ELECTRONICS DIVISION

FLIGHT CONTROL COMPUTERS FAMILY

☀ LEONARDO

Leonardo provides since early '60, solutions designed to fulfil the requirements of one of the highest critical function of an aircraft, the flight control system.
Leonardo's expertise in Flight Control Systems spans over 40 years and considerable number of aircrafts (fixed and rotary wings).

Leonardo provides aircraft manufacturers with solution ranging from single axis or secondary flight control computers and electronics to complete integration of flight control systems.

The flight control system architecture spans from simplest architecture, lowest complexity up to full authority fly-by-wire architecture, offering the following advantages:

- Compatibility with various actuation technologies (Hydraulics, Mechanical, Electro-Mechanical)
- Eased certification process (EASA Form 1 already achieved)
- Reduced integration cost and schedule risk (building blocks)

The Flight Control System (FCS), used to control the control surfaces of the aircraft, will be based on:

- Flight Control Computer (FCC)
- APSW (Autopilot).
- Building blocks of dual, dual-duplex, triplex and quadruplex FCS architecture.

Our Heritage

High Integrity
Flight Control Computer

T129

AW149 FBW

AW159

Dual Channel
Digital Autopilot

AW169

AW189

AW101 Norway

In Flight Control System, electrical signals are sent by the Flight (Control) Computer (FC/FCC) to the control surfaces. In this way, the aircraft is controlled.

- What is the advantage of automatic flight control?
- Why would we use an FC instead of a pilot?

First of all, a computer has a much higher reaction velocity than a pilot. Also, it isn't subject to concentration losses and fatigue. Finally, a computer can more accurately know the state the aircraft is in. (Computers can handle huge amounts of data better and also don't need to read a small indicator to know, for example, the velocity or the height of the aircraft.)

- Open System (HW+Equipment SW) to OEM Control Laws integration
- Customizable (servo interfaces)
- Legacy (special interface)
- Off-the-Shelf Product
- Certification Evidence
- Service History.

SC-FCC	Single Channel Flight Control Computer
DC-FCC	Dual Channel Flight Control Computer
TC-FCC	Triple Channel Flight Control Computer
FCC-T	Triplex Flight Control Computer
FCC-Q	Quadruplex Flight Control Computer

KEY FEATURES

- Multiplatform applications (manned/unmanned FW/RW)
- Dissimilar HW & RTOS (Green Hills & VxWork).
- SW Partitioned according to ARINC653 standard.
- Reconfigurable IOs.
- Up to 8 actuator drivers (either PWM or linear).
- Programmable LVDT excitation (frequency and ampl.)
- Fully digital asynchronous LVDT demodulation
- Fully-digital/high-rate programmable loop closure

Tornado

AMX

Eurofighter

Single Channel
Flight Control Computer

M346

Falco EVO

Falco Xplorer

Triple Channel
Flight Control Computer

The Leonardo's FCC family is based on two main architectures:

- **Self Checking Pair**
- **N-modular redundant**

All the FCCs (HW and SW) have been developed in accordance with DO-178B/C DAL A and DO254 DAL A.

SELF CHECKING PAIR FLIGHT CONTROL COMPUTER

The Self Checking Pair architecture is based on:
- Two identical and physically segregated FCC channels (FCC1 & FCC2 or AP CH1 & AP CH2)
- Input signals partially cross strapped and partially channel dedicated
- Output signals partially cross strapped and partially channel dedicated
- Two completely independent channels to provide Fail-Op Fail-Safe redundancy

- Each channel is based on hardware and software dissimilar in order to mitigate common mode failures
- Dissimilar Processor/RTOS/Software Factory
- Dissimilar I/O Module Design
- Software factory based on ARINC 653 partitioned RTOS.

SINGLE CHANNEL FCC

The Single Channel FCC is intended to provide FCS solutions for Fixed and Rotary Wing platforms.

It is the natural evolution of the well proven High Integrity FCC still operative on several helicopters AW129/T129 and AW159 with a huge service history.

The SC-FCC is a single channel based on two segregated lanes which are hardware and software dissimilar in order to mitigate common mode failures while adopting the same architecture of the Hi-FCC offers a reduced power management in advange of size and weight reduction.

The SC FCC can be used in a stand alone configuration to reduce Pilot workload on basic trainer (Autopilot for FW or RW). When Fail Op/Fail Safe redundancy is requested two LRUs can be used satisfying also the Survivability requirement.

MAIN FUNCTIONS

- Pilot commands of platform axes, (Pitch, Roll, Collective and Yaw)
- Control Stick Force_Feel/Back_Drive capability
- Auto Stabilization and Attitude Control of the platform
- Flight Director capability
- FCS BIT capabilities
- Digital Output (PWM)
- CAN bus

SINGLE CHANNEL FCC

Size	3/8 ATR
Weight	6.5 Kg
Power	28 VDC, 50 W max

DUAL CHANNEL FCC

The Dual Channel FCC is intended to provide FCS solutions for Fixed and Rotary Wing platforms.

It is based on two completely independent channels in order to provide Dual Duplex capability to whitstand one failure. Each channel is based on two segregated lanes which are hardware and software dissimilar in order to mitigate common mode failures.

The Dual Channel FCC has achieved EASA Form 1 Certification Approval.

It is designed to provide Autopilot functionality for civil and military platforms.

MAIN FUNCTIONS

- Pilot commands of platform axes, (Pitch, Roll, Collective and Yaw)
- Control Stick Force_Feel/Back_Drive capability
- Auto Stabilization and Attitude Control of the platform
- Flight Director capability
- FMS functionality
- FCS BIT capabilities
- Digital Output (PWM)
- CAN bus

DUAL CHANNEL FCC

Size	¾ ATR
Weight	11.1 Kg
Power	28 VDC, 100 W max

N-MODULAR FLIGHT CONTROL COMPUTER

The N-Modular Redundant architecture is based on a single
FCC Module.

This module can be provided as Multiple FCC Modules
integrated in a single LRU or Multiple LRUs with a single
FCC Module.

The N-Modular FCC is conceived to be part of a complex
Vehicle Control Management System (VCMS) composed by:
- Flight Control Computer
- Engine Interface Unit (EIU)
- Servo Interface Unit (SIU)
- GPS-aided Attitude Heading & Reference System.
  (GAHRS) (3 off)

TRIPLE CHANNEL FCC

The Triple Channel FCC is intended to provide FCS
solutions for platforms, where Fail Op-Fail Safe
redundancy is required.

This equipment integrates three independent FCC
modules within one box, for applications where weight,
volume and costs reduction are driving targets of
paramount importance.

It has been designed to provide Autopilot functionality
specially for unmanned platform, in particular is the
"core" of the Falco Xplorer Flight Control System.

Leonardo Falco Xplorer represents a complete aircraft
control chain having embedded proprietary flight control
laws and operative modes.

TRIPLE CHANNEL FCC

Size	½ ATR
Weight	7.5 Kg
Power	28 VDC, 100 W max

MAIN FUNCTIONS
- Pilot commands of platform axes, (Pitch, Roll, Collective and Yaw)
- Control Stick Force_Feel/Back_Drive capability
- Auto Stabilization and Attitude Control of the platform
- Flight Director capability
- FCS BIT capabilities
- Digital Output (PWM)

FCC TRIPLEX/QUADRUPLEX

These FCCs are conceived for jet aircrafts, whose hardware is mechanized, within the FCS, as a triple or quadruple redundant system, consisting of multiple identical hardware channels.

Each computer channel is packaged within a separate Line Replaceable Unit (LRU), and is powered by dual power sources. Each channel converts this DC power to a number of AC and DC voltages which power the channel's analog and digital internal circuitry, as well as supplying power to the external sensors associated with that channel. Each channel receives a set of sensor inputs and discrete inputs. Information transfer between FCC channels is accomplished through across the Channel Data Link (CCDL) communication line.
Each FCC includes two dual redundant MIL-STD-1553B terminals or ARINC 429 and RS422 interfaces.

The FCC provides all functionalities in conjunction with the other equipment, to implement the required FCS modes.

FCC TRIPLEX

Size	¾ ATR
Weight	11.1 Kg
Power	28 VDC, 100 W max

FCC QUADRUPLEX

Size	½ ATR
Weight	<10 Kg
Power	28 VDC, < 90 W

MAIN FUNCTIONS

- Pilot commands of platform axes, (Pitch, Roll, and Yaw)
- Control Stick Force_Feel/Back_Drive capability
- Auto Stabilization and Attitude Control of the platform
- Flight Director capability
- FCS BIT capabilities
- Digital Output (PWM)

VCMS COMPONENTS

SERVO INTERFACE UNIT (SIU)
Actuation of the surfaces and secondary aircraft control. Each SIU controls one primary aircraft surface, along with one or more secondary aircraft control. Each SIU internally includes three Single-lane Channels.

ENGINE INTERFACE UNIT (EIU)
Acquisition of engine data through analog and discrete sensors.

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