Undertaking a More Permanent Installation

PilotAware is sold as portable carry on equipment. However, it is also capable of being used in a more permanent installation. This will possibly be subject to meeting the local regulations and gaining the relevant approval(s) from the agency that certifies your particular aircraft. It is your responsibility to ensure that this is done correctly for your particular application, particularly if modifications are done to the airframe. Advice on specific requirements in the UK can be gained from your CAA, LAA or BMAA inspector.

It is entirely possible on permit aircraft to make this installation quickly and safely. However, it is prudent to get your inspector to have a look at it even if you don't make any modifications to the aircraft to ensure that you have installed it using good and accepted aviation engineering practices. So, what do you need to do?

Extending the PilotAware Inputs and Outputs.

The objective of this paper is to show how PilotAware can be installed in an aircraft so that it is out of sight with no or the minimum cables on show. This is not a recommendation on how to install, as every installation will be different. It is provided however to show how it has been done in at least one aircraft. It is your responsibility to ensure that a safe installation is undertaken in your aircraft.

The external cables and modules provided with and attached locally to the 'PilotAware Classic' when you buy it are as follows:

1. Micro USB Power Cable. *This is the cable from your 5.2V power supply to PilotAware.*
2. ADSB RTL-SDR Dongle. *This is the ADSB receiver Dongle.*
3. ADSB Antenna with cable and MCX connector. *The cable from the antenna to (2)*
4. USB WiFi Dongle. *This is the little black and red Wi-Fi Dongle*
5. USB GLONASS GPS Dongle. *This is the white GLONASS GPS Dongle.*
6. P3I dipole antenna. *This is the thick antenna screwed to the PilotAware box.*

In order to hide the 'PilotAware Classic Unit' away, say behind the dashboard, it is necessary to extend
1. The radio antennas so that they have a line of sight view of other aircraft.
2. The GPS so that it is in view of the low orbit satellites.
3. The Power Lead to provide local power
4. The audio output cable for voice alerts
5. USB extension lead for software update by memory stick.

With this done PilotAware will be both hidden from view but will also have improved performance.

The following installation uses 2 *mono-pole* antennas each of which requires a ground plane. If preferred these can be replaced by di-poles which do not require ground planes but may be slightly less efficient.

The Following additional components will be required.

1.	3 Metre 50-ohm extension cable.	2 Off
2.	SMA male to MCX Converter	1 Off
3.	GPS Mouse with USB extension cable	1 Off
4.	USB extension Cable	1 Off
5.	3 metre 3.5mm audio cable	1 Off
6.	Monopole antenna	2 Off
7.	Ground Plane 1/8" aluminium cut to size	2 Off
8.	M6 Penny washer	2 Off
9.	Cigarette Lighter socket	1 Off
10.	Anker Cigarette Lighter USB Voltage converter	1 Off
11.	Velcro	As required
12.	Cable ties	As required

The above hyperlinks show where items have been bought from for recent installations. Items 1,3,6,9 are highly recommended. The others can be substituted by other equivalents as you wish.
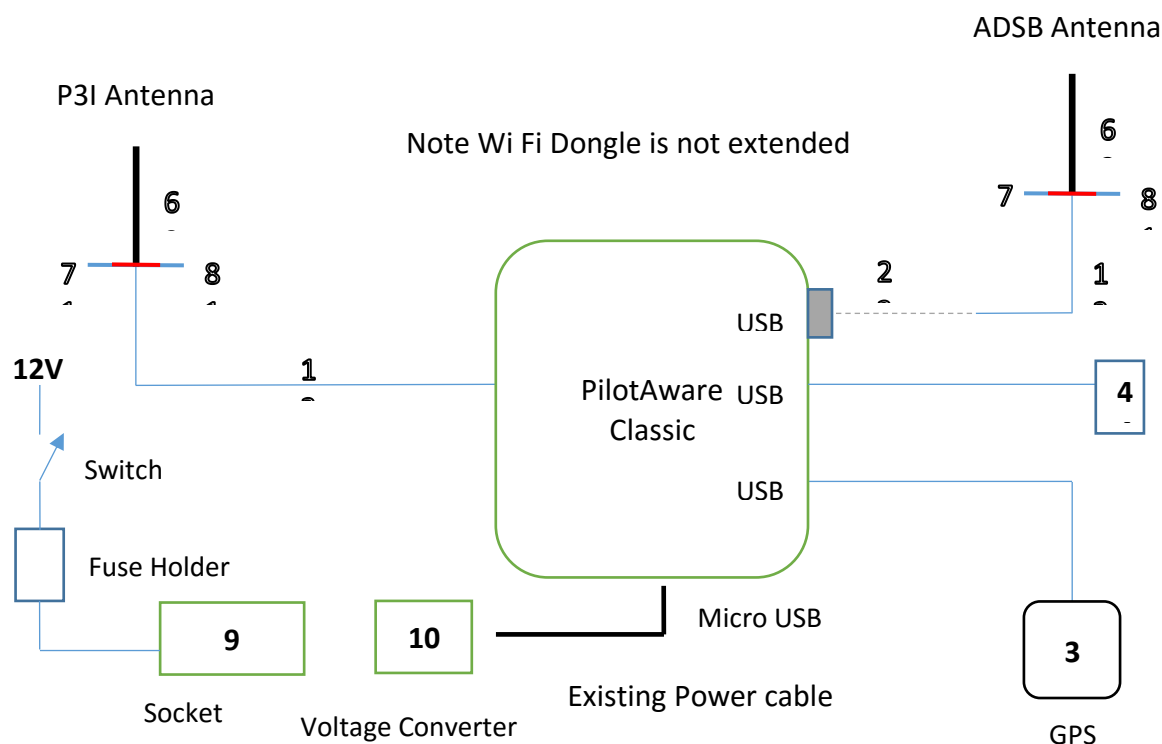
In using the above components, the original two antennas and GPS provided with the PilotAware Classic are not used. The ADSB RTL-SDR Dongle is used and connected to the antenna via converter 2 and extension cable 1.

The following diagram shows how the above components are used to extend the peripherals.

1. Remove the thick P3I antenna connected to the PilotAware Classic Unit and set on the side. This is a dipole antenna and will not be used in this installation as we will be replacing it with a monopole with a ground plane connected to the outside of the aircraft.
2. Connect one of the extension leads *(Item 1)* to the P31 50ohm SMA connector from which you have just taken the antenna in action 1 above.
3. Drill a 6mm diameter hole in the aluminium sheet ground plane and locate the male end of the extension cable through this hole.
4. Drill a 6mm hole in a suitable place in the fuselage at a suitable place that will allow the ground plane to fit inside and the penny washer to fit outside the aircraft to spread the load. Fit the nut on the male connector and tighten. (It is important that there is enough thread showing so that the antenna pin will mate with the extension lead socket and give a good electrical connection. If this is not enough, then a thinner penny washer and or ground plane will be required. In an all metal aircraft, it is possible to dispense with the ground plane but a second penny washer or equivalent is required to spread the load.

5. Do the same for the ADSB antenna using the second monopole antenna. The original ADSB Antenna (the thin one) is not used.
6. For the ADSB antenna, at the PilotAware end of the extension cable connect the MCX to SMA converter to the female connector and the connect the MCX connector to the RTL-SDR dongle. This will be a snap fit. You can then fit the dongle into the USB slot of the PilotAware Classic unit.
7. Locate the GPS mouse where it has a good view of the sky. Central on the top of the dashboard is good. Drill a hole through the dashboard top to hide the cable for a very clean installation if you dare. The USB end can then be fitted into the PilotAware Classic unit.
8. Put the Wi-Fi Dongle directly into the PilotAware Classic unit as this doesn't need to be extended
9. Insert the USB extension cable *(item 4)*, into the 4th USB slot of the PilotAware, this will be used to gain access to the PilotAware Unit for software upgrades via a memory stick. See the PilotAware Operating Instructions to do this.
10. Provide Power to the PilotAware unit via the Micro USB cable. This can be done by using a power brick or other method such as a cigarette lighter converter. In this installation, I have suggested hiding a cigarette lighter socket (item 9) behind the dash with an ANKER converter (Item10). This gives a very good low noise efficient low cost power supply that comes on when you throw the master switch. Ensure that the 12V input is via a fuse or circuit breaker and **must have an in–line switch or cut off** for electrical safety.

Additional Thoughts

1. It is a good idea to replace the original Pi Box supplied with the PilotAware Classic with an aluminium one. A suitable one is available here.
2. Use low smoke cable where possible.
3. Now that you have extended the required peripherals the PilotAware unit can be located anywhere in the aircraft. The only thing that hasn't been extended is the WiFi which will work perfectly if the unit is hidden say behind the dashboard. If, however the unit was put say under the seat in a Sports Cruiser, RV or Eurostar and was surrounded by metal then it may get shielded and the signal attenuated. If this is the case use another USB extension cable (item4) to locate the USB dongle outside the metal screen.
4. Affix the PilotAware unit using Velcro and cable tie the cables neatly so that they are not seen.
5. If you get radio interference suspect the power supply. (Use ANKER products and you should not get any problems). Some of the cheaper power bricks are noisy so just because they look like a battery don't be fooled they are not totally passive.
6. Obvious engineering good practice.
   a. Crimp don't solder
   b. Don't run cables parallel for too long
   c. Tie cables well but not too tight.
   d. Use low smoke and fume cables where possible
   e. Ensure that any power cables to the PilotAware are as short as possible and at least 22AWG as supplied with the PilotAware Classic. This ensures minimal voltage drop and 5.25V at the unit.
   f. Smear some petroleum jelly around the edge of the outside of the external antenna screw as a moisture barrier.
7. If you have a fabric aircraft same principles apply. Attach the ground plane to a suitable former and locate both antennas vertically. Theoretically they can be inside the fuselage as the fabric will not attenuate the signal but make sure that the pilot and passenger(s) and engine are not in line of site as they will attenuate the signal. Outside is therefore best. See the paper on antenna location.
8. If you don't want to use a ground-plane, then you can use the original antenna supplied with the PilotAware Classic. This is an end fed di-pole which doesn't need a ground plane. Alternatively, you can use a centre fed di-pole available from pilotawarehardware.com here. This has a sticky backed centre which allows the antenna to be fixed to a screen for example.
9. Also, the ADSB antenna looks spindly but is a very capable antenna. If you don't have a fully metal aircraft, it is possible that this doesn't need to be put outside at all. Best to have it vertically mounted and for optimal performance reduce its length to 69mm.
10. Some folks have a concern that the USB connectors will come loose. To overcome this, you can put a small bow in the connector long side using pointed nose pliers which will give a tight fit.

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Summary

Every installation will be different. However, we trust that this information helps you to make a more permanent installation in your aircraft that hides all the bits. If you need help don't forget to visit the PilotAware Forum where there will be advice from fellow pilots who will have possibly installed PilotAware in aircraft similar to yours. Also, reciprocate if you have done a successful installation and add to the knowledge.

Safe Flying.
PilotAWare Team
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