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INTRODUCTION OF DATA LINK SERVICES

(Presented by Saudi Arabia)

EXECUTIVE SUMMARY

This paper provides an overview on Saudi Air Navigation Services (SANS) ATS data link capabilities set through the new ATM system, VHF ground stations supporting VDL and ACARS services, and partnership agreement signed with a leading datalink service provider (SITAONAIR). The paper also provides information on the introduction of controller pilot data link communications (CPDLC) service with Jeddah flight information region (FIR) and departure clearance (DCL) service at certain aerodromes (Madinah, Jeddah, Riyadh, Dammam, Abha, and Gassim Towers) through automated assistance for requesting and delivering clearances, to reduce pilot and controller workload.

Strategic Goals:	This working paper relates to *Every Flight is Safe and Secure* and *Aviation Delivers Seamless, Accessible, and Reliable Mobility for All*
Financial implications:	Activities to be undertaken within existing budgetary allocations
References:	Annex 11 — *Air Traffic Services* Annex 10 — Aeronautical Telecommunications, Volume I — *Radio Navigation Aids* and *Volume II — Communication Procedures including those with PANS Status* Doc 10037, *Global Operational Data Link (GOLD) Manual* Doc 9694, *Manual of Air Traffic Services Data Link Applications* Doc 4444, *Procedures for Air Navigation Services — Air Traffic Management*

1. INTRODUCTION

1.1 The controller pilot data link communications (CPDLC) is defined as means of communication between air traffic controllers and pilots, using data link for air traffic control (ATC) communications. CPDLC allows direct exchange of standardized (pre-formatted) messages between a controller and a pilot, as an alternative to voice communications. In addition, it supports automation by using and processing the exchanged data by onboard and ground systems with error detection and reporting capabilities.

1.2 The CPDLC requirements are covered under several ICAO provisions, which mainly include: Annex 10 — Aeronautical Telecommunications, Volume I — *Radio Navigation Aids* and *Volume II — Communication Procedures including those with PANS Status,* Part 1 Chapter 3, and Annex 11 — *Air Traffic Services*. The CPDLC operational requirements are detailed under the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444) and the message set is described in PANS-ATM, Appendix 5. The *Manual of Air Traffic Services Data Link Application* (Doc 9694), and the *Global Operational Data Link (GOLD) Manual* (Doc 10037) are the main guidance material on ATS data link services, including data link initiation capability (DLIC), and CPDLC.

1.3 The CPDLC application provides the following capabilities:

a) the air traffic controllers can issue ATC clearances (level assignments, lateral deviations/vectoring, speed assignments, etc.), radio frequency assignments, and various requests for information;

b) the pilots can respond to messages, to request/receive clearances and information, and to report information;

c) provide error detection, alerting and correction where appropriate; and

d) a “free text” feature to exchange information not conforming to defined formats.

1.4 The implementation of CPDLC services are covered under COMS thread of the ICAO Global Air Navigation Plan (GANP) with several Aviation system block upgrade (ASBU) elements in Blocks 0, 1, 2 and 3. It is expected that data link communications will be used in support of various ATM enhancements among which:

a) trajectory-based operations (TBO), with new CPDLC messages to uplink route amendments (with standardized automation rules to ensure consistent flight management system implementation among the aircraft fleet); and

b) surface operations, with new CPDLC TAXI (D-TAXI) messages.

2. OVERVIEW ON AVAILABLE DATA LINK CAPABILITIES

2.1 Saudi Air Navigation Services (SANS) has deployed a state-of-the-art modular, advanced, and integrated surveillance, flight data processing and display system based ATM system for

the provision of ACC/APP/TWR air traffic control from Riyadh and Jeddah Area Control Centers (ACC), Dammam and Abha Approach Control Centers (APP) and thirteen local and remote TWRs.

2.2 The ATM system is composed of several sub-systems supporting specific functions, which include air-ground data link applications (ADS-C, CPDLC, DCL) and services for aircraft-controller interoperability. The system is currently compliant with the following data link ASBU elements: COMS-B0/1 (CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace, COMS-B0/2 (ADS-C (FANS 1/A) for procedural airspace), COMS-B1/1 (PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace), COMS-B1/2 (PBCS approved ADS-C (FANS 1/A+) for procedural airspace).

2.3 The Air-Ground Data Link Processing (AGDLP) redundant server-based function is in charge of data link applications (ADS-C, CPDLC, DCL) between aircraft and controllers and ensures the data communication with the air-ground networks infrastructure supplied by SITAONAIR as datalink service provider (DSP).

2.4 With respect to CPDLC, the AGDLP is providing the following features:

a) *ATS Facilities Notification/Contract Management (AFN/CM) Manager*. It allows addressing capability for data link applications between aircraft and ground. The AFN/CM application provides the capability to establish a logon between ATS ground and aircraft systems and peer ATS ground systems. The status of aircraft logged/de-logged is conveniently displayed to the controller.

b) *Controller Pilot Data Link Communication (CPDLC) Manager*. It allows exchange data messages between controller and pilot. The CPDLC application provides the capability to establish, manage and terminate dialogues initiated by the pilot or by the controller.

c) *Departure Clearance (DCL) Manager*. It provides automated assistance for requesting and delivering departure clearances through the data messages exchange between tower personnel and pilot.

d) *FANS*[1] *Communication Interface*. It contains the ground-end system communications interface for the ACARS network (FANS equipped aircraft).

e) *Additional features*. It includes:

1) Management of aircraft addresses or message conversion and formatting;

2) Assignment of messages to the appropriate Situation Data Display (SDD), Flight Data & Flow Management Display (FDD), Tower Flight Strip Display (TFSD), Flight Data Processing (FDP) and Surveillance Data Processing (SDP);

[1] *FANS means communications using future air navigation system applications including Air Traffic Services Facilities Notification (AFN), Controller-Pilot Datalink Communications (CPDLC), and Automatic Dependent Surveillance-Contract (ADS C) over ACARS.*

3) Monitoring of the status of data link connection to each flight and the operational procedures concerning specific flights; and

4) Validation of the received messages, e.g., check the Cyclic Redundancy Check (CRC), format of the messages, etc. An illustration on the main Air-Ground Data Link Processing .

2.5 The AGDLP interfaces with the Aircraft Communications Addressing and Reporting System (ACARS) network of Data Link Services managed by SITAONAIR for exchanging ADS-C, CPDLC, and DCL with aircraft. The interface with ACARS supports the data type that is compliant with the following standards: FANS 1/A AFN, CPDLC, and ADS-C messages according to FANS 1/A RTCA DO-258A/EUROCAE ED-100A, and DCL messages according to FANS 1/A EUROCAE ED-85A.

2.6 To support the deployment of datalink services within Jeddah flight information region (FIR), SANS signed partnership agreement with SITAONAIR where SANS make available its VHF data link Mode 2 (VDL Mode2) infrastructure: equipment (VHF ground stations (VGS), ground network, supporting systems (routing and monitoring) to be used by SITAONAIR for the provision of VHF data link Mode 2 (VDL Mode 2) service to airlines and aircraft operators that are customers of SITAONAIR AIRCOM[2] services. SANS and SITAONAIR agreed on responsibility sharing for the deployment, operation, and maintenance of the datalink infrastructure serving Jeddah FIR and on target performance metrics for the ATS AIRCOM Datalink Service

3. INTRODUCTION OF CPDLC AND DCL SERVICE WITHIN JEDDAH FIR

3.1 Under the enhancement of the ATS applications, SANS initiated an implementation program to introduce CPDLC service within Jeddah FIR and DCL service at Madinah, Jeddah, Riyadh, Dammam, Abha, and Gassim Towers through automated assistance for requesting and delivering clearances, to reduce pilot and controller workload and clearance delivery delays. The new services were the subject of formal consultation and coordination with the main airspace users to gather their views and feedback on the overall data link services within Jeddah FIR and their expectations on the introduction of CPDLC and DCL services.

3.2 The CPDLC and DCL services are provided as an alternative means of communication for non-urgent or time-critical voice communications. The ATC VHF voice communications are immediately available for intervention to address non-routine and time-critical situations. Time-criticality is mainly determined by the following factors: ATC traffic situation, end-to-end performance (systems and flight crew/controller response time), and recovery time. The airspace users should be aware that while a voice communication/response is generally expected in seconds, there is a latency of CPDLC that depends on the end-to-end system. The CPDLC service is available from FL 150 and above within Jeddah FIR to all equipped aircraft with ATN VDL Mode 2, FANS1/A, and FANS1/A+. The following CPDLC services are provided:

[2] *AIRCOM means the service provided by SITAONAIR on a global basis to support the exchanges of messages using the ACARS protocols between aircraft and ground-based systems, regardless of whether such messages support Airlines Operational Communications (AOC) or ATC applications, and regardless of whether such messages have been using Plain Old ACARS VHS stations, VDL Mode 2 stations or satellite services.*

a) data link initiation capability;

b) ATC clearances and instructions; and

c) ATC communications management.

3.3 The CPDLC message set definition follows the documents of Interoperability Requirements Standard for FANS (EUROCAE ED-100A) and Minimum Operational Performance Standards for ATC Two-Way Data Link Communications (RTCA/ DO-219) for FANS-1/A. SANS's ATM system is able to receive, process and respond to messages defined in ICAO Doc 4444 and Doc 10037. It reacts proactively to some CPDLC uplink messages, such as Cleared Flight Level change, updating the trajectory calculation, flight plan information and flight data-block accordingly.

3.4 The DCL function is integrated in the System for FANS 1/A+ equipped aircraft and performed by the Air-Ground Data Link Processing (AGDLP) and the FDP functions as explained under §2 of this paper. The DCL function is implemented in accordance with the standards: ED-85A specifications, and DCL dialogue is carried out using the Tower Electronic Flight Strips. The air traffic controller can check the status of the DCL dialogue by means of a colour background in the corresponding field of the Tower Electronic Flight Strips and DCL dialogue setting (manual or automatic mode) can be managed from the ATC TWR Supervisor's position.

3.5 The DCL message types and contents exchanged between aircraft and ATC TWR are set in accordance with the standard ED-85A, and comprise the following:

a) departure clearance request (RCD), Downlink – RCD;

b) departure clearance uplink (CLD), Uplink – CLD;

c) departure clearance readback (CDA), Downlink – CDA; and

d) flight system message (FSM), Uplink – FSM.

3.6 For the introduction of CPDLC and DCL services, SANS developed a safety risk assessment for each application, operational procedures, and transition plan covering:

a) coordination with airspace users to share information on the introduction of CPDLC and DCL and ways and means to report issues and concerns on services;

b) final checks on operational and technical readiness for the introduction of CPDLC and DCL services;

c) amendment to KSA AIP to provide details on the new services;

d) extensive operational trial period to capture major issues; and

e) post-implementation assessment over a period of 180 days to assess CPDLC and DCL data link performance in Jeddah FIR and selected aerodromes through detailed analysis of delivery performance on the following areas of interest: uplink performance, downlink performance, message reject rate, and system availability.

4. CONCLUSION

4.1 CPDLC and DCL provide means of communication between the controller and pilot, using data link for ATC communication. These applications include a set of clearance/information/request message elements that correspond to the phraseologies used in the radiotelephony environment. Standard voice radiotelephony will remain the primary means of ATC communications at all times. Any failure event concerning CPDLC and DCL will lead to a reversion to voice operation.

4.2 The implementation of CPDLC and DCL services within Jeddah FIR and at certain aerodromes is intended as a supplementary means of communication to the use of voice communication and used in the context of non-time-critical communications. The procedures related to CPDLC and DCL operations, flight planning, transfer between data authorities, types of messages and their composition, phraseology, and switch to voice communications are described under KSA AIP GEN 1.5 and AD 2.20 section for each aerodrome where DCL is introduced. They are expected to achieve the following benefits:

a) less communication on the ATC frequency;

b) increased of airspace and ATC sector capacities;

c) more pilot requests can be dealt with simultaneously;

d) reduced probability of miscommunication/misunderstanding (e.g. due call sign confusion); and

e) safer frequency changes, hence reduction of loss of communication events.

4.3 The use of CPDLC and DCL is not mandatory in Saudi Arabia and is conducted at the discretion of ATC and the pilots. In order to use the CPDLC and/or DCL services, pilots must file the respective aircraft equipage in their flight plan (FPL 2012 format), field item 10 with the appropriate J codes and field 18, as defined under PANS-ATM, Appendix 2.

4.4 Where urgent or time-critical communications are required, voice communications must be used. Voice readback is not required for any CPDLC and DCL instructions. In cases where uncertainty arises as a result of a data link message, communication shall revert to voice.

4.5 The Assembly is invited to take note of the information provided in this paper and encourage States to share information, through ICAO, on the deployment of data link applications associated with the provision of air traffic services.

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