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2020 **GUIDE** INVENTORY COUNTS USING DRONES



2020 Guide to Deploy Fully Autonomous Drones for Inventory Management in Warehouses, Distribution Centers, 3PL Sites & Air Cargo Facilities

As we bid adieu to 2019 and welcome the coming leap year, it's an opportune moment to highlight the trend in which supply chain automation is headed during the year MMXX. Automation is an inexorable trend across industries, markets, and geographies - driven by labor shortages, global competition, and technology innovation. Robots are becoming prevalent in factories as well as offices, warehouses as well as homes, airports as well as highways. The logistics and supply chain industry is a leading adopter of autonomous technologies - thanks to e-commerce. Market projections for automation solutions range from tens of billions to hundreds of billions in the coming decade - with large corporations as well as nascent startups vying for a piece of the supply chain automation pie.

Autonomy Trends in Logistics & Supply Chain

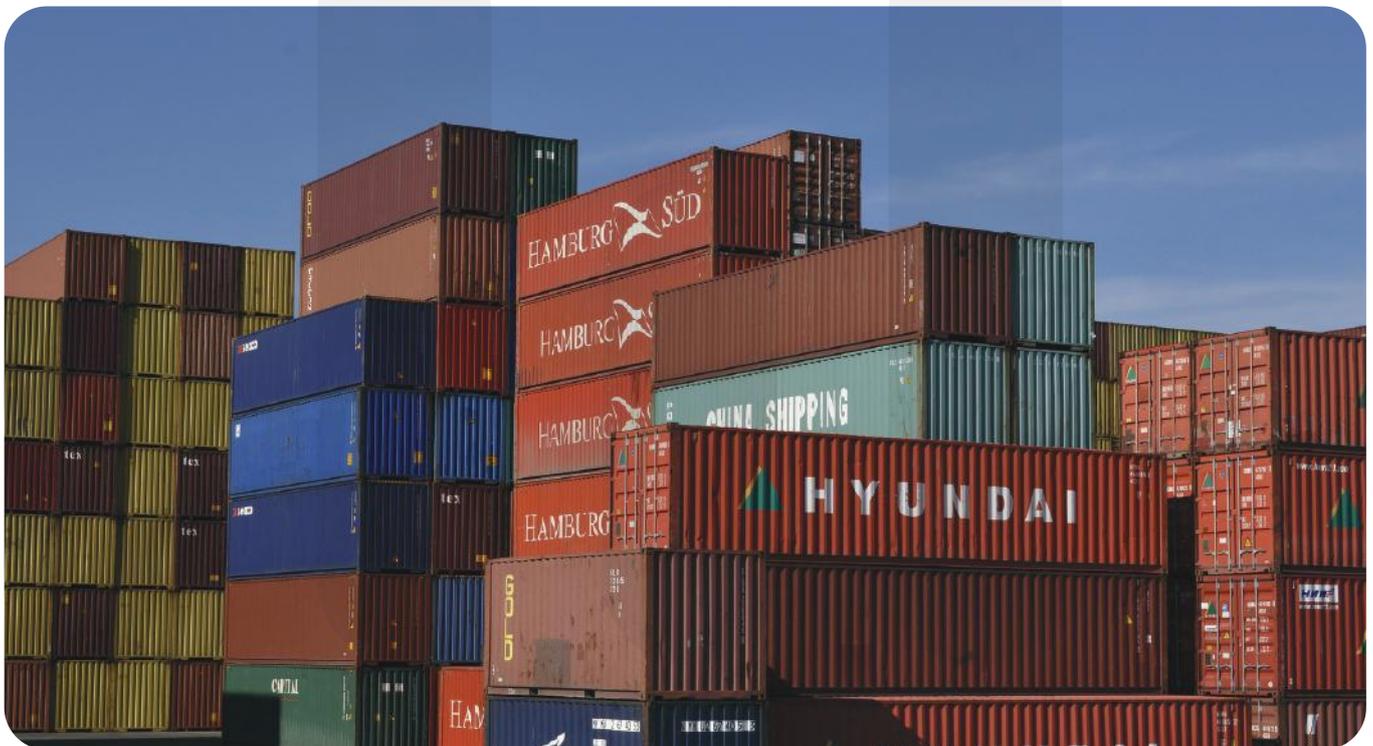
The degree of autonomy is turning out to be the key consideration in logistics and supply chain use-cases, since every manual involvement adds to the cost, safety risk, and performance uncertainty. Whether it is fully autonomous container trucks that use highways alongside manually-driven cars, or human-operated forklifts working alongside fully autonomous drones in warehouses - the higher the degree of autonomy, the greater the business value realized from automation.



Of course, capital expenditures play a crucial role in this trend – unless businesses can justify the payback period, internal rate of return and return on investment, end-to-end automation will remain a distant dream. Regulation adds a further level of complexity – flying unmanned aerial vehicles over neighborhoods for delivering packages over the last mile will take years, if not decades, because of stringent regulation – in light of security and privacy concerns.

Logistics & Supply Chain Technology Trends

Industry 4.0, Industrial Internet-of-Things ('IIoT') and similar phrases have rapidly entered common parlance, even in the supply chain industry. Underneath these concepts lie the actual technologies that promise to make things automatic, safe, cost-effective, highly scalable, real-time, mass customizable and so on.



Below are examples of some such technologies and how they are being leveraged by logistics and supply chain businesses:

- Automated ground vehicles (AGVs) that bring goods to warehouse associates in fulfillment centers, thus enable same-day delivery of online purchases,
- Artificial intelligence (AI) and machine learning (ML) techniques that enable rapid, accurate analysis – as well as a prediction – of consumer buying behavior and trends, and thus help optimize warehouse inventory,

- Computer vision systems that help identify defects in manufacturing parts, in real-time, to address quality issues proactively,
- Image & video analytics for object, facial and other recognition which in turn enables use-cases such as yard management, theft prevention, and perimeter security,
- Pervasive sensors that help create highly accurate digital twins of logistics infrastructure and thus make preventive maintenance truly possible,
- Robots that not only assemble parts with high precision, but also independently conduct all material handling activities, and,
- Unmanned aerial vehicles (UAVs i.e. drones) that deliver goods, monitor logistics facilities, scan inventory and much more.

Drones & Supply Chain Trends in 2020: Information You Need To Know

The past year has seen numerous announcements from the likes of Amazon, Google, UPS and FedEx on their drone-based supply chain offerings - primarily focused on package delivery. Via proof-of-concept projects and extensive pilot programs, these offerings have been developed, tested and refined for broad adoption - not only from the technology and regulation requirements but also from commercial and public acceptance points of view.

The FAA, via its integrated pilot programs, continues to be a key enabler of the commercial drone industry - not only in the US, but also as a thought-leader for other countries keen on developing this sector. The logistics and supply chain industry is a natural fit for drone adoption and automation; utilisation of space (i.e. the third dimension) opens up innumerable use-cases that heretofore couldn't be explored due to being limited to ground transport - indoors and in the last mile.

As UAV regulations slowly, but surely, enable drones to fly over crowds, at night and beyond the visual line of sight (BVLOS), the logistics sector will benefit immensely from being able to substitute fully autonomous drones for manually-operated vehicles. This progress in regulation will be matched by advances in drone hardware (eg. battery life, reliability, stability) and intelligent automation software (eg. navigation, perception, recognition).

Supply Chain Software – Intelligent Automation using Drones

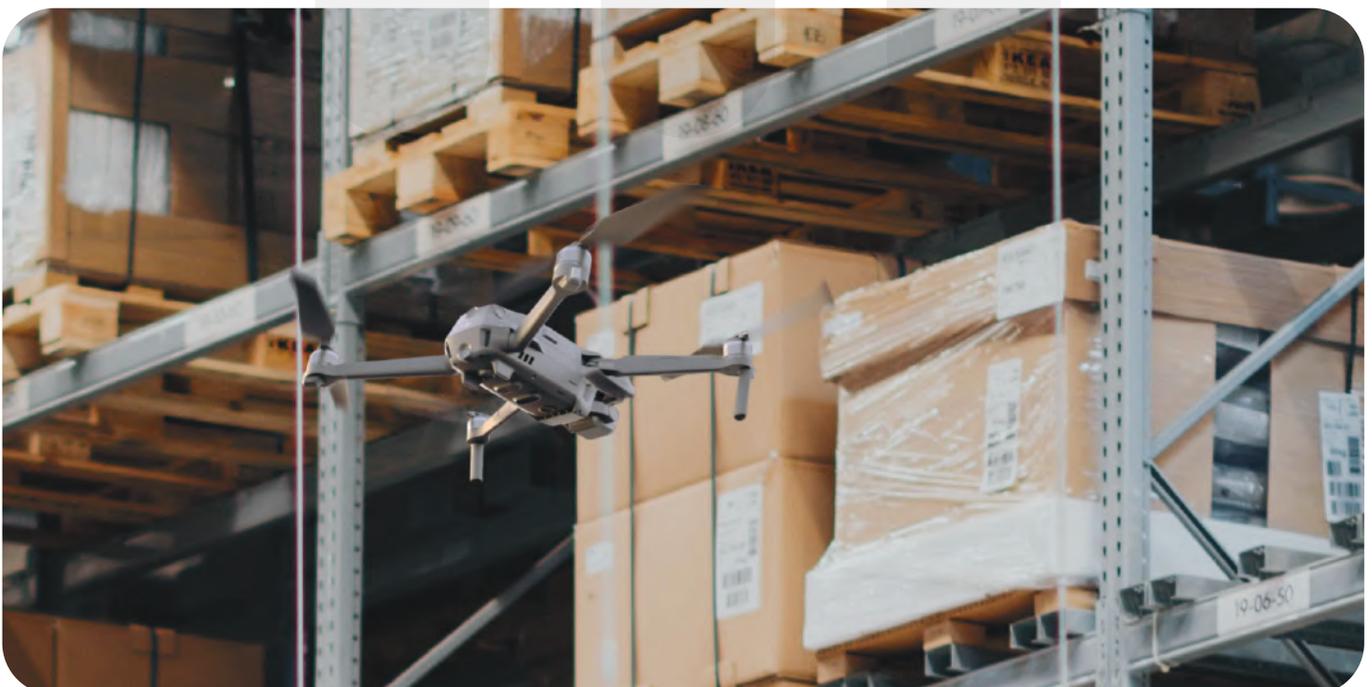
Software for drone automation is expected to follow the same trend as we have seen in the (much broader) personal computer and smartphone industries. Commoditization of hardware will be

the central theme - across components ranging from computing and communication to batteries and airframes. Value will steadily migrate up the technology stack, from hardware to software; and within the software, from operating systems and middleware to high-level applications, analytics and cloud-based collaboration.

The commercial drone industry has witnessed this trend since 2018, with vendors of custom drone hardware biting the dust and/or pivoting to software-led solutions, and the emergence of global competitors who have driven down hardware prices, while maintaining (or even improving) the performance-safety-reliability specifications of such hardware. The ability to build intelligent automation software that is hardware-agnostic, cloud-connected and API-driven is emerging as the competitive edge for enterprise drone automation, in general - and for the logistics automation use-case, in particular.

Supply Chain Strategy for Indoor Drone Adoption

Most of the media and public attention, when it comes to supply chain drones, has been on last-mile package delivery. The appeal of getting your pizza delivered via an autonomous drone, within minutes at your doorstep/rooftop, is undeniable. Yet, we rarely see drones flying around our homes, offices, factories, highways or airports - anywhere in the world! Regulation and battery technology are, of course, the root causes; exponential growth of commercial drone adoption across supply chains will require large, sustained advances on both these fronts.



However, in the interim, there is a highly compelling business opportunity for drones in logistics – that of indoor use of fleets of such fully autonomous drones, zipping and zagging around large warehouses, distribution centers, air cargo facilities and third-party logistics sites.

By shifting the focus from regulatory obstacles to technology capabilities and business value, stakeholders in the commercial drone industry are rapidly building solutions for indoor use-cases such as:

- Scanning front-facing barcodes on one-deep pallets stored in racks across hundreds of thousands of square feet in a typical large warehouse,
- Collecting top (aerial) views of bulk storage in multi-million square foot DCs that store air cargo, large appliances, heavy goods or chemical drums,
- Inspecting rooftops and perimeters aerially – and proactively detecting corrosion, intruders and potential threats to logistics facilities,
- Finding a ‘lost’ trailer or container in a very large yard, aerially and automatically, and
- Conducting a variety of audits – rapidly, efficiently, automatically, repeatedly – using video, image and barcode data collected by indoor drones.

Supply Chain Optimization Using Fully Autonomous Drones

Stakeholders at warehouses and DCs tend to have different incentives and priorities when it comes to drone adoption.

Role	Expectations from Warehouse Drone Solutions
Warehouse GM	Minimize the unavailability of aisles due to inventory cycle counts
Head, Continuous Improvement	Improve operational metrics using reliable, scalable technology
VP, Operations	Improve fulfillment metrics and customer satisfaction
Inventory Manager	Increase inventory accuracy via frequent, accurate updation of WMS data
CFO	Maximize space utilization & labor productivity, minimize pilferage & shrinkage
Head, Digital Transformation	Deploy digitization, strategically, for top-line and bottom-line impact
Manager, IT Infrastructure	Ensure data privacy, security, archival and availability
Head, Innovation	Complement in-house R&D efforts with state-of-the-art 3rd party innovation
Systems Integration Consultant	Ensure seamless integration with warehouse management systems
Inventory Auditor	Ensure timely internal audits & availability of reliable data for external audits

While the metrics may thus vary for supply chain optimization, fully autonomous drones can potentially help improve many – or most – of them. We have already seen public announcement of PoC & pilot deployments of aerial inventory scans at warehouses, DCs & air cargo facilities across the world.



The consistent feedback from such early adopters can be summarized as follows:

- Fully (not partly) autonomous drone solutions are required for large-scale adoption of drones for inventory use-cases,
- Cost-effectiveness, frequency and reliability of aerially collected data are the key considerations in supply chain optimization using drones for cycle counts,
- Video & image data that can be archived and shared globally via the cloud is an important advance over traditional barcode scanners, and
- Autonomous drones for inventory are one piece of the overall supply chain automation trend – for them to create sufficient business value, their applicability must rapidly expand to multiple use-cases such as surveillance, security, inspection, and delivery.

Drones in Third Party Logistics (3PL)

Providers of third-party logistics (3PL) services have a unique position in the supply chain automation context – they have to balance their own operational priorities with the service-level agreements (SLAs) that they have in place with their customers. The inherent tension in such arrangements (eg. cost incurred by 3PLs of inventory counts vs. customers' demand for higher frequency counts) makes drone-based automation quite attractive for 3PL sites. In fact, 3PL providers have emerged as the early adopters of aerial inventory counts using fully autonomous drones.



Underlying this increasing drone adoption by 3PLs are the following key factors:

- To rapidly recoup their investments in real estate, warehouse owners/lessees are moving from traditional aisles to very narrow aisles (VNAs), necessitating a more automated approach to inventory operations,
- To mitigate the safety, availability and reliability risks associated with manual inventory operations, managers are piloting a variety of automation solutions ranging from wire-guided lifts/trucks to AGVs and UAVs, and
- To help differentiate themselves from other 3PL providers, CXOs at 3PL realize the need to adopt technology innovation and create value-added services for their customers.

Drones in Air Cargo Facilities

It is ironic that while drone regulations are the most stringent around airports, air cargo facilities have frequently experimented with manually-flown drones - for use-cases such as inspecting runways for cracks, scanning pallet barcodes in rack storage areas, scanning aircraft surfaces as part of maintenance routines, etc. Realizing the potentially large business value from such aerial scans, air cargo and freight forwarding facilities are now deploying autonomous drone solutions - indoors - with inventory counting as the focus.

Given the relatively high frequency of pallet movement, and the wide variety of barcodes in the air cargo context, aerial inventory scans using drone fleets are turning out to be an ideal solution for fast, high-frequent, cost-effective cycle counts. The impact of consumer-driven supply chains is most

felt by such facilities - who have to handle peak shopping seasons, same-day deliveries, high-value items in transit and the exponential growth in global e-commerce.

Witness the recent news from IAG Cargo - the air cargo company that's part of the same group that owns British Airways. In the words of their Head, Innovation - "We expect aerial inventory solutions to help increase worker productivity, improve location accuracy and increase the frequency of inventory counts. The combination of cost-effective hardware and intelligent automation software is turning out to be an ideal solution for automated inventory scans - better than RFID or AGVs. Reliability, scalability, and ease-of-use were the key considerations in our decision to trial aerial inventory scans - we look forward to a production-ready solution that can



Supply Chain Drone Trends in 2020

An apt phrase to capture one of the dominant supply chain automation trends for the year 2020 would be - intelligent, indoor, inventory drones - with emphasis on full autonomy.

Many of the PoC and pilot projects of drones in warehouses and DCs are expected to mature into multi-site production deployments, primarily in the US and Europe - with 3PLs leading the way. Expect to see public news of such successes, including deeper insights into the expected/realized payback periods and business value from investments in drones for warehouse inventory management.

Happy New Year!

The FlytBase team wishes you a Happy New Year & a safe, productive, profitable year 2020. We look forward to supporting your drone projects as you drive the adoption of supply chain automation across your enterprise. Creating value for you, and your customers remains our top priority!

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