Clued up

UK Civil Aviation Authority

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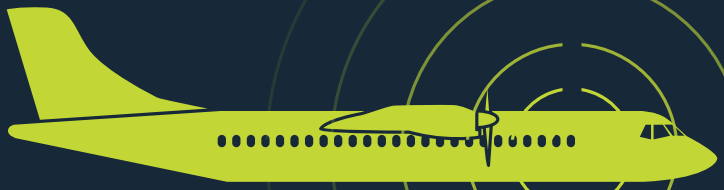

FUTURE VISION

SHARE THE AIR

ELECTRONIC CONSPICUITY

Clued up
FUTURE VISION

Publication content
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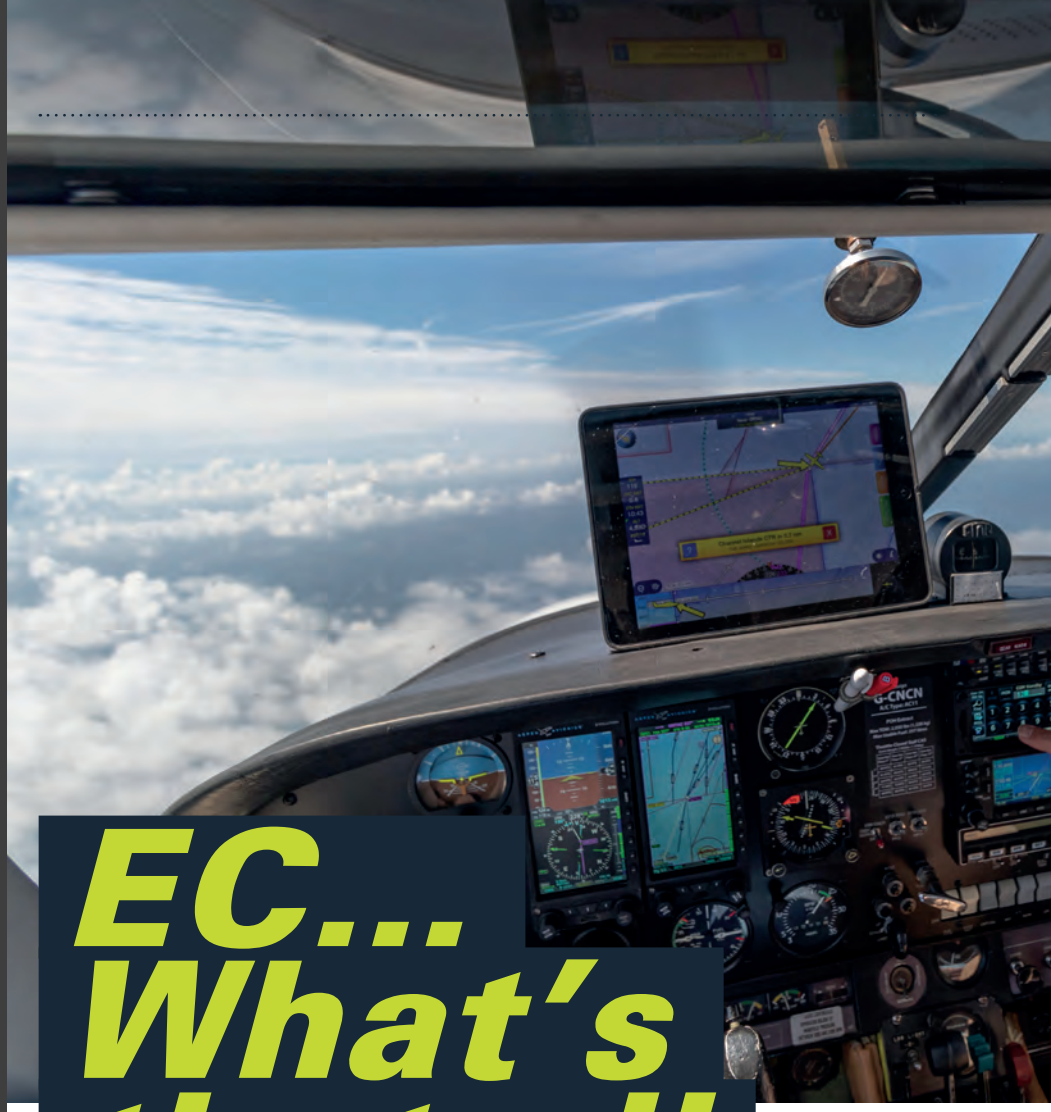
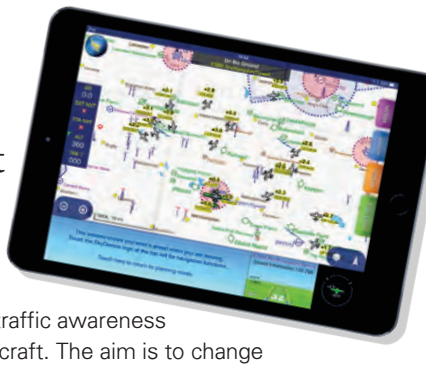


EC... What's that all about, then?



Confused or simply wondering what the fuss is all about? Well, it's all a case of looking into the future

Electronic conspicuity… it might be a heck of a mouthful simply to say, but it's the cause of much flying bar talk; what is it really, is it necessary, will the kit cost an arm and a leg and which system should I use anyway? The list of questions, comments and disagreements is endless…

Well, before getting into the detail for those new to the topic let's start by saying that electronic conspicuity is essentially an umbrella term for a range of technologies to improve traffic awareness between aircraft. The aim is to change the axiom 'See and Avoid' to 'See, Be Seen and Avoid' without the weight and power requirements of a traditional transponder; in addition, such devices could also have the spin-offs of improved airspace access and potentially weather and flight information delivered to the user's cockpit. And the cost? Far less than a transponder.

So why's electronic conspicuity such an important coming concept? That's

Bell's Nexus 4EX air taxi

Photos: James Mattil / shutterstock.com

Major companies such as Hyundai, Bell with its Nexus 4EX and Boeing have well developed programmes

because there are major changes looming in the use of the UK's airspace. Right now, like many things in life, the technological speed of advance in aviation is probably running at its fastest rate for decades and the days when flying was simply the preserve of traditional aircraft, balloons, gliders, paragliders and the like are disappearing over the horizon.

Recent advances in propulsion, energy, lightweight materials and control and stability systems mean that many types of new aircraft, small and large, manned and unmanned will be taking to the skies in the next few years.

Fancy taking an Uber-like 'air taxi' from A to B? You'll know by now that's no longer the stuff of science fiction; several major companies such as Hyundai, which has teamed up with Uber, Bell with its Nexus 4EX and Boeing with its Autonomous Passenger Air Vehicle, have well developed programmes, so air taxis in some form could potentially take off from 2023 onwards for both recreation and business.

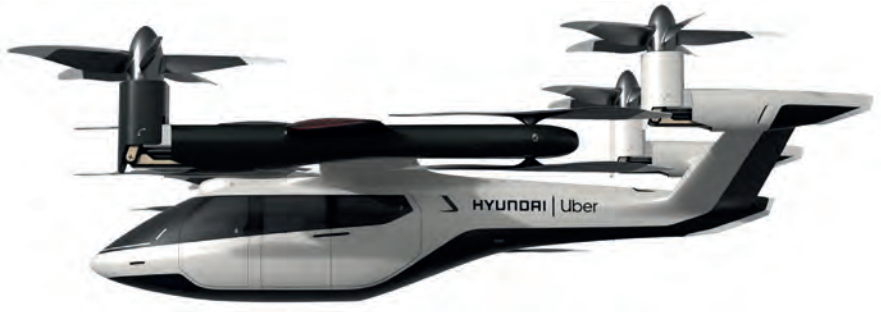
Meanwhile drones, both private and commercial, are now commonplace (who'd have said that a few years ago…) and their use is growing on average by 25% per year in the UK — there are now nearly 6,000 licensed commercial drone operators and many others who aren't yet licensed.

Then there are innovative organisations such as Amazon, currently experimenting with drones for '30 minutes click to delivery' of packages, and the National University of Ireland Galway which, in a world's first, used a drone to fly 'beyond visual line of sight' (expect to hear more of the cumbersome acronym BVLOS before long…) to deliver medicine to a diabetes patient at a remote island some 13.5 miles away before collecting a blood sample and returning.

As well as the coming potential of 'flying taxis', Boeing is also fostering the development of near-vertical take-off and landing 'personal flying devices' capable of flying at least 20 miles with its 'GoFly' competition and there's $2million dollars in prizes at stake (you can find out more about that project at goflyprize.com). So the skies are set to get rather busy in the coming years and we haven't even talked about potential space launch sites in Sutherland in the Highlands, Cornwall and Prestwick.

But, as with all advances in life and technology, there are issues and the major question now is how to integrate all this safely into the UK's current airspace system where capacity is already at a premium and based on arrangements almost 50 years old.

With aircraft in controlled airspace already using transponders for air traffic control and situational awareness, the new look at electronic conspicuity mainly concerns flights in uncontrolled airspace — though it should also have a spin-off of providing access to other areas of airspace for GA pilots, but more on that later.



This drone flew 13.5 miles over the sea to deliver medicine

Until recently most general aviation pilots have simply used 'See and Avoid' to keep out of trouble outside controlled airspace, but if the new types of aviation are to fit in safely and grow sustainably there's a coming need for something other than a good lookout to avoid a rising number mid-air encounters.

The latest annual figures from the UK Airprox Board give an idea of the size of the issue; in 2018, 319 potential collisions were reported of which 180 were aircraft-to-aircraft and 139 involved drones, compared with159 aircraft-to-aircraft and 113 aircraft-to-drone incidents in 2017, so that's a 17.3% increase in a year.

In its most basic form electronic conspicuity uses a small, low power, inexpensive transmitter supplying position, height and direction that can be picked up by other aircraft and vice versa. Used in conjunction with airfields it could also potentially cut down the number of airspace infringements for both airfields and pilots.

The kit, which is expected to be 'portable' could be used on registered and non-registered UK Annex II aircraft, Annex I non-complex EASA aircraft of less than 5700kg MTOM and for gliders and balloons (including thosecovered under ELA 1 and ELA 2).

If you haven't had the opportunity of seeing it in action, as well as the transmitter, a receiver (both usually in the same box) calculates whether there might be a conflict between you and another suitably equipped aircraft. Warnings are then given either via a display or audibly or both (something like traffic 100ft above, 11 o'clock) in good time for the pilot to locate the 'threat' and take avoiding action.

There are several excellent commercial systems already available in wide use for light aircraft, gliders, microlights, balloons and even paragliders/motors, but they use different technologies, including Flarm, P3i and ADS-B and most pilots who have used any of them would probably say they wouldn't now do without their device.

The biggest issue, though, is that not all devices can talk to each other which is, as they say, sub-optimal; no one wants to have to buy more than one piece of kit to do a job. The real key for electronic conspicuity to work properly

'There's clearly an appetite for some form of traffic warning device'

is 'interoperability' or, in plain language, ensuring that all devices current and future can communicate with each other using a common technological standard.

Given the global market for such devices the CAA says it doesn't want to impose a particular type of device or supplier, but it does want to see a standard digital technology. That might be ADS-B (Automatic Dependent Surveillance-Broadcast) technology, which as well as providing position and traffic information via GPS can also use its digital data to offer pilots weather and flight information.

The CAA recognises that devices need to successfully interact with each other to obtain the maximum benefit from electronic conspicuity. "We have recommended that anyone purchasing an EC device makes sure they are fully aware of what individual devices can and cannot do."

ADS-B has been used in successful ground trials at three UK GA airfields, Manchester Barton, Goodwood and North Weald, to see how well such ADS-B devices can also work in conjunction with airfields by displaying their traffic information to ground stations.

With the growing take-up of the new kit there's clearly an appetite among GA pilots for some form of traffic warning device — in a recent CAA survey 89% of some 1,600 pilots thought a traffic warning system would benefit safety — but, understandably, no one wants to spend a lot. Plus, they want it to be lightweight, have low power consumption, be simple to operate, provide value and not become obsolete quickly.

With that in mind, the survey looked at what might encourage pilots to use a low powered ADS-B device and cost came out top for two-thirds of those who replied. Some 40% said they were prepared to pay between £100-£250, while a further 50 percent were willing to up the ante to £250-£500. For more than half the ability to receive flight information or weather data via ADS-B was a great attraction.

Another potential benefit of electronic conspicuity is access to more airspace as we touched on earlier. As well as possibly easing access for aircraft into some already 'controlled' areas, it might also reduce the number of airfields trying to get new controlled airspace installed around them because such airspace control would be deemed unnecessary.

It's worth noting, though, that even based on ADS-B technology electronic conspicuity devices are not yet a substitute for a transponder and fulfil the requirement where transponders are mandatory, although expected policy changes in 2021 may change this.

So is electronic conspicuity worth having and will it become mandatory? The answers are yes (just ask anyone who's flown with it, chances are they'll never go back) and no – at present there's no intention of it becoming mandatory, the feeling is that a flexible approach is needed suitable to the circumstances of particular categories of aviation.

Looking ahead, there's no doubt some form of electronic conspicuity is going to be essential for flying in certain blocks of uncontrolled airspace and to aid integration as more types of 'new' aircraft rise into the skies and drones play an even larger part of everyday life — otherwise before long we might hear air-taxi drivers shouting *"Look at that bloke, what's the matter wiv 'im, can't he see us…?"*.

Human factors to think about

The benefits and issues will vary between electronic devices, so here are some ideas to get you thinking

Rely on your core flying skills

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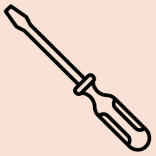
Having an EC device can be a useful safety aide, because it can help you to build a picture of the traffic and airspace around you; but it cannot show you everything. Using a device will not replace your core flying skills such as keeping a good lookout / scan and understanding the airspace conditions and rules.

Placement



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For carry-on devices, make sure your device:

- Is securely placed and cannot become loose in flight, or that parts might fall off.
- Does not impede your actions or any instruments in the cockpit.
- Works with other equipment you may be using .
- Has a fully charged battery that will last for longer than your planned flight and/or a way to recharge, if required.

Know your Device

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Make sure you understand thoroughly all the benefits and limitations of your particular EC device. Understand what it can and cannot show you and have a goal for the extra information you will need to find through your usual scan. E.g. it might only tell you about other airspace users who have the same device, you might also only be visible to users with the same device.

Stay Up-to Date

Make sure you keep yourself updated with the latest safety alerts, consultations, rule changes, airspace amendments and more from the CAA's SkyWise. Www.skywise@caa.co.uk

Include it in your flight planning

Include your device in your flight planning so that you are aware of any changes it may make to the way that you usually do things, where you fly, how you manage risks (such as traffic choke points) and how you will change your plan if the system becomes inoperable.

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Record all events or failures

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Ensure you record all safety events or issues related to using the EC; these could be as serious as an airspace infringement or near miss, or as simple as realising you didn't have the 'full picture'. It is important that we understand how these devices are impacting how we use the airspace and our flying.

So, how well does it work then?

Good question — and to find out practical electronic conspicuity trials have been carried out at three airfields

Let's be honest, busy airfields can be pretty fraught at times and even quiet ones can sometimes spring a heck of a surprise to the unwary — and that includes the crew in the tower as well as the pilots.

Pilots' tales of close calls are all-too-common, while for many tower staff at general aviation airfields the only real information they get is what the pilot tells them on the radio and what they see with their eyes. So, with that in mind, trials have been carried out to try to find a low-cost electronic solution to the potential risks, enhance safety and help to avoid airspace busts.

That's all there is to the new aerial

At this point you might be saying "yes but my lookout is pretty good" which is fair enough, but trials in the U.S. some years ago found that without traffic alerts the probability of pilots sighting a threat is generally low until just before impact, but with alerts a pilot's search effectiveness increased by a hefty factor of eight, and an alert from air traffic services or a listening watch was likely to be similarly effective.

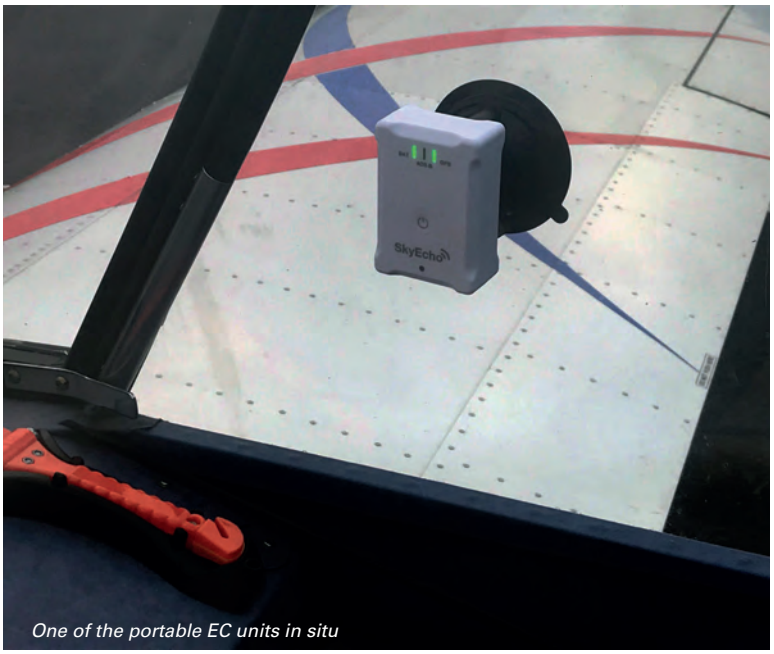
Take this example closer to home at Sibson in 2019 when two aircraft ended up on short final at the same time. Radio calls hadn't provided the pilots with good situational awareness and neither sighted the other; as the first touched down the second was 50ft above, so the air/ground radio operator decided to 'instruct' the higher aircraft to "go around" even though by rights he shouldn't have.

Airprox Board analysts reckoned that but for his 'instruction' there would have been a collision five seconds later. They added that had the aircraft been suitably equipped and the radio operator armed with an ADS-B traffic display he could have given better information much earlier, preventing the incident and the need for the radio operator (who was commended for his actions) to exceed his privileges.

Barton's tower display

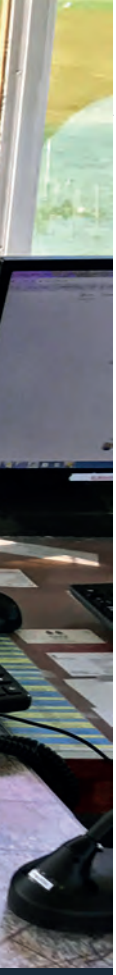
In another airprox in 2019 in the North Weald circuit, the Board also praised the air/ground operator for providing traffic info based on ADS-B that ensured there was no risk of a collision.

For the trial run by Airspace4All three airfields were selected, Manchester Barton, Goodwood and North Weald: Barton and Goodwood both have an Aerodrome Flight Information Service (AFIS) while North Weald's radio is air/ground. The trial was due to run for six months with Barton's starting in March 2019 while North Weald's and Goodwood's began in May. Barton's initial try-out was completed in August 2019 and a second phase ran until April 30, 2020. The main aims were to see whether ADS-B



One of the portable EC units in situ

Goodwood's tower with ADS-B aerial on the left



Traffic Displays at general aviation airfields would be practical, help mitigate the risk of potential mid-air collisions, help to reduce airspace infringements and check whether people were following local traffic regulations.

The airfields' Flight Information Service Officers/Air/Ground Operators were trained up to be allowed to broadcast generic traffic information and warnings if aircraft appeared to be approaching controlled airspace, but they weren't allowed to pass specific traffic information or aircraft deconfliction instructions, that remained firmly the preserve of controllers with radar ratings. While they weren't allowed to pass traffic information in a form relative to the direction of travel, "you have traffic in your 2 o'clock", geographic locations were permitted, such as "there is traffic in the vicinity of Irlam VRP".

The towers' new traffic display systems were relatively low-cost – about three percent of other broader systems, so installation is well within the means of virtually all general aviation airfields. As well as the ground stations, Airspace4All provided 50 commercially available portable ADS-B transceivers to make more local aircraft 'visible' to the displays.

Data was fed into a standard Windows 10 computer running a cost-free Virtual Radar Server so that the aircraft could be plotted on a map on a conventional low reflection PC monitor. The main cost was an ADS-B ground receiver and a receiver/aerial (£1499 at the time). The setup was reasonably straightforward, only requiring a small amount of IT expertise.

Then it was down to the daily business at the airfields with the operators providing enhanced advice, information and warnings as appropriate. To monitor the trial's progress, the operators provided daily and monthly feedback which produced some additional and surprising results ranging from pilots mistaking runways or heading for controlled airspace, to others not being quite where they thought they were…

One report, for example, said: "*G-XXXX reported six miles west when in fact he was showing as three miles south-west. One minute later [the] aircraft was downwind so the pilot position report was definitely wrong and the ADS-B data was proved correct and accurate*".

Clearly most of the operators liked the system and wanted to keep the kit after the trial. Essentially, they said the displays were safe, reliable, very accurate and not a distraction. Many added that it was a valuable additional tool that provided positive safety benefits to aircraft. The trial did, though, require commitment from airfield management and staff to provide the installation, training and supervision, and an openness to change.

Their comments were summed up well by one who said: "*Having been a FISO for some 20 years it has been nothing but a positive. It enables me to provide a much better service as a FISO giving me a tool to enhance my own situational awareness. Rather than relying solely on (often inaccurate and woolly) position reports, I can now confidently know where aircraft are and identify relevant traffic information and assist pilots in avoiding conflict*".

And it seems the pilots liked the system too; interestingly, the trial has so raised general awareness of ADS-B in the wider general aviation community that there's been a noticeable increase in the number of people fitting their own ADS-B units at the airfields where the trials took place.

There were, of course, some issues including poor cockpit positioning of the portable ADS-B units masking the aircraft's signal, pilots forgetting to switch them on, lack of charge, not switching off on the ground resulting in 'clutter' on the traffic display screen and using a device programmed with information for the 'wrong' aircraft.

In summary, the trial's report said that overall the ADS-B Traffic Display was found to be an effective and economic means of providing accurate and timely traffic information to aircraft at and around a GA airfield. Its installation was welcomed by ATS and AGCS operators.

A recommendation added that ADS-B position data should be usable/ treated by air traffic services as exactly equivalent to a pilot position report. In the absence of a pilot position report (if the aircraft isn't on frequency, for example) then the position date is all that ATS has to pass on as traffic information and even with pilot position reports the ADS-B position is usually more up to date and often more accurate.

So, with phase one concluded, where does ADS-B in relation to general aviation airfields go from here? At present, all of the results are being examined and further trials are expected this year.

If you'd like to read the latest official guidance to on setting up ADS-B in general aviation aircraft you'll find it in AIC (Y141/2019) on the NATS website (nats.aero).

Devices shown are PilotAware Rosetta, Air Avionics TRS, Garmin GDL 50, LX Nav, SkyEcho 2 and Aboba

Getting kitted-out

There are many pieces of kit available. The question is, what's right for you?

Before getting your aircraft and/or yourself equipped for EC you need to spend a few moments to answer some key questions about your operating environment and your objectives Initially your need to consider:

1. Do I want a portable system I can move from aircraft to aircraft, or do I want something that will be installed in a single aircraft?
2. If you are looking at a single aircraft then what equipment does it have already and what type of airworthiness regime does it operate under (eg EASA, LAA, BMA, BGA, etc)?
3. Do I want to be able to interoperate with existing EC that's using non-ADS-B protocols, and if so which ones are most important to me?

Once you have the answers to these three questions you can go on to look at the three elements which need to be catered for when providing a 'See and be seen' EC solution. These are:

Transmit: How will I broadcast my position?
Receive: How will I receive other aircraft position reports?
Display: What's the best way to display the information, and any resulting alerts, to the pilot?

As few fully integrated solutions are available you'll typically need two or more devices to provide all three elements. The good news is that in many cases you may already have equipment that can be used to fulfil some of the required functions. The routes to enabling ADS-B out for the general aviation fleet have been laid out in AIC 141/2019*.

We'll go on and look at each element in more detail and give some ideas of the options available. As the UK avionics market is constantly changing we can't, of course, cover every device here, and new ones will no doubt come on sale once the roll-out of EC picks up pace, so it's always worth a bit of research to see what is the latest available.

TRANSMIT

The first question here is whether the aircraft you are considering is already equipped with a Mode S Transponder that's ADS-B capable (also called 'extended squitter'). With modern Mode S equipment this is likely to be the case, and the transponder will simply need a source of GPS derived position information to be connected.

If you don't have a Mode S transponder you might want to install one for increased visibility to ATC, in which case fitting a GPS source at the same time would be sensible — most commonly available transponders support this. Integrated units such as the Garmin GTX345 are also emerging and provide a Mode S Transponder with GPS, ADS-B-out and ADS-B in. As with any certified avionics you need to check the approval status for your aircraft and usage.

If you don't have Mode S, and are not planning to do so, or want a 'carry-on' solution then the ADS-B transmit function can be satisfied by a stand-alone device which complies with '*CAP 1391: Electronic Conspicuity Devices'. The prime example of this currently is the uAvionix SkyEcho 2, which will both transmit and receive ADS-B, has an integrated GPS and ADS-B antenna and is battery powered for 'carry-on' use. Recent CAA rules allow you to use CAP 1391 devices alongside existing transponders, but you must ensure the transponder is not also sending out an ADS-B signal.

If you want to provide GPS data to an existing transponder you can achieve this with a certified device such Trig's TN72 GPS Receiver. However the CAA also allow the provision of GPS data from uncertified sources, so if you have existing GPS capability — perhaps from another EC device such as Flarm, PilotAware, or from navigation equipment which can output GPS data, then you can also connect that to your transponder. For General Aviation air-to-air use either form of GPS is suitable, but if you want commercial traffic to 'see' your ADS-B position then go for a certified source. While the connection of a GPS to a modern Mode S transponder is normally relatively straightforward, a number of processes need to be followed depending on the airworthiness maintenance regime you're following.

Either route, a Mode S device with GPS input or a stand-alone CAP 1391 device, will give you the capability to broadcast your position so that you can 'Be Seen'.

RECEIVE

To be able to assess traffic around you the next step is to to 'See', so the first stage is to ensure you can receive ADS-B

and then forward that information to a display. The receiver and display need to be linked together, so you need to ensure your selected products will communicate with each other. There are various means of passing electronic data, wired (RS232), Bluetooth or Wi-Fi, and common protocols are typically either GDL/90 or NMEA based.

If you've decided to go the CAP 1391 route then it's likely that device will receive ADS-B as well as transmit it. If you are using a Mode S transponder you'll normally need a separate receiver. There are two approaches here, but whichever you choose the selection needs to be done in tandem with the choice of traffic display as not all displays work with all receivers.

- You can get a GPS with an integrated ADS-B receiver and examples are given in the table below, but this is just a sample and there are also open-source solutions. However, you need to check your choice works in the UK environment as some will be aimed at the U.S. where ADS-B implementation is slightly different.
- You can take the opportunity to improve your interoperability with non-ADS-B electronic conspicuity systems by choosing, for example, a PilotAware (PAW) or a Power-Flarm/ADS-B based device (several manufactures are available). Examples are given below but this list is not comprehensive. Some of these devices have integrated displays and most can either be permanently installed or used as a 'carry-on' solution.

**CAP 1391 specifies Electronic Conspicuity (EC) devices that have the ability to signal their presence to other airspace users, thereby turning the "see-and-avoid" concept into "see-BE SEEN-and-avoid".*

** AIC 141/2019 Enabling ADS-B out in the UK General Aviation Fleet explains how connection of a GPS position source can be achieved.*

GPS/ADS-B Receivers

Dynon *(dynonavionics.com)*	f.u.n.k.e *(funkeavionics.de)*	Garmin *(garmin.com/en/gb)*	Levil Aviation *(levilaviation.com)*

Multi-protocol devices

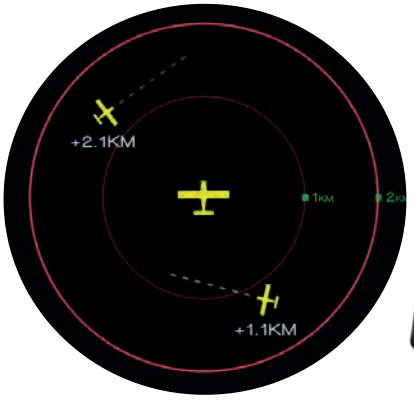
Maker	Device	Integrated Display	Receives	Transmits	Connect to Display/EFB
AIR Avionics *air-avionics.com*	AIR Traffic Receiver System *(Panel mount)*	Optional	ADS-B[1], Mode-S, Flarm	Flarm	Serial RS232, ARINC429, Wi-Fi
Flarm *flarm.com*	PowerFlarm Core	No	ADS-B[1], Mode-S, Flarm	Flarm	Serial RS232
	PowerFlarm Portable	Yes	ADS-B, Mode-S, Flarm	Flarm	Serial RS232
LXNav *lxnav.com*	FlarmBat *(Portable)*	Yes	ADS-B[1], Mode-S, Flarm	Flarm	Serial RS232, Bluetooth
	PowerMouse *(Behind Panel mount)*	Yes	ADS-B[1], Mode-S, Flarm	Flarm	Serial RS232, Bluetooth
LxNavigation *lxnavigation.com*	FlarmEagle Mobile *(Portable)*	Yes	ADS-B[1], Mode-S, Flarm	Flarm	Serial RS232
	FlarmEagle *(Behind Panel Mount)*	No	ADS-B[1], Mode-S, Flarm	Flarm	Serial RS232
PilotAware *pilotaware.com*	Rosetta *(Behind Panel Mount)*	No	ADS-B, Mode-S, P3i, Flarm[2]	P3i	Serial RS232, Wi-Fi
Uavionix *uavionix.com*	SkyEcho 2 *(CAP 1391) (Portable)*	No	ADS-B, Flarm3	ADS-B	Wi-Fi

Notes
1. ADS-B & Mode-S reception is an optional add-on to most PowerFlarm based devices
2. PAW devices receive Flarm via re-broadcast from the ground based Open Glider Network or via an attached Flarm receiver
3. SkyEcho receives Flarm, but requires Flarm-licenced EFB software to decrypt (eg SkyDemon, EasyVFR V4, or ForeFlight).
4. Funke TM250 Flarm display is non-directional unless a Flarm receiver is connected
5. Where a device is marked 'behind panel mount' it requires external power but could be mounted in any convenient location.
6. Mode-S detection is non-directional, except for PilotAware which uses multilateration (MLAT) via the OGN network to derive location

FLARM/PILOTAWARE

Flarm and PilotAware traffic awareness and collision avoidance systems have been available for many years. They provide both like to like 'See and be Seen' using their own protocols and the ability to detect other devices including ADS-B transmitters and Mode S transponders. FLARM Technology Ltd. use a form of licensing regime to allow a variety of other hardware and software vendors to make compatible equipment, go to flarm.com/products/powerflarm/product-selector to see all the other options available.

PilotAware aims to provide a low cost approach using an open protocol, licensed software and commonly available hardware as well as their own products. See the pilotaware.com website for more details.

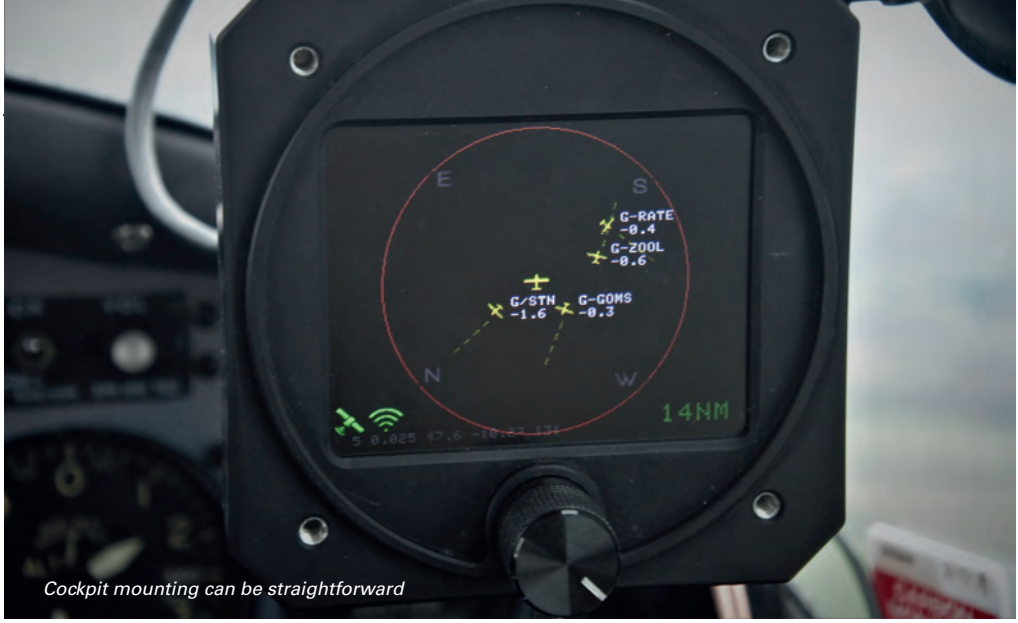


Devices shown are Flarm display, Aircrew traffic display and Garmin G600TXi

DISPLAYING TRAFFIC

Alongside your ADSB receiver you need some form of display to show the traffic around you, and optionally generate verbal or visual warnings of potential conflict. The important factor here is to ensure that your chosen solution allows you to easily scan the display while still keeping a good lookout; electronic conspicuity is only an assistance to a good visual scan. It helps greatly to have audible warnings, either through voice or alarm sounds, and many solutions provide this.

Here there are three options, you can either have an integrated receiver/display, a dedicated traffic display, or use a moving map (EFB or integrated) that supports traffic data from your receiver.



Cockpit mounting can be straightforward

➔ **Moving map or electronic flight book (EFB) displays have the advantage of showing you where the traffic is along your route, but you should also consider the in-cockpit position of your mapping system in relation to your eyeline and whether you can get audible warnings.**

- Most popular EFB software (e.g.SkyDemon, EasyVFR , ForeFlight, or AirNavigation) will interface to a variety of receivers, including Flarm, SkyEcho or PilotAware, as well as a number of the GPS/ADS-B receivers. Connecting between the receiver and the electronic flight book is normally wireless, either Bluetooth or Wi-Fi. The vendors and receiver manufacturers will document the options available.

- If you have an existing panel mounted map display such as those available from Garmin or Dynon then they will often have capability of interfacing to a receiver and displaying traffic information. There is a wide range of options here, so it's best to check with your vendor.

- Other software based 'traffic radar' displays can be used, for example PilotAware provide a simple traffic radar that can be used on a smart-phone.

➔ **Receivers with an integrated or attached traffic display are noted in the table. Several Power-Flarm devices have this capability and displays range from a simple 'LED-clock' to a more detailed traffic monitor.**

➔ **A dedicated 'traffic monitor' often has a radar-like display showing multiple targets and normally integrated audible alerts for conflicting traffic. They can be mounted in the panel, or on the panel face or glare-shield and can be a simple 'clock' display or a more detailed 'traffic radar'. Most are designed to operate alongside a PowerFlarm-based receiver, but some support other Display/Receiver interfaces.**

Traffic Display (examples)

Maker	Model	Display Type	Receiver Interface	Functions	Supported Receiver Type
Aboba Electronik *aboba.ch*	V4 / V4M	Panel	RS232	LED Clock, Distance	PowerFlarm
Aircrew *aircrew.co.uk*	Aircrew Traffic Screen	Panel/Surface	RS232, Wi-Fi	Traffic, A/H	PowerFlarm, PAW, GDL/90
AIR Avionics *air-avionics.com*	Air Traffic Display	Panel/Surface	RS232	Traffic	PowerFlarm, Garmin/TIS
LxNav *lxnav.com*	TrafficView	Panel	RS232	Traffic, map	PowerFlarm family
	Flarm View	Surface/coaming or panel *(57mm)*	RS232	Traffic	PowerFlarm family
LxNavigation *lxnavigation.com*	Traffic Monitor	Panel/Surface	RS232 or CANBUS	Traffic, map	PowerFlarm family
	Colour Display	Surface/ Coaming	RS232	Traffic	PowerFlarm family

***Installation requirements** depend on the maintenance regime you are using for your aircraft. Portable devices can be used in any GA aircraft provided they do not interfere with the controls, vision or electronics.*

If you wish to connect a GPS source to your transponder or permanently install other electronic conspicuity equipment in a non-EASA aircraft the LAA and BMAA provide documented procedures. For EASA gliders most manufactures have a 'blanket' technical note allowing such installations

For EASA light aircraft many traffic devices are covered by Minor Change approvals or EASA Standard Changes (CS-STAN). In particular CS-STAN now also authorises aircraft maintenance engineers to connect a GPS position source (certified or non-certified) to an ADS-B capable transponder, but this work has to be done by a licensed engineer.

Note: Various "clock" displays are also available for attachment to PowerFlarm, and can be obtained from LXNav, LxNavigation or Aboba Electronik .

Products shown at time of going to press (October 2020)


Devices shown are LXNav, PilotAware, FlarmBat, and (top) Aircrew

Cut the cost of new kit

Thinking of fitting an electronic conspicuity device? There's funding available to help out

You'll recall that during the change to 8.33kHz radios back in 2018 the CAA paid up to 20 percent of the cost of new equipment and some 6,000 pilots took up the offer. With the move to encourage GA pilots to adopt electronic conspicuity a similar funding system has now been set up with funding from the Department for Transport.

The scheme, which will also include some drone users, opened on October 5, 2020 and will run until March 31, 2021 (or earlier once the funding is used up). Anyone meeting the requirements will be able to claim a 50 percent rebate of the purchase cost of an EC device (including VAT) to a maximum of £250 per applicant. It's expected that up to 10,000 rebates will be available.

WHAT ARE THE REQUIREMENTS TO APPLY?

- Funding is for carry-on or aircraft-fitted devices only. Ground system components do not qualify for this scheme.
- Applicants can claim a single rebate of 50% - up to £250 - on EC equipment purchased.
- Only equipment purchased from 1st October 2020 until 28 February 2021 will be eligible for rebate.
- You must produce a proof of purchase receipt.
- You must hold at least one of the following UK issued pilot licences (UK or EASA part FCL):

- Private Pilot's Licence (PPL)
- Commercial Pilot's Licence (CPL)
- National PPL (NPPL)
- Sailplane Pilot's Licence (SPL)
- Balloon Pilot's Licence (BPL)
- Light Aircraft Pilot's Licence (LAPL)

Or be a registered member of either the British Hand Gliding and Paragliding Association (BHPA) or the British Gliding Association (BGA).

- Alternatively, if you are UAS/UAV operator then you must hold an authorisation issued specifically to them by the CAA (i.e. a permission, exemption or 'operational authorisation').
  Note: General Exemptions, permissions or authorisations which are aimed at a wider and no specific group of operators are not included.

ELIGIBLE EQUIPMENT

There is a range of EC solutions on the market that manufacturers and the communities have developed for their own needs and using these technologies provides several benefits to the airspace user, however purchasers need to understand the limitations of such sub-systems and which other users / systems they can interact with.

The main equipment able to be used on an aircraft for EC purposes currently available (and that a refund can be claimed against) includes:

- ADS-B Out capable transponder inclusive of GNSS position source (Mode S ES Enabled).
- ADS-B Out capable transponder without GNSS position source (Mode S ES)
- Certified GNSS source for Mode S ES transponders (Including a GNSS position sources in line with the recently published AIC2019Y141, an example being Trig TN72)
- FLARM
- Power FLARM
- Pilot Aware Rosetta
- Sky Echo 2

We will consider requests from device manufacturers for alternative or newly developed equipment to be added on a case by case basis.

WHAT DO I NEED TO CONSIDER BEFORE PURCHASING AND USING EC EQUIPMENT?

'See and avoid' is the foundation for Visual Flight Rules flying in the UK. Electronic Conspicuity devices can improve situational awareness for pilots but do not replace the fundamental role of 'see and avoid'. Pilots using such devices should be aware of their functionality and what they can, and cannot, do. Devices are not always interoperable with each other. This means that users of one type of device may or may not be electronically visible to each other, may have different standards of reliability and accuracy, and may use different parts of the radio spectrum for transmitting signals.

The DfT and CAA are not recommending any specific device to pilots but do recommend that all pilots understand and consider the functional benefits, and limitations, of any EC device so they make informed decisions on the level of reliance that can be placed on the information provided to them.

While not a definitive list the table below describes the currently most used EC technologies, a high-level understanding of the interoperability between them and which are certified.

	Which traffic receivers can see them?					
Conspicuity beacons	**ADS-B-in devices (certified)**	**ADS-B in Rx**	**Airborne Collision Awareness Systems (ACAS)**	**Pilot Aware Rosetta (PAW)**	**Power FLARM**	**Sky Echo 2 (SIL-1 Device) CAA CAP 1391 approved**
ADS-B Out transponder certified GPS	YES	YES	YES	YES	YES	YES
ADS-B out transponder uncertified GPS (Surveillance Integrity Level (SIL) 0)	NO*2	Variable*4	YES	YES	YES	YES
Power FLARM	NO	NO	NO	YES*1	YES	YES*3
Pilot Aware Rosetta (PAW)	NO	NO	NO	YES	NO	NO
Sky Echo 2 (SIL-1 Device) CAA CAP 1391 approved	YES	Variable*4	NO	YES	YES	YES

*1) Dependent on proximity to ground infrastructure

*2) Certified Traffic receivers normally exclude reports from transponders & beacons set to SIL 0

*3) New development requires a FLARM decode licence and a suitable display

*4) Transponders or beacons with a non-certified GPS may not be detected by a certified ADS-B in device. Systems with a quality indicator of System Design Assurance (SDA) ≥ 1 can be ''seen' '. In the above table, the term certified means a device that has been tested for meeting EUROCAE/RTCA standards and operates in the aviation spectrum.

In parallel to the grant scheme, work will continue on a long-term strategy for Electronic Conspicuity in the UK. Surveillance technology will continue to develop quickly and, together with the DfT, we are open to exploring and embracing new technologies. Applicants should be aware that in common with other technologies in any sector, any device purchased today is not necessarily guaranteed to meet any future EC requirements.

HOW TO APPLY

Applications can be made via our online stakeholder portal (just tap CAA EC into your search engine if you're not already registered) and run until March 31, 2021 (or until the funding is used).

For more more information go to

- Airspace Modernisation Strategy
- Information on EC devices caa.co.uk/cap1391
- AIC2019Y141: the steps that can be made to enable 'ADS-B out' throughout the General Aviation fleet to reflect recent changes and developments from EASA.

NORTH WEALD FEBRUARY 5, 2020 16:40 GMT

We were 4nm to the west of North Weald (our home airfield) inbound from Denham and had notified North Weald Radio that we intended to join left-hand downwind for runway 02 which was acknowledged, we then heard a Cirrus announce they were departing on runway 02 and would be turning left.

We then had a short conversation with the radio operator requesting to do a few circuits when we got back, which they acknowledged. In the meantime the Cirrus had departed, turned westbound and was now climbing to circuit level as we were about to join at the very base of the downwind leg which put us on a closing course less than 0.5nm away.

Due to the planning in the cockpit for the circuit detail we had taken our eyes off the Cirrus and it was only when we got a Traffic Alert from our electronic conspicuity system that we both located the Cirrus visually and took avoiding action by immediately turning downwind.

The Cirrus would have been flying into a low sun so would have had difficulty seeing us and we would have been momentarily distracted by setting up for circuits creating a potential conflict situation. This is just one occasion when ADS-B has enhanced safety for us.

- Terry Kent
PPL/IRR, 30 years flying experience and 800 plus hours. Aircraft Pipersport.

Rise of the drones

Commercial use of unmanned aircraft is expanding quickly and there are far-reaching developments in the air

Amazon are well advanced with their drones

First aid - one of the many coming uses

Photo drones are getting larger

Photos: Shutterstock

One of the often-quoted benefits of wider adoption of electronic conspicuity is allowing more users to access airspace. Primarily that means commercial drone users. But what difference would it make to them and how would it be delivered?

Apart from a few trials and very controlled situations pretty much all drone flying requires the operator to be able to see their craft all of the time so that they are able to spot, and then avoid, any other air traffic. In most uncontrolled airspace drones have as equal right to access as any other aircraft but, in reality, drone users are much more likely to see an aircraft before its pilot spots the drone.

Being required to keep their drone in sight is no big deal for many drone users and doesn't really stop them from doing any flying they want to. But, for many of the commercial and public service opportunities that drones are now starting to offer, it certainly does.

Take, for example, the undeniable benefits of using a drone as part of a search and rescue operation; delivering a defibrillator to a heart attack victim in a remote village; inspecting remote infrastructure such as overhead power lines, wind farms and oil rigs and, of course, the more commercial applications like deliveries.

Some use of what's known as 'extended visual line of sight', where spotters are deployed along the drone's route to report back to the pilot is allowed, and in other cases areas of airspace can be shut to other users, but that can't be a long-term solution.

So, for most uses to be effective all of these really need the drone to be operated outside the user's human visibility so-called Beyond Visual Line of Sight. That obviously requires some other way to be able to avoid conflict.

Even the average enthusiast drone costing well under £1,000 comes fitted with technology that's pretty rare in the average GA aircraft. That includes GPS navigation and automatic prevention of entering airspace that the drone doesn't have permission to use, auto stabilisation, emergency auto return to home, simple collision avoidance and, in newer drones, electronic devices.

Large certificated drones are already

REMOTE DRONE OPERATIONS – SEES.AI TESTING

The ability to use drones to inspect infrastructure is obvious. When you then tie that to infrastructure in remote or difficult to reach situations it becomes even more compelling.

The premise of the work being undertaken by sees.ai is to allow inspection drones to be remotely controlled by a central location. That means operating the drone beyond the visual line of sight of the operator. An example could be using a drone to inspect an oil rig after a storm.

At the moment to achieve that a suitably approved operator would need to be on the rig permanently or flown in. With the sees.ai proposal and BVLOS flying being permitted, then a drone based on the rig permanently could be flown at any time by an operator many hundreds of miles away. By using virtual reality, the drone operator is placed in a 3D version of the drone's real environment allowing them to fly precisely, even close to obstacles.

"Enabling everyday drone flying beyond visual line of sight is a game changer, providing the opportunity for unmanned vehicles to monitor critical infrastructure, make deliveries and support our daily lives in an efficient and environmentally friendly way."
- David Tait, Acting Head of the UK Civil Aviation Authority's Innovation Team.

flying safely in controlled airspace where they operate just like any other airspace user and easily meet the equipment requirements such as a transponder.

So, from a drone perspective, the route to getting the equipment to operate safely in uncontrolled airspace is relatively straightforward. But for detect-and-avoid to be most effective the drone obviously needs other users to transmit a signal it can 'see'. Hence the desire to increase the numbers of existing airspace users fitting electronic conspicuity.

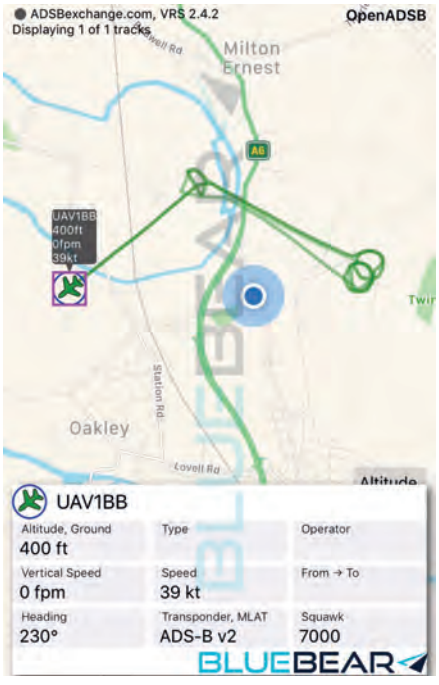
Many, but not all, future applications for drones will be at lower UK airspace levels, so building a fuller electronic real-time picture of operations in the airspace will be key, particularly among GA and military users.

Increasing the use of EC devices is only one part of the bigger 'detect-and-avoid' system, but it is one of the more crucial and effective ones. The CAA's new innovation team has been working with a number of organisations and companies to help industry drive the issue forward. Earlier this year they published their roadmap for how BVLOS drone operations could become an everyday occurrence (caa.co.uk/cap1861). It sets out a clear roadmap of achieving BVLOS.

Key to that map is industry testing and trials. As in all aspects of aviation such operations will never be allowed unless they meet acceptable safety levels. The CAA innovation team runs a 'sandbox' (a safe testing environment for evaluation) that enables organisations to run trials with its co-operation. Two of these current trials are directly helping to develop the international understanding and development of BVLOS. The work with sees.ai (see box out) is looking at how drone platforms themselves can use BVLOS.

The second trial involves a specific airspace corridor to be used by both unmanned aircraft and traditional airspace users. Known as the National Beyond visual line of sight Experimentation Corridor (NBEC) it runs between Cranfield Airport and the Blue Bear Systems research base in nearby Oakley.

The team have been flying unmanned aircraft, in coordination with the airport, into Cranfield's air traffic zone to show how these different types of operations could safely coexist in the near future. All of this work will feed into the bigger domestic and internal development work to make safe drone BVLOS flying an everyday occurrence.



One of the Blue Bear drone flights

IT'S A FAST GROWING WORLD

Regardless of what you think about drones they are now a large and ever-growing part of UK aviation. Their commercial applications grow every day and manufacturer DJI quotes nearly 300 lives saved throughout the world by drone operations.

Hundreds of UK companies are developing the sector into one of the fastest growing in aviation, and organisations from all over the world are moving here to take advantage of the testing and regulatory assistance being offered.

A PwC study in 2018 predicted that we would see over 76,000 drones operating in the UK by 2030 bringing £42bn into the economy and 628,000 jobs.

Over a third of the predicted 76,000 drones are expected to be operating in public service – healthcare, education etc.

UK innovation charity NESTA has been working with five cities (Bradford, London, Preston, Southampton and the West Midland) on how they could take advantage of the technology. As a result they believe public services in cities could save £1.1bn in 15 years.

Consumer research has revealed that there is significant public support for using drones in this way and more than 90% of the public expect drones to regularly undertake tasks such as traffic monitoring, powerline inspection and assisting farmers in the next six years.

Crop checking is just one of the fast-growing uses of drones

AIRSPACE & SAFETY INITIATIVE

Good practice for all pilots.

Safety through collaboration.

Where are you flying today and who will you be listening to?

A listening squawk enables an air traffic controller to alert a pilot if their aircraft looks likely to infringe.

Check which listening squawks and frequencies you will need before your next flight.

airspacesafety.com/listening-squawks/

Guidance and resources online:

airspacesafety.com

Tailored news, notifications and alerts **from the CAA**

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