Introduction:

The CAA have announced a rebate scheme to encourage pilots to fit electronic conspicuity devices(referred to as EC) to their aircraft. The scheme gives a 50% rebate of the purchase cost of a device, up to a maximum of £250. The scheme runs until 31st March 2021. The CAA have stopped short of making the fitting of an EC device mandatory for now, but given the increased safety that these devices offer, it seems sensible to look at fitting one.

Before you rush off to look at the scheme, and spend your money, we thought you might find some simple information useful to help you make a decision. Electronic conspicuity can be a confusing and complicated subject, not least because there is no one solution backed by the CAA. Each solution has its pros and cons. Things can get technical pretty quickly, and we've tried to avoid getting into that too much. Plus, there's some debate to what system is best and most suited to future expansion - none are perfect, and it's up to you to decide which route to go down.

We are going to aim this at the majority of you, in the UK, with factory-built gyros, fitted with basic transponders, and using Sky Demon. Other navigation software apps will also support EC devices, and you should check if yours does.

Important notes – your eyes are still your best source of safety:

- These devices are not infallible.
- Not every aircraft will be carrying a device, so you definitely won't see those.
- It's all too easy to spend your time head down in the cockpit looking at the screen watching for aircraft. Don't fall into this trap, and train yourself not to do it!
- Having one system does not necessarily mean aircraft using the other system will see you.
- At low level, terrain may block or attenuate an EC signal.

What is electronic conspicurity?

In its simplest terms, EC is making your aircraft "visible" to other aircraft, by continuously transmitting a signal other aircraft can pick up (aircraft to aircraft).

The signal gives the following information about your aircraft:

- Identity
- Location
- Altitude
- Speed

This information (apart from identity) is derived from GPS (satellite signals).

You already have a kind of EC device in your gyro – your transponder. Your transponder sends back information about your gyro every time it gets "scanned" by a radar system. The important part to note here is that your transponder only sends this information when it gets scanned by a radar. Your transponder doesn't provide your location and speed.

Transponder Signal:

① Radar scans aircraft　　　② Aircraft transponder replies

Mode A: Squawk
Mode C: Alititude + Squawk
Mode S: Altitude + Squawk
　　　　　+ Identification data
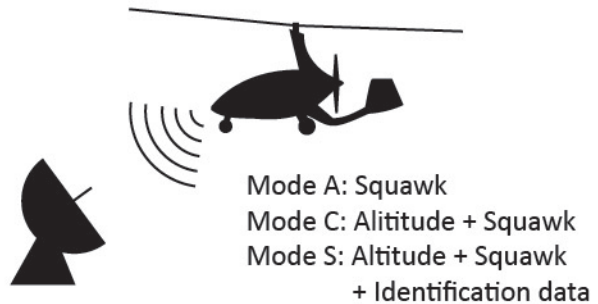
Electronic Conspicuity Signal (EC):

Each aircraft continually sends out EC signal:
- Identity
- Location
- Alititude
- Speed

The EC signal can be picked up by other aircraft with an EC receiver.

What device do I need?

If you have more advanced avionics in your gyro, other than a basic transponder, it is possible that you are already sending out an ADSB signal, so we strongly suggest you read your transponder manual or check with your gyro manufacturer.

In the UK there are three systems used to provide electronic conspicuity: FLARM, ADSB and Pilot Aware (PAW).

FLARM:

This is primarily used by gliders and is a short-range aircraft to aircraft signal. A network of ground-based stations, called the Open Glider Network (OGN), relay this information to other FLARM aircraft. Pilot Aware makes use of this network and have expanded it.

ADSB (Automatic Dependent Surveillance Broadcast):

ADSB is already used by commercial aircraft with certified avionics, but its use for general aviation has not been adopted by every country. Most transponder manufacturers will have a solution which will include ADSB.

Three terms to note:

- ADSB-Out means the devices continually sends out your identity, position, speed, and height.
- ADSB-In means the device can pick up signals from other aircraft which are sending their position, speed and height using ADSB-Out. This implies that you're going to need some way of showing this information in your cockpit to make use of it.
- SIL (Source Integrity Level). ADSB devices using non-certified GPS to give them their location will show up as SIL = 0, which means aircraft with certified avionics and ATC, may not see your ADSB signal. This is because they consider it unreliable so ignore it. SIL = 1 means the device is using a certified GPS, so you will be seen.

Note, you will not see PAW aircraft unless they have their PAW device wired into their transponder. There's more information on this later.
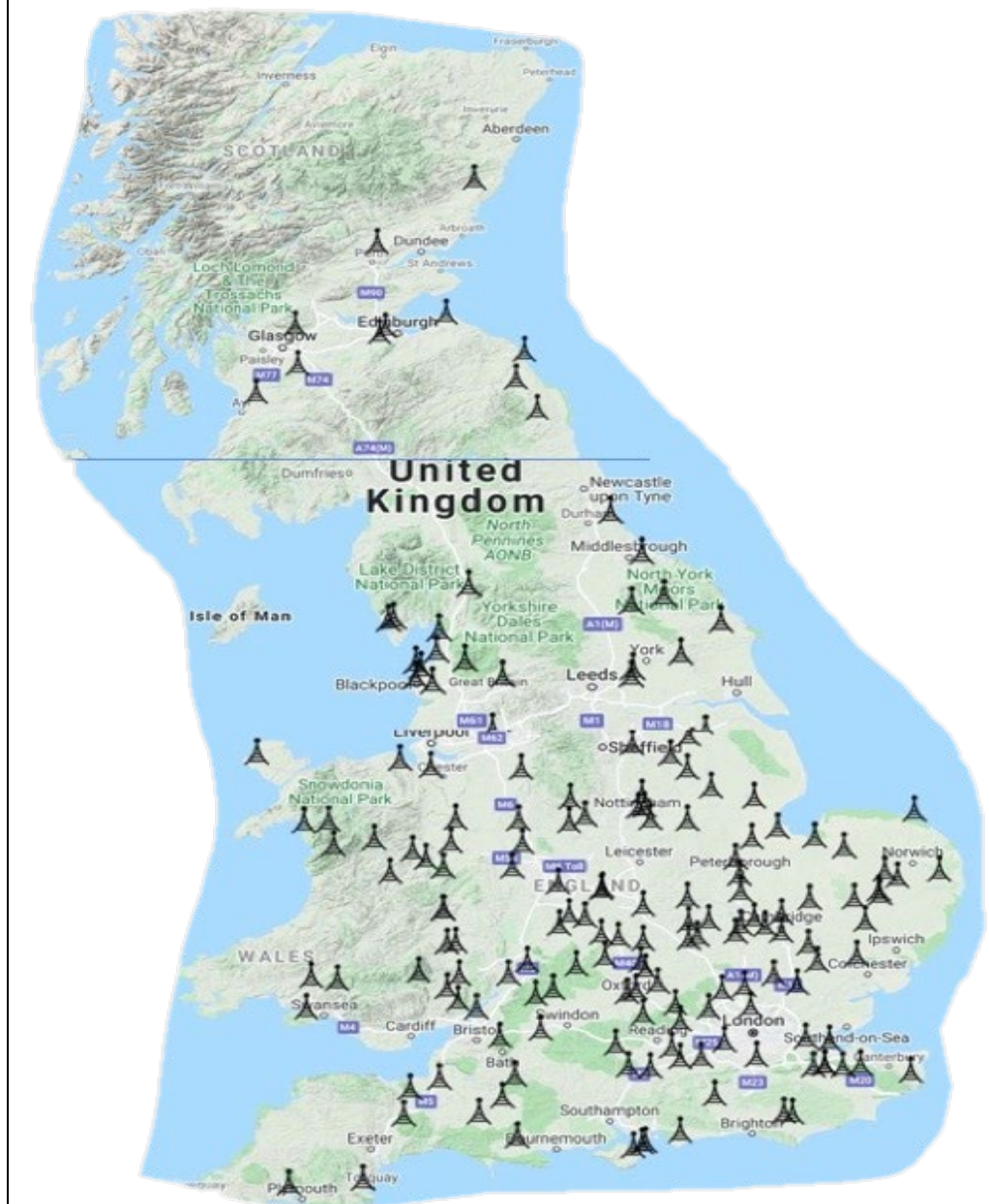
PAW (Pilot Aware):

Pilot Aware is a private UK based company that have developed their own system separate and different from ADSB. We're going to refer to this as PAW.

Like ADSB, PAW can be picked up aircraft to aircraft. However, their unique thing is that the PAW signal is also picked up by a network of ground-based stations – the ATOM GRID - in that can relay this information on to PAW equipped aircraft that may not be in range of each other. The ground-based stations can also relay information to PAW equipped aircraft derived from other sources such as the Radar360 network, this helps in turning Mode S bearingless targets into ones with known positions. We will cover bearingless targets in the Pilot Ware Rosetta section.

Below is a map showing locations of the ATOM GRID base stations as of the 16th November 2020. Each station has a 100Km range, but ground features / terrain may reduce this. More ATOM stations are being continually added.

Location of Pilot Aware ATOM GRID ground-based stations 16/11/2020:

The network is not a government run thing – it's voluntary, and it relies on flying clubs, airfields, organisations, and individuals to set up a base-stations. Pilot Aware supply the electronics and software free of charge, the volunteers supply the antennas, internet, and power.

Note, ADSB-In devices will not be able to see you unless you wire your PAW device into your transponder. There's more information on this later. Currently, no transponder manufactures, or certified avionics support the PAW signal.

<u>The main options available to pilots wishing to add EC to their gyro:</u>

The three options we're going to look at are:

- Sky Echo 2.
- Pilot Aware Rosetta.
- Use your existing transponder as an ADSB-Out device.

Note on WiFi: Sky Echo 2 and Rosetta use WiFi to connect to your tablet / phone. They act as a local WiFi network you connect to. This may be an issue if turning on WiFi, and connecting to a network, stops your tablet / phone using your 3G / 4G for internet connection. This is only an issue if you want to use the internet for data whilst flying - for weather and plates etc. It seems Android tablets / phones have this issue.

<u>Sky Echo 2:</u>

A small, self-contained, battery powered, ADSB-Out and ADSB-In box. You'll need to link it to your Sky Demon in order to see the other aircraft around you.

Who you will see:	Who will see you:
- Aircraft with ADSB-Out. - FLARM aircraft (requires FLARM decoding subscription from Sky Demon which costs £30 per year).	- Aircraft with ADSB-In (Note: only some certified avionics will see you). - PAW aircraft.

Pros:	Cons:
- Simple. - SIL = 1. Some aircraft with certified avionics will also see your ADSB signal. - No external power supply as it has a built-in rechargeable battery. - No cables or antennas required.	- It only does ADSB In and Out. You will not see PAW only aircraft. - More expensive than Pilot Aware, but you are paying for a certified GPS device with a SIL = 1. - No way to expand or upgrade like external antennas.

Pilot Aware Rosetta:

A self-contained box, powered by a USB cable, with optional external antenna kit for improved reception. It does more than the other devices listed here with the help of PAW ground-based stations.

By default, Rosetta does not do ADSB-Out, so other aircraft with ADSB-In will not see you. To get ADSB-Out of Rosetta, you will need to wire it in to your transponder. We cover this in the "Use your existing transponder as an ADSB-Out device" section, and sadly it's not a trivial a process for us gyro owners.

A unique feature of the Rosetta is that it will display bearingless targets. These are transponder signals it picks up that have altitude information, but as you will remember, transponder replies don't provide location information. Rosetta guesses the range to you based on the signal strength, but it can't tell you where, in relation to your aircraft, the other aircraft is - it just knows its altitude and guessed range. When Rosetta is in contact with a PAW ground-based station it is able to provide additional location information for some of these bearingless targets. You can turn this feature off if you find it too distracting, but some people find it useful to know there is an aircraft somewhere potentially local to you.

You'll need to link it to your Sky Demon in order to see the other aircraft around you. However, you can use its internal generated display system that will come up on your tablet or phone when viewed in a web browser.

Although it does more than the other devices mentioned here, this depends on whether you've connected your Rosetta to your transponder, and if you're within range of a PAW ground-based station. The following four scenarios are what you need to understand about how this affects what you see, and who sees you:

Scenario 1: Rosetta <u>not connected</u> to transponder, and <u>not in range</u> of a PAW ground-based station:	
Who you will see:	Who will see you:
- Other PAW aircraft. - Aircraft with ADSB-Out. - Bearingless targets from transponder signals with altitude information. - FLARM aircraft (if you have an additional FLARM receiver plugged into the Rosetta).	- Other PAW aircraft.

Scenario 2: Rosetta <u>connected</u> to transponder, and <u>not in range</u> of a PAW ground-based station:	
Who you will see:	Who will see you:
- Other PAW aircraft. - Aircraft with ADSB-Out. - Bearingless targets from transponder signals with altitude information. - FLARM aircraft (if you have an additional FLARM receiver plugged into the Rosetta).	- Other PAW aircraft. - Aircraft with ADSB-In (Note: certified avionics will not show you).

Scenario 3: Rosetta <u>not connected</u> to transponder, and <u>in range</u> of a PAW ground-based station:	
Who you will see:	Who will see you:
- Other PAW aircraft. - Aircraft with ADSB-Out. - Bearingless targets from transponder signals with altitude information. - FLARM aircraft. - Additional traffic information derived from the PAW network.	- Other PAW aircraft. - FLARM aircraft (if you have an additional FLARM transceiver plugged into the Rosetta). - Other PAW and FLARM aircraft connected to the PAW network.

Scenario 4: Rosetta <u>connected</u> to transponder, and <u>in range</u> of a PAW ground-based station:	
Who you will see:	Who will see you:
- Other PAW aircraft.	- Other PAW aircraft.
- Aircraft with ADSB-Out.	- Aircraft with ADSB-In (Note: certified avionics will not show you).
- Bearingless targets from transponder signals with altitude information.	- FLARM aircraft (if you have an additional FLARM transceiver plugged into the Rosetta).
- FLARM aircraft.	
- Additional traffic information derived from the PAW network.	- Other PAW and FLARM aircraft connected to the PAW network.

Pros:	Cons:
- Receives the widest number of sources of EC information due to the network of ground-based stations.	- ADSB-Out is not provided by default. You need to wire it in to your transponder for this. Without doing this only other PAW aircraft will see you.
- The remote mounted antennas mean you can position these to give you maximum signal reception and transmission.	- SIL = 0. When connected to your transponder to provide ADSB-Out. Aircraft with certified avionics will not show your ADSB signal.
- Low price even without the CAA rebate.	- Needs an external power supply from something like a USB cable plugged in to your 12V socket with a USB adaptor in it. You need a descent one of these as Rosetta needs a 2.1 Amp adaptor. Also, you most probably already have your phone or tablet plugged in to your 12V socket. Be wary of drawing too much current from your gyros 12v socket! Pilot Aware stress how important a good power supply is as it may prevent Rosetta from working reliably.
	- The ground-based stations do not provide full coverage of the UK, although coverage is pretty good.
	- As it's a voluntary network, some of the ground-based stations may or may not be up and running.
	- Yearly subscription fee (currently £12 per year).

<u>Use your existing transponder as an ADSB-Out device:</u>

This is probably the more complicated and expensive of all the solutions we've discussed, and there's a few of things to make clear first:

- Whilst you could do this yourself, you will still need a Certified Engineer with a Transponder Test Ramp to sign it off and complete the Minor Mod approval in accordance with CAA CAP1419 and CAA Form 123.
- If you are going to start drilling holes in your aircraft, you/your engineer may need to ask the aircraft manufacturers advice / approval.
- Pilot Aware mention filling in forms for the LAA to get approval – you cannot use these for a factory-built gyro, even if your gyro is on the LAA register. The LAA does not yet cover factory-built gyros this way.
- Check your transponder can do ADSB-Out with "extended squitter". If it doesn't then, you'll need a new transponder if you want to go down this route.

Unless your transponder is very old, or very basic, it will most probably be capable of providing an ADSB-Out signal, but it will need a GPS source plugged in to it. There are dedicated GPS signal devices, or Pilot Aware Rosetta can act as one. Some transponders will need a software upgrade and will have to be sent back to the manufacturer to have this done. See what "What we know about Funke transponders below".

Once a GPS source is connected to your transponder, it will continually transmit an ADSB-Out signal.

The word to look out for is a "certified" GPS source, meaning that your ADSB-Out signal from your transponder will be seen by other certified avionics. Note that Pilot Aware Rosetta is not a certified GPS source. Certified GPS sources tend to be expensive. It seems that Trig do one to plug in to their transponders – the TR72 - and this should work with a Funke transponder as well as most of the Trig transponders fitted to Magnis. We have not found a f.u.n.k.e. equivalent.

Who you will see:	Who will see you:
- You won't see anybody as you're ADSB-Out only (unless you're using Pilot Aware Rosetta as your source).	- Aircraft with ADSB-In (Note: see information about certified GPS source above). - PAW aircraft.

Pros:	Cons:
- SIL = 1. With a certified GPS source, this is the only truly certified ADSB-Out device which will be seen by all avionics, certified or not (does not apply to using Rosetta as GPS source).	- ADSB-Out only. You will not see anyone (unless you're using Rosetta as a GPS source). - Expensive, especially when you add in certified engineers fees. - It's complicated because of the approvals required.

What we know about f.u.n.k.e. transponders:

The Trig GPS source TN72 + antenna can be connected to a f.u.n.k.e. TRT800H provided it has firmware 104 and software V6.3.

f.u.n.k.e. TRT800H transponders made before November 2011 can only be upgraded to the most basic form of ADSB-Out (position and Altitude, no velocity data) with software V5.2.B. Update costs are over £300. And, therefore not economical.

However, if you own one of these earlier units f.u.n.k.e. would like to offer BRA members the opportunity to have their original unit recycled and replaced by a new one, which is capable of full ADSB-Out functionality (suitable GPS source not supplied) at 50% of retail price. Typically this will cost you about 1200 Euros.

TRT800H made after November 2011 S/N-30580611 to S/N-30860716 can be updated to latest software (cost approx. 300 Euro plus shipping). Units made after March 2016 S/N-30860816 can be updated free of charge (plus shipping).

Further Reading:

uAvionix (Sky Echo 2) website:

www.uavionix.com

Pilot Aware (Rosetta) website:

www.pilotaware.com.

November issue of the LAA magazine.

Sky Demon Traffic Display information:

https://www.skydemon.aero/inflight/traffic.aspx

Details of CAA Cap 1419 can be found here:
https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=7779

Details of the CAA scheme can be found here:

https://www.caa.co.uk/General-aviation/Aircraft-ownership-and-maintenance/Electronic-Conspicuity-devices/