

# Radar detection and classification of small UAVs and micro-drones



## The Challenge

Small UAVs and micro-drones are becoming more and more available to the general public for leisure activities and exploited in commercial applications (inspections, professional filming, support to agriculture, deliveries). However, there is growing concern for accidental or even criminal misuses of these platforms (privacy violation and illegal filming, flying over restricted areas, collision hazard with other aircraft, smuggling of illicit substances, use in terrorist attacks with explosives or chemical payloads).

How do we detect drones accessing restricted areas? How do we discriminate them from natural false targets like large birds? How do we classify between different drones to spot the 'rogue' ones, perhaps those loaded with suspicious payloads? Different technologies have been proposed, but what are the best ones and can we improve them?

## How is it solved?

Our work focuses on the use of radar for detection and classification of small drones. Radar systems can provide good capabilities, especially at long ranges and poor visibility conditions (thick fog, night-time), but conventional radar are not optimized to sense these platforms, as they are smaller and slower than traditional aircraft and fly at lower altitude.

We are investigating the Radar Cross Section and micro-Doppler signatures of different models of commercial and custom-made micro-drones, exploring the effect of radar parameters (frequency band, polarisation, number of sensors) and scenario parameters (number, shape, and materials of the drones, as well as deployment geometry of sensors and targets). These experimental data can improve the detection and classification of micro-drones.

## Why it is important

Better understanding of the radar signatures of micro-drones can help integrate manned and unmanned aircraft in the airspace, improve the situational awareness of operators and regulators, and support authorities to detect and react to potential misuses.

In particular, this can benefit manufacturers of sensors and systems for drone detection and classification, regulators and air traffic controllers as well as commercial operators and manufacturers of drones by providing a safer and better managed operational context for drones, and law enforcement authorities responsible for protection of national assets and infrastructure which may be threatened by criminal usage of drones.

## Partner organisations:

- NATS
- Parrot
- Blue Bear Systems Research
- FFI Norway (Norwegian Defence Research Establishment)
- Fraunhofer FKIE

## Applications

- Defence & security
- Air safety

## Contact details:

Dr Francesco Fioranelli  
School of Engineering  
francesco.fioranelli@glasgow.ac.uk  
Tel: 0141 330 4301