

Installing your PilotAware Classic.

Introduction

Now that you have bought your PilotAware Classic, it's time to consider where to position the unit and the various interfaces in your aircraft.

PilotAware is initially designed as 'carry on' equipment to be used as portable equipment or can be installed more permanently, if allowed by your aviation certification authority.

Powering the PilotAware

The PilotAware unit has been designed to work off a USB voltage of 5.25V capable of supplying 2.1 Amps. It is very important that this is a stable power supply and not interrupted or allowed to go below 5V. Also it should not create a significant amount of radiated noise either through radio interference or induced noise into the primary power source. This can affect other electronic equipment in your aircraft particularly noticeable in the radio reception. If the power is interrupted or drops below 5V 2.1A, then the PilotAware unit will take about 60 seconds to reconnect to your navigational equipment.

It is important that you use the power lead supplied with the PilotAware Classic but with this, providing the correct power supply is very easy using one of the following methods.

1. Use a USB power block such as the Anker PowerCore 20100 or the smaller Anker Power Core 10000 unit which is the same size as the PilotAware unit.
2. Use a good quality cigarette lighter DC/DC voltage converter capable of delivering a constant 2.1 Amp supply. The Anker Power Drive 2 Model 2310 is very suitable for this. Beware of running additional consumer items from the cigarette lighter voltage converter as this may reduce the power available for PilotAware and cause the Raspberry pi to reset. Do NOT use cheap cigarette lighter, DC/DC converters as these are noisy and unreliable.
3. If you are operating an EASA aircraft or you want an EASA approved power supply for PilotAware, certified units can be bought from www.charge4.co.uk.

If there are any problems with your PilotAware unit then first check that you are using a reliable power supply and a good quality 20AWG cable. This is by far, the most common reason for failure of the unit experienced to date.

Locating the PilotAware Unit

If an external antenna is not to be used, then the PilotAware unit should be located such that the thick antenna can 'see' out of the aircraft. The natural place for this is the dashboard coaming which has proven to be a good choice in many installations. However if the dashboard coaming is used, ensure that the unit is not positioned where it will get too hot on cloudless days as this will affect the reliability of the unit. The core temperature of the unit should not be allowed to go above 85 degrees centigrade. The core temperature is displayed on the Home Page of the PilotAware unit. The antennas must be vertical for optimum performance so it is preferable if the PilotAware unit and the antenna

have a vertical orientation. (i) for optimum antenna operation (ii) minimum surface area to direct sunlight.

Locating the Antennae

ADSB Antenna (the thin one)

The thin antenna connected to the PilotAware unit via a 1 meter cord is a receive only antenna for ADSB signals. This should be mounted vertically for optimum performance but as it is very sensitive and ADSB signals are strong, this is not critical. Also it is acceptable to reduce the length of this by cutting it with a pair of strong cutters and it will still work. Many people cut the antenna in half for optimum performance and better vertical location possibilities. This antenna correctly mounted, will receive signals from traffic over 100Kms away so location of this antenna is not so important.

PilotAware Antenna (the thick one)

It is important that you do not turn your PilotAware unit on without the thick P3I antenna connected. This will void the warrantee on the Bridge and possibly cause irreparable damage to it. Even worse it may make the Bridge TX/RX circuit work intermittently giving an inaccurate reading.

A very simple understanding of the laws of physics will help you decide where to locate the PilotAware for maximum effect. More technical users with even better advice will no doubt, post their advice on the PilotAware forum to help optimize the advice given here. Radio propagation, as the Buddha would say has many paths to perfection.

PilotAware uses the 869.5 MHz SRD Band (P3I) to transmit and receive signals between participating aircraft. This is how we can 'See and be Seen'. Where we position the antenna has a considerable effect on the performance of PilotAware both in its transmission and reception. In tests we have shown that with a correct type and a correctly positioned antenna, PilotAware has a range of 20Km+, more than enough for a secondary conspicuity aid. So what stops a PilotAware installation achieving this from any location in the aircraft?

Attenuation

Radio waves prefer what we call 'free space line of sight'. For our purpose we can assume that they work best in cold dry air with nothing in the way. Unfortunately, this is the best case and is virtually never achievable. Things do get in the way and the air can have variable density (due to temperature and humidity) all of which have an effect on performance. In the same way that a frosted glass window will disrupt light waves some things will totally block, partially block or distort radio waves. This is particularly so in the case of metal. If you want to prove this put a radio in a sealed biscuit tin and you will see that it doesn't work. Likewise, if PilotAware is put into a sealed metal aircraft it will not work properly.

However, all metal aircraft are not sealed as they have doors and windows which let radio waves in. That's why your mobile phone sometimes works in the air, but it's not ideal. Also in most aircraft there is a huge mass of metal in the engine up front, or in the case of a micro-light weight shift or pusher aircraft, behind the pilot which will absorb a lot of the PilotAware radio energy reducing the range. Get the idea? When radio waves go through metal they are significantly reduced, or attenuated as radio engineers say.

Attenuation also happens when radio waves go through water. To prove this put your radio in a bucket of water and again it will not work. Oh no! sorry, that's for a completely different reason, so don't try that at home.

So where is the water in a light aircraft, particularly with an air cooled engine. Well I'm sorry to have to say this but as far as physics is concerned, radio waves regard you, the pilot, and your passenger(s) as a big bag(s) of water. Again that's how microwave oven work by heating up the water in the stuff you put in the microwave oven. Makes sense?

Therefore, you need to position your antenna such that it avoids both metal and water.

Positioning the antenna

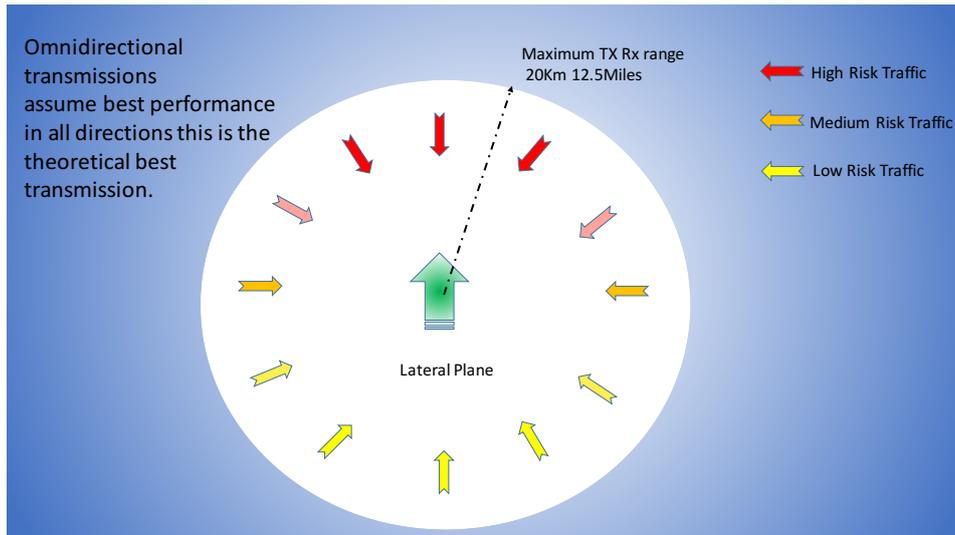
If you position the antenna directly behind a front mounted engine the signal will be attenuated (lowered) going forwards. If you position the antenna in front of the pilot and passenger the signal will be attenuated (lowered) going backwards.

Therefore, for an internally mounted antenna, depending on your aircraft configuration you need to position the PilotAware where it transmits and receives with a clear view of the surrounding area without passing through metal or water, either to the front the back or side to side. If you don't it will still work but not as well!

If possible, it will always be better if an external antenna is used for the thick PilotAware antenna. This is why your transponder antenna and your air band radio antenna are both mounted externally for maximum efficiency. This can be done by extending the thick antenna on a 1 or 2 metre extension lead or using a dipole aerial on an extension lead. These leads are available from Pilotawarehardware.com.

For practical reasons the transmission of PilotAware 868Mhz (P3I) signals should be considered as omnidirectional. This means radiating out in all directions like the ripples from a stone thrown into a pool.

The diagram below (fig1) shows that the probable risk of collision is greatest in an 180° arc in front of the aircraft. The risk gets less as we move to the rear of this until a collision from directly behind is considerably less probable.



Therefore, when positioning your antenna, you should take the probability of danger from the position of other aircraft into account, along with the metal and water content of your aircraft that will be in the way of your omnidirectional transmissions.

For example, an antenna mounted on the coaming in front of the pilot and passenger will have a good range looking forwards and sideward but will be attenuated in a forwards and slightly downwards and rearward direction due to the engine and passengers respectively.

It is not possible to look at all installations as these will be different for each aircraft configuration and as time progresses the good folk on the PilotAware forum will no doubt give advice on all aircraft types.

Antennas mounted outside the aircraft are usually best as they put distance between them and the 'metal' and the 'water'.

Monopole or Dipole

You may have heard of monopole and dipole antennas. What's this all about? Well without getting into detail all you need to know is that with a monopole antenna you need an earth plane with a dipole you don't. The PilotAware Classic comes complete with an end-fed dipole antenna as standard for P31 so needs no earth plane and is good to go. Centre fed dipoles are also available on an extension lead if this fits your installation better.

An earth plane is a metal base that the antenna sits on and to which the outside metal part of the antenna is connected. The bigger the better but a piece of aluminium about 1/16 to 1/4 inch thick by about 6 inches square or a similar size that fits the space you have will do.

Obviously to fit an antenna so that it is outside the aircraft will require drilling a hole in a metal, wooden or composite aircraft, including the pod on a trike, or fixing the antenna to an aluminium brace and cutting the fabric, on a tube and fabric aircraft such as a Eurofox or SkyRanger.

Usually 2 metres of extension cable is sufficient to facilitate the antenna extension and this has been shown to work well. Both the PilotAware P3I TxRx antenna and the ADSB Rx antenna will benefit from external mounting however as the ADSB-in is receive only and the 1090MHz transmissions from ADSB are strong this is usually less of a problem for up to a 20Km range. Extension cables and antennas, both monopole and dipole, are available at pilotawarehardware.com.

Approval

If you do wish to install an external antenna, the manufacturer of your aircraft or importer, should be consulted as to the best practice to fit an external antenna for your type of aircraft. Also your licensing authority such as the CAA, LAA, BGA, BHGA or BMAA in the UK, will need to be consulted for the relevant approval. This may require the granting of permission so to do, a fee and an inspection by an authorized inspector following the installation. As owner of the aircraft it is your responsibility to ensure that this is done correctly and in order. In other European countries the regulation process may differ and it is your responsibility to ensure that you adhere to the local regulations.

In summary

It testing PilotAware Classic, the positioning of the antenna has been shown to be very important to get the best out of the PilotAware installation. No doubt, as more and more different types of aircraft are fitted with PilotAware units, advice will be forthcoming on the best place to fit the antenna and the route to approval for the various authorities. Keep an eye on the PilotAware Forum. www.forum.pilotaware.com

So, remember the basic physics when locating your antenna so that you have the best chance of seeing and being seen.

The PilotAware Team

August 2016