Scaling BVLOS Operations through Robust Connectivity & Autonomy Infrastructure

Discover the potential of BVLOS drone operations and the importance of reliable connectivity for safer and more efficient drone flights. Learn from the industry experts.

Powered by **FlytNow**

Introduction

BVLOS drone operations hold immense potential to transform the way we live and work, offering innovative solutions across a wide range of industries, including logistics, agriculture, and inspection. These advanced operations have the capacity to increase efficiency, reduce costs, and expand the reach of various services.

As the industry transitions toward automated BVLOS operations, one of the most important considerations that goes without saying is safety. Having a reliable and always-on communication solution that provides robust performance, flexible data transmission is going to be a must-have for safer operations. Consider flying a drone remotely with no or delayed knowledge of where the drone actually is!

At a NestGen '23 session, we had a conversation with Yoav Amitai, CEO of Elsight, a connectivity platform dedicated to delivering extremely reliable, high bandwidth, real-time connectivity even in the most challenging and remote areas. Yoav discusses the current challenges as well as the connectivity solutions that would be required to make BVLOS operations a reality.

Yoav Amitai
CEO, Elsight

What exactly is BVLOS? How is it different from VLOS or EVLOS?

Before delving into the connectivity solutions, let's look at the differences among VLOS, EVLOS, and BVLOS operations. According to the definition:

Difference between VLOS, EVLOS and BVLOS

VLOS, or **Visual Line of Sight**, refers to drone operations in which the aircraft is flown within the Pilot in Command's (PIC) visual line of sight, with the VO "co-located" and in direct communication with the PIC.

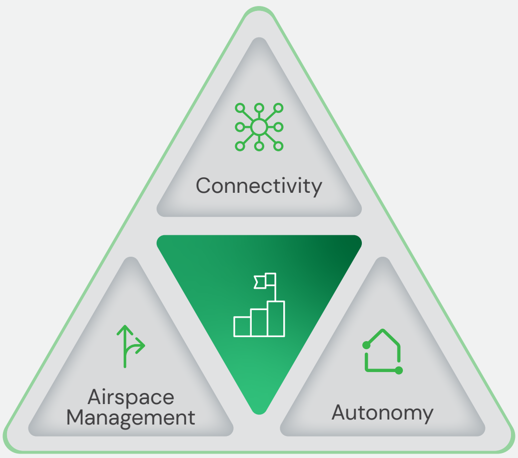
EVLOS, or **Extended Visual Line of Sight**, is a UAS operation in which the pilot and/or observer maintain constant visual awareness of the airspace. The aircraft may be flown out of sight of the PIC, but it must remain within visual range of VO at all times, with the PIC in command at all times.

BVLOS or **Beyond Visual Line of Sight** are operations wherein the aircraft is flown beyond the PIC's or VO direct sight of the aircraft.

However, as Yoav mentions, "Determining the precise distance at which an operation is considered VLOS, EVLOS, or BVLOS is unrealistic because it is dependent on a variety of factors such as the size of the drone, the terrain or landscape, weather conditions, and regulations." Even if the drone is within range, any obstacles or interference between the operator and the drone can make the operation to be BVLOS. Furthermore, if a single operator controls multiple drones, even if they are within VLOS range, regulatory authorities may still consider the operation BVLOS due to the increased complexity of the operation, which necessarily involves additional safety measures and certifications."

Challenges in BVLOS Drone Operations

Now that the definitions are clear, Yoav delves into three main technological challenges associated with BVLOS drone operations are:



1. Airspace Management

BVLOS operations require effective management of the airspace, particularly in environments where multiple operators are operating in the same airspace. Ensuring communication between the operators to avoid conflicts or collisions, and managing both crewed and uncrewed vehicles in the same airspace are significant challenges that need to be addressed.

2. Connectivity

Connectivity: Finally, BVLOS operations necessitate consistent and reliable connectivity between the drone and the operator, particularly when the drone is traversing long distances. Real-time communication is required for a variety of applications, including security, inspection, and agriculture, and maintaining connectivity becomes a critical challenge in BVLOS operations.

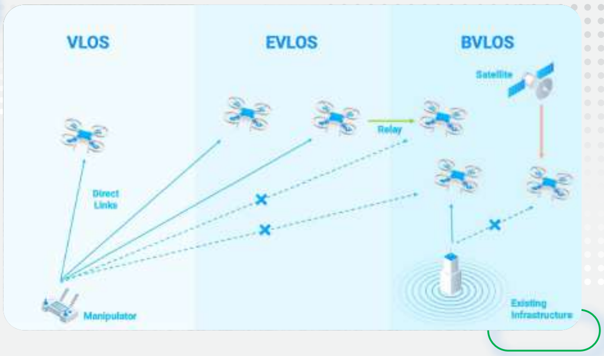
3. Autonomy

BVLOS operations at scale require taking the human factor out of the loop. This entails developing autonomous software capable of operating drone fleets efficiently and safely, lowering labor costs and increasing productivity. Drone autonomy can improve safety measures by reducing human error and making the system more reliable.

In this blog post we'll delve into two of the key challenges and **recommend solutions for solving connectivity issues & enabling autonomous operations.**

Maintaining Reliable Connection between the Drone and Ground Station

It has been established that reliable communication and data transmission are critical for managing airspace, maintaining autonomy, and overcoming technological challenges, particularly when the drone is outside the direct radio frequency communication range with the PIC. So what are the connectivity options? Let's explore:



How VLOS, EVLOS and BVLOS works

Standard Point-To-point Proprietary RF

A common wireless communication method that establishes a direct, closed network between the operator and the drone, allowing for real-time communication and control. These systems, however, have several limitations, particularly in BVLOS operations:

- For starters, their limited range makes them unsuitable for long-range operations, limiting the mission's scope.
- They are susceptible to interference, particularly in densely populated areas where many wireless devices use the same frequencies, such as 2.4 or 5.8 gigahertz.
- Because these systems generate a local network, they are unsuitable for cloud-connected solutions and the integration of additional applications, limiting the overall mission scope.
- These systems' power consumption is also high when compared to other solutions, which can limit the mission's duration.

Satcom

Satellite communication is another option for wireless communication in drone operations. Though they provide good coverage, but has a bunch of limitations:

- One major issue is the limited available bandwidth, which can make it difficult to transmit real-time data, particularly video data. Because of the limited bandwidth, the quality and latency of video is very low.
- Satellite communication can be expensive, which may not be economically viable for some drone use cases.
- In terms of the solutions available in the market, most of them are either too big or too bulky for use on drones. The ones that enable streaming along with C2 and telemetry weigh typically around 1.5 kilograms. This limits the payload capacity of the drone and reduces its overall performance.

Cellular/Mobile:

Working over public cellular infrastructure, primarily LTE and 5G/4G, is the most cost-effective and productive wireless communication option for BVLOS operations. The following are some of the benefits of using this method:

- Its ability to support swarm topologies for communication. It can accommodate one-to-many or one-to-one topology, offering greater flexibility in drone operations.

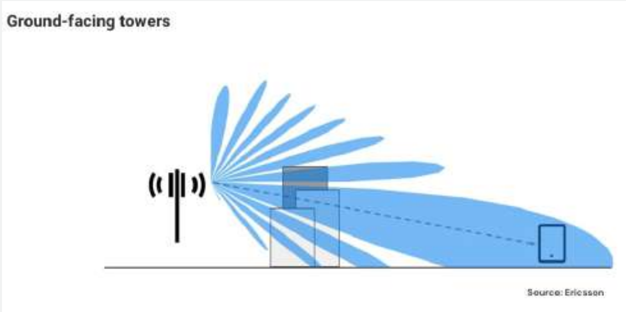
- It doesn't require line-of-sight or a ground control station, and there is no range limitation. This makes it ideal for long-distance BVLOS operations, with the communication system capable of operating across multiple countries and continents while maintaining high bandwidth and latency quality.

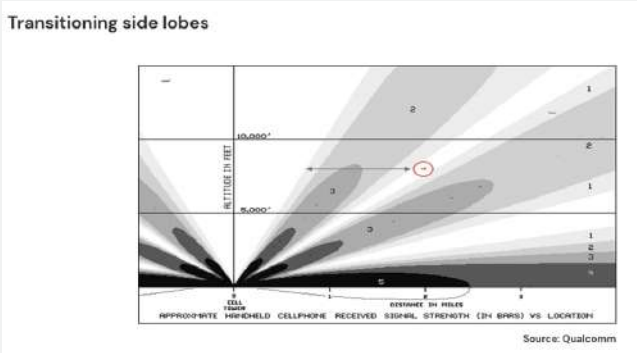
- Cellular infrastructure is widely available, with estimates indicating that it covers between 85 and 92% of the world, making it an accessible and reliable option for BVLOS operations.

- It works on the internet infrastructure, allowing the use of SaaS applications that enable real-time data streaming and data analysis over the cloud.

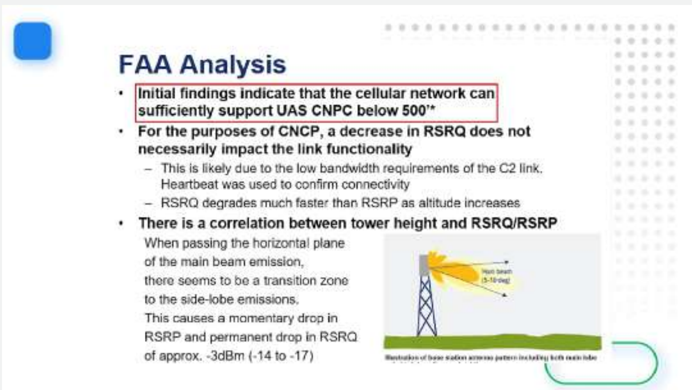
- The cellular communication modules and infrastructure are designed to work on battery devices, making them lightweight, low power, and less demanding in terms of real estate on the drone. This ensures that it has no effect on the overall performance or stability of the drone, making it a viable option for BVLOS certification.

> *Yoav also highlights the challenges of working with public cellular infrastructure with graphs from Ericsson and Qualcomm. "The challenge we face with cellular infrastructure is that it is optimized for terrestrial communication and not designed to work efficiently at high altitudes," he says. The antennas are designed for the average handset on the ground, where the majority of subscribers are located and where operators have licenses to use specific frequencies. When working with drones, communication takes place on the antenna's side lobes, and being directly above the cell tower can result in zero communication, making reliable communication a significant challenge."*



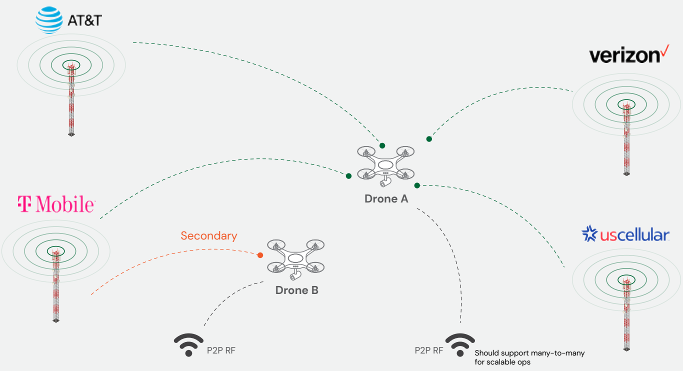


Yoav also shares another interesting analysis presented by Verizon and the FAA called the airborne LTE operation (ALO), which found that the cellular internet network is capable of sufficiently supporting unmanned aerial systems' control and non-payload communication below 500 feet. While this shows that the infrastructure can work at those heights, there are still blind spots where there is no network available.



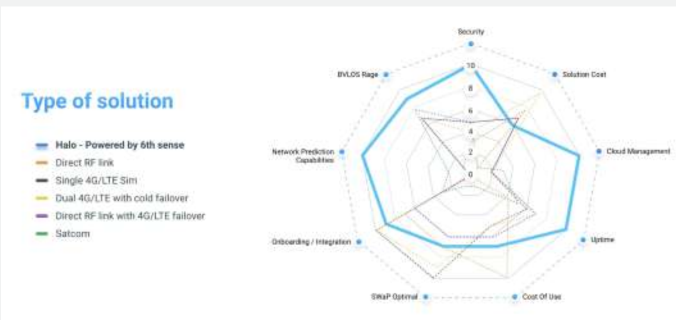
How Elsight Halo solve connectivity challenges

To combat the challenges of public cellular networks, Yoav suggests a multi network approach, which is exactly what Elsight's product – Halo offers. By aggregating all available IP links (4X cellular or RF X SIMs solution with link failover) to a one bonded link, Elsight's system optimizes communication channels for drones, ensuring that data and commands can be transmitted and received in real-time with high reliability. This enables statistically better coverage with more reliable communication, which Yoav calls as a **"connection confidence."**



This approach overcomes the challenges of a single connectivity infrastructure by providing increased redundancy and a more reliable connection for drones, even in areas where coverage may be limited or obstructed.

As the first AI-powered connectivity solution, Halo boasts a small form factor, lightweight design, and power consumption that is less than half that of an average kitchen light bulb. This innovative solution saves on Size, Weight, and Power (SWaP) while providing onboard communication capabilities.



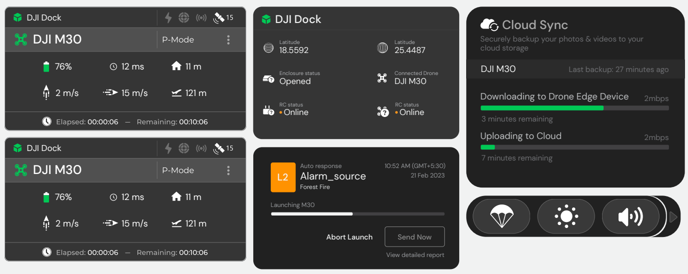
Need for autonomy to scale BVLOS operations

As Yoav mentioned, the third challenge would be autonomous operations. As the drone company continues to expand, so will the demand for cost-effective and efficient solutions that can operate at scale.

Autonomy contributes significantly to this by lowering labor costs and increasing productivity, making drone operations more economically viable. Furthermore, removing the human factor from the loop improves BVLOS safety and reliability significantly. Unlike humans, software can operate drones with precision and consistency, without being hindered by fatigue or human error.

How FlytNow automates your drone operations

As an enterprise cloud-based software solution, FlytNow enables operators to conduct drone operations remotely & autonomously from anywhere in the world without having the need to be present on site. Connectivity solutions such as Elsight Halo, let operators unlock the full potential of the software solution:



- **Video management:** The platform allows operators to view multiple high-quality video feeds with ultra-low latency, making it easy to monitor and control drone operations from a remote location. Operators can also share real-time video data with stakeholders located elsewhere, enhancing collaboration and decision-making. The platform also enables integration with VMS and other static video feeds, providing operators with a comprehensive view of their operations.

- **Device management:** FlytNow's device management tools enable operators to manage and monitor their entire drone fleet, including docking stations. The platform integrates with weather stations and live weather forecasting tools like Windy to enable users to autonomously abort a mission in extreme weather conditions, ensuring the safety of the drone and surrounding areas.

- **Cloud-media sync:** With the access to decent connectivity, users can in a hassle-free way sync media from the drone's SD card to their private cloud storage. Once the drone has completed its mission, users can autonomously sync the media without the need for manual intervention.

- **Integrations for BVLOS enablement:** FlytNow also provides seamless integration with other technologies such as ADS-B, Detect-and-Avoid, parachute recovery systems and software such as UTM platforms for airspace awareness enabling remote operators to get a holistic view of their operating environment as well as ensure safe operations.

The diagram below shows how FlytNow and Halo works in conjunction.

To conclude, embracing the future of BVLOS drone operations requires a steadfast commitment to developing and implementing robust connectivity and autonomous software solutions. This enables businesses to unlock the full potential of this groundbreaking technology, driving innovation and growth across industries and ultimately shaping a safer, more efficient world.