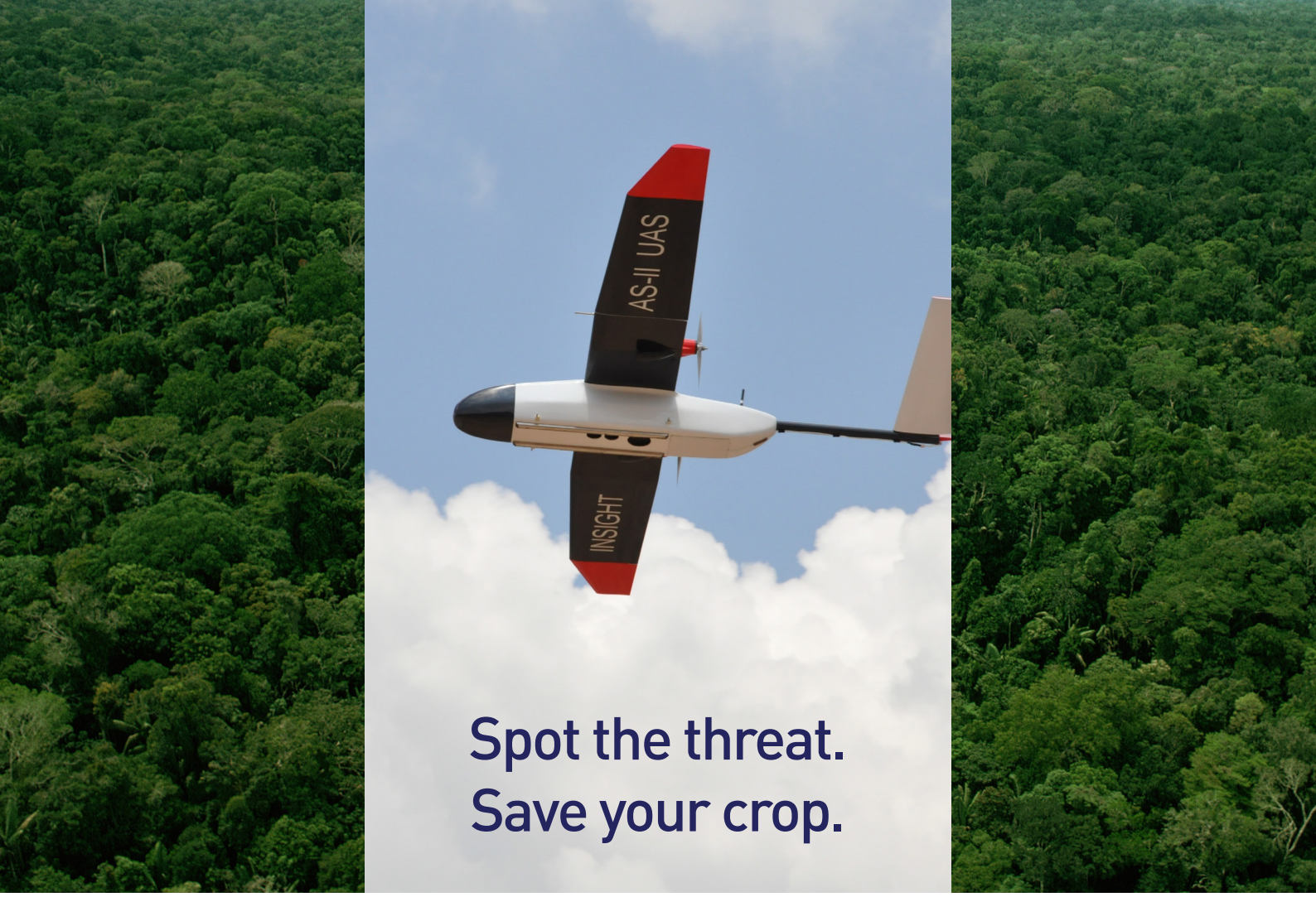


Spot the threat.
Save your crop.

Automation. Intelligence. Insight.

THE WORLD'S MOST INTELLIGENT, PRECISE, AND COST-EFFECTIVE AERIAL SURVEY AND INSIGHT SOLUTION FOR **PLANTATION MANAGEMENT**

INSIGHT ROBOTICS

Saving the world bit by bit, grid by grid.

Damage to your valuable business can quickly escalate in intensity from hard-to-detect sources such as pest infestations, plant disease, and drought.

Palm, timber, and rubber crops are vital to the world economy. Yet they are extremely difficult to access for monitoring. Estate owners struggle to prevent deadly disease and pest infestations, drainage damage, and other problems.

Operating costs and risk of disaster to plantation crops can be reduced through effective monitoring and early detection.

Aerial surveys and data collection are optimal for this application, but they have been too unwieldy and expensive to deploy widely – until now.

Insight Robotics has developed the most precise, easy-to-use, intelligent, and cost-effective aerial imaging solution on the market today. Our aerial survey and insight solution consists of an unmanned aerial vehicle (UAV) equipped with specialised sensors to provide high-resolution terrain mapping and crop assessments with precision and efficiency. These analyses give land managers the insights to fine-tune growing conditions in a matter of hours instead of days.

Insight Robotics' Aerial Crop Health Management System is specially designed to address the needs of plantation companies for monitoring the health of their crops. It has been developed based on industry best practices in cooperation with leading producers in Southeast Asia.

The aerial survey and mapping system provides management with timely and accurate risk-related information about their plantation such as terrain information, crop health, insecticide coverage/effects, drainage issues, etc.

Our autonomous aerial survey solution accesses hard to reach areas, bringing back key crop health information in hours instead of days.

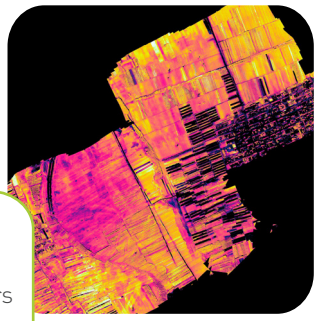
BENEFITS

Our agricultural aerial survey solution is specifically tailored to meet the demands of clients managing agricultural land areas between 1,000 and 30,000 hectares, with a larger payload, higher and longer flight times, and high-definition sensors required for this type of aerial surveillance in large, hard-to-access oil palm and similar plantation areas.

The Aerial Crop Health Management System uses a fixed-wing unmanned aerial vehicle with a sensor package sized to meet the demands of hard-to-access sites covering significant areas. The following diagram illustrates its key features and benefits:

Efficient gliding fixed-wing to improve cruising time (2 hours)

Industry-leading precise visible light sensor to image with 5 cm per pixel Ground Sample Distance (GSD)



Durable carbon-fibre skeleton to reduce maintenance needs

Flexible 2.5kg usable payload to run two sensors for data consistency

Secure wireless connectivity to ensure safe, continuous operations

Optional parachute landing to adapt with rugged, changing conditions

Additional multispectral sensor to simultaneously produce vegetation index

Stablising V-tail to assure robustness in adverse weather

SYSTEM COMPONENTS

The integration of these components is what makes it so precise, powerful, and cost-effective for aerial surveying:

AUTONOMOUS GROUND CONTROL SYSTEM

The Ground Control System consists of a powerful laptop with a flight path pre-programmed using sophisticated computer algorithms. Manual control is unnecessary (except on occasion for take-off, belly landing, or emergency situations).

ADVANCED AIRFRAME

The UAV airframe can be landed on its belly or by firing a parachute. The airframe is also highly aerodynamic. With a 10:1 glide ratio, the UAV is very efficient, providing low operating costs and high endurance levels. The removable V-tail means that it can be easily transported, allowing for fast turnaround times.

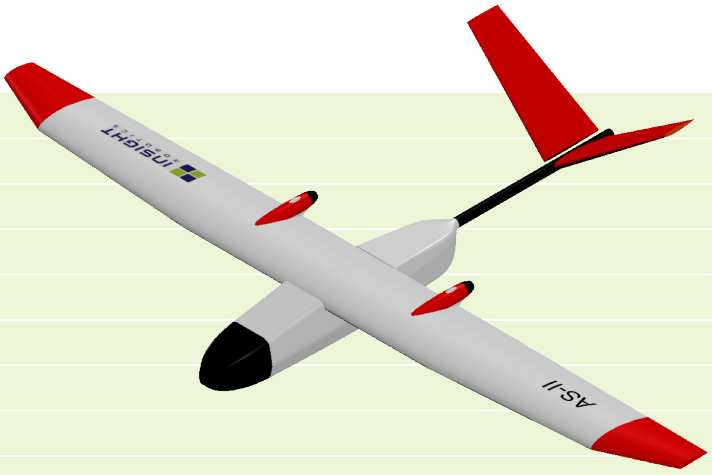
SIMULTANEOUS MULTI-SENSOR OUTPUT

With a tailored payload specification, two sensors can work side-by-side during a single flight. These sensors include a digital single lens reflex (DSLR) camera and a modified compact digital camera. Both cameras have removable infrared filters, which can be used to block certain light spectrums suitable for multispectral images for NDVI or calculations of other vegetation indices.

RAPID IMAGE PROCESSING

Insight Robotics' cutting-edge image processing techniques mean that outputs can be produced and delivered in five hours or less.

SPECIFICATIONS

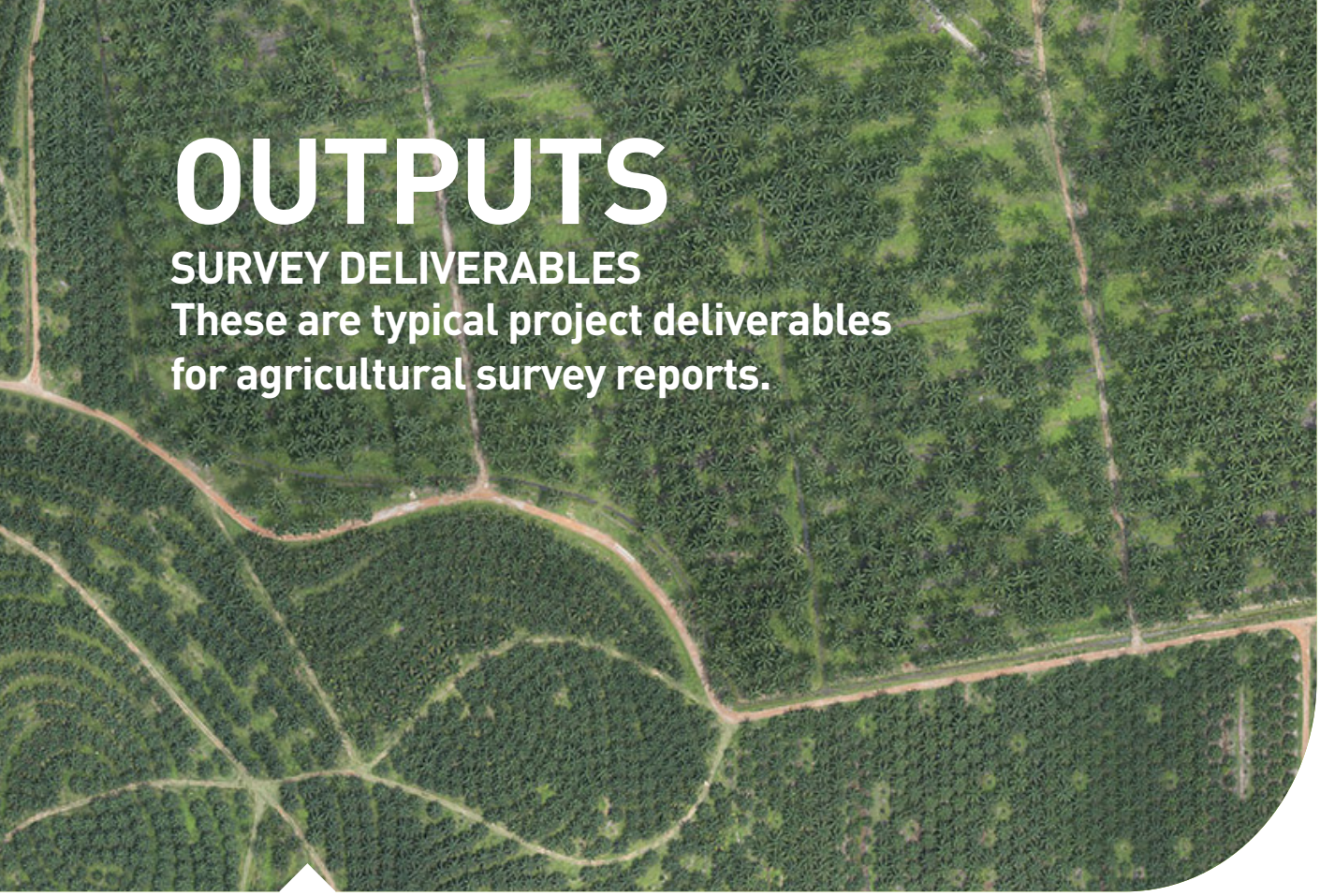


Length	2 m
Wing Span	3.3 m
Max. Flight Ceiling	3000 m
Max. Distance	180 km
Speed Range	50 - 140 km/h
Cruise Speed	90 km/h
Takeoff Speed	40 km/h
Flight Time	2 hours
Effective Payload	2.5 kg
Total Take-off Weight	< 20 kg with Full Payload
Wind Resistance	12 m/s
Take-off and Landing	Pneumatic launcher / belly landing / parachute
Productivity	2000 ha in one flight with 5cm GSD

AERIAL SURVEY WORKFLOW

There are several stages involved in collecting and analysing aerial imaging data. The following table briefly introduces each stage of pre-flight, flight-day, and post-flight activity.

	Insight Robotics Team Activity	Client Activity
Assessment	Set survey objectives. Develop specific questions for analysis.	Provide background information such as site coordinates, historical concerns, etc.
Flight Planning	Develop comprehensive flight plan and submit to regulatory body for approval.	Provide relevant documentation to support regulatory submission.
Flight Day Preparations	Set out ground control points on site.	Allow Insight Robotics flight team access to site.
Flight Day Data Acquisition	Two Insight Robotics pilots launch the UAV and supervise the flight. After the flight, the data is checked for quality.	Optional attendance at flight day, subject to safety requirements.
Processing	Raw images are pre-processed into an orthophoto. Computational analysis is then undertaken to develop digital terrain and elevation models. Analysis of models is used to produce an assessment report.	Prepare IT equipment (PCs, tablets, etc.) to access models. Assure Internet connection of sufficient bandwidth.
Deliverables	Issue assessment report and digital files including: orthophoto, terrain model, and NDVI calculations (see details next page).	Attend meeting to discuss survey results.



OUTPUTS

SURVEY DELIVERABLES

These are typical project deliverables for agricultural survey reports.

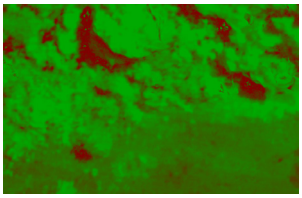
Raw images – High resolution images at down to 1 cm per pixel show colour, texture, and shading.

DOM – (**Digital Orthophoto Model**) Images taken by aerial survey system are put in a mosaic to form one enlarged image of the surveillance area. This is known as an orthophoto or DOM. DOM gives plantation managers a 2D map to quickly visualise their assets with accurate point coordinates.

DEM – A **Digital Elevation Model** is created from the geographic and topographic information gathered from the ground control units combined to form one large 3D wireframe or mesh. This is the building block for 3D models.

DSM – The **Digital Surface Model** is a 3D model of the surveyed area with the orthophoto super-imposed. The use of ground control points provides accuracy in xyz coordinates. Accurate coordinates permit precise mapping of assets upon which to base ownership rights and valuations.

DTM – A **Digital Terrain Model** is created by removing the above-ground details of the DSM such as buildings and trees, where only the terrain remains. Understanding the terrain enables plantation managers to make drainage plans based on a complete and timely terrain map.



NDVI – A **Normalised Difference Vegetation Index** is a graphical image representing the level of photosynthetic activity by the vegetation. The lighter the shade on the NDVI image, the higher the level of photosynthetic activity. Plantation managers can analyse crops based on photosynthesis levels to see cases of poor health and take action before the situation escalates:

- poor irrigation
- lack of magnesium in soil
- worms or insects
- disease

ABOUT INSIGHT ROBOTICS

Expensive and deadly risk can be mitigated through early detection. Insight Robotics safeguards industry's natural resources and infrastructure with intelligent early-warning threat detection.

Insight Robotics is an award-winning technology company whose mission is to make the world a better, safer place to live. We develop automated technology and services to give industry data-driven insights to quantify their risks and plan accordingly.

Data collected through robots and sensors are presented as early-stage intelligence through our GIS platform so that stakeholders can intuitively assess their risk and respond based on real-time data. Timely intelligence mitigates risks and protects their resources and infrastructure, thus containing dangerous or costly situations before they can escalate.

The Insight Robotics advantage is based on getting decision-making personnel the actionable information they need to prevent disasters through our:

- Proprietary geospatial intelligence platform that displays real-time data alongside trend analysis, enabling users to leverage key insights in real time.
- Industry-leading disruptive robotics technology that makes industrial GIS applications affordable and easy to use.
- Groundbreaking use of sensor technology for advanced data collection and analysis to give new levels of insight.

Patents pending for Insight Globe, the core processor of our intelligent survey and mapping systems. Insight Globe's geospatial algorithms combines 2D imaging to make a 3D map with pinpoint coordinates and push real-time incident location reports to moderators via mobile, PC, or tablet.

INSIGHT ROBOTICS

INSIGHT ROBOTICS LIMITED
1507-1510 Laford Centre
838 Lai Chi Kok Road
Cheung Sha Wan, KLN, Hong Kong
Tel: +852 2325 2777
Fax: +852 2325 3777
Email: info@insightrobotics.com

www.insightrobotics.com