# AIRCRAFT AVIONICS INSTALLATIONS

**TL 3.03**
Issue 11
October 2015

## 1. INTRODUCTION

For all aircraft on the British register, whether on a Permit to Fly or Certificate of Airworthiness, and including aeroplanes, microlights and gyroplanes, there are certain requirements that need to be met in relation to aircraft avionics that transmit radio signals. This Technical Leaflet applies to VHF radios (transceivers) and transponders. Although radio navigation devices (DME, etc) aren't directly covered by this leaflet, the maintenance advice in section 7 is still relevant.

Advice on radio interference problems is given in TL 3.14
ELT installations are dealt with in TL 3.18

## 2. FLIGHT RADIO-TELEPHONY OPERATOR'S LICENCE

All operators of radios in aircraft, whether of permanently installed equipment or portable 'hand-held', are required to posses a Flight Radio-Telephony Operator's Licence. Such licences are issued by the CAA on successful completion of an appropriate course. Courses are usually conducted as part of the PPL training syllabus and include some airtime as well as ground school instruction and exam.

The fundamental purpose of the licence is to allow the CAA to ensure that radio transmissions in the aviation environment are made only by competent 'qualified' individuals. For further information we suggest you contact a local flying training organisation directly, or the CAA Flight Crew Licensing Department, Tel. 01293 573700.

## 3. RADIO LICENCE

All owners of aircraft fitted with radio equipment must obtain a radio licence from the CAA, which must be renewed every three years for as long as the aircraft remains in service. There is a fee, which varies depending on the extent of the equipment fitted. The application form DAP1902 and details of the fees can be downloaded from the CAA website at http://www.caa.co.uk. This also applies to hand-held radios that are installed in aircraft.

## 4. EQUIPMENT APPROVAL

All radio equipment including portable equipment and transponders installed in UK aircraft must be of a 'type' approved by the CAA or EASA. Usually the equipment manufacturer or importer will have dealt with this matter. Details of avionics types that have been approved are provided on the CAA and EASA websites. If in doubt about the status of new equipment, check with the supplier or contact the CAA, Tel. 01293 573134. Note that equipment obtained abroad, and even the latest products from well-established manufacturers, are sometimes found to be of a type that is not approved by CAA or EASA. Aircraft imported or found fitted with non-approved equipment will need to have that equipment removed.

'Passive' equipment that just receive signals, such as GPS units, do not need to have an equipment approval. Where a GPS unit is connected to a transponder to provide 'ADS-B out', the process for approval of new equipment installations can be found in form LAA/MOD7 and for already-approved installations in form LAA/MOD14.

Legislation has been introduced in Europe regarding the capability of voice communication radios:

- From 17 November 2013: all new radio installations must conform to the 8.33 kHz spacing standard. This applies to newly built aircraft and existing aircraft replacing their equipment. Aircraft being imported or rebuilt with an already-fitted non 8.33 kHz radio need not upgrade at this point providing it is of a type approved for use in the UK.
- From 1 January 2014: no aircraft may fly IFR in class A, B or C airspace unless equipped with an 8.33 kHz radio. No aircraft may fly VFR in class A, B or C airspace unless equipped with an 8.33 kHz radio if that airspace is operating under 8.33 kHz channel spacing.

- From 31 December 2017: all radio installations must conform to the 8.33 kHz spacing. The only exceptions being those items of equipment designed to operate only on the 25 kHz channels that have been specified in the legislation (two emergency frequencies and nine data frequencies). Back-up radios must also comply with this requirement.

UK CAA has recently issued a generic approval for 8.33 kHz hand-held radios that meet minimum requirements. The conditions of approval are given in CAA Information Notice IN-2013/192. Owners buying a radio purporting to be approved to this standard should obtain written confirmation from the manufacturer that the conditions of CAA Aircraft Equipment Approval certificate LA301075 have been met.

The installation of a transponder is a useful tool in helping other airspace users be aware of your position. Although Mode S units are mandatory in certain areas (e.g. above FL100, the London TMA, transponder mandatory zones, etc – full details in UK AIP-GEN 1.5), it is still permissible to install Mode A or C units on aircraft where transponder carriage is voluntary. Note, however, that the long-term ambition of the CAA is to phase out Mode A and C units and so they may have a limited useful life. Also, the requirements might be different when flying in other countries.

## 5. AVIONICS INSTALLATION APPROVAL

The installation of permanent transmitting avionics into LAA aircraft must be approved by the LAA. Note that avionics equipment designed to be portable (hand-held radio, hand-held GPS, etc) do not need installation approval.

The investigation of an avionics equipment installation involves checking that the avionics equipment is of an approved type, an inspection and ground test of the installation followed by a flight test. Applications for avionics installation approval must be made using a form LAA/MOD7 which must be completed and signed up by a suitably approved LAA inspector or suitably licensed CAA avionics engineer.

Provided that the inspector is satisfied that the avionics installation meets the required design criteria and has signed the declaration on the LAA/MOD7 form and the aircraft has a valid Permit to Fly or PFRC (Permit Flight Release Certificate), a flight test is to be carried out according to schedule LAA/FT-AVIONICS.

Approval is given by LAA Engineering once the installation is shown to be of an acceptable standard and a satisfactory flight test report is received. Since May 2008 this has been signified by LAA Engineering issuing an avionics installation approval certificate AD917/LAA for the aircraft which is sent to the aircraft owner.

Subsequent changes and upgrades to avionics equipment will require the same attention as above, including application on form LAA/MOD7 followed by a flight test according to flight test schedule LAA/FT-AVIONICS.

Where a Mode S transponder installation has already been approved on a form AD917/LAA and an owner subsequently wishes to connect a GPS to the transponder, an application may be made on form LAA/MOD14. Approval of the connection following a satisfactory test is signified by the issue of a certificate AD917/LAA/ADS-B for that aircraft.

## 6. AVIONICS INSTALLATION PRACTICES

The following points are those that will need to be satisfied during installation and maintenance.

- Electrical installation must be in accordance with the **equipment manufacturer's instructions**.

- Equipment must be securely installed leaving no possibility that equipment can fall free, perhaps causing injury or **jamming controls,** especially in aerobatic aircraft.
- The existing **structural integrity** of the aircraft must not be compromised by the avionics installation: holes must not be drilled in structural components.
- The pilot must be able to operate associated switches and controls **from the 'strapped-in'** position and switches and controls should be suitably **marked** and **placarded**.
- Installation must not interfere with the satisfactory operation of the aircraft's controls or systems. For example, movement of control column must not be restricted and the pilot's line of sight of cockpit instruments should not be impeded.
- The quality of the pilot's **external view** should not be degraded.
- Installation must not present a hazard to the aircraft in the event of failure of the equipment; proper **electrical circuit** installation should avoid this possibility.
- Possible hazard to the occupants in the event of a **crash** should be minimised by ensuring that protruding knobs and brackets do not present in line with occupant's head, knees, etc, and that adequate soft furnishing protection is provided.
- Equipment should not unduly restrict occupant **emergency egress** from the cockpit.
- Associated **wiring and cables** must be properly 'bundled' and secured. Unsupported and spaghetti wiring is not acceptable.
- Only aviation quality wiring and terminals should be used. PVC-insulated wiring should not be used.
- The aircraft **weight schedule** must be amended and the aircraft **compass** must be checked and **swung**.
- Proper circuit protection must be incorporated.
- **Aerials** should be soundly installed with aerial cables properly routed and secured.
- A satisfactory flight test is required.
- Checks must be made that the equipment is not affected by other electrical systems (e.g. strobe lights) and also that the transmitting equipment does not adversely affect other systems.
- GR 18 (CAA CAP747) recommends that multiple radio systems are not fed by a system whereby a single failure (of fuse, switch, relay, etc) does not render all the radios unavailable. An excellent article by Bob Nuckolls describes a very sensible approach (www.aeroelectric.com/articles/avmaster.pdf).
- Where a GPS is connected to a Mode S transponder, the transponder must be set to **SIL=0** and **SDA=0**.

While there is no legally mandatory requirement to fit a **back-up press-to-transmit** button in Permit aircraft, it makes good sense to do so in case of failure of the primary PTT switch. In radio-equipped aircraft which are fitted with dual controls, separate PTT buttons should be available for the pilots in the P1 and P2 position and the intercom wiring should be arranged so that radio transmissions can be made from either headset depending on which PTT button is depressed. Radio transmissions ('sidetone') and reception should be clearly audible in flight from both pilot positions. This is now more important than in the past because 2-seat Permit aircraft are increasingly being used for carrying out coaching flying and biennial review flights, which include a requirement to demonstrate and monitor radio calls. It is impossible to provide effective coaching unless clear communication is available between the P1 and P2 positions, as well as to and from the ground. Circumstances have also arisen in the past where the check pilot could not transmit from the P2 position and was unable to transmit a warning call when an emergency arose.

Consult your intercom manufacturer for the necessary wiring and switching circuits required to achieve the above.

Note that special additional requirements apply for the fitment of **auto-pilots** in LAA aircraft – contact LAA Engineering for information when required.

## 7. CONTINUED MAINTENANCE

LAA aircraft avionics installations must be inspected during the annual inspection for the Permit to Fly renewal to show that they are in good working order and remain securely installed. In particular, during flight test the quality of transmission and reception of radios should be checked. The CAA's Light Aircraft Maintenance Schedule (LAMS) requires CofA aircraft to have a radio transmission frequency tolerance check every 3 years and LAA recommend that LAA aircraft owners contact a suitably equipped avionics engineer for this check on a similar basis.

It is advisable to check the altitude encoding information transmitted by Mode C and S transponders, as received by the air traffic unit, corresponds with the aircraft's altimeter at the corresponding pressure setting, at least annually. The programmed aircraft identifier code should also be checked regularly. LAA recommends that avionics equipment, such as transponders and navigation equipment, should also be presented to a suitably equipped avionics engineer for checking and testing from time to time.