Speed is the new Currency.
Increasing costs and demand in the logistics supply chain combined with disruptions can erase half a year's profits for most companies. To build resilience companies can integrate Electric Aircrafts in the "Middle Mile"

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ABSTRACT

The race to shorten click-to-customer cycle time is arguably the single greatest influence[1] on the shape of future omnichannel supply chains. Needless to say, the bar continues to rise for retail and direct-to-consumer brands.
How much does speed matter? research[2] by McKinsey shows that when delivery times are too long, almost half of omnichannel consumers will shop elsewhere. While this drives demand for faster and even same-day delivery, no one would dispute that the COVID-19 pandemic created significant disruption to global supply chains[3]. Nothing like this had happened in decades, and many operators relied on strategies that only partly addressed their challenges coupled with The Russia-Ukraine conflict[4], wider geopolitical implications and renewed COVID-19 lockdowns in China have compounded an already bleak global supply chain situation. Existing restrictions imposed on Russia and the potential for further restrictions continue to impact fuel costs, contributing to the wider supply chain crisis. While freight markets have limited direct exposure to Russia and Ukraine, global logistics will have to contend with an increasing number of risk factors, including restrictions to airspace, uncertainty on the future path of consumer demand and ongoing bottlenecks related to China's COVID-19 response.
Regardless of the disruption and as delivery times compress, the detailed physics of the supply chain becomes increasingly important. Simply put, seconds count. Most fulfillment operations need time to pick and pack deliveries—by itself, that process takes an average of four to eight hours, though best-in-class omnichannel operations can fulfill orders within two hours of customer purchase.
estimate that retailers can provide two-day delivery to 80 percent of the US population by using approximately three distribution centers across their network. However, offering next-day delivery to 80 percent of the United States would require more than eight distribution centers—even more if retailers want to solve for lower parcel expense and density. Indeed, next- or same-day parcel delivery can cost retailers more than $15 per package, which is not tenable for the majority of retailers.
With problems mounting in the complex supply chain which evolves as fast as one click buy and the physical infrastructure inability to adapt in time to realistic costs there's still one hope for a rapid relief.
We are about to experience another period in technology advancement in logistics and transportation termed the Cambrian Explosion. Same as the development of historic period 542 million years ago, when the first more sophisticated animal life appeared on Earth. Prior to the Cambrian explosion, most organisms were simple, composed of individual cells occasionally organized into colonies. Over the following brief - in

[1] https://www.mckinsey.com/industries/retail/our-insights/same-day-delivery-ready-for-takeoff
[2] https://www.mckinsey.com/industries/retail/our-insights/retail-speaks-seven-imperatives-for-the-industry
[3]https://www.mckinsey.com/business-functions/operations/our-insights/supply-chains-to-build-resilience-manage-proactively
[4] https://www.jpmorgan.com/insights/research/russia-ukraine-crisis-market-impact

geological terms - period of 70 to 80 million years, the rate of diversification accelerated by an order of magnitude and the diversity of life began to resemble that of today.[5]

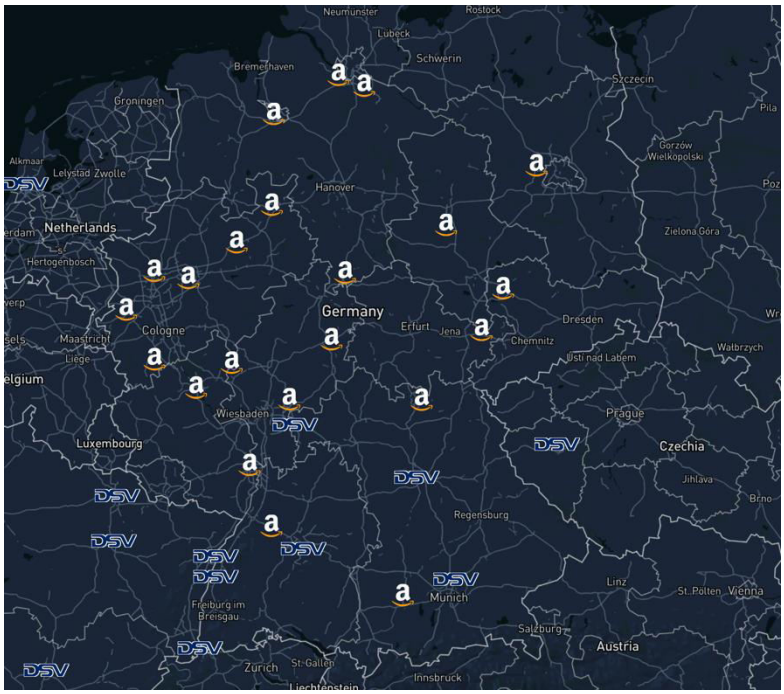
The Cambrian explosion and the technology companies explosion are basically the same thing, In technology, the evolution from the PC as the center of gravity, to mobile and then the IoT is quickening to the point where we will leap from billions of deployed IoT devices today to 1 trillion devices by 2035. The devices will transform healthcare, infrastructure and the way data is channeled and used to improve lives.

Same is the case for transportation of cargo and people in the 3rd dimension is to be witnessed in this article and in the very near future, the – Advanced Air Mobility "AAM". At the heart of the AAM[6] concept vision are next-generation aircraft allowing direct access to urban, suburban, and most easily to rural areas using non-traditional airports. First Matured by common camera quadcopters - Electric propulsion is the enabler of new aircraft designs which are built to solve transportation challenges and inefficiencies which have reached Plato in improvements. Those new types of aircrafts resembling "flying cars" because they share more features with a car than an airplane, we will witness a new network – an evolution oh the helipad - a decentralized micro airports that create the "Supergrid[7]": Going beyond 4PL logistics and logistics marketplaces. Supergrid logistics refers to the next dimension of consolidation, orchestration, and optimization of global supply chain networks, integrating swarms of different production enterprises and logistics providers. This opens new business opportunities for various players, including established 4PL providers, specialized companies, and even smaller local couriers and startups. Those new airports could potentially be an unused open area, piers, helipads, dirt roads, and fields which offers access directly to the final destination without the need to go through traditional airport process and location. Logistics has the potential to be the largest market in the drone economy by the end of the decade. However, widespread drone delivery operations will require a clear regulatory framework, robust uncrewed aircraft traffic management infrastructure, and broad community.

1 The Problem with the Current Logistics Supply Chain when dealing with increased demand for same-day shipping and disruptions

The one central requirement for same-day delivery or any delivery network that requires the versatility to adapt to delays and disruptions is simple yet challenging: a dense network of warehouses. In Germany, for example, 11 well-placed warehouses that stock the same assortment—and can move it from click to ship in no more than two hours—would be needed to cover all tier-1 and tier-2 cities. Top 20 nonfood and top 13 grocery retailers while the average large retailer covers onlv 2 of them. [8]

Opening at-scale distribution centers—which often requires more than $100 million in capital for each distribution center—is likewise not feasible for many retailers.



[5] https://cup.columbia.edu/book/the-ecology-of-the-cambrian-radiation/978023110613

[6] AAM

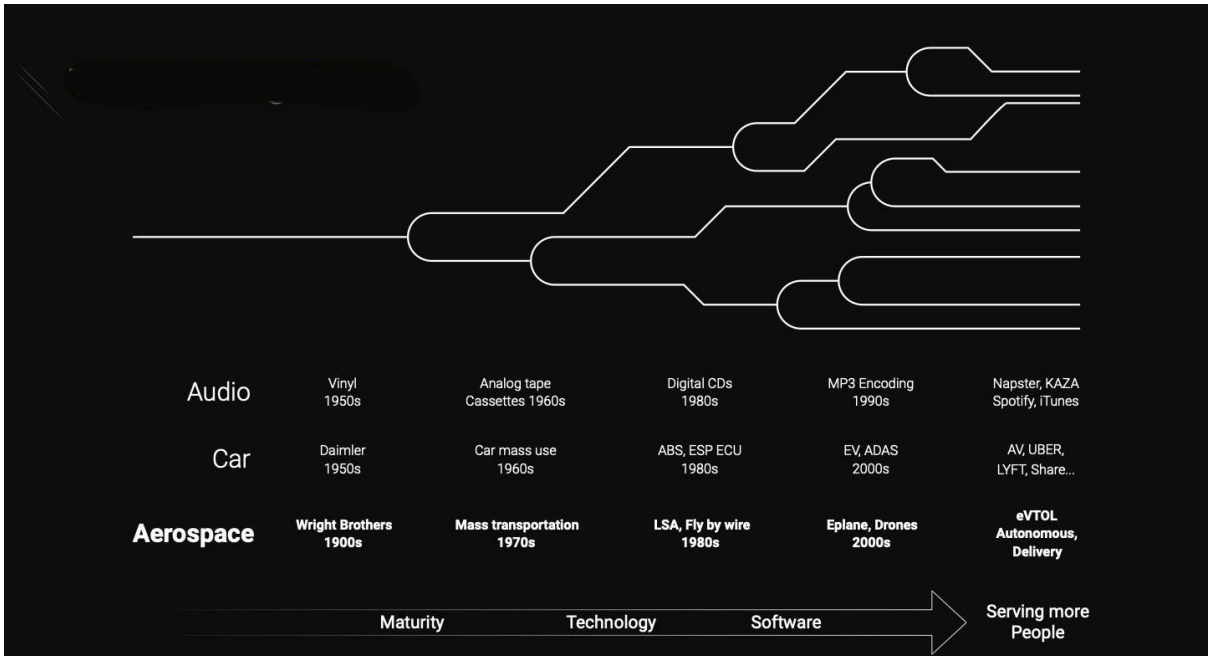
[7] The DHL Supergrid

[8] https://www.mckinsey.com/industries/retail/our-insights/same-day-delivery-ready-for-takeoff

Challenges with the current infrastructure include:

- Inventory accuracy. Stores generally have lower inventory accuracy rates (70 to 90 percent) than distribution centers typically enjoy (more than 99.5 percent).
- SKU complexity. When the online assortment includes channel exclusives, endless aisles, and even third-party products, minimizing margin-eroding split shipments across the network becomes challenging.
- Demand forecasting. Positioning inventory across distribution centers, various store types, and market fulfillment centers remains a struggle for most retailers; in fact, of all the levers to help retailers solve for speed to customer, accurate demand forecasting and distributed-inventory placement may have the greatest impact outside of network changes.
- Picking costs. While there are exceptions, for a majority of retailers the cost of in-store picking is much higher—typically 1.5 to 2 times higher on a cost-per-pick basis—than picking at distribution and fulfillment centers.
- Execution quality. Stores weren't designed with fulfillment in mind, nor are they necessarily staffed or equipped with the technology to do so at scale. Particularly during peak times, it's hard for most stores to manage exceptions, ensure accurate picks, and tightly control cycle times to customers—all of which are important to a great customer-delivery experience.

2 The Cambrian Explosion in Aviation



The evolution of this domain began with Aerospace - A term used to refer collectively to the atmosphere and outer space. Highly active activity in Aerospace Counter, with a plethora of commercial, industrial, and military applications. Aerospace engineering consists of aeronautics and astronautics. Aerospace organizations research, design, manufacture, operate or maintain aircraft and spacecraft. It continues to the wright brothers - were the first to build and fly a usable aircraft, with an engine, control, and the ability to fly a human inside it. They also contributed greatly to the understanding of the means necessary for the aircraft and to the development of technology related to aviation. The Wright brothers' development was based on conclusions from previous attempts. The brothers soon realized what the mistakes of the previous inventors were. The next one is Moss transportation - A private shuttle company in Nassau, their services include airport shuttle shares, private airport shuttle, island tours and shuttles as well as various group services. In 1980s' the technology was Fly-by-wire; a type of flight control system in which the aircraft's steering means are not directly controlled by the pilot, but by a computerized system that mediates between the pilot and the aircraft. In these systems the pilot commands are converted to electronic signals, and the flight control computer determines what is the best way to propel the steering surfaces to provide the desired response from the aircraft. In 2000s' until today, the big technology is ePlane; a cutting-edge online trading and insights platform for aerospace parts and repair services. Leading in Aerospace Procurement with Innovation and Digital Transformation, ePlane connects buyers, sellers, and MROs

from across the world. Although this big development of technology, we are still looking for "the next big thing", and we are sure that it refers to autonomous delivery and eVTOL (electric vertical take-off and landing). The current technology combined with software will allow unmanned aircraft to make deliveries in a safer, more convenient, and cheaper way.

2.1 Aircraft Types

- **Multicopter** - an unmanned aerial vehicle that creates lift by rotating a bladed propeller.
- **Lift & cruise** - It's a design, with the passenger pod supported on a pair of large wings. These feature long propulsion pods running front to back, which hold three large lift props apiece, and a fourth pair are elevated to a higher plane to keep the aircraft compact. The propulsion pods are linked at the front by an additional front wing, complete with control surfaces, and there's a pusher prop at the rear of the cabin for horizontal flight.
- **Vectored thrust** - The ability of a jet or rocket aircraft to tilt the exhaust jet from the engine, and allows control of the flight direction or rotation of the aircraft. Vector propulsion was initially developed for airplanes to allow for short and even vertical take-offs and landings
- **Augmented lift** - A Lift augmentation system is a device installed on the wing of an aircraft to produce an increase in lift at a given speed. It is useful at low speed because it reduces the stall speed (the plane can fly more slowly). It can be installed on the leading edge of the wing ("leading edge slats") or on the trailing edge ("wing flaps"). it gives STOL capability to the aircraft (short take-off and landing).
- **Conventional** - In a conventional aircraft the gear consists of two primary wheels under the forward part of the fuselage and a tailwheel. The opposite configuration is called a tricycle gear, with a single nose wheel and two main wheels farther back.

3 Concept of Operations (CONOPS)

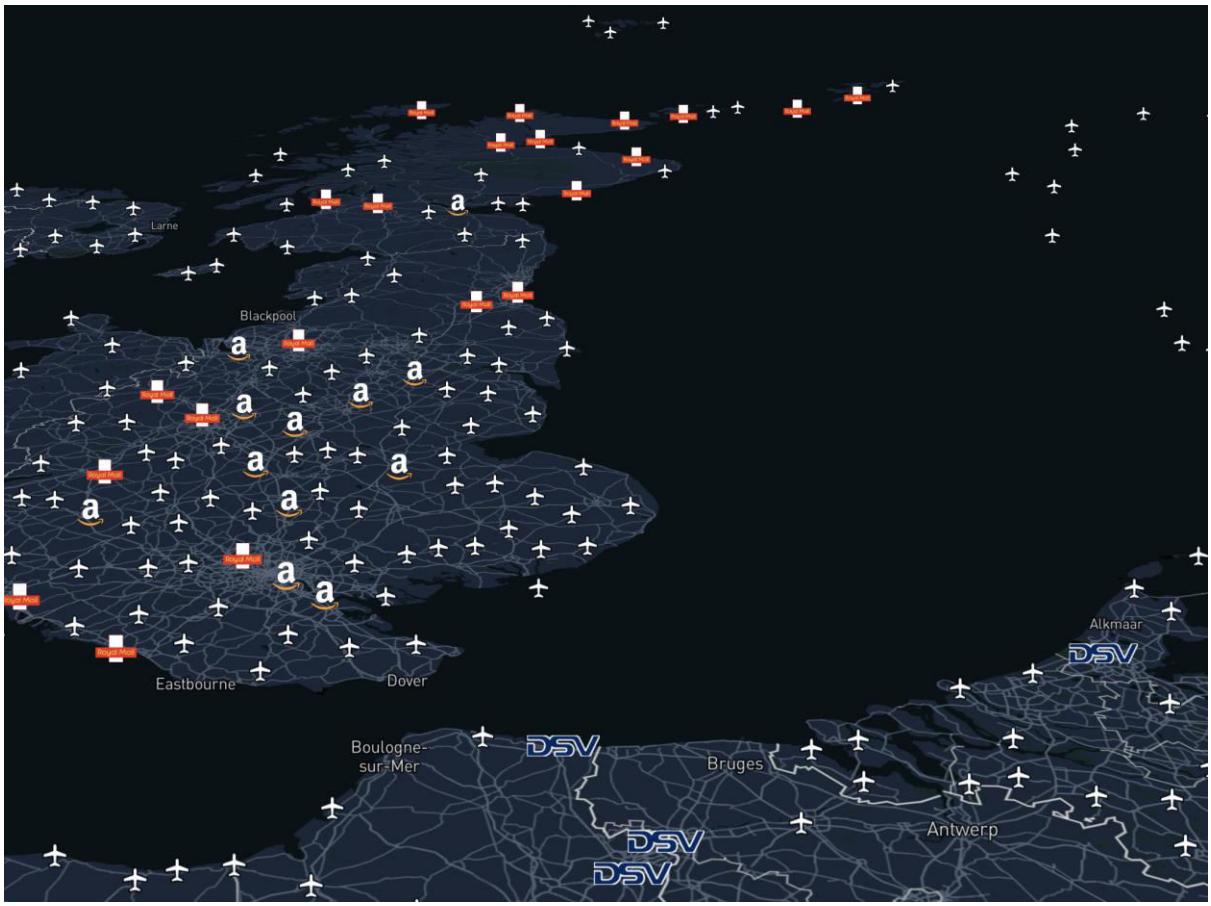
The operation of electric aircraft drones should be regulated in a manner proportionate to the risk of the specific operation. Considering the broad range of operations and types of drones, it is proposed to establish 3 categories of operations and their associated regulatory regime: Open, Specific and Certified.
The Open operation category of drones, should not require an authorisation by an Aviation Authority for the flight but stay within defined limitations for the operation (e.g., distance from aerodromes, from people, etc.). The “specific” operation category will require an Operations Authorisation by an Aviation Authority with specific limitations adapted to the operation.
Certification will be required for operations with a higher associated risk due to the kind of operation or might be requested on a voluntary basis by organisations providing services such as remote piloting or equipment such as detect and avoid. This concept has been developed to address two main goals:

i. Integration and acceptance of drones into the existing aviation system in a safe and proportionate manner
ii. Foster an innovative and competitive drone industry, creating new employment, in particular for SMEs.

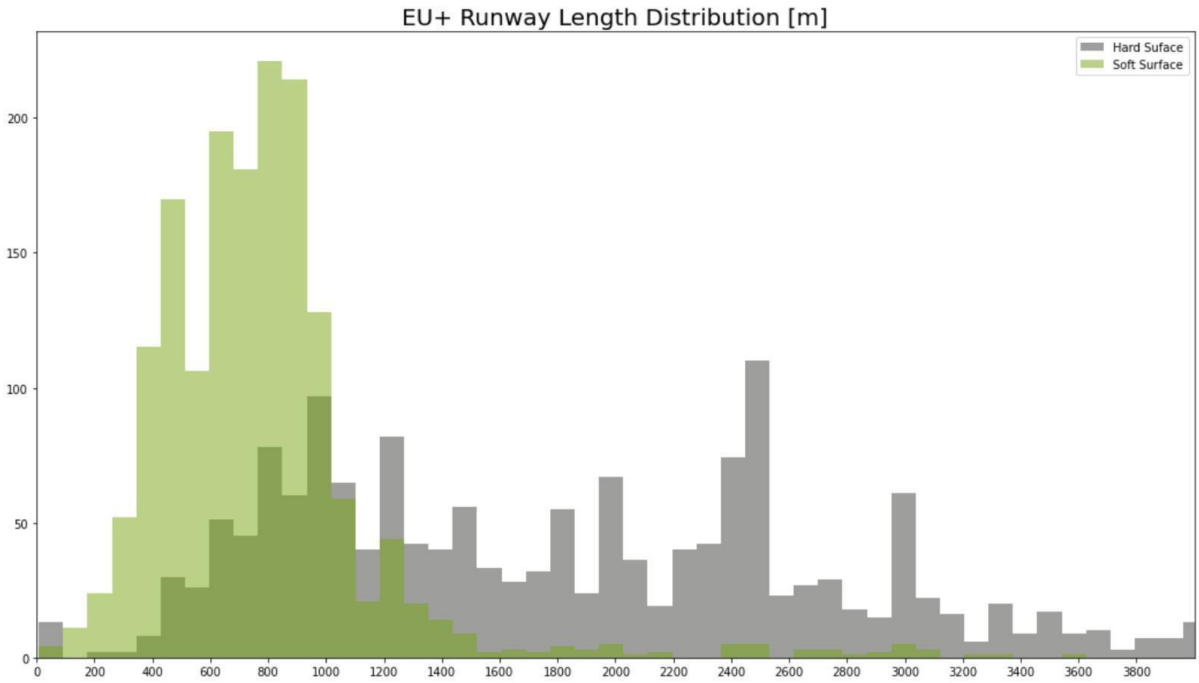
To achieve both goals simultaneously, the regulatory regime needs to set a level of safety and environmental protection acceptable to society as well as provide protection for other public interests, such as privacy and security, on the one hand, and offer enough flexibility for the new industry to evolve, innovate and mature on the other hand. The regulatory framework should not simply transpose the system put in place for manned aviation but must therefore be proportionate, progressive, risk based and the rules must express objectives that will be complemented by industry standards. Only this way can we address the challenges posed by the wide variety of drones and their operation and support SMEs to learn and progress from simple operations to higher risk operations as they gain experience allowing them to increase the range of operations and application. The regulatory framework must be an enabler and not

an impediment; hence striking the right balance between innovation and societal concerns about safety, environmental protection, privacy and security. Furthermore, this approach will allow to put on equal footing commercial and non-commercial operations. This concept focuses on safety risks but recognises the importance of risks to privacy and security.

3.1 To take-off aircrafts need to land first: Correlation Between Distribution Centers and Existing Infrastructures and the potential and convenience of building more air crago portals



We fused a few data sources together to create a map of the existing airfields in western Europe and England and found a distance-based correlation of roughly 80 percent of cities are within 20 [km] from an existing airfield capable of operating well the new types of aircrafts with length distributions as follows:



3.2 Future Infrastructure

If we follow the trendline of smaller aircrafts, decentralized micro airports and Supergrid logistics based on electric propulsion we can anticipate that the future of airfields will also resemble and share more elements with parking lots.

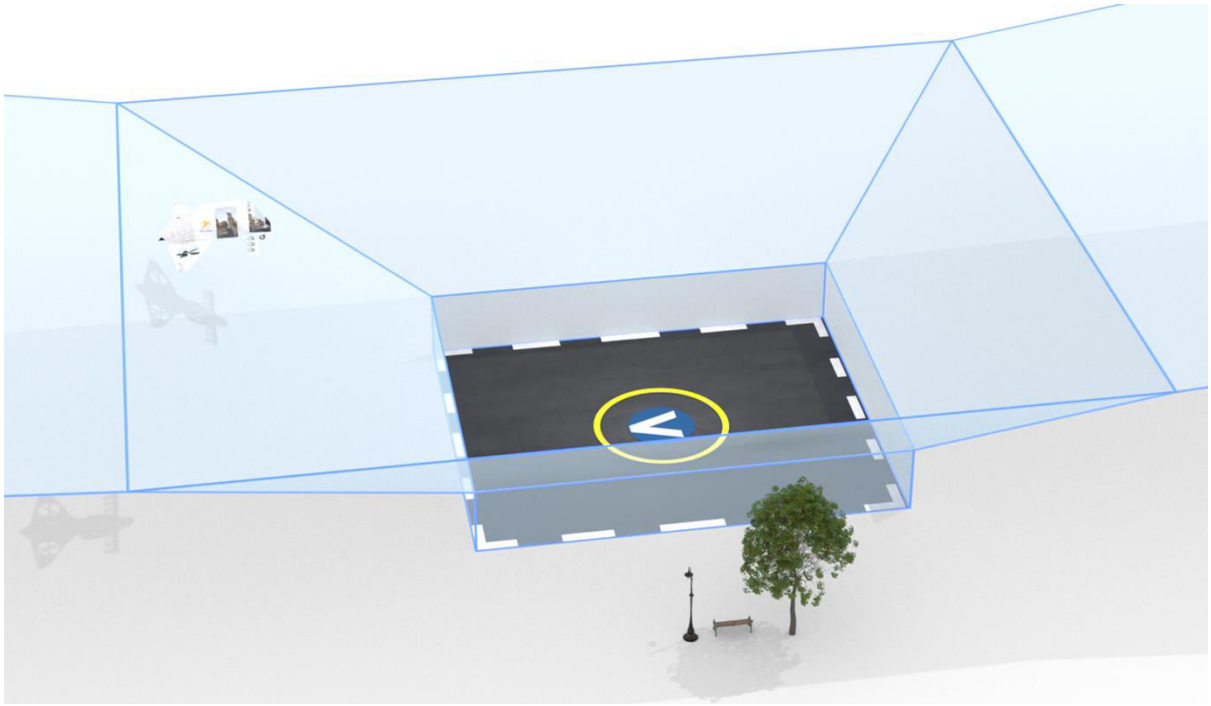
Parking lots exists where real-estate is expensive and efficiency is key.

It is estimated that such micro airports will be divided to rural – "Microports" and urban types – "Vertiports."

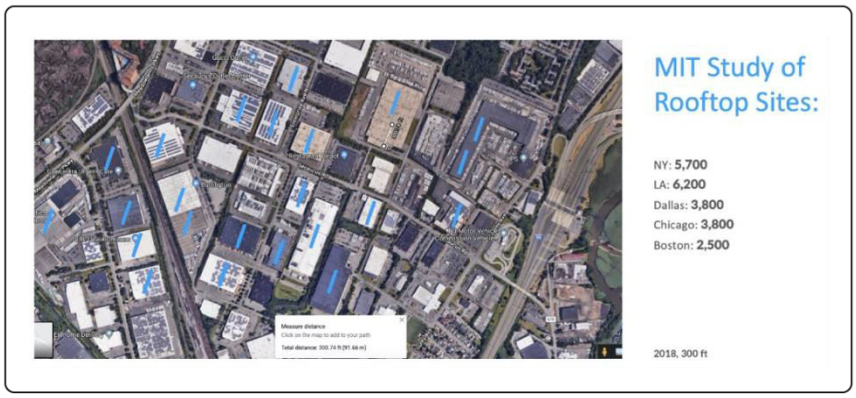
The key difference lies in the mode of transportation, cost of real-estate and types of aircraft.

3.2.1 "Vertiports"

The greatest operational barrier to deploying the AAM is the infrastructure written by Uber elevate program whitepaper researching the AAM concept. Airports, heliports, or vertiports[3] must be strategically located in proximity to areas of user demand and have sufficient aircraft and passenger throughput to support at-scale UAM "Urban Air Mobility" operations.



One MIT study tested the amount of available Rooftop and suggested the following data:



- *Vertihubs.* Vertihubs are the largest structures. Envisioned as stand-alone buildings constructed in central, high-traffic areas, they will have around ten active takeoff and landing areas, plus 20 additional spaces for parking or maintenance. Vertihubs could also include some level of retail and other services for passengers. We estimate they could cost $6 million to $7 million to build and $15 million to $17 million per year to operate.[3] Our operating-cost estimates do not include the cost of power for charging or refueling.[4]
- — *Vertibases.* Vertibases are medium-size structures, either newly built or created by retrofitting existing structures such as parking garages and corporate-headquarters rooftops. Located in medium-traffic areas, such as suburbs, or at major work or retail locations, vertibases would have around three active takeoff and landing spaces, plus six additional spaces for parking or vehicle

maintenance. We estimate they could cost $500,000 to $800,000 to build and $3 million to $5 million per year to operate.

Vertipads. Vertipads represent the smallest structures and would function as the spokes in the hub-and-spoke network. As with verti- bases, they could be newly built or created by retrofitting existing structures. Typically located in suburban or rural locations (up to 50 miles from the rest of the network), they would have one takeoff and landing area, plus two spots for parking or vehicle maintenance. We estimate they could cost $200,000 to $400,000 to build and $600,000 to $900,000 per year to operate.

4 Results and Discussion

The use of drones in the logistics sector is very advantageous, enabling a wide range of applications.
Drones can be put-to-use in the transportation or delivery of customer purchases, which is a great solution for urban areas with heavy traffic congestion. As well as pallet scanning within distribution centers, enabling the operations team to view inventory stored at the facility, as well as search for lost merchandise in hard-to-reach spaces. Joint with security surveillance of large areas for logistics such as warehouses and factories. In addition, drones allow us to reach areas that cannot be accessed by other modes of transport. This way, it is possible to expand the radius of action of the companies that make the shipments. These vehicles are also very useful in emergency situations when rapid transport of medical and relief packages to remote areas is needed. To date, many delivery tests have been carried out focused on medical supplies.
The application of drones in logistics means a reduction in distribution costs and faster deliveries. In addition to having high benefits for the environment thanks to reductions in urban traffic and therefore, in CO2 emissions.

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