

SKYbox: the new range of Flight Test Installation

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Abstract:

Flight testing is one of the key activities required to certify and deliver aircraft to our customers. To this end, we carry out flight tests on prototypes known as flight test aircraft but also in serial aircraft or production aircrafts ready to be delivered to Airlines.

The SKYbox project aims to offer a new range of Flight Test Installation (FTI) solutions. These less intrusive and more modular solutions ease the installation and provide FTIs at the cutting edge of technology.

Key words: Flight Test Installation, Architecture, SKYbox, Trolley.

Introduction

Flight testing is one of the key activities required to certify and deliver aircraft to our customers. To this end, we carry out flight tests on prototypes known as flight test aircraft. Throughout a programme life cycle, these aircrafts are used to validate the various changes.

In some cases, these aircrafts are not sufficient, as they may lose their representativeness compared to in-service aircrafts. A flight test aircraft is not, in fact, necessarily upgraded with all changes in the programme and can not represent all the aircrafts of the fleet in service. Therefore customer aircraft just coming off the Final Assembly Line (FAL) and at the latest standard are used.

At the same time, Airbus must also respond to their customers about major in-service problems (MISP). The analysis of such problems may require tests on aircraft already in service, in order to troubleshoot and to provide a rapid response to our customers.

The first FTI equipment were installed from the beginning of the Airbus A300 programme in the early 70s and were built specifically for each aircraft and program. The still in-service FTI solutions date back to the A380 programme (first flight in 2005) and the A350 programme for the most recent ones (first flight in 2015). Some FTI solutions are therefore starting to become obsolete.

Today, flight test aircrafts are used by engineers on a daily basis to exhibit enhancements and innovations during flights thus making our

products more competitive. This modifies the testing profile and pace and therefore requires an increased agility.

Within this context, the SKYbox project aims to offer a new range of FTI solutions to meet all types of tests for all types of aircraft. The main driver is to ease the installation providing a more modular and less intrusive FTI based on the cutting edge of technology.

The first short-term target refers to the installation on board aircraft just coming off the FAL and equipped with their cabin.

These solutions are then extended to more heavily instrumented flight test aircraft.

Architecture concepts

The architecture follows two main drivers:

- 1/ Core functions concentration
- 2/ Distributed architecture

The selected strategy consists in moving some equipment closer to their customers in order to reduce the number of wires to be installed:

- Data acquisition closer to the sensors thanks to remote acquisition unit [1]

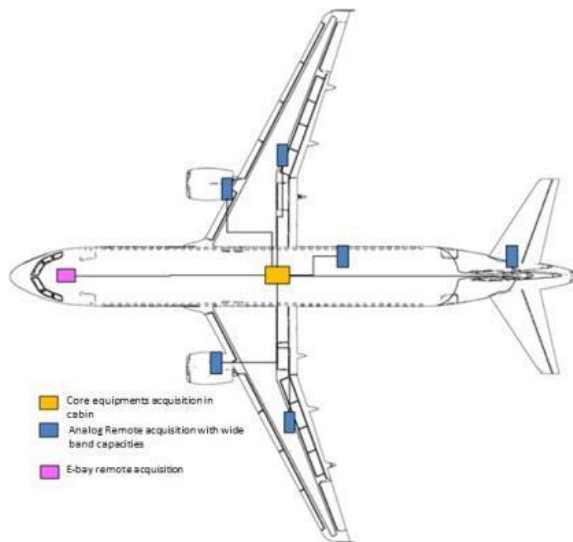


Fig.1. Generic remote architecture principle.

- Commands closer to the equipment to be piloted thanks to remote I/O system

- Video encoder closer to the video cameras

All these remote equipment are connected to the core FTI thanks to Ethernet connections.

The SKYbox range focuses primarily on 3 solutions:

1/ An avionic bay module grouping together the FTI's core functions for development tests on FAL aircraft

2/ A cabin trolley, which can be installed in a galley and complements the functions of the avionics bay module for development and certification tests on FAL or flight test aircraft

3/ A cabin bay, as a replacement for the trolley, on aircraft requiring a heavy test installation

These 3 solutions are complemented by a display and test steering station with a new FTES (Flight Test Engineer Station).



Fig.2. Architecture and Installation synoptic for medium installation.

The complete Skybox range will make it possible to renovate existing installations and be more efficient on new installations thanks to a reduced footprint, increased ease of installation and increased modularity:

Modularity: SKYbox solutions allow to cover the scope of all flight tests while keeping a functional architecture common to all these solutions.

They are able to adapt to changing requirements during a test campaign by adding additional modules (such as additional computing power) or additional functions.

Footprint: New technologies significantly reduce FTI congestion. To illustrate: a state-of-the-art computer - for processing test data in real time - can replace 10 older generation computers

such as those present on the FTI of the A350 development. On a complete installation, the space saving (reduction of a factor 8) and mass is remarkable:



Fig.3.Previous solution with corresponding core functions - weight ~450kg.



Fig.4.SKYbox trolley - weight ~100kg.

Easy installation: The smaller dimensions allow the use of form factors that facilitate installation on board aircraft. For aircraft with an already equipped cabin, for example, a trolley can be used, which can be installed in the galley like a conventional food trolley.

New solution description

A new FTI system (format ARINC600 / avionic computer) has been developed in order to put more functionalities in the same volume as the current system, thanks to miniaturization of components: time base and DGPS capabilities have been added to current bus acquisition and recording capabilities. This system is installed in the avionic bay and can be used alone, possibly connected to a laptop for real time visualization.

For more demanding test needs, this avionic bay module can be linked to a FTI trolley. This

trolley concentrates the main core FTI functions in a very reduced volume:

- Data processing
- Network (FTI data and intersystem communication)
- Recording
- Electrical sources selection (2 sources and output power up to 17kVA)
- Electrical generation and distribution

In order to display the information provided by the avionic bay module and the trolley, a new Flight Test Engineer Station (FTES) is developed with the same drivers: modularity, reduced footprint, easy installation.



Fig.5.Installation of a FTES in a cabin A/C.

Conclusion

Part of the new SKYbox solutions has been flying on development aircraft since September 2020 with expected gains in ease of installation and modularity, hence a better customer satisfaction.

These solutions are defining our policy for flight test installation for the coming years.

In order to continuously improve the non intrusivity and the installation of our FTI equipments, we need now to prepare the next generation by using smaller size equipment, new technologies available on the market (less wire, wireless, optical fiber, MEMs sensors, mini and micro computer systems, ...) and cost efficient solutions.

References

- [1] S. Martin, C. Perret, Adapted acquisition systems for future FTI architecture, *ETTC* 2013;