

Safe drone flight – assuring telemetry data integrity in U-Space scenarios (‘SDF’)

Executive summary

The SDF project was set in the context of a wider thematic challenge to mitigate the safety and security vulnerabilities of future Communications, Navigation, and Surveillance systems in Air Traffic Management (CNS/ATM).

As guardians of UK airspace, NATS’ primary focus is ensuring the safety of all airspace users. Achieving this requires safety-critical and related data, including location-based data which is crucial for building accurate and complete situational awareness. In a conventional, manned aviation scenario, this data would typically be sourced from NATS’ primary and secondary radar surveillance networks. In contrast, in a typical U-Space scenario, Air Navigation Service Providers (ANSP) may not have the capability to survey and locate all consumer drone-sized Uncrewed Aircraft (UA) using its surveillance assets and may need, instead, to source this data from distributed, untrusted sources, such as the drones themselves. This raises the challenge of assuring that the incoming data is secure – that it hasn’t been maliciously or unwittingly changed – across a plurality of different U-Space scenarios. In other words, the assurance of safety and security in a mixed airspace user environment requires a high level of integrity of drone telemetry data across the Unmanned (air) Traffic Management (UTM) system.

Forensic readiness requirements to address the safety and security challenges associated with drone surveillance systems were investigated as part of *The Drone Identity – investigating forensic-readiness of U-Space services* Engage first wave catalyst fund project. That work, undertaken by the two entities supporting the SDF project, produced the *LiveBox* prototype that enabled further investigation of safety goals and managed the trade-offs between them and other constraints through self-adaptation.

The aim of the SDF project was to develop the *DroneBox* novel drone surveillance system, a predecessor to the *LiveBox* prototype, but rather than considering forensic data, the focus of this research was real-time drone telemetry data. The SDF project sought to mature the *DroneBox* prototype through industrial application while also understanding requirements on drone surveillance systems in terms of assuring the integrity of drone telemetry data and the mechanisms and system design principles that may be employed to do so.

The SDF project had three research activities:

1. Concept and prototype assessment
2. U-space scenario planning
3. Evaluation and validation activities

Through collaboration between NATS and the Open University (OU), all three activities have been carried out, resulting in a number of reports, the results and conclusions.

Notable outcomes include:

- **Capability study** that confirmed the prototype met the requirements to perform the validation activities as part of the project
- **Suitability assessment** which established that a blockchain-based solution using mobile drone witnesses was suitable for short surveillance operations in lower very low level (VLL) airspace in urban environments
- A set of U-space Beyond Visual Line of Sight (BVLOS) drone **use cases and scenarios**

- A set of cyber security mechanisms for **assuring digital trust**, commentary on their applicability to drone telemetry data, and an architectural design requirement on drone surveillance systems to have multiple embedded layers of security controls
- **Services and use case hazard assessments** which resulted in the deduction of the allowable data integrity failure probabilities, setting minimum requirements on the quality of the drone data needed for the provision of U-space services

Two SDF workshops were held over the course of the project which were attended by key internal and external stakeholders and both were very well received.

The intention is to publish a paper on the *DroneBox* prototype, seek future grant opportunities to further mature the concept, and disseminate the findings even wider through an upcoming conference.

This project brought together and leveraged the academic expertise from the OU with the industrial application and aviation knowledge from NATS. Doing so brought the early-stage *DroneBox* prototype closer to industrial application while identifying new research avenues to explore.



This project has received funding from the SESAR Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 783287.