# ⟨eBee

senseFly

## The drone for precision agriculture

# 4 good reasons to choose the eBee Ag

**‹eBee**

senseFly

## 1 Versatile

The **eBee Ag** is supplied with a customised S110 NIR camera as standard. However you can also choose the customised 110 RE, the 110 RGB, or the precise four-band Airinov multiSPEC 4C.

## 2 Reliable

The **eBee Ag's** artificial intelligence and robust lightweight construction ensure it will survive numerous flights (and landings), thus safeguarding your investment.

## 3 Easy to use

The **eBee Ag** is a fully automonous drone. Just select the area you want to map using our **eMotion** software, launch your drone, and the **eBee Ag** will fly, acquire images and land itself.

## 4 Your complete solution

Every **eBee Ag** is supplied with two advanced software packages: **eMotion 2** for flight planning and control; and **Postflight Terra 3D** photogrammetry software for post-flight image processing and analysis.

# S110 NIR

This customised 12 MP camera is electronically integrated within the eBee's autopilot. The **S110 NIR** acquires image data in the near infrared (NIR) band, the region where high plant reflectance occurs. Its exposure parameters can be set manually and its RAW files are fully supported by the eBee Ag's software.

Example applications: biomass indication, growth monitoring, crop discrimination, leaf area indexing.

# S110 RE

**Optional**

This customised 12 MP camera is also electronically integrated within the eBee's autopilot. Unlike the NIR version above, the **S110 RE** acquires data in the red edge band, the region where a plant's reflectance changes from low to high. The **S110 RE's** exposure parameters can also be set manually and its RAW files are fully supported by the eBee Ag's software.

Example applications: plant stress assessment, chlorophyll indication, senescence analysis, drought assessment.

# multiSPEC 4C
AIRINOV

**Optional**

The **multiSPEC 4C** is a cutting-edge sensor unit developed by Airinov's agronomy specialists and customised for the **eBee Ag**. It contains four separate 1.2 megapixel sensors that are electronically integrated within the eBee's autopilot. These sensors acquire data across four highly precise bands, plus each sensor features a global shutter for sharp, undistorted images.

Example applications: biomass indication, leaf area indexing, nitrogen recommendation, phenology and many more.
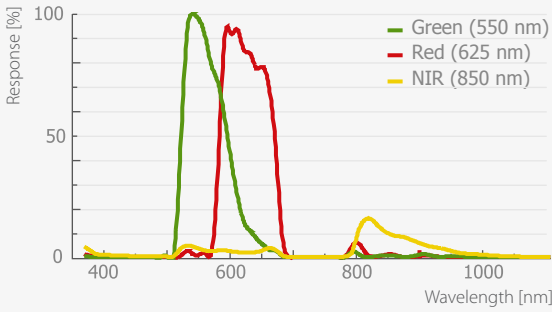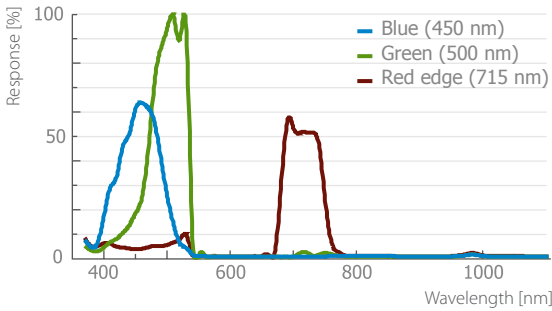
# S110 RGB

**Optional**

This customised 12 MP camera is electronically integrated within the eBee's autopilot. The **S110 RGB** acquires regular image data in the visible spectrum, plus its exposure parameters can be set manually and its RAW files are fully supported by the eBee Ag's software.

Example applications: real colour 2D and 3D visual rendering, chlorophyll indication, drainage evaluation.

**Response [%]**

100
50
0

400    600    800    1000

Wavelength [nm]

— Green (550 nm)
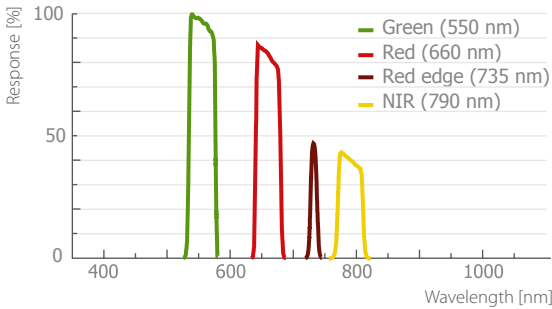— Red (625 nm)
— NIR (850 nm)

## High resolution NIR images

The **S110 NIR** provides Green, Red and NIR band data, allowing vegetation indices to be computed at a high-grained resolution. NIR data for example is used by indices such as NDVI to assess biomass and plant health, commonly indicated by high levels of reflectance in the NIR region.

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**Response [%]**

100
50
0

400    600    800    1000

Wavelength [nm]

— Blue (450 nm)
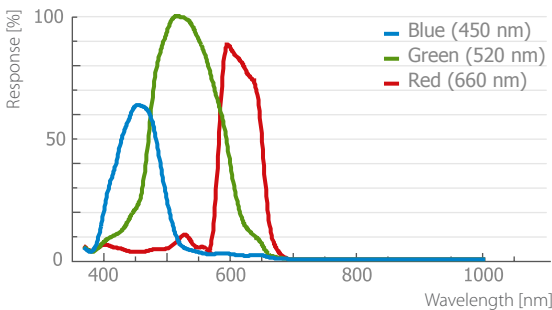— Green (500 nm)
— Red edge (715 nm)

## High resolution red-edge images

The **S110 RE** provides Blue, Green and Red-edge band data, allowing vegetation indices to be calculated at a fine-grained resolution. Red-edge data is used by various indices to evaluate plant stress and chlorophyll concentration, indicated by the shift in a plant's transition from low to high spectral reflectance.

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**Response [%]**

100
50
0

400    600    800    1000

Wavelength [nm]

— Green (550 nm)
— Red (660 nm)
— Red edge (735 nm)
— NIR (790 nm)

## Ultra precise 4-band accuracy

The **multiSPEC 4C** provides image data across four highly precise bands - Green, Red, Red-edge and NIR - with no spectral overlap. In addition, its upward-facing irradiance sensor automatically compensates for sunlight variations, resulting in unparalleled reflectance measurement accuracy.

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**Response [%]**

100
50
0

400    600    800    1000

Wavelength [nm]

— Blue (450 nm)
— Green (520 nm)
— Red (660 nm)

## High resolution RGB images

The **S110 RGB** provides standard Green, Red and Blue band data. This can complement data acquired by the cameras above with visual real colour renderings.

# A reliable platform

**Very light & hand-launched**
Easy take-off and landing

**Autopilot & artificial intelligence**
Automonous flight and landing

**Accurate & efficient**
Up to 1,000 ha (2,470 ac) in a single flight

**Modular design**
Easy to transport

**Automatic safety procedures**
Intelligent failsafe behaviours

**Ground distance sensing & linear landing**
High-speed optical sensor and lens

**Electric**
Low noise, zero pollution

**Oblique imagery**
Up to 50° inclination

# Technical specifications

## Hardware

| | |
|---|---|
| Weight (inc. camera) | 0.7 kg (1.5 lb) |
| Wingspan | 96 cm (38 in) |
| Material | EPP foam, carbon structure & composite parts |
| Propulsion | electric pusher propeller, 160 W brushless DC motor |
| Battery | 11.1 V, 2100 mAh |
| Camera (default) | 12 MP S110 NIR |
| Cameras (optional) | 12 MP S110 RE, multiSPEC 4C, 12 MP S110 RGB |
| Carry case dimensions | 55 x 45 x 25 cm (21.6 x 17.7 x 9.8 in) |

## Operation

| | |
|---|---|
| Maximum flight time | 45 minutes |
| Cruising speed | 36-57 km/h (10-16 m/s) |
| Radio link range | up to 3 km (1.86 miles) |
| Maximum coverage (single flight) | 1,000 ha (2,470 ac) |
| Ground sampling distance (GSD) | down to 2 cm (0.78 in) |
| Orthomosaic accuracy | down to 3 cm (1.18 in) |
| Digital Elevation Model (DEM) accuracy | down to 5 cm (1.96 in) |
| Multi-drone operation | yes (inc. mid-air collision avoidance) |
| 3D flight planning | yes |

# Package contents

- eBee Ag foam body (inc. all electronics & built-in autopilot)
- Pair of detachable wings
- 12 MP S110 NIR still camera (inc. 16 GB SD card, battery, USB cable & charger)
- 2.4 GHz USB radio modem for data link (inc. USB cable)
- Two Lithium-Polymer battery packs & charger
- Spare propeller
- Carry case with foam protection
- Remote control & accessories (for safety pilots)
- User manual
- Fully featured software included

# Intuitive planning & control software
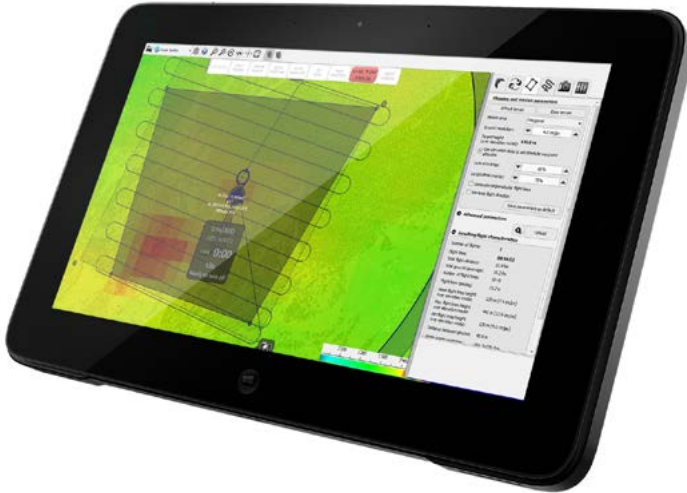


**eMotion 2**
senseFly

Quick to learn and easy to use, **senseFly's** intuitive **eMotion 2** ground station software lets you plan, simulate, monitor and control the trajectory of the **eBee Ag** both before and during flight.

**1 Plan:** Simply draw a polygon over the area of interest, then define the required ground resolution and image overlap. **eMotion 2** will automatically generate a 3D flight plan showing the **eBee Ag's** projected trajectory.

**2 Simulate:** Run a virtual flight that simulates wind strength and direction. Then, if necessary, update your flight plan and save it for future use.

**3 Monitor:** Once launched, view the **eBee Ag's** flight parameters, battery level and image acquisition progress in real time.

**4 Control:** Made a mistake with your planning? Reprogram your drone's flight plan and landing point while in flight.

Once the **eBee Ag** has landed, **eMotion's** automated data management window allows image geotagging and the recording of flight parameters. (S110 RAW images are pre-processed during geotagging to prepare these for index computation. **multiSPEC 4C** images are automatically geotagged.)

# Professional mapping & index calculation software



**Postflight
Terra 3D**
*Powered by Pix4D*
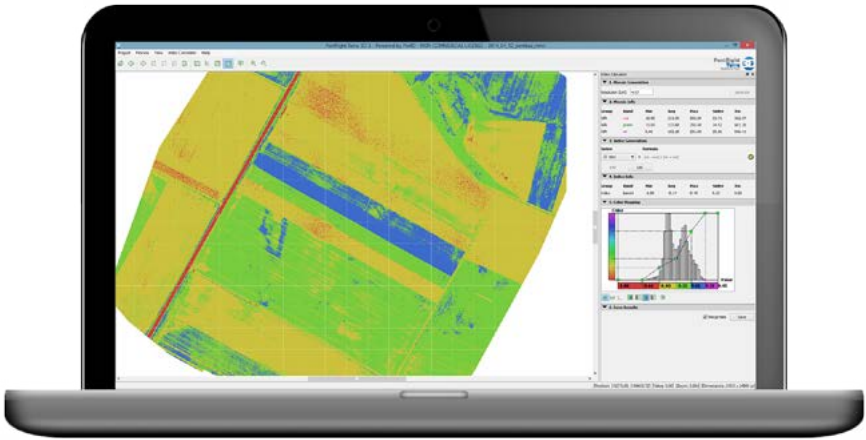
**Postflight Terra 3D** is a professional photogrammetry program that runs on your desktop computer or laptop. It is used to process aerial imagery into 2D maps and 3D models, with centimetre accuracy, in just a couple of clicks.

- **Postflight Terra 3D** features an index computation tab. Select a band from your S110 or multiSPEC camera and automatically compute NDVI, or input custom formulas to create the exact map you require. Customizable colour mapping enables you to clearly highlight the values of most interest.

- Generate false-colour geo-referenced orthomosaics & 3D models for visual analysis or further custom processing.

- Create quick orthomosaics in the field at 25% original image resolution to check image overlaps before full processing. This fast processing option is also useful for more precise flight planning in **eMotion 2**.

*eMotion2 and Postflight Terra 3D are supplied as free downloads with every eBee Ag purchase.*

# senseFly

## a Parrot company

More info at: www.sensefly.com

**Where can you buy your eBee Ag?** Find your nearest reseller at www.sensefly.com/about/where-to-buy or use the QR code on the left.

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Switzerland

 Swiss made

**About senseFly:** senseFly designs, assembles and markets autonomous mini-drones and related software solutions for civil professional applications such as precision agriculture, land surveying, construction, environmental conservation and more.

## Parrot

**A Parrot company:** In summer 2012 senseFly joined the Parrot group.

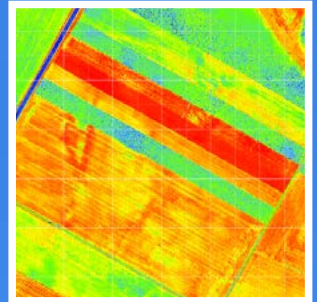# eBee applications for precision agriculture
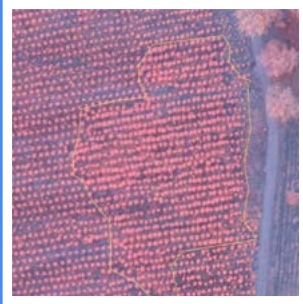


**Nitrogen recommendation**



**Tree classification**



**Weed detection**



**Plant counting**



**Relative biomass estimation**

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