

Advanced **Drone** Operations: Unlocking the Technology's Full Potential



In recent years, drones have expanded beyond consumer or specialist use to become a commercial option that provides a robust return on investment (ROI). As Unmanned Aircraft Systems (UAS) are more accessible, operators across a wide range of applications have embraced the technology to accurately map areas and gather the data needed to make better-informed decisions.

But technology does not stand still, and the result of ongoing innovation is the progress of more advanced drone operations which can help improve safety for both people in the air and on the ground, while also saving long-term costs and increasing efficiency.

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ADVANCED DRONE OPERATIONS

- Flights Beyond Visual Line of Sight (BVLOS)
- Operations Over People (OOP)
- Missions at night
- Missions within restricted airspace
- Flying multiple drones simultaneously

These flights typically require additional planning and permissions from the appropriate authorities to address any safety or logistical considerations. Drone users must first ensure their chosen UAS and supporting software can fly safely while adhering to the regulations imposed by the relevant Civil and National Aviation Authorities. Generally, this involves submitting requests and providing detailed operation descriptions and procedures.

Although the process to get approvals vary between countries and can often be lengthy, important steps are underway to make advanced drone operations more accessible for different industries, such as GIS & mapping, agriculture, construction, energy, mining, environmental and humanitarian.

In this white paper, we'll look at:

- Different types of advanced drone operations
- Regulatory landscape in the U.S., EU, Canada and Brazil
- What's next for the industry

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DIFFERENT TYPES OF ADVANCED DRONE OPERATIONS

Advanced drone operations have in common the need to be approved by a relevant authority. Applicants must be able to prove specific requirements, such as:

- Fail-safe features for the flight plan, the drone and the software
- Trained operators in the relevant software and hardware
- Access to the right supporting equipment, such as communication tools

BEYOND THE VISUAL LINE OF SIGHT (BVLOS)

BVLOS expands project functionality. While Visual Line of Sight (VLOS) flights operate to a range in which the pilot maintains visual contact with the drone, on BVLOS missions the UAS is out of the operator's view, allowing them to map larger or remote areas, meaning that one single flight saves valuable time in the field.

Given the vast potential of flying BVLOS, there is a significant commercial opportunity to scale up the technology in a fast, efficient, and reliable way.

Benefits

- Ability to map long-distance areas quickly and efficiently
- Survey remote and/or hazardous sites easily and safely
- Improved efficiency, mission's ROI and cost-effectiveness

BVLOS drone technology. Fixed-wing drones are ideally suited for BVLOS operations as they are lightweight, safe and easy to operate, with efficient batteries and airframes to map large areas. There is also extensive data supporting the durability and reliability of these systems thanks to thousands of hours of safety testing, which can help streamline and accelerate the approval of BVLOS requests. In contrast, Vertical Take-Off and Landing (VTOL) UAS are heavier and so may not be able to cover as much distance or pose more of a threat in the event of a crash.

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Industries that benefit from BVLOS operations. The capability to fly for longer periods opens a range of uses, including the mapping of long-distance sites such as fields in the **agriculture sector**, by helping operators avoid repeated repositioning to ensure the line of sight with the drone.

BVLOS also offers opportunities to improve the safety of mapping **high-risk areas**, such as oil and gas facilities or **mining sites**, since the drone user can avoid getting too close to hazardous objects. It is also used in **construction** and **utility inspections** to track progress on projects or regular monitoring, helping save time, expenses and protecting the workforce. As BVLOS becomes more advanced, there is further potential for **insurance companies** to use drones as a risk assessment tool in gathering up-to-date data.

OPERATIONS OVER PEOPLE (OOP)

Operations Over People refers to “a flight where a small UAS flies over any part of any person, regardless of how long the flight is over the person”, according to the Federal Aviation Administration of the U.S. (FAA).

Benefits

- Cover zones where uninvolved people may be present
- Fly and operate drones safely over urban areas
- Larger distance missions on normally prohibited sites

Necessary to fly BVLOS. Gaining OOP approval is also essential to fly BVLOS as, unless flying totally above a ground-controlled area it is difficult to guarantee that a drone can avoid people and traffic once it has traveled Beyond the Visual Line of Sight. OOP approval is therefore required not only for urban areas, but in applications such as mines and construction projects where uninvolved people are likely to be on-site.

The testing to get the OOP approval allows the authorities to check if the aircraft is dangerous when flying over people, which could potentially cause injury in the event of a collision. Key components, such as the propeller or the energy transmitted on impact, must be properly checked to pass stringent approvals.

FLYING WITHIN RESTRICTED AIRSPACE AND/OR AT NIGHT

Both flying a professional drone at night and in restricted zones - around airports, military bases or hospitals, among others - also require additional safety and logistical considerations, but the advantages can be a lifesaver.

Benefits

- Time-saving in life-threatening situations and challenging terrain
- Quick assessment of the situation for disaster response
- Thermal drone camera allows search and rescue missions

Gaining approvals for these operations. Although there are often no specific limitations for night flying, UAS must always be within the pilot's line of sight, meaning any drone should be illuminated to allow the pilot to fly responsibly, without collisions. Similarly, flights around airfields and airports are tightly restricted, unless appropriate permissions are granted, and it's synchronized with air traffic control.

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FLYING MULTIPLE DRONES SIMULTANEOUSLY

Currently, drones are usually flown separately or with multiple pilots. However, advanced operations with fleets had increasingly become a viable option in recent years – particularly with the rise of autonomous flights.

Benefits

- Improved efficiency for data collection and additional mission capabilities
- Coverage multiplied and reduced mission time
- Easily mapping of linear infrastructure

Multi-drone flights for time-sensitive missions. Using multiple drones simultaneously multiplies your coverage, and this is especially useful for time-sensitive flight scenarios. For example, instead of taking five flights using traditional VLOS methods, the use of BVLOS and the option of fleets could result in just one flight – helping to save costs and ensure operations are more viable.

“Using multiple drones simultaneously multiply your coverage, and this is especially useful for time-sensitive flight scenarios.”

Some flight management software, such as [eMotion](#), enables the multi-drone mission functionality, allowing to fly up to four drones simultaneously from a single computer.

THE REGULATORY LANDSCAPE

With the commercial use of drones more widespread than ever, it is essential to have the right approvals in place to conduct advanced drone operations. However, guidelines and progress vary across the globe.

U.S. REGULATIONS

Regulatory body: [Federal Aviation Administration](#) (FAA).

Regulatory framework: The FAA has a Code of Federal Regulations, called Part 107 rules, and pilots must have a Part 107 license to operate commercial drones. However, for advanced operations special waivers are required.

In case of emergency operations, the FAA can “quickly issue authorizations for natural disaster and other emergency situation responses”, even though there is no change to the application process.

BVLOS

Part 107.31 waiver is needed, which the aviation authority reviews on a case-by-case basis before approval. The BVLOS waiver application must state a detailed description of the mission, the hardware capabilities, the Detect and Avoid Systems (DAA), the command and control equipment (C2) and the operator's training, among others.

OOP

Part 107.39, officially called “Operation over human beings.” The rule was published in the Federal Register in April 2021. Applicants are required to detail several UAS security tests, to provide injury mitigation plan, operational data - altitude, airspeed, area of operation, time flying over people -, equipment, pilots certificates, safety procedures, etc.

MISSIONS AT NIGHT / RESTRICTED AIRSPACE

For operations at night, the company or operator needs a 107.29 waiver. Regarding flight over restricted airspace, the FAA states, “drone pilots planning to fly under 400 feet in controlled airspace around airports must receive an airspace authorization from the FAA before the fly”. To do so, the application must be made through the Low Altitude Authorization and Notification Capability (LAANC) system.

MULTIPLE DRONES

The waiver required to fly multiple drones simultaneously is Part 107.35, called “Operation of multiple unmanned aircraft”, for drones weighing less than 55 pounds / 25 kg on takeoff.

EU REGULATIONS

Regulatory body: [European Union Aviation Safety Agency](#) (EASA).

Regulatory framework: The Open Category group together all the standard operations for which different requirements and pilot training apply, depending on the activity and the weight of the drone. Advanced operations are not part of them, they are under the Specific Category.

BVLOS, OOP, MISSIONS AT NIGHT, IN RESTRICTED AIRSPACE OR WITH MULTIPLE DRONES

There are three ways to obtain these operational authorizations:

- **Operation risk assessment:** as the EASA states, “the drone operator is required to conduct a risk assessment of the intended operation” and the means to mitigate them by using one methodology that helps identify the risk level, as the Specific Operations Risk Assessment (SORA). It must be submitted to and approved by the respective National Aviation Authority (NAA).
- **Predefined Risk Assessment (PDRA):** the EASA defines it as “an operation authorization through a predefined risk assessment”, for which the agency has a list of the most common operations in Europe and their risk assessment. The drone operators are just required to put in place a list of actions to conduct the operation safely.
- **Light UAS operator certificate (LUC):** operators can ask the NAA to assess their organization and “grant you the privilege to self-assess the risk of operations and self-authorize them”, accordingly to the EASA. The privileges are allocated to the drone operator.

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CANADA REGULATIONS

Regulatory body: [Transport Canada Civil Aviation](#).

Regulatory framework: The authority developed a Remotely Piloted Aircraft System (RPAS) Safety Assurance rating to be filled in by the drone manufacturers, identifying the system capabilities and the advanced operations the specific UAS is eligible for, between controlled airspace, near people and over people.

BVLOS, MISSIONS AT NIGHT / WITH MULTIPLE DRONES

To perform these advanced operations in Canada a Special Flight Operations Certificate (SFOC) is needed. The procedure to get one is to send an application to Transport Canada Civil Aviation with details about the operation, the Operational Risk Assessment (ORA) and a checklist of documents to read. Submissions are reviewed in an average of 21 calendar days, but additional time may be needed if extra information is required.

IN-FLIGHT Data partnered with senseFly to test BVLOS flights in Canada.

CASE STUDY: IN-FLIGHT DATA

In 2018, Canadian commercial drone operator, IN-FLIGHT Data, carried out the country's largest BVLOS UAS Operations trial to date in the <25 kg / <55 lbs category, with support from senseFly. The trial returned more than 120 datasets, spanning 14 different test sites and covering over 1,500 km total linear flight distance, enabling data to be gathered across several different verticals. The flight safety data collected was subsequently provided to Unmanned Systems Canada and Transport Canada, to help define BVLOS risk models for different categories of unmanned aircraft for future operations. IN-FLIGHT Data also conducted the first urban BVLOS UAS project in the third most populous city in Canada, Calgary. The goal was to demonstrate that BVLOS UAS flights could be conducted safely and efficiently, while providing cost reductions and operational efficiencies.

OOP AND MISSIONS IN RESTRICTED AIRSPACE

Since January 2020, the senseFly eBee X, eBee Geo and eBee Ag are approved for [Operations Over People](#) and in controlled airspace by Transport Canada. These operations are a fundamental requirement for professionals looking to expand their mapping capabilities with BVLOS missions, of which the eBee X Series are capable of flying.

BRAZIL REGULATIONS

Regulatory body: [National Civil Aviation Agency of Brazil \(ANAC\)](#)

Regulatory framework: All UAS with a maximum takeoff weight above 250 g / 0.55 lbs need to be registered in the ANAC system. To operate a drone in Brazil, operators must follow the rules established by the National Civil Aviation Agency, the Air Force Department of Airspace Control (DECEA) and the National Telecommunications Agency (ANATEL).

BVLOS

The UAS must be certified by the ANAC according to the Brazilian Civil Aviation Special Regulation RBAC-E No. 94, Subpart E., and demonstrate safety requirements through detailed engineering analyses and in-depth flight testing.

In July 2021, the National Civil Aviation Agency approved [Beyond Visual Line of Sight \(BVLOS\)](#) flights to be carried out in Brazil using senseFly's eBee X drone. Following the certification, eBee X operators in Brazil now only require a CAER (Special Airworthiness Certificate for RPA) waiver before flying BVLOS operations.

OOP, MISSIONS AT NIGHT, IN RESTRICTED AIRSPACE OR WITH MULTIPLE DRONES

For these advanced drone operations, the operator needs to get a Special RPA Certificate of Airworthiness (CAER) and verify that the drone has been authorized by the ANAC.

WHAT'S NEXT IN ADVANCED DRONE OPERATIONS?

The potential benefits of advanced drone operations in the commercial settings are significant. Partnering with authorizing bodies or institutions will be integral to enabling the commercial drone industry to be able to collect more data and build on the regulations already in place. For example, working with a university can encourage knowledge sharing, allowing companies to follow regulatory progress from key stakeholders, like the FAA. Authorities are also looking more closely at the possibilities for improved unmanned aircraft system traffic management, where airspace is effectively shared between drones and other aircraft. This development is crucial for being able to fly over a congested area in the future.

DETECT AND AVOID SYSTEMS

Although Detect and Avoid systems are not yet widespread in the industry, they are an important step in making advanced drone operations planning more achievable and easier to scale up in the future. As Detect and Avoid technology becomes more refined and sophisticated, it may eventually replace the need and use of visual observers, which must currently be stationed every 1km on the ground. But while it can simplify approvals, adding extra people to operations can create financial stresses for commercial companies.

Another key consideration in implementing a Detect and Avoid system is the additional weight it can add to UAS. This is particularly true when it comes to 360-degree Detect and Avoid systems which, while providing a radial view of an area, can add more weight than their counterparts with more limited fields of view. Operators must therefore balance the potential safety improvements of using these systems with the drawbacks of additional drone weight. This technology may also require the provision of more on-the-ground equipment, which can add additional set-up and operational costs, although these costs typically would not outweigh the value of the system itself.

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Although regulations are becoming more flexible, there is still progress to be made to ensure widespread understanding and recognition of the benefits of advanced drone operations, as well as help make them more accessible to operators looking to navigate the often long field of approvals. Previously, for instance, request communications and processes have not been streamlined and do not always transcend across companies, or even countries – but there is optimism for the future scalability of these operations as progress continues to be made.

For operators, the key to supporting progress in this area will be maintaining communication with the relevant authorities at every step in the approval process. Connections are vital and working with the authorities is a two-way process: both parties want to learn more about advanced drone operations and streamline the administration requirements. Working directly with a drone manufacturer can also be helpful, as they can provide the knowledge to build a strong case for the authorities. With the right connections, advanced operations can be carried out easily and efficiently, and commercial companies can reap the rewards. With access to more data and improved operations, the future for advanced drone operations is exciting and the outlook for the industry is positive.

ABOUT SENSEFLY

Founded in 2009, senseFly, an AgEagle company, develops and produces a proprietary line of eBee-branded, high performance fixed-wing drones for professional use. Safe, ultra-light and easy to use, our autonomous drones are utilized by thousands of customers around the world in agriculture, government, surveying and construction, among other industry verticals, to collect actionable aerial intelligence that empowers them to make better decisions, faster.

For more information on advanced drone operations or for assistance with the application process, please contact us at info@sensefly.com



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