



 **DRONES IN LOGISTICS**  
**More than just delivery!**

## Drones in Logistics

There have been several high-profile European drone trials for customer delivery, and in some parts of the world these are now in regular use transporting healthcare supplies. This is only part of a drone's capabilities – they have the potential to offer significant safety, efficiency, cost and accuracy benefits in the supply chain both inside and outside the warehouse.

### **Benefits**

- 🔥 **Efficiency** – speed of drones vs. MHE movements
- 🔥 **Capability** – can reach areas within the warehouse or remote communities that are difficult to reach by other means more quickly
- 🔥 **Safety** – reducing the need for personnel working at height – 80 major injuries per year due to working at height
- 🔥 **Financial** – drone costs can be lower than MHE required for surveying or counting
- 🔥 **Accuracy** – drones can electronically capture data (e.g. barcode, mapping) and integrate directly into existing systems
- 🔥 **Environment** – often drones are battery powered and have zero emissions at the point of use

### **UK challenges**

- 🔥 Need visual line of sight (VLOS) for effective & safe control (unless CAA agrees experimentation corridor)
- 🔥 Developing CAA regulatory environment for drone airworthiness certification & operations
- 🔥 Presence of people, fixed structures and moving vehicles requiring obstacle sensing & safe avoidance
- 🔥 A drone's configuration & design will constrain its payload which will limit its capabilities

Additional challenges with flying outside the warehouse

- 🔥 UK airspace is already busy
- 🔥 Observers will be needed for extended- and beyond-VLOS operations
- 🔥 Performance and flying characteristics affected by wind & weather
- 🔥 Drones not yet integrated into UK air traffic management/control
- 🔥 Need to sense and avoid other air traffic

### **Safety and regulation**

For internal operations where the risk is to the drone operators, and company staff and property, the requirements are likely to be set by the insurer. These requirements could be the satisfaction of product safety rules (e.g. CE marking or similar), and HSE requirements for safe equipment, operator training & safe operation of equipment.

The difference between internal and external drone use is the exposure of uninvolved persons to any unmitigated safety risks of aircraft design or operation, i.e. crash leading to loss of life, injury and/or damage to property. This is when civil aviation bodies, such as the CAA, will require compliance with aircraft airworthiness and operations regulations.

## Drones in Logistics

Previously a commercial drone operator required a pilot and owner/drone registration (Flyer and Operator Ids) and a Permission for Commercial Operation (PfCO). The system transitioned late last year to a Certificate of Competence (CoC) and the General VLOS Certificate (GVC), with an Operational Authorisation issued after a practical flying test and predefined risk assessment for the intended flying task.

The circumstances for which regulation compliance is simplest will likely be for light weight and small drones operated internally (where the risk to uninvolved persons is eliminated) or externally (where the risk to uninvolved persons can be controlled), separated from other air traffic, away from manned aircraft operating sites and below 400ft.

### **Current uses of drone in Logistics**

- 🔥 Marketing photography (teams, operations & buildings)
- 🔥 Inventory counting/checking
  - DroneScan integrated to WCS CSnx WMS trialled at Musgrave, Ireland
  - Flytbase have autonomous drone system at IAG Cargo, Madrid with wireless charging
  - InventAIRy XL by Doks, which includes a ground based AGV with a drone tethered via a charging cable
  - Audi vehicle location at Neckarsulm, Germany
- 🔥 Medical supply to islands and remote areas
  - Windracers' Isle of Wight trial
  - Skyports in the Scottish Highlands
  - Zipline in Africa
  - Wingcopter in Malawi, Vanuatu & Ireland
- 🔥 Commercial & customer delivery of small packages
  - Amazon trial Cambridge, UK
  - Wingcopter, Germany

### **Potential additional Logistics uses**

- 🔥 Civil airliner Maintenance, Repair & Overhaul organisations (MROs) are using drones to survey aircraft condition during scheduled maintenance. These techniques could be applied for racking and automation equipment surveys.
- 🔥 Drones are currently used for building and land surveying, and these technologies and operational techniques could be expanded to Logistics for building surveys (e.g. internal/external, structure, solar panels, bulk liquid storage, etc).
- 🔥 Aerial video of operational yards and warehouses to enable analysis of people, machine & stock movements for optimisation, congestion relief, etc.
- 🔥 Stock condition and warehouse perimeter security checks

## Drones in Logistics

### Logistics research and development

- Consolidated delivery, transporting multiple, larger items, e.g. SF Express (China), Volocopter, Wingcopter/UPS, etc.
- Flying warehouses with delivery drones – Amazon airborne fulfilment centre (patented 2016)
- Passenger transport/air taxi – e.g. Vertical Aerospace, Lilium, Airbus, Boeing, Wisk, Joby, etc.

### Logistics Partners research and development

For the last year we have been evaluating drone solutions focussing on drone operations inside the warehouse, including stock checking and racking/lighting/automation inspection. We have found various solutions on the market, but most of them are still being trialled or piloted status warehouses. We have been unable to find an existing solution that we could view operational in a UK warehouse yet, although we have seen remote or video demonstrations of two solutions. These solutions utilise a mix of cameras and scanners to read barcodes and have various solutions for charging or powering the drone.

Using our aircraft, systems and software development skills in conjunction with our Logistics experience Logistics Partners has developed and flight tested several prototype drones for use within the warehouse. We have worked Masters Logistical Services Ltd to test these prototypes in an operational warehouse and distribution environment. Masters Logistical provide a wide range of 3<sup>rd</sup>-Party Logistic solutions to customers, offering a complete warehousing and distribution service from their base near Ely, Cambridgeshire. Masters Logistical understand the benefits that technology can bring to improve the service they can offer their customers. And by working together means that the drone system is being developed and rigorously tested in a real-world environment.

So far, initial tests of our prototypes have shown:

- Drones can successfully capture barcodes on pallets ready for comparison with Warehouse Management Systems
- We have demonstrated that piloted drones are capable of safe and easy flight inside the warehouse
- Drones can facilitate a stock check without the need for personnel lifting equipment improving the health & safety, accuracy and efficiency of the count

There are several challenges that any solution needs to overcome:

- A drone system needs to be able to cope with the variety, quality and positioning of barcode labels on pallets in a Third-Party Logistics warehouse
- Lighting levels can affect the reading of barcodes
- Inventory counts can be limited by drone battery life, but there are a number of viable solutions to this
- Off the shelf drones appear to be robust enough for the warehouse environment

## **Drones in Logistics**

The R&D project is ongoing, but Logistics Partners hopes to become the leading consultancy for the use of drone technology in warehouses. It's also in discussion with other drone solution providers to support their solutions.

### **Conclusions**

There is lots of investment and research into product engineering development & operational uses. But the larger drones will all require regulatory compliance and infrastructure changes broadly similar to current small transport aircraft requirements before they become widespread in the UK.

The quick wins with relatively fast ROI and H&S gains for inventory control and warehouse & equipment inspection means that 2021 could be the year that drone technology becomes a reality to warehousing and distribution operations at all scales.

### **Authors**

#### **Eur Ing Kieron Parnell CEng MSc BEng MRAeS SFTE**

Kieron has a wealth of aircraft design, development, Test & Evaluation (T&E) and certification experience on UK, European and US military manned and unmanned aircraft, gained over the last 30 years.

#### **Lynn Parnell FCILT**

Lynn has 30 years Logistics experience including technical and operational roles within Supply Chain. In 2000 she formed Logistics Partners Consultancy Ltd, specialising in Logistics software and technology projects. Lynn is an Ambassador for Transaid.

#### **Logistics Partners Consultancy Ltd**

Logistics Partners Consultancy Limited is currently celebrating 20 years of providing independent advice on technology in Logistics. Since Lynn Parnell founded the company it has assisted customers select and implement numerous warehouse management, transport management and delivery management solutions, using RF, voice and tablet technology.

Kieron Parnell joined the business in 2019 bringing extensive skills in aerospace engineering, including aerodynamics, avionics systems, flight test & evaluation, and certification for both large manned and small unmanned aircraft. With this mix of skills Logistics Partners has this year been researching the benefits drone technology could bring to the Supply Chain.

## **Company information**

- Logistics Partners Consultancy Limited
- Registered in England and Wales - Company Number 11887221
- Registered Address: 181 Wisbech Road, Littleport, ELY, CB6 1RA

## **Author contact information**

If you have any questions regarding this report, please contact:

- Lynn Parnell
- Tel: 07771 623 929
- Email: [lynn@logisticspartners.co.uk](mailto:lynn@logisticspartners.co.uk)
  
- Kieron Parnell
- Tel: 07766 168 368
- Email: [kieron@logisticspartners.co.uk](mailto:kieron@logisticspartners.co.uk)