Revolutionising Airspace Management for Safe Drone Operations

As the integration of unmanned aerial vehicles (UAVs) becomes more widespread, the safe and efficient management of drones in urban and industrial airspaces is crucial. The rise of commercial drone operations presents new challenges for regulators and operators alike, including the risk of mid-air collisions, airspace violations, and disrupted aviation operations.

MyDroneFleets (MDF), developed by Garuda Robotics, addresses these concerns by offering a comprehensive platform for drone tracking, surveillance, and regulatory compliance. This white paper outlines the core challenges facing the aviation industry in managing UAV traffic and demonstrates how MyDroneFleets can help ensure safe, scalable drone operations.



Managing Congested Airspaces

As drone technology continues to expand in capability and application, the aviation industry faces the growing challenge of managing congested airspaces filled with both manned and unmanned aircraft. The surge in drone use across sectors like logistics, agriculture, and emergency services has heightened the need for robust airspace management solutions.

A prime example of the disruptive potential of unmonitored drone operations is the 2017 Gatwick Airport incident[1], where unauthorised drone activity caused massive delays and flight cancellations, grounding airport operations and rerouting thousands of passengers. Incidents like this underscore the need for comprehensive drone management systems. Without such systems in place, UAVs could easily compromise critical infrastructure, public safety, and regular air traffic flows.

Key Challenges in Drone Airspace Management

One of the major challenges in UAS management is ensuring seamless communication between drones, air traffic control (ATC), and regulatory authorities. Unlike traditional manned aircraft, drones often lack standardised communication channels with ATC, making it difficult for operators to receive instructions or for authorities to intervene in case of an emergency. This fragmentation of communication is further complicated by varying regional regulations, which create confusion among drone operators about where and how they are permitted to fly.

Another issue is the complexity of regulatory compliance, particularly for advanced operations like Beyond Visual Line of Sight (BVLOS) flights—key to unlocking the full potential of drones in logistics and infrastructure management. Many operators struggle with the complex and extensive regulatory approval process for such operations, as traditional flight planning and management systems are not fully equipped to handle the unpredictable flight patterns of drones. While built-in geofencing systems help prevent drones from entering restricted areas, there is a lack of harmonised data across manufacturers, leading to inconsistencies in compliance.

To overcome these challenges, there is a growing need for a unified UAS Traffic Management (UTM) system that can integrate real-time drone tracking, enable remote identification (RID) of UAVs, and automate flight approval processes to streamline operations.

Singapore's UTM Journey: Establishing a Global Benchmark

Singapore has emerged as a global leader in drone traffic management, setting a high standard for UTM systems worldwide. Through the Civil Aviation Authority of Singapore (CAAS), the country has developed a forward-looking UTM framework that integrates Remote ID tracking for all commercial UAV operations.

In 2019, CAAS awarded Garuda Robotics an exclusive contract to develop a Remote ID tracker for all commercial UAV operations. This system was commercially rolled out in 2022, making MyDroneFleets the longest-operating full-stack UAV tracking and surveillance system globally. By pioneering this solution, Singapore has established a benchmark for other nations looking to safely integrate UAVs into their airspace.

[1] https://www.theguardian.com/uk-news/2017/jul/02/drone-forces-closure-of-gatwick-runway-and-diversion-of-many-flights

MyDroneFleets: A Full-Stack UAV Tracking and Surveillance Solution

MyDroneFleets (MDF) is a complete UAV tracking and surveillance system designed to manage the growing complexity of airspaces occupied by both manned and unmanned aircraft. At its core is the MyDroneFleets UAV Tracker G2, a Network RemoteID tracking device that enables real-time telemetry, independent of the drone's flight controller.

Real-Time UAV Tracking and Surveillance

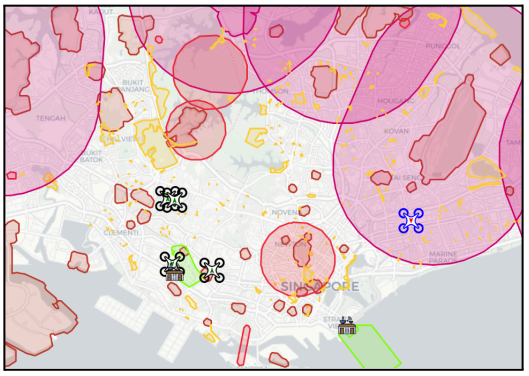
Illustration 1. MyDroneFleets UAV Tracker G2



The UAV Tracker G2 provides continuous real-time tracking and telemetry, utilising Global Navigation Satellite Systems (GNSS) to deliver precise position data. The tracker blends signals from GPS, GLONASS, and BEIDOU constellations to determine the latitude, longitude, and altitude of a UAV, with an accuracy of approximately 3 metres under clear skies. This accuracy, combined with global 4G LTE connectivity, ensures reliable tracking regardless of the UAVs environment or operational range.

This data is displayed on the Airspace Visualizer, a centralised interface that gives air traffic controllers, operators, and safety officers a real-time view of UAV locations, altitudes, speeds, and flight paths. Through Remote Identification (RID), MDF assigns unique digital identifiers to each UAV, allowing regulatory authorities to monitor and verify the identity of every drone in operation. By leveraging this real-time data, authorities can monitor UAV activity, prevent airspace violations, and ensure regulatory compliance, minimising the risk of collisions or unauthorised flights.

Illustration 2. MyDroneFleets Airspace Visualizer

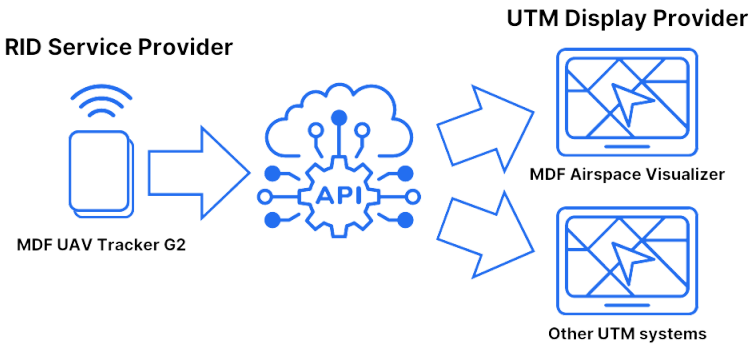


Customizable and Scalable API Integration

MDF's open architecture allows it to be integrated with a wide range of third-party systems, making it highly adaptable to the specific needs of different users. Regulatory authorities, air traffic management systems, and commercial operators can use MDF's API to customise the platform according to their operational requirements.

This API-driven flexibility also enables service providers to build their own Display Provider (DP) modules on top of MDF's core infrastructure, allowing them to create tailored interfaces for specific use cases. Whether managing a small fleet of drones or overseeing a national UTM system, MyDroneFleets can be scaled to meet the needs of any organisation.

Figure 1. MDF System Architecture



Real-World Case: Managing Airspace at the XPRIZE Rainforest Semifinals

In June 2023, MyDroneFleets played a critical role in ensuring the safe, compliant, and efficient management of airspace during the XPRIZE Rainforest Semifinals. This global competition, aimed at advancing our understanding of rainforest ecosystems through the use of UAVs and other autonomous technologies, posed complex logistical and regulatory challenges. Held in Singapore, the event brought together 13 international teams, each deploying UAVs equipped with advanced sensors, cameras, and other environmental monitoring tools to capture critical biodiversity data in challenging, remote locations.

Managing this high-stakes competition involved ensuring the safe operation of over 90 UAVs, with a total of 521 BVLOS sorties conducted over five full competition days. The complexity of managing these drone operations was heightened by Singapore's stringent regulatory requirements, which include adherence to strict geofencing rules and the need for multiple permits such as the Unmanned Aircraft Pilot License (UAPL), Unmanned Aircraft Operator Permit (UOP), and Activity Permit (AP).

Many teams were unfamiliar with these regulations, and some had never operated in Singapore before, further complicating the process.

MyDroneFleets provided the backbone of the competition's airspace management, ensuring that all UAV operations were safe, compliant, and efficient. The platform tracked every drone in real-time, monitored compliance with local airspace regulations, and provided automatic alerts if any UAV breached competition boundaries. In cases where violations occurred, MyDroneFleets triggered immediate alerts to both the operators and the safety officers, allowing for rapid corrective action.

In addition to real-time tracking, MyDroneFleets streamlined the regulatory process for international teams, automating the submission and approval of flight plans and integrating with Singapore's Centralised Flight Management System (CFMS). This integration ensured that all flights adhered to national airspace regulations, despite the high volume of sorties and the complexity of the competition. The system's ability to scale and manage hundreds of drones simultaneously showcased its potential for handling large-scale, real-world drone operations.



A Safe and Scalable Future for Drone Operations

As the commercial and industrial use of drones expands, the need for comprehensive airspace management systems will become increasingly critical. MyDroneFleets offers a proven solution to the challenges of managing UAV operations at scale. By providing real-time tracking, automated flight approvals, and seamless integration with existing air traffic systems, MyDroneFleets ensures that drones can safely and efficiently operate in both congested urban environments and remote locations.

The success of MyDroneFleets at the XPRIZE Rainforest Semifinals demonstrates its capacity to handle complex, large-scale operations in a real-world setting. With its ability to integrate with national UTM frameworks and scale to meet the demands of any operation, MyDroneFleets is well-positioned to lead the future of drone airspace management across industries and regions.

