Understanding the structure of a Technical Standard Order (TSO) - I

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We have already discussed about TSO on IYK 12, but, on that occasion, just showing that it is the most important means to obtain an approval of a design of equipment by the airworthiness authority (ANAC, FAA), with a view to the installation of a equipment in a civil aircraft and, in some cases, in military aircraft too. But in this IYK our intention is to show how the applicant must interpret each item of a TSO, in order to facilitate their work in that direction.

In this opportunity, we consider important to pass to those who honor us with reading our IYK that our goal, with the preparation of these papers, is in perfect harmony with the objective established in the Statute of DCA-BR, which is to contribute to the development of aeronautical certification and protection of the environment.

By doing so, we believe to be collaborating mainly with our airworthiness authority, ANAC, in the dissemination of knowledge to the Aviation Community concerning the "World of the Airworthiness". In other words, we believe to be, in this field, a proactive force in the national scene.

ANAC translates the title Technical Standard Order by "Ordem Técnica Padrão (OTP)" and defines, in document CI 21-009A, that the OTP are the Technical Standard Orders (TSO) of the FAA, adopted in full, in English, and whose index is the Advisory Circular (AC) 20-110 of the FAA.

In this way, when we speak about TSO, we also are speaking about OTP.

We remind that the TSO approval is not the only way to the manufacturer to have your item approved for installation on an aircraft, but it is the most comprehensive way to have an equipment as a candidate for such an installation.

The document "TSO" is a thorough technical specification for various types of equipment, which requires a series of steps which has to be proven by the applicant through exhaustive documentation. The most notable is that the requirements contained in a TSO cover the entire life cycle of the equipment; It is, no doubt, a very important fact.

Generally speaking, a TSO is structured at least in the following items:

(.) **Subject**;

(1) **Purpose**;

(2) **Applicability**;

(3) **Requirements**;

(4) **Marking**;

(5) **Application Data Requirements** ;

(6) **Manufacturer Data Requirements;**

(7) **Furnished Data Requirements; e**

(8) **How To Get Referenced Documents**.

Let us see each of these items.

(.) **Subject** - Refers to equipment identification. Eg 406 MHz Emergency Locator Trasnmitter.

(1) **Purpose** - this item inform that the TSO is intended for those who want to get a TSO Authorization or a Letter of Design Approval (LODA)[1] for his equipment, establishing minimum performance standards (Minimum Performance Standards - MPS) for an equipment (for example, an Emergency Locator Transmitter-ELT). Said in other words, this item informs that the TSO is a minimum specification for equipment design and that it must be fulfilled as condition to an applicant obtain approval and TSO marking (see (3) below) for his equipment.

(2) **Applicability** - This item informs that the TSO applies to equipment whose design is

[1] TSO approval issued by the FAA to equipment developed in other countries with which the United States has concluded bilateral agreements.

submitted to the authority after the effective date of the TSO.

Generally, the FAA does not accept TSO approval requests based on a version prior to the effective date of the latest version of the TSO. However, requests based on previous version may be accepted up to six months after the completion of the current version, provided that the applicant demonstrates that was already working in equipment design, based on the previous version, before the affectivity of the current version.

(3) **Requirements** - are the so-called minimum performance Standards which the TSO treats by the acronym, ie: MPS. These MPS in general are contained in other documents, such as those of RTCA (Radio Technical Commission for Aeronautics), the ARP of SAE International, etc. As an example, we mention the DO-204A - Minimum Operational Performance Standard, applicable, for example, for the 406 MHz ELT.

The item is divided into **Functionality; Failure Condition Classification; Functional Qualification; Environmental Qualification; Software Qualification; Electronic Hardware Qualification;** and **Deviations.**

(a) Functionality -This subitem identifies the functions of the equipment referred to in the TSO. In the case of the ELT, its function is to locate aircraft have had their flight stopped due to an accident.

(b)Failure Condition Classification – The goal here is to present the severity of each failure condition in the event of a malfunction or loss of function of the equipment. The severity, as we have seen elsewhere, may be Minor, Major, dangerous Hazardous and Catastrophic. In the case of the ELT, malfunction or loss of function (no output signal) has minor severity because it brings no consequences for the safety of the aircraft. The system will have then be designed with this requirement of severity allocated in the design.

(c) **Functional Qualification** - Here is presented how it should be demonstrated that the equipment fulfills its function with the expected performance, specifying a specific test on the ground or in flight, or indicating a document that will serve as a basis for this demonstration. In the case of the ELT, the TSO provides that the functional performance shall be demonstrated in accordance with the conditions specified in RTCA/DO-204 (now in "A" version).

(d) **Environmental Qualification** - in General, the relevant TSO specifies directly the 204 or the DO 160 (now in version G), for environmental tests dedicated to the type of equipment. FAA permits to use another standard, but this has to be discussed with the Authority. So, in our opinion, it is better to stick with the TSO to avoid lengthy discussions with the Authority.

We will continue in the next IYK.

Thank you

References

(1) **ANAC**: CI 21-009A – Relação das Ordens Técnicas Padrão (OTP). Brasil, 25/05/1.999.

(2) **FAA**: AC 20-110L – Index Aviation Technical Standard Orders. USA, 10/10/2000.

(3) **FAA**: CHANGE Technical Standard Order, Appendix 1: Formal and Guidance for the Preparation of TSO. USA, 11/23/2010.