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## CAN NON-TSO'D EQUIPMENT BE INSTALLED IN A TYPE-CERTIFICATED AIRCRAFT?

It is widely believed that all avionics equipment that is installed in a type certificated aircraft must have TSO authorization. The purpose of this pamphlet is to examine this idea by references found in FAA documentation. The scope of this discussion will be limited to aircraft with a standard category U.S. airworthiness certificate. To begin lets first take a look at the CFRs.

### 14 CFR 91 Subpart C— Equipment, Instrument, and Certificate Requirements.

#### Section 91.205 —Powered civil aircraft with standard category U.S. airworthiness certificates: Instrument and equipment requirements.

(d) Instrument flight rules. For IFR flight, the following instruments and equipment are required:

- (2) Two-way radio communication and navigation equipment suitable for the route to be flown.

There are also some general references as to the performance requirements of installed equipment. Please refer to 14 CFR 23 Subpart F Section 23.2505, 23.2510, 23.2520

At this point it would be the responsibility of the installer to verify that the installed equipment meets the requirements of the above part 23 sections. One means to insure this would be to only install TSO'd equipment. TSO'd equipment is equipment that the FAA has examined and determined that it meets the requirements of Part 23. Another way would be to review the requirements set forth for a particular type of equipment (i.e. communication or navigation radio) by referring to a particular TSO document. The TSO document will spell out the minimum performance standard for a type of equipment, usually by referencing an industry-standard organization's documentation such as that of RTCA Inc. (Radio Technical Commission for Aeronautics). At this point in our discussion one might be overwhelmed by the process and choose the path of least resistance and go with the TSO'd equipment. Or one could look to the manufacturer of the equipment for information as to what standard the equipment was manufactured to. This information is typically found in the specifications section of the equipment's installation manual. The idea that a piece of equipment meets the requirements of a recognized standard such as a TSO but not have the TSO authorization is backed up in FAA Order 8300.16A APPENDIX A. **Definitions (10) Meet Minimum Technical Standard Order (TSO) Established Standards.** Means that the equipment need not have TSO approval, but that it meets requirements set by the TSO.

The next topic that comes up in the discussion is whether or not the installation is required to be recorded on FAA Form 337 and whether it will require a field approval. These questions are answered by examining the requirements for the use of Form 337 and for field approvals. 14 CFR Part 1 Section 1.1 defines a minor alteration as an alteration that is not a major alteration. Some examples of major alteration are defined in Appendix A of Part 43. Unfortunately the installation of radio equipment is not appropriately covered in the appendix.

FAA Order 8300.16A Chapter 3 provides guidance as to determining if an alteration is major or minor. In this discussion it will be broken down into a series of questions the installer might answer to arrive at a designation of the alteration as major or minor.

General alterations:

Does the proposed alteration have an appreciable effect on the certificated weight? (i.e. A change in the maximum takeoff weight limitations,

limits, etc.)

- Does the proposed alteration have an appreciable effect on the structural strength?
- Does the proposed alteration have an appreciable effect on the performance?
- Does the proposed alteration have an appreciable effect on the powerplant operation?
- Does the proposed alteration have an appreciable effect on the flight characteristics?
- Does the proposed alteration have an appreciable effect on other characteristics affecting the airworthiness?

**Yes to any of the above questions: The proposed change is a major change in type design requiring the application for a Supplemental Type Certificate (STC).**

**Confirmed no to all: Continue.**

- Is it possible that the proposed alteration might have an appreciable effect on the certificated weight? (i.e. A change in the maximum takeoff weight limitations, minimum landing weight limitations, etc.)
- Is it possible that the proposed alteration might have an appreciable effect on the certificated balance? (i.e. A change in the forward or aft center of gravity limits, etc.)
- Is it possible that the proposed alteration might have an appreciable effect on the structural strength?
- Is it possible that the proposed alteration might have an appreciable effect on the performance?
- Is it possible that the proposed alteration might have an appreciable effect on the powerplant operation?
- Is it possible that the proposed alteration might have an appreciable effect on the flight characteristics?
- Is it possible that the proposed alteration might have an appreciable effect on other characteristics affecting the airworthiness?
- Does the proposed alteration alter the wings?
- Does the proposed alteration alter the tail surfaces?
- Does the proposed alteration alter the fuselage?
- Does the proposed alteration alter the engine mounts?
- Does the proposed alteration alter the control system?
- Does the proposed alteration alter the landing gear?
- Does the proposed alteration alter the hull or floats?
- Does the proposed alteration alter the elements of an airframe including spars, ribs, fittings, shock absorbers, bracing, cowling, fairings, and balance weights?
- Does the proposed alteration alter the hydraulic and electrical actuating system of components?
- Does the proposed alteration alter the rotor blades?
- Does the proposed alteration change the empty weight or empty balance which results in an increase in the maximum certificated weight or center of gravity limits of the aircraft?
- Does the proposed alteration change the basic design of the fuel, oil, cooling, heating, cabin pressurization, electrical, hydraulic, deicing, or exhaust systems.
- Does the proposed alteration change the wing or any fixed or movable control surfaces which affect flutter and vibration characteristics?
- Does the proposed alteration convert an aircraft engine from one approved model to another, involving any changes in compression ratio, propeller reduction gear, impeller gear ratios or the substitution of major engine parts which requires extensive rework and testing of the engine?
- Does the proposed alteration change the engine by replacing aircraft engine structural parts with parts not supplied by the original manufacturer or parts not specifically approved by the Administrator?
- Does the proposed alteration include the installation of an accessory which is not approved for the engine?
- Does the proposed alteration include the removal of accessories that are listed as required equipment on the aircraft or engine

- Does the proposed alteration make any conversions of any sort for the purpose of using fuel of a rating or grade other than that listed in the engine specifications?

**Yes or maybe to any of the above questions: The proposed change is a major alteration requiring approved data, recording of FAA Form 337 and a log book entry.**

**Confirmed no to all: Continue.**

- Has the Administrator issued an Advisory Circular that requires the use of approved data for this installation/alteration?

**Yes: Follow the guidance contained in the Advisory Circular.**

**No: Continue.**

- Has the Administrator issued policy (HBAW, FSAW, etc.) that requires the use of approved data for this installation/alteration?

**Yes: Follow the published policy.**

**No: The alteration is a minor alteration with no additional published guidance therefore the use of acceptable data is authorized and the alteration/installation must be recorded in the appropriate maintenance record. Follow the provisions of Part 43, 65 and/or 145 as appropriate.**

Appliance alterations:

- Does the alteration affect the basic design of the appliance?

**Yes: Continue.**

**No: The alteration is considered an appliance minor alteration.**

- Is the alteration of the basic design of the appliance made in accordance with recommendations of the appliance manufacturer or in accordance with an FAA Airworthiness Directive?

**Yes: Continue.**

**No: The alteration is considered a major appliance alteration.**

- Does the change in the basic design of radio communication and navigation equipment approved under type certification or a Technical Standard Order have an effect on frequency stability, noise level, sensitivity, selectivity, distortion, spurious radiation, AVC characteristics or ability to meet environmental test conditions and other changes that have an effect on the performance of the equipment?

**Yes: The alteration is considered a major appliance alteration.**

**No: The alteration is considered a minor appliance alteration.**



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