ATMGE/24 SYMPOSIUM

27-Sep-2017
EU CPDLC MANDATE
At the Single Sky Committee (SSC) Meeting 55, which took place on 14/15 Jan 2015, the SSC passed a favourable opinion on the proposed amendments to Regulation (EC) 29/2009 (DLS-IR). The regulation 2015/310 which amends Regulation 29/2009 has now been published and is available from the European Commission web site.

The important date changes to Regulation (EC) 29/2009 in a simplified form are:
- The amended regulation will be applicable as from 05 Feb 2018
- All ANSPs should be ready by 05 Feb 2018
- All aircraft should be equipped by 05 Feb 2020 (there is no longer a distinction between forward fit and retrofit)

Link to Reference Documents
• EUROCONTROL Specification on Data Link Services (EUROCONTROL-SPEC-0116) is the primary document
• Complements the Implementing Rule (EC 29/2009)
• It applies to all ATN/VDL 2 Data Link Equipment
  – Aircraft communication and display systems, including an ATN Router and an ATN End System
  – VDL 2 Airborne Radios
  – VDL 2 Ground Radios and Stations
  – ATN Air-Ground and Ground-Ground Routers
  – ATC Ground Centre communication and display systems, including an ATN End System
  – Ground Data Recording equipment
• Defines detailed requirements, explanatory materials and conformity assessment materials providing means of compliance (MOC) associated with the DLS implementing rule
CPDLC Implementation in Europe

- Operational
- Initial Operating Capability
- Not yet operational

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4.1 Constituents of a DLS System

Figure 1: ATN Data Link System Architecture
The use of VDLM2 air/ground Data Link as an enabler for CPDLC Mandate has encountered implementation issues.
DEPLOYING A DATA LINK SYSTEM
Deploying a Data Link System

- Deploying a Data Link requires careful planning for an Air Navigation Service Provider (ANSP):
  - the new system components (ATN Routers, DL-FEPs) must be integrated with existing systems;
  - ATN Network and VDL stations must be deployed and/or contracts with CSP must be established
  - functional, system and interoperability testing must be performed before going live;
  - and the Controllers must be trained.

- It requires careful planning and coordination as several actors and systems are involved.
Data Link Components

VDL2 Network

Airborne Router

ATN A/G Router

ATN Network

ATN G/G Router

FDPS

AGDLS/DL-FEP/DLS

ATC Centre

ANSP ATN Router

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Deployment of three components

A. Procurement and/or upgrade ATC Centre for CPDLC/ATN
B. Procurement of AGDLS/DL-FEP and ANSP ATN Router
C. Procurement of ATN Network and VDL M2 Ground Stations
   - Directly
   - Service provided by Communication Service Providers

The procurement and/or deployment of ATC components (ATC Centre, AGDLS) is not dependant on the provision of ATN/VDL network.
DATA LINK EVOLUTION
• VDLM2
  – Low-bandwidth air/ground Data Link
  – Aircraft equipage currently is VDLM2
  – EU Mandate requires VDLM2 coverage
  – VDLM2 shares AOC/ATC traffic in one single channel
  – En-route and airport data in one single channel

• Recovery Plan
  – VDL Multi-Frequency with dedicated en-route frequency when required
  – AOC data to other sub-networks

• Other candidates for ATC sub-network
  – Satellite (ESA Iris Precursor, ...)
  – SESAR 2020 is looking at LDACS, AeroMACS and satellite
Data Link System Architecture

- FANS Aircraft
- ATN Aircraft
- ATN Network
- FANS Network
- ATN A/G Router
- ATN G/G Router
- ACARS Processor
- ATC Centre
- ANSP ATN Router
- AGDLS

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A/G Data Links

- A/G datalink: 3 Key Components
  - Physical Links
  - Networks
  - Applications/Services
Multi link concept

Existing Systems (VDL2)

- Airport surface: AeroMACS
- General terrestrial: LDACS
- Satellite: Oceanic + Continental
A/G Data Links: Networks

Networks:
- ACARS/FANS
- ATN/OSI
- ATN/IPS

Legacy/Existing Networks

Future Network(s)
• ATN using IP instead of OSI Protocols
• Need to distinguish Standardisation of ATN/IPS (agreement and development required specifications) from Implementation of ATN/IPS (deployment of required infrastructure).
• Standardization of IPS
  • ICAO WG-I (2016-2020)
  • AEEC IPS Safety Services (2016-2019)
• Implementation.
  • 2-5 years after standardization completed.
• R&D Projects
  • SESAR-2020
  • CleanSky2
  • ESA - Iris
ATN/IPS General Requirements

- ATN/IPS shall be designed to support next steps communication requirements, with a long term duration/perspective (e.g. ATN-B3)
- ATN/IPS systems/equipment shall be designed to support data exchanges over future efficient (high speed) A/G subnetworks (AeroMACS, LDACS, SATCOM)
- Ground ATN/IPS infrastructure shall accommodate ATN/OSI avionics ATN B1 & B2 developed for Europe
- Airborne ATN/IPS architecture and systems shall be fully secured and comply with the Security Regulation and associated requirements
- ATN/IPS is based on IP Protocols
A/G Data link: Applications

- **ATN-B1 Applications**
  - With European CPDLC Mandate Profile
- **ATN-B2 Applications**
  - Standards available
- **ATN-B3 Applications**
  - Future applications (Beyond 2028-2030)
• Standards
  - ED-228A/DO-350A, *Safety and Performance Standard for Baseline 2 ATS Data Communications (Baseline 2 SPR Standard)*
  - ED-229A/DO-351A, *Interoperability Requirements Standard for Baseline 2 ATS Data Communications (Baseline 2 Interop Standard)*
  - ED-231A/DO-353A, *Interoperability Requirements Standard for Baseline 2 ATS Data Communications, ATN Baseline 1 Accommodation (ATN Baseline 1 - Baseline 2 Interop Standard)*.

• ATN-B2 Rev A – April 2016
ATN-B2 Overview

- Data Link Initiation (DLIC)
- ATC Communications Management (ACM)
- Clearance Request and Delivery (CRD)
- ATC Microphone Check (AMC)
- Departure Clearance (DCL)
- Data Link Taxi (D-TAXI)
- Information Exchange and Reporting (IER)
- Position Reporting (PR)
- 4-Dimensional Trajectory Data Link (4DTRAD)
- In-Trail Procedure (ITP)
- Interval Management (IM)
- Oceanic Clearance Delivery (OCL)
- Dynamic Required Navigation Performance (DRNP)
• Reuse of existing deployed physical links and networks

• Transition Considerations
  – Aircraft
    • Monolingual Aircraft (B1 or B2)
    • Bilingual Aircraft (B1 and B2)
  – Ground
    • CPDLC Mandate (B1)
    • SESAR Demonstrations (B2 only)
    • Operational Deployment (B2 with B1 accommodation)
DATA LINK ROADMAP
• Different approaches due to commercial and technical considerations
SESAR 2020
Single European Sky ATM Research

This project has received funding from the SESAR Joint Undertaking under the European Union’s Horizon 2020 research and innovation programme under grant agreement 731818.
Airtel was member of SESAR 1
Airtel is member of SESAR 2020 as NATMIG
**North European ATM Industry Group (NATMIG)**
  - consortium
    - Airtel ATN of Ireland,
    - Saab of Sweden and
    - SINTEF of Norway.
  - The consortium was founded in 2007 with the purpose of creating a stakeholder body to participate in SESAR.
  - NATMIG will run projects valued at approximately €20 Million as part of SESAR 2020
PJ14 Future communication links
PJ14 Multi link concept

Existing Systems (VDL2)
- Airport surface: AeroMACS
- General terrestrial: LDACS
- Satellite: Oceanic + Continental
PJ14 Overview

- SESAR 2020 Industrial Research
- EECNS (Essential and Efficient Communication Navigation and Surveillance Integrated System)

- Purpose
  - The PJ 14 CNS aims to specify and develop the future Technologies coming from the Communication, Navigation and Surveillance domains in order to support and manage the Operational Services, like the 4D Trajectory Management, in the future ATM System.

- Communication solution
  - PJ14.02.01 LDACS
  - PJ14.02.02 Satellite
  - PJ14.02.04 Future Communications Infrastructure
  - PJ14.02.06 AeroMACS
• **Solution PJ.14-02-01:** FCI Future Terrestrial Data Link has the objective to develop and standardize the candidate future terrestrial data link system LDACS.
  - support the development and standardization of the LDACS technology.
  - contribute to the development of a harmonized global standard.
  - develop and verify a fully functional LDACS prototype and assess the impact on other systems.
  - The prototype will be integrated into an FCI validation platform (with other links)
PJ14.02.02 Satellite

- **Solution PJ.14-02-02**: Future Satellite Communications data link is focused on the near and long satellite data link technologies for both continental and oceanic regions.
  - Compliance with ATS B2
  - Development of technical specifications and validation procedures for Long Term SATCOM (class A SatCom)
  - Intermediate step of the i4D based on ESA Iris Precursor solution (Class B)
  - Technical validation of satellite Air-Ground Datalink for Long Term SATCOM integrated in the FCI (ATS B3, ATN/IPS, multilink)
  - Standardization at global level (ICAO, EUROCAE) of proposed solution for Long Term SATCOM;
  - Coordination with ESA Iris Programme and the reuse and consolidation of the ESA Iris programme prototypes where possible
Solution PJ14-02-06: Completion of AeroMACS Development

- Integrate and verify the AeroMACS Data Link with ATN services, both at ground and on-board.
- Initially ATN/OSI will be considered, while ATN/IPS will be verified subsequently, in line with the ICAO roadmap.
- The AeroMACS A/G datalink will also be integrated with the multilink environment,
- Definition and potential implementation handover from AeroMACS to VDLM2 during take-off, and vice-versa during landing.
- The Network and Security System requirements will be finalised, also in relation to multilink.
- A digital voice communications solution over AeroMACS (VoIP) will be finalised and verified.
- The solution will also support the standardization process.
• **Solution PJ.14-02-04:**
  - FCI Network Technologies (ground deployment)
  - develop and standardise the FCI elements that integrate all the future terrestrial data link systems
    - LDACS (PJ14-02-01),
    - Satellite Communications (SatCom) (PJ14-02-01)
    - AeroMACS (PJ14-02-06)
  - this solution will address transversal topics
    - security,
    - safety,
    - civil-military interoperability with ground/ground communications networks.
  - The solution will demonstrate multi-link to a mobile end system (e.g. airplane) by means of LDACS, AeroMACS, and SATCOM data links.
• SESAR 2020 Very Large Scale Demonstration (VLD)

• Purpose
  – Demonstrate ATM benefits through the use of downlink 4D trajectory data in ground systems.

• Objectives
  – Airborne industry will demonstrate for the first time, a certified airborne unit capable of downlinking ADS-C EPP data
  – ANSP and ground industry are building pre operational systems platforms capable of receiving and processing ADS-C data including EPP (Extended projected profiles)
  – Demonstration of Operational Benefits of Initial trajectory Information (EPP)
PJ31 Revenue flights
AIRTEL

We are ready to guide ANSPs to meet the CPDLC mandate successfully
• **Products**
  — Operational products
  — Test systems
  — VDL Monitoring systems

• **Adaptable**
  — Each ANSP has specific requirements and Airtel adapts to meet these needs

• **Proven technology**
  — 13 European ANSP use our software
  — Over 2,000 aircraft are equipped by Airtel
  — Integrated with all major system integrators

• **Experience**
  — Working in Data Link since its inception in ATC
  — Key member of ELSA consortium report

• **Ready for the future**
  — Partner in ESA Iris Precursor and Iris Evolution to provide CPDLC ATC using satellite network
  — SESAR 2020 member participating in PJ14 new sub-network and network technologies and future ATN B2 applications

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Validating CPDLC deployment

Ground Validation Suite

Airborne Router

Airborne Router

ATN Network

ATN A/G Router

ATN G/G Router

ANSP ATN Router

AGDLS/ DL-FEP/DLS

FDPS

ATC Centre
Ground Validation Suite

- Ground Validation Test Systems provide testing means that require less actors and systems.
- Simulation of up to 1,000 aircraft
- Early detection of interop problems
- Independent Validation
- Easy setup
- No coordination required with CSP or Avionics
- Large emulations
- Testing of valid and invalid scenarios
- Shadowing of operational scenarios
Monitoring VDL Deployments

- Airborne Router
- ATN A/G Router
- ATN G/G Router
- ANSP ATN Router
- AGDLS/DL-FEP/DLS
- ATC Centre
- Mobile Test Platform

VDL2 Network

ATN Network

FDPS
European ANSP Customers
We are ready to guide ANSPs to deploy CPDLC

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