

## Certification in Type Design Modifications (Civil Aviation)-I

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The modifications of the type design of an aircraft, its systems and equipment are inevitable. But there are those who think that they only occur in the operational phase. It is not true. Sometimes they also occur in the production phase, ie, with the type design already certified.

We will not address here the changes that are made during the development phase of an aircraft, systems and equipment, which are controlled by a configuration management system of the companies that develop these items. The changes that will be considered here are those that occur after the design of the aircraft is certified.

An aircraft has systems, and these, equipment. Therefore, it is possible to modify an aircraft, a system or an equipment, or all of these items simultaneously.

Let us consider initially the modifications of aircraft and systems.

Whatever the modification, when it will be carried out, must be preceded by an assessment of the potential effects on the certification base in order to identify the modification as "Major Modification" or "Minor Modification", as defined in 14 CFR Part 21 of the FAA or RBAC 21 of the ANAC.

Minor Modification is one that has no appreciable effect on the weight, the balance, the structural strength, reliability, operational characteristics and other characteristics affecting the airworthiness of the product. All other modifications are Major Modifications.

Unfortunately, say "... has not appreciable effect ...", we have to agree, is something subjective. So not infrequently, the applicant for a modification may have difficulty in identifying if the modification is "Major" or "Minor". When there is such a doubt, the best thing to do is

discuss it immediately with the Airworthiness Authority (FAA, EASA, ANAC).

The holder of a type certificate (TC) of an aircraft may make changes in the type design through a "TC Modification" or an "Amended Type Certificate - ATC".

If an applicant for a major change is not the holder of the type certificate, he will must apply to the Authority Airworthiness one supplemental type certificate (STC). This occurs, for example, with companies dedicated to perform modifications on aircraft.

With regard to equipment, we remember first that there is a particular regulatory process for project approval and authorization for production. This process is called Approval TSO (Technical Standard Order).

We remember also that an equipment with TSO approval is a candidate for installation, but this can only happen if the equipment is compatible with the aircraft environment, that is, it cannot produce or suffer some sort of interference in the internal environment of the aircraft.

We also said, another time, that when there is no an approved TSO for the technology of a particular equipment, the manufacturer may apply to the Authority for Approval PMA (Parts Manufacturer Approval), but valid only for installation in a particular aircraft.

The Modification of equipment with TSO Approval may also be "Major" or "Minor". The holder of a TSO Approval may, himself, approve minor modifications, ie, he does not need to submit it to the Authority. But the Major Modifications must necessarily be submitted to the approval of the Authority.

Let us return to the modifications in general, that is, modifications of aircraft, systems and equipment.

An important aspect that cannot be overlooked are the logistical consequences of a modification. No matter how small a modification is, there will always be logistics consequences in one or more of its factors (spares, GSE, training and maintenance manuals).

From the point of view of safety, it should be recorded that, if a modification insert or remove or change existing functions, be aircraft level, system level or equipment level, we have to check the impact on objectives (requirements).

This means that we have to perform that safety assessment process, but on the appropriate level, which we have already discussed in this space, when we presented the IYK series dedicated to safety assessment.

As points out the Ref. 1, with which we share our experience, but perhaps with slight differences, the main types of modifications are the following:

- (1) introduction of a new aircraft-level function;*
- (2) Installation of an equipment or system on an aircraft, without changing functions of the same;*
- (3) adaptation in an aircraft of an equipment or system existing in other aircraft already operating;*
- (4) modification of a system or equipment, without adding new functions to them; and*
- (5) modification of an aircraft in the production line.*

To address each of these cases, "in one breath", even briefly, it would be necessary to more space than the available at this point. So we will continue in the next IYK.

See you

## References

- (6) **SAE:** ARP 4754A, Guidelines for Development of Civil Aircraft and Systems, USA, 2010.
- (7) **FAA:** CFR 14 Part 21, Certification Procedures for Products, Subparts D e E. USA, 1964.
- (8) **ANAC:** RBAC 21, Certificação de Produtos Aeronáuticos, Subpartes D e E. Emenda 01, Brasil, 2011.