Electronic Conspicuity - General Aviation Airfields' view of the world !

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## Steve Cooper - Flight Information Service Officer, Manchester (Barton)

Our skies are a crowded place, and it's getting busier ! NATS (The UK's largest Air Navigation Service Provider (ANSP), **handled 2.2 million flights during 2015** , however there are many many more flights managed by other ANSPs, or that do not receive any form of Air Traffic Service at all.

Since the early days of aviation, the principle means of avoiding collisions, at least for aircraft flying under 'Visual Flight Rules' has been 'See and Avoid' - that is that avoidance between aircraft has been achieved by pilots looking out of the window and following the Rules of the Air (the 'Highway Code' of the sky), to avoid other aircraft - But what happens if some, or perhaps most of the aircraft sharing our skies don't have a pilot on board to do the seeing ?

New technologies such as drones means that this is now a reality, and whilst, for now, in theory, drones in order to comply with **Article 94 of the Air Navigation Order** meed to be operated in 'Visual Line of Sight', so their operator can see and avoid other aircraft, the demand from the likes of Amazon with their **'PrimeAir'** will, subject to regulatory approvals, see 'Beyond Visual Line of Sight' drone operations becoming the norm - In future there will need to be some method for these drones to 'know' about other aircraft, manned and unmanned, and for drones to be able to sense and avoid other traffic.

It may surprise many readers, especially those not involved in the aviation industry, that not all aircraft are being watched over by Air Traffic Control on Radar Screens (which cost many millions of pounds to commission, maintain and staff) - The vast majority of the UK, especially at low level where General Aviation (light aircraft, helicopters, police helicopters, air ambulances etc etc), as well as military aircraft spend most of their time, is 'Uncontrolled Airspace' (also known as Class G), with only the airspace at higher levels, or surrounding major airports being 'controlled', here manned aircraft can - where available - choose to receive a radar service, or may simply fly using the 'See and Avoid' principle.
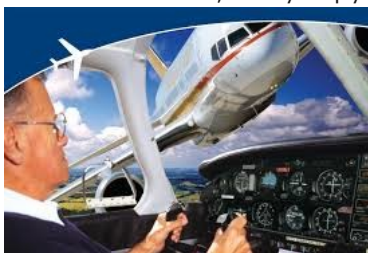
Aircraft straying in to Controlled Airspace from uncontrolled airspace without an appropriate and specific clearance from Air Traffic Control cause **'Airspace Infringements'**, of which there are **around 800 reported per year** - This creates risk to aircraft, including passenger flights, operating in to airports, and places additional pressure on Air Traffic staff as well as cost to airlines in fuel, as aircraft have to be separated by 5 nautical miles or 5000ft from 'infringers' . In the worst case, the consequences of a mid air collision between a light aircraft and a commercial aircraft, or a drone and any aircraft are catastrophic and would likely have far reaching consequences on the industry.

In the fast moving technological world we live in is there a cost effective solution that both reduce the number of infringements, and helps with the vast growth in drones making them visible to other airspace users? The answer is 'yes', and several General Aviation airfields including Manchester (Barton) are about to start a trial to look at its effectiveness!

Automatic Dependent Surveillance Broadcast (ADS-B)

Most readers will be familiar with GPS - Global Positioning System, we make use of it for our Car Sat Navs and in our smart phones. Simplistically, ADS-B is a method of sending GPS data from an aircraft to other aircraft, or to ground based receivers and satellites.

Aircraft and Drones equipped with ADS-B Out ('Out' being the ability to transmit data, 'In' being the ability to receive data), transmit their position and altitude every second on, and this can be received by either fixed ground based receivers (for instance an Air Traffic units), or portable units (for instance another aircraft)

Here at **City Airport Manchester (Barton)** we've teamed up with **Airspace4All** who have provided a **Uavionix pingStation** aerial which we've mounted up on the roof of our control tower . It sits there quite happily receiving ADS-B transmissions from as far as the Scottish Borders and down to the south coast of England, across the North Sea and out towards Dublin - A massive area of airspace!

The cost of this receiver is measured in thousands of pounds, not the millions a traditional ATC Radar would. This is key - General Aviation airfields have limited budgets and lack much of the technical expertise large airports and ANSPs such as NATS enjoy, and therefore solutions have to be simple and cost effective.

The data received by the pingStation is fed in to a standard Windows10 workstation attached to the airfield's network. The workstation is running an application called **Virtual Radar Server**, which allows the aircraft's positions to be plotted on a highly customisable map. At Manchester Barton we'll be monitoring an area of roughly 10 nautical miles around the airfield and have depicted airspace boundaries and 'Visual Reference Points' (VRPs), where aircraft commonly report. This display is recorded 24x7 for analysis and playback as required - The playback can be performed from any machine on the network so as not to interrupt the live display.

For us to make use of such a display we've had to go through an approval process with **Civil Aviation Authority** - Manchester (Barton), provides an Aerodrome Flight Information Service (AFIS), staffed by Aerodrome Flight Information Service Officers (AFISOs), who are not licensed or trained to provide any form of radar service - we've therefore had to agree a training package and a full safety case to start the trial use of the display. That's recently be signed off, and we'll be delivering the training very soon in anticipation of commencing the training in early 2019. In parallel the CAA are **consulting on licensing of Flight Information Service Officers**, including the use of surveillance based data.

The trial will allow FISOs to broadcast information such as generic traffic information to aircraft and warnings as to when they appear to be approaching controlled airspace. There will be no passing of specific Traffic Information, of deconfliction of aircraft - that remains firmly the preserve of Air Traffic Controllers with Radar ratings!

ADS-B is in itself an emerging technology for General Aviation, and whilst some aircraft are equipped with transponders that provide ADSB-Out (and In), most do not. The **CAA stated in August 2017** that :

ADS-B 'in/out' using 1090 MHz is its preferred national system to improve electronic conspicuity for general aviation

Therefore over the course of the next few years the avionics industry will move more towards producing more transponders for GA aircraft which have inbuilt ADS-B. As we, and Airspace4All and the CAA are all keen to progress trials it's been decided to supplement the limited number of GA aircraft based at Barton with ADS-B by loaning a number of 'SkyEcho' devices - these have kindly been provided by Airspace4All for the purposes of the trial and based aircraft operators that fly often (typically flying schools), will be invited to take part in the trial - Dispensation has been gained from the CAA to allow aircraft to use both traditional transponders and these devices together.

Here's a look at components of the system end-to-end

What's in it for pilots ?

As well as the advantages of AFISOs having increased situational awareness of air traffic, and being able to offer airspace warnings to participating aircraft there's even more advantages for GA pilots by making use of ADS-B. I mentioned ADSB-In, this allows data to be sent in to the aircraft cockpit and displayed on an appropriate device, such as an tablet or smartphone, or in to a GPS with moving map.

for in cockpit traffic warnings, and potentially weather information , such as Rainfall Radar and TAF and METAR data.

This data increases the pilot's situational awareness allowing for better decision making, therefore in itself reducing the risk of airspace infringements and collisions with other aircraft.

What about drones ?

ADS-B is not only limited to manned aircraft - like anything the ADS-B transmitters and receivers can be miniturised, and a range of devices are built specifically for drones:

This means that ADSB-Out equipped Drones can be seen by ADS-B equipped Air Traffic units. This technology was recently demonstrated at Manchester Airport with ADS-B equipped drones operating alongside commercial aircraft as part of **Operation Zenith**. The trial at Manchester (Barton) is essentially future proofed so drones transmitting ADSB-Out will show on our screen when operating in the vicinity - This will allow the Air Traffic staff to ensure such drones are being flown with their knowledge and agreement **as required by the Air Navigation Order**.

DJI, the world's number one producer of drones has started offering 'AirSense' on some of its models depicting other ADSB equipped drones and ADSB equipped aircraft operating in the vicinity , to aid operators in visually acquiring other airspace users so they can take action to avoid. It's highly likely that this technology will roll out to other DJI models soon !

Summary

The last few years have seen a fast paced and rapidly developing move to electronic conspicuity - The 'See and Avoid' principle will always be the number one means of collision avoidance, but there's so many more factors and airspace users that 'See and Avoid' is quickly changing, to 'See, BE SEEN, and avoid' (**as the CAA puts it**), meaning that whilst - for the manned VFR pilot , or drone operator operating within Visual Line of Sight, they remain wholly responsible for collision avoidance by by visually acquiring and avoiding other airspace users , electronic conspicuity is beginning to play an increasingly important part in General Aviation and Air Traffic environments.

Working towards delivering the first AFIS unit to make use of surveillance data is both exciting and challenging - especially as I'm doing this alongside a full time role in a completely different industry. If you'd like to hear more, or just want to reach out please don't hesitate to get in touch ! I'll post more as the trial progresses .

Steve C.
Service Level Manager at TalkTal...

Steve C.

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Kathryn Gilchrist
Kathryn Gilchrist
PA at Northwards Housing
8mo

Wow that is amazing Steve well what an achievement that will be

Like   Reply

Steve Hutt
Steve Hutt
Project Lead, Electronic Conspicuity for Airspace4All / Website Designer/Developer/Manager/Editor for Airspace4All
8mo

More info on this trial is available on the Airspace4All website:
https://airspace4all.org/projects/ec/ec-detail/

Like   Reply | 1 Like

Chris Gault
Chris Gault
Corporate Tax Associate Director
8mo

Nice article Steve!

Like   Reply | 1 Like

Adrian Price
Adrian Price
Senior Research Analyst at NATS
8mo

Steve, Your statement that "in theory, most drones should be operated in 'Visual Line of Sight' " is factually incorrect. It is not a theory, it is UK law as documented in the ANO. Also the sentence containing the phrase " 'know' about other aircraft" is factually misleading too. The alternative to VLOS is detect and avoid (aka sense and avoid). Finally, please do not distort the meaning of "See, Be Seen and avoid". The meaning of this is quite literal for the Human pilot the and is not to be interpreted as "Detect, Be Detectable and Avoid. Manufacturers of traffic information systems for GA make it clear that their systems do not replace the pilot's responsibility for Seeing and avoiding other aircraft. If you are suggesting a GA pilot should use an ADS-B receiver to detect and avoid a drone that is being flown BVLOS then you are provoking misuse of equipment that is not designed or intended to fulfill the safety case for BVLOS.

Like   Reply | 6 Likes   1 Reply

Adrian Price
Adrian Price
Senior Research Analyst at NATS
8mo

Hi Adrian Many thanks for taking the time to comment. The article was primarily designed as an introduction to ADS-B use at GA airfields, rather than an in depth technical look at the legalities of the use of such systems - but as I've made mention then you're right about the need to be accurate - so I've made a few amends to address and emphasis your points. I'd argue that something being illegal (operating BVLOS), doesn't mean it doesn't happen today - A quick search of YouTube will throw up examples of recreational drone operators flying through cloud layers and/or a considerable distance away where VLOS would be impossible.   It's a bit like saying that in theory no cars are traveling at greater than 70mph on a motorway. It's against the law, yes- but the reality is that it does happen. Anything that can help reduce the risk is of benefit in my opinion. As I emphasised in the article, it's actually the CAA that suggest that EC turns 'See and Avoid' in to 'see, BE SEEN, and avoid' (see link in article), but I take the point that this could be read differently - I've added some wording to stress the need to see and avoid and that remains paramount. Thanks again Steve

Like   Reply | 1 Like

Anthony B.
Anthony B.
Airfield Manager, Team Leader Aviation Services (MOD Boscombe Down) at QinetiQ
8mo

Steve, a great solution to the Class G airspace dilemmas as we transition to The future air navigation system (FANS). Please do keep me updated as the trial

Like   Reply | 1 Like

Neil Goudie CEnv MIEMA   8mo
Industrial Emissions - Regulatory Specialist at Environment Agency

The challenges of meeting the demands of a modernising uncontrolled, and controlled, airspace environment with myriad users is clearly layed out in your excellent post. The mantra of 'See and Avoid' is moving towards a new 21st century adage of 'See and Be Seen' through conspicuity technological improvements. That only works by having everyone working together and avoiding unintended consequences on flight safety by implementing solutions that works for one group and not for. After all the sky is only an extension of the 'green and pleasant' land that lies below it.

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