Software Defined Radio for Highly Integrated System Architecture

CRIAQ Project AVIO-505

Abstract

- Integration of navigation, communication and surveillance systems under a single universal reconfigurable platform
- Establishment of an optimized integrated system to eliminate redundant hardware, resulting in substantial weight reduction and significantly reduced power consumption
- Development of a software radio platform for multipurpose aeronautics and aerospace applications
- Demonstration of the benefits of ICT in efforts to reduce GHG
- Demonstration of the multiples advantages of integrating current and future applications such as DME, Transponder Mode S, Wide Band Radio and ADS-B within a single box
- Generic multi-system redundancy built into the antenna
- **Project duration:** 4 years (2012 to 2015) **Budget:** 1.8M$

Objectives

- Demonstrate the capabilities and performance of software defined radios (SDR) in aerospace
- Reduce the weight and use of equipment
- Reduce the number of radios, Coax cables and antennas by rethinking costly redundancies
- Reduce the overall wiring required for navigation, communication and surveillance systems interconnections and number of distinct systems units
- Reduce the number of parts to increase reliability and safety at the system level
- Reduce GHG emissions by lowering the power consumption, and weight of onboard systems
- Optimize and reduce the development and integration time of new systems using a common platform
- Reduce the onboard electromagnetic fields (or HIRF) generated by multiple high power consumption systems

Technological Benefits

Environmental

- Project based on industry environmental needs by reducing the weight of the aircraft
- The ICT (Information and Communication Technology) reduces the need for fuel which contributes to a significant reduction of GHG emissions
- Minimum hardware replacement and recycling via software applications upgrades for improved or new functionalities

Original Equipment Manufacturer

- Reduction of costs and development time of new equipment via a single platform that is innovative and reconfigurable
- Reduction of certification and integration efforts for new applications
- Simplified repair and maintenance

Retrofit Applications

- Replace expensive legacy avionics with additional applications
- Provide a low-cost growth path for future upgrades

Regulatory Evolution

- Addresses new operational standards such as NextGen
- Supports the automated airspace concept based on Automated Airspace Computer System (AACS)

Demonstrated Avionic Technologies

Distance Measuring Equipment (DME)

The DME provides information on the line-of-sight distance from the aircraft to the ground station. The airborne DME equipment operates at 1025MHz to 1150MHz with a bandwidth of 126MHz, which is further divided into 126 channels with a bandwidth of 1MHz. Using a different transmission scheme called mode X and mode Y doubles the number of channels.

Mode S Transponder

The Mode S (S for Select) Transponder has been designed as an evolutionary addition to the Air Traffic Control Radar Beacon System (ATCRBS) to provide the enhanced surveillance and communication capability required for Air Traffic Control (ATC) automation. Mode S performs all the functions of Mode A and C transponders, and has data link capability. Mode S Transponder specific advantages:

- Surveillance of a large number of aircraft with better accuracy and increased surveillance reliability
- High degree of data integrity in ground-to-air, air-to-ground and air-to-air data links
- In TCAS equipped aircraft, the TCAS transmits coordination/interrogations to the other aircraft via the Mode S link in order to ensure the selection of complementary Resolution Advisories (RA)

Wide Band Radio (WBR)

Another target of the AVIO-505 project is a SDR based air-to-satellite, air-to-air and air-to-ground wide-band communication link whose specifications still need to be defined. Basically, there are two questions that need to be answered before creating the design requirements: with which satellite type the WBR will communicate and what protocol will be used.

Automatic Dependent Surveillance – Broadcast (ADS-B)

The ADS-B is an Air Traffic Management (ATM) surveillance system that replaces traditional radar based systems. ADS-B is like a large wireless network where the ground stations are Wireless Access Points and the aircraft are clients. Aircraft report their own position via the network and receive back, from the ground system, traffic and other information. Computers on the ground integrate all the information and provide controllers with timely warnings of problems.

Institutional Partners

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Industrial Partners

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