## - Environmental Tests for Avionics Equipment -

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The avionics equipment developed for military and civil aviation are subjected to batteries of tests, among which are the so-called environmental tests, which occur in environments similar to those of the operational phase of the aircraft.

The environmental testing equipment for civil aviation are provided in the document RTCA<sup>1</sup> DO-160 (Environmental Conditions and Test Procedures for Airborne Equipment), now in version G, while the military equipment has been subjected to such testing following the procedures in MIL -STD-810 (Environmental Test Methods and Engineering Guidelines), now also in the version G.

Let's start with DO-160G.

FAA Advisory Circular 21-16C provides that the procedures contained in D0-160 can be used in TSO<sup>2</sup> authorizations.

DO-160 contains 26 test methods, while the MIL-STD-810 covers 28.

A notable difference between the battery of tests of each document is relevant to military equipment tests that only exist in MIL-STD-810. They are: gunfire tests and acoustic noise tests.

DO-160 also deals with electrical testing and electromagnetic interference (EMI) tests, which does not occur in MIL-STD-810.

The electrical part in the military area, is covered in MIL-STD-704 (Aircraft Electric Power Characteristics), now in version F, and electromagnetic interference in MIL-STD-461 (Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment), currently in version F and MIL-STD-464 (Electromagnetic Environmental Effects Requirements for Systems), in version C.

As for the other tests, such as: low pressure, high and low temperatures, sand and dust, explosive atmosphere, etc., both documents retain similarity.

A notable feature of the MIL-STD-810 is the so-called Tailoring, process by which a supplier makes a choice or a change in testing procedures, conditions, variable values, etc. used in them, according the environmental scenario for his equipment operation. The MIL-STD-810 strongly encourages the vendor to do the tailoring.

Of course, this process of tailoring has to be discussed with the Program Manager that manages military contracts for the purchase of equipment, assisted closely by area of certification of the military institution who are acquiring the equipment.

When the equipment is developed on behalf of the supplier, ie, without a contract placed by military institution, but that at some point, might be of interest of that institution, and the supplier wishes to obtain certification by the certification body of the military institution, he will have a double discussion with the mentioned certification body: (1) the choice of environmental testing and (2) a possible tailoring for the tests.

In the case of avionics equipment, there are minimum requirements for environmental testing, at least in the military area: altitude, humidity, vibration and temperature tests. The MIL-STD-810 describes properly the effects of environmental stressors in avionics equipment. The standard prescribes then the multitest 520.3, to verify the simultaneous

<sup>&</sup>lt;sup>1</sup> RTCA – Radio Technical Commission for Aeronautics.

<sup>&</sup>lt;sup>2</sup> TSO - Technical Stander Order.

effects of these four environmental stressors, in a single camera test.

However, there is no a camera of tests in Brazil to simulate, at the same time, an environmental test for these four variables, for which reason their effects are observed in separated tests for each variable. Anyway, even if they are made separated, they are the minimum requirements for environmental testing avionics equipment.

We finished at this point, suggesting once again that our reader consult the references listed below.

See you.

**References:** 

- (1) RTCA: DO-160G Environmental Conditions and Test Procedures for Airborne Equipment, USA: RTCA, 2010.
- (2) DoD: MIL-STD-461 Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment, USA: DoD, 2007.
- (3) DoD: MIL-STD-464C, Electromagnetic Environmental Effects Requirements for Systems, USA: DoD, 2008.
- (4) DoD: MIL-STD-704F, Aircraft Electric Power Characteristics, USA: DoD, 2004.
- (5) DoD: MIL-STD-810G, Environmental Test Methods and Engineering Guidelines, DoD, USA, 2008.
- (6) SPITZER, Cary R. Digital Avionics Systems: Principles and Practice. 2. Ed. New York (USA): McGraw-Hill, 1993. 277p.