

ATC Data-Link



Growth of air traffic and its increasing complexity call to introduce appropriate Data-Link solutions to support Air Traffic Services according to ICAO technology roadmaps. In particular the 4D Trajectory Management Operational Concept needs to be supported by a reliable, scalable, modular, and efficient Data-Link solution capable to grant interoperability constraints:

- Unique wireless communication platform capable to support ATC and AOC operational services
- Wireless data link connection of AOC Communication Service Providers (ACSPs)
- Monitoring of the on-board system of VHF Data Link Mode-2 (VDL-2) coverage availability

Air Navigation Service Providers (ANSPs) are primarily responsible for operational Communication (Data and Voice) ATS services. Consequently ANSPs have to directly manage the Communication Network. The Advanced Data-Link Solution has then to satisfy those requirements and the performance constraints requested by ATM service providers.

The Advanced Data-Link is an integrated system providing ATM/ATC operational services including Airline Operational Communications (AOC) sharing the same infrastructures. The Advanced Data-Link complies with the following features:

- Priority Assignment to ATC versus AOC messages such to comply with ATC delay time constraints
- Reduced RF conflict and EMC pollution by a unique radio access able to support and manage different ACSPs and ATS End Users
- Performance Monitoring of ATC and AOC traffic flows
- Dynamic frequency management in operational scenarios
- Modular and Scalable Architecture capable to manage different ATC/AOC operational configuration according to service needs
- Compliance with operational concepts developed in R&D international programs as SESAR, NEXTGEN, and CARATS
- Optimization of band Allocation, exploiting outcomes and recommendations of the Report EASA on CIR 29/2009– May 2014 edition

- Improvement of data integrity to guarantee the requested safety and security target levels according to the international Risk Classification Schemes
- Seamless Communication System to support ATC and AOC operational services to manage both En-Route and Terminal air movements

- Ground segment implementing ATN protocols through proper Network elements (Air Ground Router and Dual Air Ground Router)
- CPDLC and ADS-C functionalities among aircrafts, ACCs, and airports, in all phases of flight

LEONARDO SOLUTION

Leonardo offer of an Air Transport System (ATS) has been tailored on the key technical features and Advanced Data-Link Infrastructures as follows:

- Full compliance to CIR 29/2009 requirements on Data-Link services for the Single European Sky, providing operational availability $Ao > 99,995\%$
- Compliance to Report EASA on CIR 29/2009 about multifrequency, with optimization of DL infrastructure coverage. This configuration, including the multifrequency functionality, enhances operational service throughput. In addition, the DL Infrastructure Solution is aligned in terms of functionalities and performance figures with the new CIR 716/2014, concerning the Pilot Common Project (PCP) supporting the ATM Master Plan
- Unique ATC-graded Air-to-Ground infrastructure for Air Navigation Service Providers (ANSPs), complying with QoS constraints; e.g. Roundtrip (2-way) delay, functional and non functional performances, RMA, Safety and Security
- Open, scalable, and modular architecture to support management of ATS and AOC services, in normal operating mode, or ATS services only for non-AOC airlines
- Deployment of unique Data-Link infrastructures

SYSTEM ARCHITECTURE

Data-Link Infrastructures are based on a multi-protocol network articulated on the following segments:

- Wireless Access Network, managed by the MGS100 (Multi-mode Ground Station) component, implementing all required interfaces to support ATS and AOC services:
 - VHF Data Link Mode-2, supporting ATN, AOC ACSP1 and AOC ACSP2 traffic flows according to Dual Squitter functionalities
 - VHF ACARS
- Central Function supporting MGS100 in implementing mobility management policies in the multifrequency environment
- Ground segment marking interconnection boundaries with ACSPs network infrastructures capable to exchange ACARS messages between MGS100, ACSPs networks, and Airports
- Network Management System, composed by:
 - Fault and Configuration Management System for every Network Element (EMS: Element Management System)
 - Performance Monitoring System (PMS) and Recording



CPCDL - C

Advanced Data-Link Infrastructure solutions support Operational Concepts for ATM as defined in R&D international programmes: SESAR for EU, NEXTGEN for US, and CARATS for Japan. The following ATN B1 CPDLC services are currently supported according to 29/2009 mandates:

- Clearance request and delivery
- Information exchange and reporting
- ATC communication management
- ATC microphone check

Multifrequency functionalities embedded in Data-Link grant high operational availability, leading to a smooth transition to safety-critical and high performance capabilities, as requested by the ATN B2 Baseline CPDLC, including ADS-C functionalities. The context to be met by the ATN B2 implementation includes

- 4D trajectory negotiation and synchronization
- Operational terminal information
- Runway Visual Range
- Hazardous weather reporting
- Taxi clearance
- Flight-deck based interval management

The Advanced Data-Link Infrastructure solution is also able to support de facto standards like FANS 1/A baseline. The following topics are supported by FANS 1/A:

- Departure Clearance
- Position Reporting (ADS-C)

FUTURE COMMUNICATION INFRASTRUCTURE (FCI)

Leonardo is pioneering the development of the Future Communication Infrastructure (FCI), a new IP-based worldwide communication infrastructure intended for global aviation systems. The Air-Ground segment of the FCI is based on new broadband A/G Data-Links, such as Long-term SatCom and LDACS. The FCI can also support new voice functionalities (e.g. sector-less voice communication) as well as air defence operations and civil-military coordination through ground/ground communication segments. The flexible use of Data-Links requires definition and specification of the multilink function, as well as of an IP Mobility management solution.

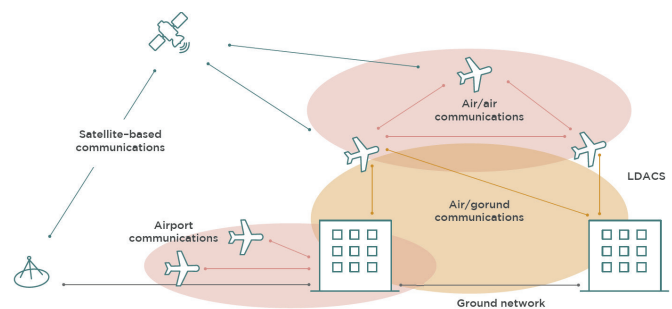
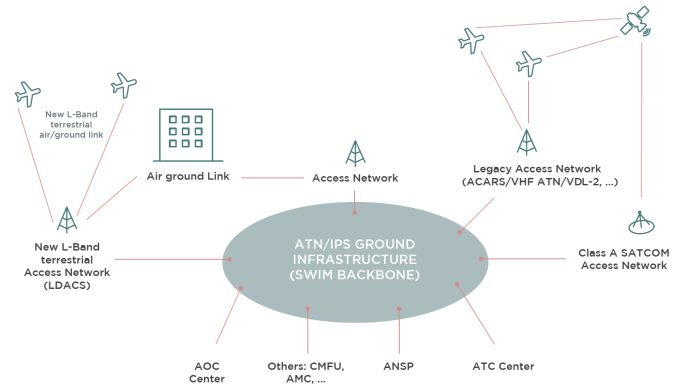
The FCI is a “system of systems” integrating existing and new technological components. The FCI will also grant secure seamless operations, complying with current and future requirements, and safeguarding investments in infrastructures and equipment. In FCI future A/G Data Link technologies (LDACS, Class A SATCOM) coexist with legacy radio technologies (VHF, AM, VDL-2), being supported by a common IP infrastructure based on ATN/IPS.

Leonardo solution grants the following benefits:

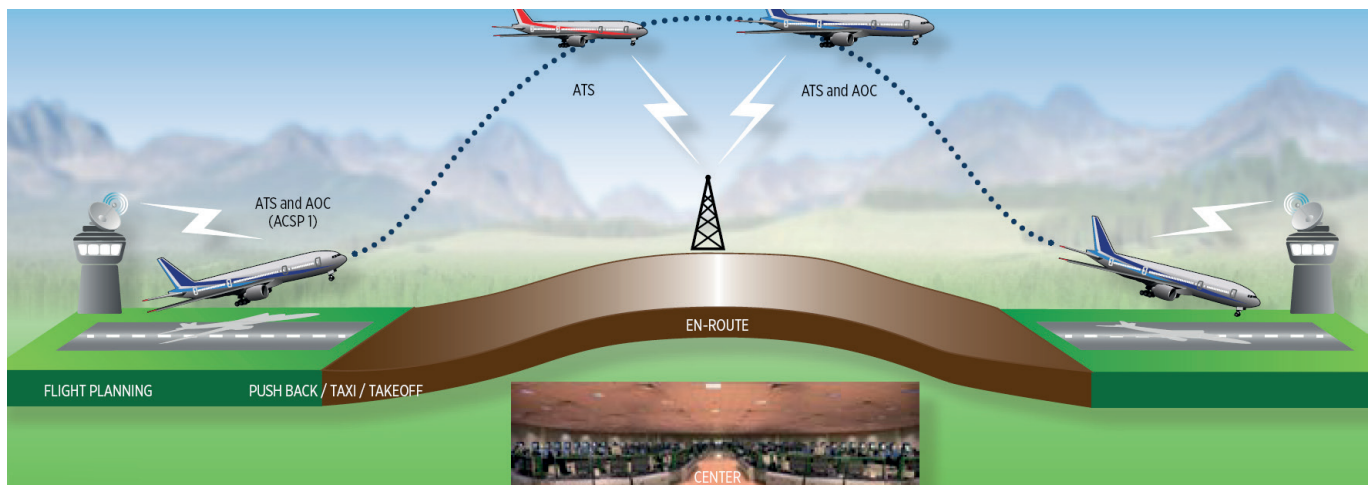
- Worldwide communication infrastructure supporting current and future ATC and AOC services while maintaining the adequate Class of Service during all flight phases
- Infrastructures capable to manage more than one Data-Link in all flight phases
- Security countermeasures within the whole FCI

LDACS

LDACS (L-band Digital Aeronautical Communication System) is the future SESAR terrestrial Data-Link technology. LDACS is a ground-based broadband Data-Link system developed for continental airspaces, En-Route, and Terminal Area communications. The technology is developed in the L-band frequency, shared with legacy navigation and surveillance aviation systems.



LDACS shall be part of ATN over IP (ATN/IP) and is candidate to become the first integrated communication, navigation, and surveillance technology for Future Communication Infrastructure (FCI). LDACS covers both high-rate data and voice communications, and will grant ICAO security requirements. The Open Network Management ATC (ONMATC) solution shall be the common baseline to implement FCAPS features for LDACS and other ATC Data-Links (e.g. VDL-2).



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