THE UAV GEOFENCING MANIFESTO

WORK IS ALREADY WELL UNDER WAY ON GEOFENCING STANDARDS TO CREATE 'NO-FLY ZONES' FOR UAVS. **SCOTT SIMMONS** AND **SIMON CHESTER** REPORT ON THE LATEST DEVELOPMENTS – AND HOW YOU CAN BECOME INVOLVED

It should come as no surprise to anyone that there are places that you can't fly your UAV. These 'no-fly zones' are defined by aviation authorities and help to maintain the safety or security of an area or group of people – such as maintaining privacy over a military installation or protecting the passengers of a commercial aircraft from collision with a UAV.

However, autonomous UAVs and UAV operators are often ignorant of restricted airspaces – especially with so many 'hobbyist' UAVs now on the market. As such, we can't rely on prior knowledge to maintain the sanctity of these no-fly zones: no-fly zones need to be automatically provisioned to aircraft or their control systems, and the aircraft or operator should receive appropriate guidance when approaching or entering such a zone.

The boundaries of these no-fly zones are commonly referred to as 'geofences' and describe a threshold over which an aircraft must take an action, such as not crossing that threshold. Geofences are typically mapped to specific boundaries relative to the ground and often by altitude above the ground surface.

Geofences, like anything, can be digitised in almost limitless ways: from a sequence of coordinates to a text description of an outline. Additionally, there are different ways that geofences can be interpreted – are they fencing an aircraft in or are they keeping aircraft out? To further complicate things, geofences can be:

- Static: such as around a military installation
- Time-limited: such as around the time a dignitary is at a location
- Dynamically changing over time and/or space: such as around an aircraft or a motorcade transporting a dignitary.

With all these variables, how can we ensure that the intended 'no-fly zone' created by an authority and represented

as a geofence is correctly interpreted by the many makes and models of UAV?

The answer, of course, is standardisation.

A central mechanism

Given that no-fly zones are managed by a small number of aviation authorities, a central publishing mechanism could easily be established to provide accurate and up-to-date geofences that define these zones. This mechanism would not only give aviation authorities a way to test and confirm a manufacturer's compliance, it would also reduce the liability of compliant manufacturers in the event of a breach by a customer. With this in mind, a publishing mechanism is likely inevitable.

Indeed, EUROCAE Working Group 105 is working on a standardised description of geofences that will describe permissible and non-permissible flying areas. A standardised description of geofences is a great first step, but these geofences must also be provisioned to the aircraft in a manner that ensures that all aircraft interpret the geofence the same way.

Thankfully, the problem of standardised geofence encoding and provisioning has already been solved by other industries. Geofencing has long been a core function of GIS and is commonly used in the logistics and transport industry. Geofencing is also used – albeit with different nomenclature – in air traffic control.

OGC, therefore, already has a host of standards that could be used to encode and provision authoritative, automated geofencing across the UAV industry.

A standardised encoding for no-fly-zone geofences could use OGC's Geography Markup Language (GML), KML or the IETF GeoJSON standard. For publishing the geofences to the web, OGC API – Features or Web Feature Service (WFS) are ideally suited to the task, as they allow for web-based identification, query and provision of geofence information to the UAV and/or its control software.

For the full provision of geofence data to UAVs, the OGC would recommend that either a new standard or a profile of an existing standard be developed. This would encode the attributes of a geofence necessary for any UAV to respond to the proximity of a geofence.

Measures, some quite novel, are commonly being undertaken to remove UAVs from no-fly zones - but isn't prevention better than cure?

New standards

In fact, OGC is already working on developing standards for use in the UAV industry.

OGC's UxS Domain Working Group (DWG) is populated with stakeholders that are discussing, documenting and defining interoperability requirements for a host of unmanned systems, including not only the flight-based systems we've been discussing in this article, but also any on the ground or in/under the water. In fact, at the OGC Technical Committee Meeting in Toulouse in October, the UxS DWG held a joint meeting with OGC's Aviation DWG to discuss such interoperability requirements, including those surrounding the issue of interoperable geofencing requirements for UAVs.

To aid in manufacturers' implementation of any future mandatory geofencing, OGC would additionally develop best practice guides that outline the purpose of and handling requirements for geofences. While the standards documents would describe the technical requirements for implementation, these best practice guides would provide information on how a UAV must behave when approaching or crossing a geofence boundary based on the attributes contained in the geofence data, such as: not entering restricted airspace, notifying the operator to turn off a camera, changing the aircraft's altitude, etc.

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The participants in the session in Toulouse identified a small handful of initiatives under way for defining geofences, but agreed that more work is required to harmonise these efforts and establish a simple exchange and provisioning protocol for all types of geofences. The OGC UxS DWG is cooperating in the ANSI Unmanned Aircraft Systems Standardization Collaborative in drafting a standardisation roadmap to identify standards gaps (including for geofences) and operational behaviours in the standards landscape.

Please join us

With work already begun on standardising the geofences that define no-fly zones, it will only be a matter of time before UAV manufacturers are required to implement a method that ensures their aircraft comply with the no-fly zones when in the air. OGC's UxS DWG is discussing and documenting any interoperability and technical requirements from UAV stakeholders to make implementing such a system as easy and beneficial as possible.

If you would like to actively help shape the standards surrounding UAV geofences, consider becoming an OGC member and joining the UxS DWG. If you would like to join in discussions similar to those held recently in Toulouse, OGC members and non-members alike are welcome to join the UxS DWG mailing list – info for doing so is available on our website.

Scott Simmons is chief operations officer and executive director of the standards programme and Simon Chester is communication manager at the OGC (www.opengeospatial.org)