of the wind

⁸ By default the take-off transition altitude is set to 20 m. In difficult launch conditions you can set both the take-off heading and the take-off transition altitude in the Setup Phase tab, as described in the *eBee* Extended User Manual.

⁹ see the *eBee* Extended User Manual for a more detailed explanation on waypoints and how to modify them

at the landing location and choose an approach direction as much against the direction of the wind as possible. It will then fly downwind in the opposite direction of the approach direction, turn 180° and begin descending in the approach direction until it lands on the ground underneath the centre of the Home waypoint. The approach angle is around 20° and the drone will reverse its thrust if needed to maintain a suitable airspeed during this phase.



Note: There are a number of requirements that must be fulfilled to ensure a successful Linear landing. The *eBee* Extended User Manual describes in more detail the Linear landing process and how to properly define approach sectors in more complex terrain. In particular, in the case of strong-wind conditions, low light or low-contrast terrain, the precision of the final landing location around the Home waypoint is reduced. Therefore, it is safer to plan for more clearance, especially along the possible landing axes.

If there are no suitable approach sectors to perform a Linear landing the drone can also perform a Circular landing around the Home waypoint. When initiating a Circular landing around the Home waypoint the drone will switch off its motor and glide down while circling around the Home waypoint at the waypoint's radius. During the Circular landing procedure the drone uses its ground sensor to measure the height above the ground, if the ground is well textured and there is enough light. When it reaches an altitude of 25 m above the ground the drone will level out, estimate the direction of the wind and resume its descent so as to touch down against the wind while remaining on the circle defined by the Home waypoint.



Caution: The ground sensor can only provide usable feedback in daylight conditions above flat terrain that contains enough visual texture. If these conditions are not met the drone cannot ensure a touch-down against the direction of the wind. Landing in the direction of the wind in strong-wind conditions may result in a high landing speed and damage to the *eBee*.

To prepare a Circular landing, place the Home waypoint in a location that has no obstacles within a radius of 50 m (or 20 m more than the Home waypoint radius) to give the drone enough space to land. Ensure that the entire landing area is flat to allow the ground sensor to function properly. By default, the radius of the Home waypoint is 30 m. In high-wind conditions it is recommended to increase this diameter¹⁰.



Caution: The radius of the Home waypoint, and thus of a Circular landing, can be reduced to 20 m but should only be done in low wind conditions (<3 m/s). Reducing the radius of the Home waypoint below 30 m in moderate- or high-wind conditions can result in damage to the drone when it contacts the ground during a landing. As indicative values, the Home waypoint radius should be set to 30 m for wind speeds below 5 m/s, 40 m for wind speeds between 5-8 m/s, and to 50 m for wind speeds above 8 m/s.



Note: In case of strong-wind conditions, the drone may drift even further than 50 m away from the center of the Home waypoint when performing a Circular landing. Therefore, it is safer to plan for even more clearance in the downwind direction.

By default, the Home waypoint is set to an altitude of 75 m/ATO. In case a Go to Home Waypoint procedure is triggered during flight¹¹ the drone will, by default, determine the highest altitude between its current altitude and the Home waypoint's altitude, and climb in a circle towards that highest altitude (if required). Once it reaches this highest altitude it will then fly towards the Home waypoint.

Due to this behaviour, the altitude of the Home waypoint should be selected with care; it should be at least 20 m higher than the surrounding obstacles to avoid the risk of a crash, but should not be set too high to reduce the effect of potentially high winds and altitude and to prevent the drone from getting lost. Alternatively, you can change the altitude transition behaviour within the Setup Phase tab. See the *eBee* Extended User Manual for more information on altitude transition be-

¹⁰ see the *eBee* Extended User Manual

¹¹ either automatically due to an In-flight warning or manually using *eMotion*

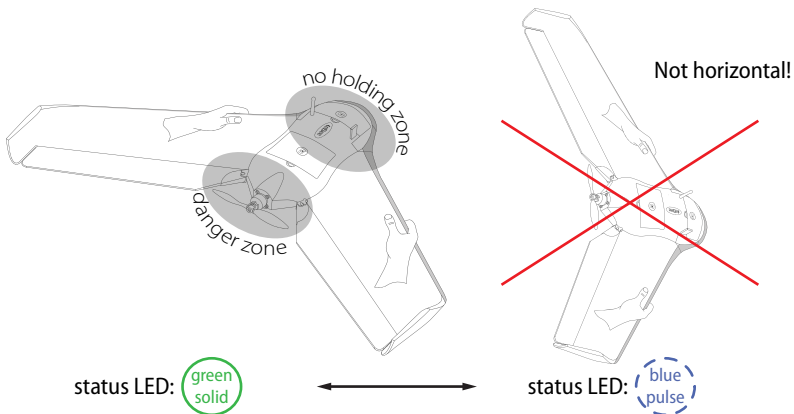
haviours and how to modify them.

2.4 Take-off

Once you've planned your mission and the *eBee* status LED is solid green you can launch it using the procedure on the following pages.



Caution: Make sure to keep the propeller area free of all obstructions at all times during the launch procedure.



Step 1: Orient horizontally and against the wind

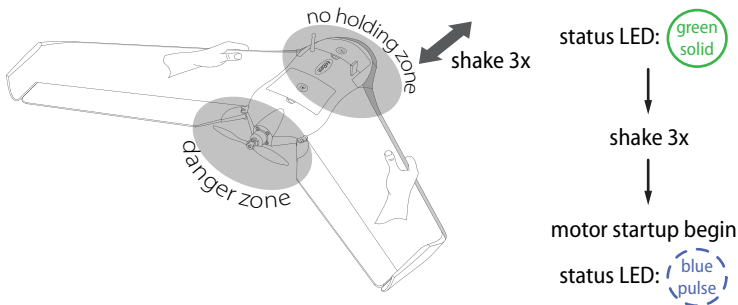
Orient yourself against the direction of the wind, and confirm that the take-off direction in front of you is free of obstacles. Firmly grasp the drone with both hands, one hand on the front of each wing as shown in the figure. Hold the drone horizontally with the nose pointed against the wind and level wings.



Note: If the drone detects a condition that prevents correct take-off a Take-off veto will be displayed in *eMotion* and the status LED will start pulsing blue. The *eBee* Extended User Manual describes the possible Take-off veto messages and the user action that should be taken to remove them. For example, if the drone is not oriented horizontally the status LED will start pulsing blue until you re-orient it horizontally, at which point the status LED turns solid green again.



Caution: It is imperative to launch the drone directly against the wind, otherwise it will be unable to gain enough speed during take-off and likely crash. Likewise, launching the drone in high winds above the specified safe wind speed of 12 m/s is dangerous and can result in a crash.

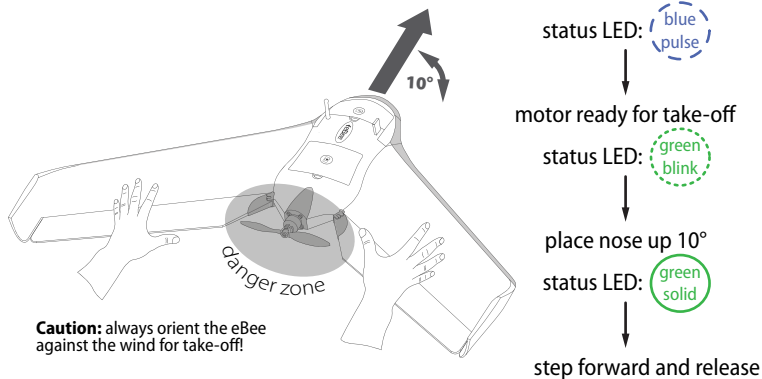


Step 2: Switch the motor on

Shake the *eBee* back and forth 3 times longitudinally (within approx. 3 seconds) to begin the motor power-up sequence. The status LED will pulse blue until the motor is at full power and ready for take-off.



Note: You do not need to hurry to launch the drone. In case you want to shut off the motor, just repeat the back and forth action three times and the motor will stop.



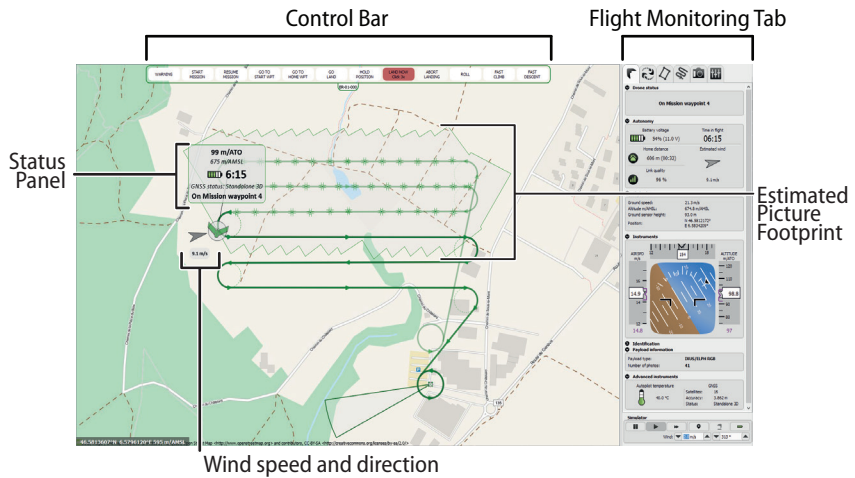
Step 3: Launch the eBee

Once the motor is at full power the status LED will blink green. Orient the drone with approximately 10 degrees nose up and level wings. When the angle is correct the status LED will turn solid green, indicating that the drone is ready for take-off. Launch the drone with a gentle push by walking 1-2 steps forward while releasing it with both hands in a purely forward motion.

After take-off, the drone tries to maintain its initial direction, or follow the directional take-off heading you set, by keeping its wings level with full thrust until reaching the take-off transition altitude, by default 20 m¹². At this point, it will switch into waypoint navigation mode and fly towards the Start waypoint. Once it reaches the Start waypoint location and altitude the drone will circle around the waypoint 1-2 times to estimate the wind and calibrate its sensors before starting the mapping mission¹³.

¹² see the eBee Extended User Manual to change this parameter

¹³ The eBee may also be programmed to wait at the Start waypoint for a command before starting its mapping mission. See the eBee Extended User Manual for more information.



2.5 In-flight monitoring and control

You can monitor and control your drone while in-flight through *eMotion* using the Map Area and the Flight Monitoring tab in the Sidebar.

The Map Area displays the current position of your drone, updated live as the drone executes its flight. A small arrow and infobox show the speed and direction of the wind as measured by the *eBee*. The Status Panel that follows the position of the drone displays basic flight information including battery charge, flight time and altitude, both above the take-off location (ATO) and above mean sea-level (AMSL). This same information is reproduced in the Flight Monitoring tab, along with other useful flight data .



Note: All waypoints, image locations and flight paths displayed in *eMotion* are a reflection of the data contained within the drone autopilot. If at any point the connection between *eMotion* and the drone is lost, the drone will by default continue its planned flight, including the imaging mission and the selected automatic landing, fully autonomously. If you would like the drone to return to the Home waypoint instead of continuing its mission when it detects a loss of connection you may set the appropriate parameter in the Flight Parameters tab, as described in the *eBee* Extended User Manual.

During the Mission phase of the flight the *eBee* will automatically take pictures at pre-defined moments based on the parameters that were defined during mission planning. The estimated area captured on the ground is displayed in the form of a continuously-updating polygon in the Map Area.



Note: The *eBee* will not take a picture unless it is in the correct location and altitude. Some reasons for not taking an image are strong head wind, large off-track distance or incorrect altitude. A corresponding message is displayed in the Status Panel if a picture is not taken.

At the top of the Map Area is the Control Bar, which can be used at any time to send commands to your drone as well as to acknowledge warning and failure messages if they occur. During a fully autonomous flight the *eBee* will control its flight autonomously from take-off to landing and you do not need to use any of the control buttons. They can however be useful in unexpected situations to temporarily hold position by pressing the 'HOLD POSITION' button or to send the drone to the Home or Start waypoints with the 'GO TO HOME WPT' or 'GO TO START WPT' buttons, respectively. Alternatively, you can direct your drone to any location by right-clicking in the Map Area and using the contextual menu. We recommend you use the simulator to learn the effects of the buttons on the drone. Detailed descriptions of the buttons and their effects on the drone are described in the *eBee* Extended User Manual.

2.6 Landing

After finishing a mapping mission the drone will, by default¹⁴, return to the Home waypoint and automatically initiate a landing sequence. During a Linear landing, the drone will land in a straight line according to the process described in the *eBee* Extended User Manual. In case of a Circular landing the drone will land in a circle according to the process described in the *eBee* Extended User Manual.

Disconnect the battery from the drone before picking it up. We recommend you immediately import the images and flight data after each flight (see section 'Importing images and flight data' on page 49) before putting the *eBee* back in its case for storage. When disconnecting the wings, be sure to pull gently in the axis of the wing struts to prevent damage to the wing struts. Check the wing struts for any damage before putting them into the storage case. Remove the propeller if you don't plan on using the *eBee* for an extended period of time.

2.7 Potential in-flight errors

The drone can encounter two types of error messages while flying: In-flight warnings and Critical failures. In-flight warnings typically indicate a dangerous situation such as a low battery or strong winds and typically result in a Security action such as a return to the Home waypoint. In-flight warnings appear in blue or yellow in the Flight Monitoring tab. Critical failures occur only when the drone's ability to fly is severely compromised, such as a loss of GPS signals or an empty battery. The situation will be displayed in red in the Status section of the Flight Monitoring tab. When a critical failure arises, the drone will immediately perform an emergency landing.



Caution: We recommend that you familiarise yourself with the possible in-flight errors to have a better understanding of what happens if they occur in the field. A full list of possible In-flight warnings and Critical failures and the drone's reaction to them is described in the *eBee* Extended User Manual.

¹⁴ see the *eBee* Extended User Manual for information on changing the default behaviours of the drone



Note: It is important to keep track of the location of the drone during a Critical failure until the moment it reaches the ground. Its position's coordinates can aid in finding it afterwards. Instructions on how to find a lost drone can be found in the *eBee* Extended User Manual.

3 Processing image data



Goal of this section: In this section you will learn how to import images and flight data from your *eBee* and create basic mapping products directly in the field to gauge the quality of the images that you gathered.

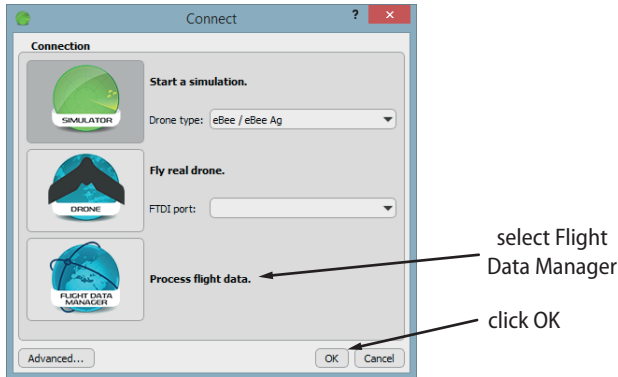
3.1 Importing images and flight data

The next step to creating mapping products, after completing a flight, is to import the raw images and log files to a computer. The *eBee* records flight data onboard in a special Drone Flight Log file. The Drone Flight Log tracks important information throughout a flight, such as sensor data, location and control inputs. The file is required for assigning location information (geotags) to the images taken by the drone. The file is also required and must be sent to senseFly Ltd in case an issue occurred during the flight¹⁵. A similar *eMotion* Flight Log file is created within *eMotion* during a flight and serves as a backup in case the Drone Flight Log file cannot be recovered.

eMotion features a Flight Data Manager to help you transfer and consolidate all the data related to a mapping mission. Open the Flight Data Manager by clicking on the Flight Data Manager icon when you load *eMotion*. Alternatively, click on the  button in the Toolbar and select 'Flight Data Manager...'

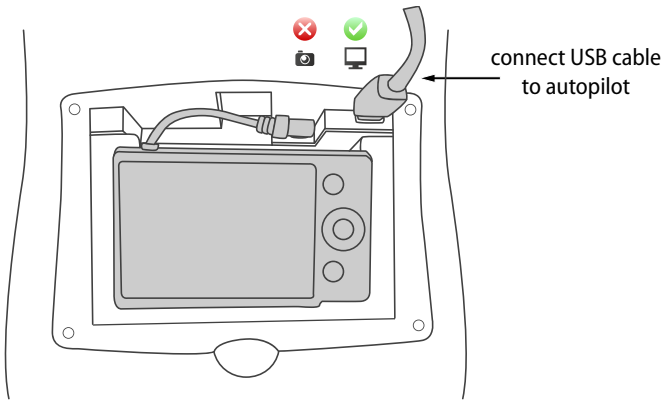
¹⁵ see the *eBee* Extended User Manual

Quick start guide



Follow these steps to import data from the drone:

- **Step 1 - Select a flight:** If the flight was monitored from the computer you are using to import images then the flight is saved within the local database. Select the date that the flight took place. A list of flights (including number of images taken) from that date will appear in the combo box, select the one you wish to import.
- **Step 2 - Create a directory:** Choose a directory name that uniquely identifies your flight (e.g. the date, the name of the area, etc.).



- **Step 3 - Prepare data for import:** To import the Drone Flight Log, connect the supplied USB cable to the *eBee*'s autopilot, marked with a  icon. Connect the battery to the drone if it is not already connected. The status LED will become white and a new storage drive will appear on your computer.
To import images, remove the SD card from the camera, insert it into the SD card reader of your computer and select 'Import from SD-card reader'. Alternatively, transfer the images from the camera by lifting it out of its compartment just enough to connect a USB cable to it and turn the camera on. Copy all the images into a temporary folder on your computer. Select 'Import from a specific folder' and choose the temporary folder.
- **Step 4 - Import flight logs:** Confirm that the Drone and eMotion Flight Logs found by the Flight Data Manager are correct. You may select logs manually if they are not correctly detected.
- **Step 5 - Import images:** Confirm that the images corresponding to your flight were found and matched to the Drone Flight Log correctly.

- **Step 6 - Select outputs:** Choose the output actions to execute and files to create. Geotagging images is necessary to create geoinfo, KML and *Postflight Terra 3D* files.
- **Step 7:** You may now disconnect the drone. Eject the SD-card drive and the drone drive before removing the SD-card and the USB cable, respectively. Disconnect the battery and USB cable from the drone. Insert the SD-card back into the camera, put it back properly into its compartment and ensure that it is turned off. You can now open the KML file in *Google Earth™* or the project in *Postflight Terra 3D* for further processing.

3.2 In-field image quality check

Postflight Terra 3D software¹⁶, available as a free download with the *eBee* package, can be used to rapidly create a Quality Report directly in the field. The Quality Report that is automatically generated as well as the orthomosaic provide immediate feedback on the quality of the images gathered during your mission.

You can open a project for processing in *Postflight Terra 3D* directly from the Flight Data Manager after importing your data by clicking the 'Open project in Terra' button. You will now see the main *Postflight Terra 3D* window. The position of your images will appear as red dots in the Map Area of *Postflight Terra 3D*.

¹⁶ powered by Pix4D; see section 'Installing *eMotion*, *Postflight Terra 3D*, and the ground modem drivers' on page 19 for installation instructions