International Civil Aviation Organization
CAR/SAM Regional Planning and Implementation Group (GREPECAS)

WORKING PAPER

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Fourth GREPECAS–RASG-PA Joint Meeting and
Twenty-second Meeting of the CAR/SAM Regional Planning and Implementation Group (GREPECAS/22)
Virtual Phase (Asynchronous, 16 September to 11 October 2024)
In-Person Phase (Lima, Peru, 20 to 22 November 2024)

Agenda Item 5: **Implementation of CAR/SAM Air Navigation Services (ANS)**
5.2 Communication, Navigation and Surveillance (CNS)

CPDLC IMPLEMENTATION IN BRAZIL

(Presented by Brazil)

EXECUTIVE SUMMARY

This paper presents the implementation of Controller Pilot Data Link Communications (CPDLC) in the Brazilian upper continental airspace, its technical and operational characteristics, and it also shares the planning efforts carried out, good practices and identify new challenges.

Action:	a) ICAO - direct efforts towards establishing standardized indicators to measure the effectiveness of CPDLC implementations in terms of operational benefits. b) ICAO and States - develop actions together with airline associations and aircraft operators with a view to promoting the upgrade of on-board capabilities for the CPDLC data link scenario planned for the CAR and SAM regions.
Strategic Objectives:	• Safety • Air Navigation Capacity and Efficiency • Environmental Protection
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1. Introduction

1.1 CPDLC, an acronym for Controller Pilot Data Link Communications, employs preformatted, standardized messages corresponding to the standard phraseology used in radiotelephony in the provision of Air Traffic Services (ATS).

1.2 The application is recommended by the International Civil Aviation Organization (ICAO) as one of the enabling technologies of air traffic management concepts of the future, and provides greater automation and management of communications, having as main benefits the reduction of congestion in voice channels, greater availability and coverage for aeronautical communications, reduced

misunderstandings in communications during the ATS provision, and reduction in the workload of air traffic controllers and pilots.

1.3 VHF voice channels were the only means used between controllers and pilots for communications in ATC and the provision of Air Traffic services en route (ACC), in terminal areas (APP) and at aerodromes (TWR) in Brazil.

1.4 However, the use of voice imposed some limitations that hindered the efficiency and effectiveness of communications between controllers and pilots, such as: a) flawed understanding due to accent, voice intonation, or even incorrect phraseology; b) difficulties in understanding messages due to language barriers, as a result of possible lack of proficiency in the English language either on the part of controllers or pilots; c) occurrence of spurious noises, hissing, echoes, which interfere with the frequency used; and d) interference due to misuse of the frequency spectrum.

1.5 Furthermore, there may be congestion on the frequency used. In the case of complex authorizations, such as new route information or traffic information, when carried out by voice, they tend to be laborious and require several repetitions and retransmissions.

1.6 All these factors, together, lead to the increase of the workload of both ATCO and pilots. Failures of understanding and workload were two of the main contributing factors to the occurrence of aeronautical incidents in Brazil.

1.7 The Department of Airspace Control (DECEA), through its SIRIUS BRAZIL Program, has been working in cooperation with stakeholders such as the Communication Service Provider (SITA On Air), the ATC Automation Systems Developer (ATECH), the Brazilian Air Force operational and technical teams, and the aeronautical community to operationalize the CPDLC in the Brazilian continental airspace.

2. Discussion

2.1 Brazil has implemented FANS data link services in both domestic and remote operations.

2.2 The data link service has been provided since 2009 in the oceanic airspace corresponding to the FIR-Atlantico (SBAO): CPDLC, as the primary means of communication, and ADS-C are available.

2.3 DECEA maintains a concession contract for data link services with SITA. A vast network of VHF data link ground stations has been deployed to provide coverage throughout the continental airspace above FL245 and some selected Terminal areas.

2.4 In continental airspace, Pre-FANS services DCL and D-ATIS have been available for 26 of the main national airports since 2014.

2.5 The initial operationalization of CPDLC in domestic airspace occurred in selected sectors of national airspace, which were strategically selected because of the fleet characteristics (CPDLC capabilities are already implemented in aircraft on international routes), low airspace complexity and low traffic volume.

2.6 In order to verify the adherence of CPDLC to the operational times currently used for communications in air traffic control using voice, many tests were carried out to evaluate data link performance in the Brazilian continental airspace.

2.7 On September 9th, 2021, CPDLC FANS 1/A became operational in Brazil in an area corresponding to more than 3.5 million km2 and in class A airspace, above FL250, in sectors 1 to 5 of FIR-Amazonica (SBAZ) and sectors 1 to 6, 9 and 10 of FIR-Recife (SBRE).

2.8 The main project challenges were:

a) Promoting the self-development of an Air Traffic Control and Piloting Simulator using data link;
b) Evaluating human-machine interface and the automated functionalities available in the national ATC system;
c) Defining new HMI requirements for the ATC System to optimize ATCO screen windows, automation process, awareness of data link connection status, among others;
d) Having continuous participation and monitoring of experienced professionals from the technical and operational areas, from the development of new HMI requirements, testing and solving bugs, to its effective operational implementation, in order to avoid any development rework and additional costs;
e) Developing the operationalization phases, the prototype scenario for the implementation of continental CPDLC and the recommendations to be considered for the operations;
f) Providing Manuals and ACC Operational Models update;
g) Identifying possible DECEA rules that would be impacted by the introduction of CPDLC in the ATC, re-issuing related legislation and drafting new publications;
h) Establishing a methodology to determine ATC airspace capacity using CPDLC;
i) Adjusting the methodology to measure ATC sector's capacity for extracting workload variables;
j) Ensuring that the technical parameters of the ground-ground and air-ground networks enable a safe CPDLC operation in the Brazilian continental airspace;
k) Carrying out performance tests for the national data link using laboratory aircraft and aircraft from national and international airlines;
l) Identifying cognitive and psychomotor human skills necessary for CPDLC operation in continental airspace, to define technical and operational know-how necessary for ATCOs, create a specific CPDLC course, and develop training and a capacity building strategy for all ATCOs;
m) Identifying hazards, performing risk assessment and classification, developing the CPDLC Continental Safety Risk Management Document and coordinating and implementing mitigation and/or corrective solutions;
n) Developing and implementing a solution to enable the timely updating of repetitive flight plans (RPL) with information of aircraft registration – a requirement for the CPDLC data link logon;
o) Planning and executing Technical and Operational Proofs of Concept;
p) Developing and executing a strategy for dissemination of the Project, its characteristics, and benefits, in order to raise awareness among users and reduce resistance to the new operational reality; and
q) Analyzing the workload before and after CPDLC implementation.

2.9 The initial operationalization was divided into 3 phases to enable the gradual integration of the application into the operational routine of the users, to facilitate the assimilation of the CPDLC application by the ATCO, to avoid possible resistance due to the implementation and, at the same time, to allow the monitoring of the technical performance, the use of operational doctrines and specific adjustments to maintain or improve safety levels. The implementation steps were based on predetermined periods of operation throughout each day so that, in an evolving manner, they can handle greater air traffic volume.

2.10 The transition between the phases has occurred simultaneously and in a coordinated way between Recife and Amazonico Centers to avoid discontinuity of the operations, and it was informed through aeronautical publications.

2.11 Since June 2023, the CPDLC has also been available at FIR- Brasilia (SBBS). The CPDLC usage in this FIR was also planned in phases to allow gradual adaptation of ATCO and crews to the use of the system, and to monitor operation prior to general implementation.

2.12 By December 2024, the implementation of CPDLC in Brazil's upper airspace will have been completed and the application will also be in full use at FIR-Curitiba (SBCW).

2.13 All CPDLC messages provided in Doc 10037 – Global Operational Data Link Document can be used. An assistant ATCO is not allowed to send any kind of clearance messages, instructions, or traffic information.

2.14 The ATC system, called SAGITARIO, is provided by Atech, a Brazilian company within the Embraer Group, specialized in developing solutions for critical missions and technologies to support decision making.

2.15 The application is provided through a terrestrial communication infrastructure operated by SITA, through the ACARS network - FANS 1/A or FANS 1/A+ data link system, using VDL Mode 2, VDL Mode A in airspaces above FL250, inclusive. The subnet SATCOM can also be used.

2.16 In continental Brazilian airspace, the CPDLC connection is only possible if the aircraft with CPDLC capability is registered in the SITA network. Operators who have a contract with another CSP should check with their provider about the interoperability between the contracted service and the SITA service.

2.17 It is not mandatory for all aircraft to be equipped with CPDLC data link avionics FANS 1/A or FANS 1/A +. There is no airspace segregation. Thus, CPDLC has been used in the Brazilian continental airspace in a mixed environment, that is, where ATS will be provided both for aircraft capable and not capable of using CPDLC.

2.18 Given the achieved operational gains with the CPDLC usage, specially related to operational safety, Brazil strongly encourages the fleet upgrade and the priority use of the VDLm2 subnet.

2.19 Since the launch of the project, a team of professionals experienced in data link has followed the operation in the Amazonico, Recife and Brasilia Area Control Centers. To date, no significant operational or doctrinal problems have been identified. The few specific technical problems were quickly resolved and did not impact the ATM or the aviation safety.

2.20 The technical-operational experience acquired through the use of the CPDLC over 3 years will allow Brazil to reassess the implementation and operation to identify potential opportunities for systemic improvements and doctrinal and normative enhancements.

2.21 Data link technologies and different methodologies have been used to support CPDLC implementations around the world and the scope for improvements to ATM and, consequently, to society.

2.22 Knowledge and sharing of the improvements achieved with the implementations of enabling technologies foreseen in GANP, by ANSP, is a powerful tool for greater awareness of the aeronautical community and boosting the equipping of aircraft with specific avionics required.

2.23 For the full recognition of the effectiveness of the implementations and the benefits of using CPDLC, it is essential to establish basic indicators. Such indicators/parameters can support States in recognizing advances that are aligned with what is expected in the GANP, on the way to the ATM of the future, as well as planned in view of the demands identified in the respective airspace.

2.24 In addition, the establishment of common indicators would allow the identification of trends and patterns, opportunities for system improvement or the provision of ATC service using CPDLC, either locally or between ICAO States and regions, guiding the implementation of more effective strategies through precise adjustments.

2.25 The enhancement of the benefits arising from the use of data link applications in air traffic control, at regional and global levels, requires efforts for the coordinated/harmonized implementation of CPDLC standards and procedures by States and is highly dependent on user adherence to the new scenario, through equipping aircraft with the specific avionics required.

3. Conclusion

3.1 The Conference is invited to discuss and conclude on the need for ICAO to direct efforts towards establishing standardized indicators to measure the effectiveness of CPDLC implementations in terms of operational benefits.

3.2 The Conference is invited to discuss and conclude on the need for ICAO and States to develop actions together with airline associations and aircraft operators with a view to promoting the upgrade of on-board capabilities for the CPDLC data link scenario planned for the CAR and SAM regions.

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