BVLOS ACROSS THE DRONE INDUSTRY

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INTRODUCTION

Unmanned aviation has firmly entrenched itself in modern life. While its benefits are already being felt across a wide range of sectors, a huge seam of potential is still yet to be tapped. The key to unlocking this next level of utility is the widespread adoption of BVLOS - Beyond Visual Line of Sight – flight operations. This ebook will introduce the reader to some of the basic ideas behind BVLOS drone operations in civilian sectors. It outlines four key verticals that have the potential to be radically transformed by the adoption of BVLOS, as well as the challenges that stand in the way of making this a reality. Finally, it proposes an all-in-one solution to these challenges, and shows how working with Elsight can help you expand the horizons of your drone business, no matter the application.

CHAPTER 1

THE CASE FOR BVLOS

Who will benefit from the next level of drone operations?

As the name suggests, BVLOS involves drones continuing their operations out of sight of a human observer. While defense forces around the world have a long history of flying BVLOS missions, frameworks that enable flights in civilian airspace are only just beginning to emerge.

Successful adoption of BVLOS operations will bring the efficiency and cost-effectiveness of commercial and industrial drone flights to another level, as the aircraft will be permitted to fly longer without having to return to base or be handed over to another operator, and achieve more in a single flight. BVLOS will also be crucial for a variety of drone-based public services, including law enforcement, medical delivery, and search and rescue.

The increased proliferation of BVLOS flights is also likely to drive the development of new advanced unmanned aerial systems that can take advantage of the new regulations, which in turn will then push the boundaries of what is possible with BVLOS – a kind of “arms race” that will benefit the entire industry.

From visual line of sight to beyond

Unlike military usage of UAVs, which dates back decades, commercial and industrial use of drones is a relatively recent phenomenon. In the United States, the Federal Aviation Administration (FAA) authorized the first commercial drone flight over water in 2013, paving the way for the first land- based flight permit the following year.

Almost all drone flights in civilian airspace are currently conducted within visual line of sight (VLOS), and in most jurisdictions around the world this includes all amateur flights. For commercial UAV operators, permits may also be given for EVLOS (extended visual line of sight) missions, which allow the drone to fly beyond the VLOS range of the pilot as long as additional human observers are present to cover the extra distance.

Commercial drone flights could theoretically be covered by a successive chain of human observers that ensure the entire airspace surrounding the drone’s flight path is safe at all times, and flights have also been made using ground-based radars to perform the same function. For operations that cover the vast distances required for applications such as large-scale infrastructure applications, both the costs and the logistics involved quickly make this an impractical solution.

Some BVLOS drones have used FPV (first-person view) technology that transmits a live camera feed of the surrounding area back to the operator. However, this setup provides subpar depth perception and peripheral vision, and the industry is moving towards detect-and-avoid solutions such as Iris Automation’s Casia, which also offer the advantage of potential full automation of the drone flight.

Before we look further into the technology that could power fully automated BVLOS flights, we shall go in-depth into four verticals within the drone industry that stand to benefit from the leap to BVLOS.

CHAPTER 2

PUSHING THE STATE OF THE ART WITH BVLOS DRONE INSPECTION

Railways, roads, pipelines, power lines – all these elements of critical utilities and infrastructure, and many more, need to be maintained to keep things running smoothly and avoid potential catastrophe. Cracks, corrosion, wear and tear and vegetation encroachment are just a few of the issues that companies need to keep on top of to minimise downtime and accidents and maximise profitability.

Traditional methods of inspection, even those involving helicopters and manned aircraft that can access hard-to-reach areas, have their downsides, many of which can be solved by the use of drones.

The unmanned aerial advantage

Perhaps the most important factor that drones bring to the table for utilities and infrastructure inspection is enhanced safety. The costs of catastrophic accidents are not only human – settlements, increases in insurance premiums, and loss of reputation could all be disastrous for a utility company.

Drones can help cut costs across the board, with the average cost of operation far undercutting helicopters and manned aircraft. In addition to reducing required manpower, aerial inspection also often does away with the need to shut operations down, and this is especially vital for oil and gas where a day's downtime can cost hundreds of thousands of dollars.

Data collection via unmanned aircraft far outclasses what is possible with manual methods. Drones can get closer to towers, power lines and other structures than manned aircraft can, allowing them to capture more precise data and higher-resolution details.

The gateway to seamless BVLOS inspection

Drones have already entered widespread use and changed the face of the inspection industry, improving operations by leaps and bounds. The next horizon is to massively increase profitability by moving from small numbers of pilot-based drone operations to entire fleets of autonomous UAVs that can operate with unlimited range, with the ability to easily scale up your business as the market demands. But is there something that stops the industry from taking it to the next level?

Many countries and jurisdictions currently restrict drone operations to VLOS, meaning that the aircraft can travel at most 500 metres from the pilot under standard aviation regulations. Infrastructure and utilities can span vast distances – pipelines can stretch across entire countries, and the United States contains millions of miles of power lines. Another rapidly expanding field within the inspection industry is solar farms, which are only set to increase in size as the demand for renewable energy climbs all around the world.

BVLOS flights make inspection of such colossal distances and areas economically feasible, as drones can travel further in one flight, doing away with the need to constantly relocate the inspection team and reducing downtime for the drone. The amount of data that can be collected in one day is significantly increased, and so is efficiency as a result.

BVLOS drone operations are currently incredibly difficult to gain authorisation for – the United States Federal Aviation Administration has to date granted only a tiny percentage of the thousands of requests it has received. So if you are aiming to push the state of the art with BVLOS inspection

CHAPTER 3

HARVESTING PROFITS WITH UAV PRECISION AGRICULTURE

As an alternative to expensive manned aviation or limited ground-based observation and checking, drones have the potential to revolutionize precision agriculture. Unmanned aerial surveying allows farmers to improve productivity as well as maximise the quality and yield of their crops, while driving down incidences of pests and disease. In addition to data capture, drones can be used to plant seeds, apply pesticides, and perform a variety of other tasks with much greater speed and precision than manual methods can achieve.

With the ability to deliver imagery and sensor data that beats dated and low-resolution satellite intelligence and is more efficient than hiring an airplane or helicopter pilot, the demand for drone-based precision agriculture is on the rise. This demand is driven by the advancement and increased accessibility of drone technology, as well as a shortage of skilled labour in many countries.

Owners of large farms spanning hundreds or thousands of acres can especially stand to benefit from drone technology, which could allow them to cover their entire holdings in a day or two instead of taking weeks or possibly months. The gathering of real-time data will allow decisions to be made and action to be taken almost immediately, which can be vital given the seasonal nature of farming and the need to quickly take advantage of fleeting weather conditions.

The bottlenecks in scaling up for economic viability

Currently, regulatory landscapes around the world are making it difficult to turn this dream into reality. Drone operations in most countries are largely limited to visual line-of sight even in rural areas, meaning that drones can fly at most around 500 metres away from their operators. For an agricultural professional with a lot of land to cover, this means driving from field to field, setting up and repacking the drone each time, and painstakingly trudging through the work in a piecemeal fashion. This excessive drain on time and resources will quickly destroy any perceived efficiency boost from using unmanned technologies.

VLOS operations can also be troublesome for growers of tree-based crops, where a relatively low-flying drone will be much harder to keep track of than if it were flying over fields of corn, wheat or similar produce.

In order to realise the advantages of economy of scale, and to enable autonomous operations with fleets of drones, BVLOS flights will be required. As anyone following the ever-changing drone industry knows, the FAA and other aviation regulation bodies keep a tight leash on BVLOS operations, approving only a small proportion of the requests for authorization that they receive.

The good news is that the game is slowly changing, and if you can prove that your BVLOS drone platform is safe, ultra-reliable and up to spec, your chances of getting on the road to certification increase significantly.

CHAPTER 4

KEEPING PACE WITH MODERN LIFE WITH DELIVERY BY DRONE

It sounds like the ultimate in modern convenience, a science-fiction concept come to life – drone delivery, direct to your door. The nascent unmanned delivery industry has the potential to revolutionise not just online shopping and last-mile logistics but also the supply of hospitals, offshore vessels and hard-to-reach areas such as remote communities and disaster-struck regions.

In addition to providing enhanced accessibility compared to manned aircraft and road vehicles, delivery drones could cut down air pollution and road congestion once adopted widely. Unmanned aerial vehicles can also provide highly efficient service, as their manoeuvrability and small size allows distributors to cut out the middleman and send goods straight from the warehouse to the final end-recipient.

The ongoing COVID-19 pandemic has helped accelerate the development of drone delivery services, as the technology allows for contact-free delivery and lessens people's need to leave the house. Some drones do not even need to land in order to deliver their cargo, using a quick-release tether system to release a package while hovering in the air.

Getting drone delivery off the ground

While the technologies already exist, setting up a drone delivery business is not as easy as strapping a package to a drone and wishing it bon voyage. Many countries either limit commercial drone operations solely to visual line-of sight, or require an extensive certification and proving process for operations that wish to go beyond this limit. Drone deliveries may also have to take place in segregated airspace that is not shared with other air traffic and does not pass over populated areas, in order to minimise the risk of collision and injury.

VLOS flights limit the delivery range to a distance of only around 500 metres from the operator, and regulations usually forbid the drone from passing behind buildings, trees and other obstacles. Constricting drone flights to segregated airspace or a designated flight corridor is clearly not practical, especially in urban areas where manned aircraft are plentiful and drones may have to make deliveries anywhere within the region.

In order for a drone delivery service to be scalable, sustainable and economically viable, aircraft must be free to operate BVLOS and in shared airspace. This level of integration into everyday operations and infrastructure requires a huge amount of safety protocols, and aviation bodies have struggled to smoothly incorporate drones into their regulatory frameworks.

Slow though it may be, the good news is that the wheels are turning and the groundwork is being laid piece by piece. Some aviation agencies such as the United States' Federal Aviation Administration have begun to approve BVLOS drone operations on a case-by-case basis, subject to proof that the platform meets a series of rigorous standards.

Right now, only a small percentage of requests for authorization are approved, but if you can put forward a solid case for your drone delivery platform being safe, reliable, and up to spec, your chances of being certified will increase.

CHAPTER 5

EXPANDING BOUNDARIES WITH BVLOS MAPPING AND SURVEYING

The geospatial industry has been one of the most widespread and enthusiastic adopters of drone technology, and it's easy to see why when you consider the advantages drones bring to the creation of deliverables such as orthomosaic maps and 3D LiDAR point clouds.

The use of drones for mapping and surveying allows GIS professionals to bring down project man-hours and costs compared to the use of manned aircraft, and lets specialists reduce their time in the field. Drones can take off from and land almost anywhere, with the ability to access hazardous and otherwise difficult-to-reach areas such as mountainous regions, coastlines and volcanoes. They can also fly at lower altitudes, meaning that surveys can be performed faster with higher resolutions and with less interference from weather conditions such as cloud cover.

Businesses across many industry verticals have come to understand the value of drone data, and these developing industries will in turn drive the advancement of drone technology. Taking wide-scale aerial imagery collection to the next level, however, will come with its own share of teething issues.

Scaling up for BVLOS

In order for UAV mapping and surveying businesses to push the current limits of efficiency and profitability, drone operations must go beyond visual line of sight. Allowing drones to capture greater amounts of data in fewer flights, BVLOS operations will be the key to unlocking the next level of large-scale drone mapping and surveying.

Currently, under many jurisdictions, drone operations are largely limited to visual line-of sight in both urban and rural areas, meaning that the aircraft can only travel at most around 500 metres away from their operators. Given that many mapping and surveying projects involve large areas of many square miles, this means that drone pilots must spend significant amounts of time relocating to different points and unpacking and repacking equipment.

BVLOS flight will remove many bottlenecks to productivity, simplify the mapping of vast areas and long corridors of land, and potentially pave the way for fully automated operations. Currently, scaling up for BVLOS is a complex process that involves many hoops to jump through.

Regulation and proving your case

The biggest hurdle facing the emerging BVLOS industry right now is regulation. While the FAA, the European Union Aviation Safety Agency (EASA), and other aviation regulation bodies around the world have begun to approve BVLOS flights on a case by case basis, only a very small percentage of the requests receive make it through to operational flight.

Due to the limited amount of data on the safety and success of BVLOS operations, and the currently highly fluid state of development of regulations, business looking to gain permission for BVLOS must present a thorough and highly convincing safety case. Aviation regulators, already highly risk-averse, are playing it extra-safe with the disruptive technologies that will allow drones to scale up to limitless operations.

One of the key concerns in assessing the safety of BVLOS drone flight is a reliable connectivity solution. If you can provide assurance that your long-range drone mapping or surveying platform includes a failsafe communications system, especially for data gathering in urban areas and critical zones such as construction sites, your chances of gaining certification will increase significantly.

CHAPTER 6

THE SOLUTION

Issues - paperwork and practical

As we have seen in our examination of four different markets, safety is the major commonality. As with all matters in the world of aviation, safety is the first priority for BVLOS drone platforms, and for good reasons. The human impact of a high-profile drone crash in civilian airspace is obvious, and as we have seen in the world of autonomous driving, could set the development of widespread BVLOS drone flights back by years.

Safety concerns naturally lead to issues of regulation. Regulatory frameworks are still in their infancy, and again, as anyone who works in aviation will know, these wheels turn slowly! Aviation authorities are incredibly picky about who they hand out their coveted BVLOS waivers and certifications to – the FAA, for instance, turns down over 99% of applications.

Connectivity is key

Other than a robust Detect-and-Avoid (DAA) solution, the key to safe BVLOS drone operations in both urban and rural areas is a reliable never-fail communications and connectivity solution. You need to be sure that your drones can achieve as close to 100% uptime as possible.

Connectivity is obviously important in cities and populated areas, where failure carries a high risk of injury to the populace. As we have seen in our examination of different verticals, many BVLOS applications may require drones to travel long distances, and to pass through a variety of communications environments and networks. Reliable operation in rural and remote areas, which will not all offer the same communications options, is thus also vital.

Drone command, control and data transmission with maximal uptime that works anywhere is important not only to ensure safe operations at all times, but also so that the drone can do its job at all times and keep the all-important data flowing.

To reiterate, then - the best way to avoid rejection by regulatory bodies, enable your BVLOS applications to take flight, and provide superior customer service is to use a proven communications solution that provides robust performance, flexible data transmission and the highest levels of safety and security. Is this still a pipe dream for the drone industry?

An always-on, highly adaptable solution for BVLOS communications

Until now, no communications solution has offered a robust way to deal with the aforementioned challenges in a way that provides close to 100% connectivity and uptime. Elsight’s Halo platform has been engineered from the ground up to provide an innovative solution to connectivity issues that often plague long-range drone operations.

By combining multiple cellular and radio-frequency links into one seamless communications pipeline, Halo maintains high-bandwidth transmission that automatically utilises the best available method. The future-proof system is even ready to take advantage of 5G and satellite communications as these become more widespread. The versatile platform's unique 6th Sense bonding capability constantly utilizes and monitors all available links, checking for compromised channels.

Halo also provides fully-encrypted real-time security, preventing malicious attacks that could compromise the operation of the drone or the integrity of its data, and thus solving another main concern of regulatory bodies.

CHAPTER 6

THE SOLUTION

Halo can also help designers and systems integrators reduce the SWaP (size, weight and power) budgets for their new drone platforms, providing a reliable way to take advantage of cloud computing servers and offload certain essential processing functions such as image and video analysis. Not only can you save processing power which can be used instead to extend the flight time of your platform, but you may also be able to select a smaller, lighter, less powerful onboard computer, providing further SWaP savings.

As the industry begins to adapt to the new demands arising from the need to scale up for BVLOS, now is the time to think about developing your certifiable drone platform. Whether your target market is delivery, agriculture, inspection, mapping and surveying, or one of a myriad of other exciting possibilities, Elsight can help you seamlessly integrate Halo into your application, saving development time and costs and allowing you to be first to market. With the issues of safety and foolproof connectivity taken care of by our state-of-the-art technology, the door is open to make your operations as efficient and economically viable as possible.

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