International Civil Aviation Organization

Fourth Meeting of the Asia/Pacific Air Traffic Management Automation System Task Force (APAC ATMAS TF/4)

Bangkok, Thailand, 28 – 30 June 2023

Agenda Item 4: ATM Automation System Implementation Experience by States

4.4 Development of New Technology

Domestic-CPDLC implementation in New Zealand

(Presented by New Zealand)

SUMMARY

This paper presents an overview of New Zealand's progress in designing and implementing Domestic-Controller/Pilot Datalink Communication (D-CPDLC)

1. INTRODUCTION

1.1 Airways New Zealand is working with both airspace users and the national Regulator to enable Domestic-CPDLC (D-CPDLC). This paper provides an overview of D-CPDLC application in New Zealand and progress made so far towards implementation.

2. DISCUSSION

Initiation

2.1 Global, Regional, and New Zealand's own, Air Navigation Plans identify datalink as an important enabler of CNS in the future air navigation system. New Zealand's National Airspace and Air Navigation Plan specifically identifies CPDLC application in domestic airspace.

2.2 Airways has supported CPDLC and ADS-C in New Zealand's Oceanic airspace (NZZO) since the late 1990s via its Oceanic Control System (OCS). To facilitate domestic application, Airways identified the need for a compatible CPDLC capability when procuring its new domestic ATM system in 2016.

2.3 Coinciding with the domestic ATM replacement, Air New Zealand (the national airline), began a Domestic fleet replacement/upgrade program that incorporated FANS1/A capability.

2.4 In 2020 Airways created a Concept of Operations for D-CPDLC in New Zealand. The primary considerations in design were:

- Regulatory standards and guidance
- Sky-X capability
- D-CPDLC application in other States
- Achieving effective implementation – i.e., optimal controller/aircrew use

2.5 The Operational Concept can be summarised as:

- DO-258A based FANS 1/A
- Enroute focused within existing VHF RTF coverage
- Small message set integrated into existing function
- Simple and automated message exchange with Revert-to-Voice as fall back
- Use at controller discretion for non-time critical communication

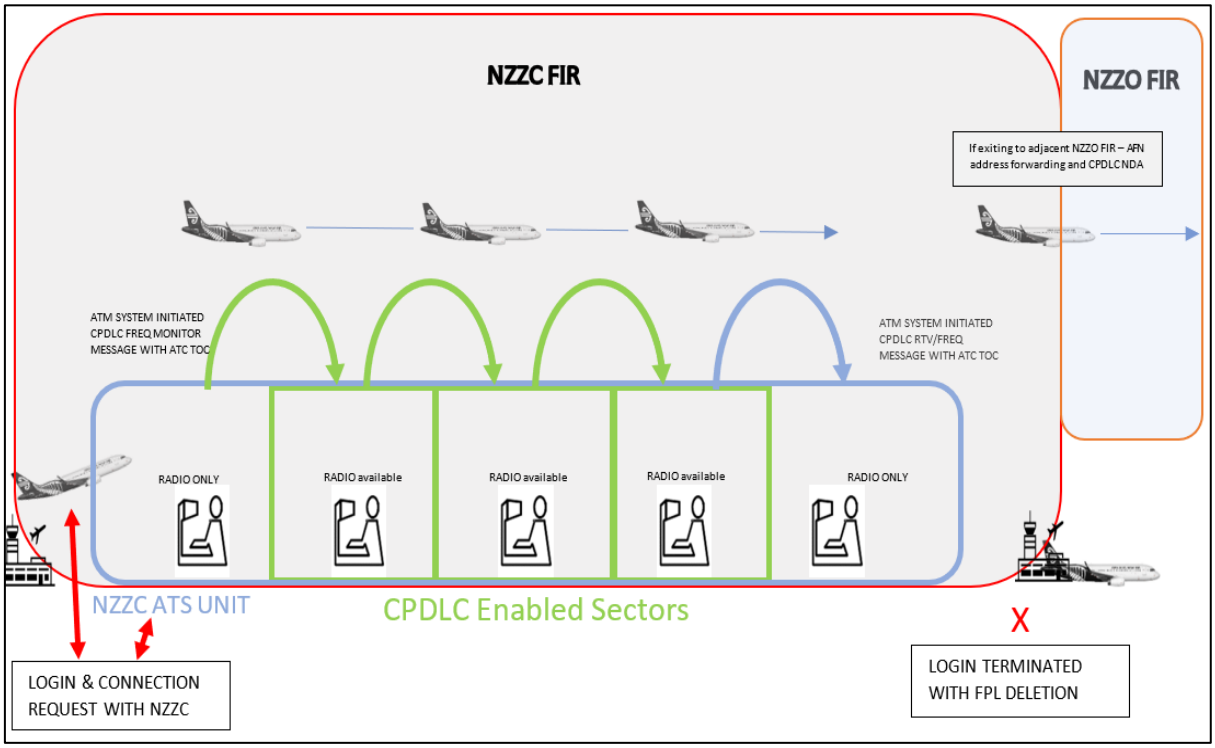

Fig. 1 – High Level concept of D-CPDLC application

Development

2.6 Delayed by the impact of the COVID pandemic, the Regulator, Airways and Air New Zealand commenced discussions in 2021 for the implementation of D-CPDLC. Starting with review and confirmation of the Operational Concept, an iterative design process has continued from that point as shown below.

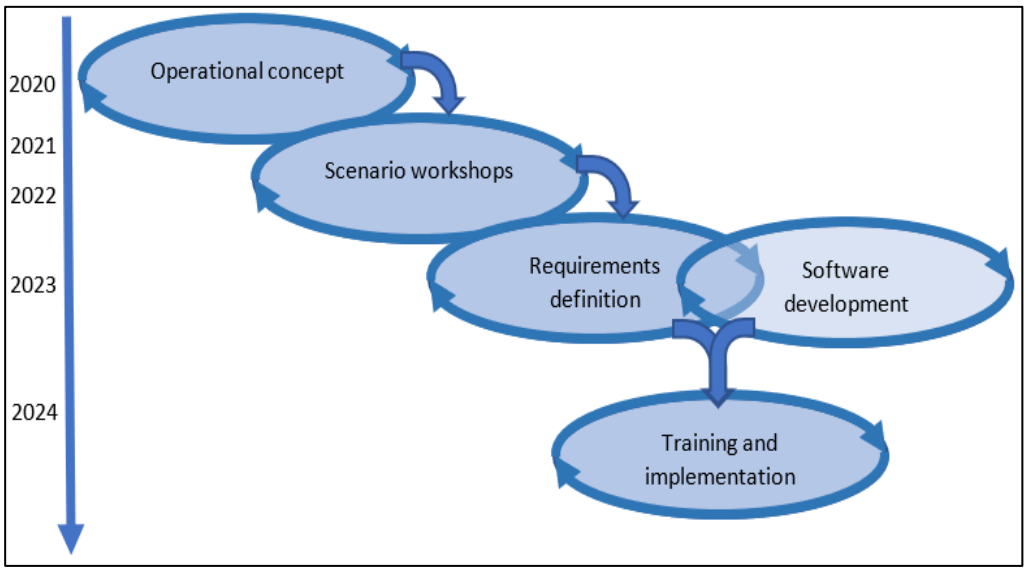

Fig. 2 – Design process over time

2.7 Scenario generation consisted of a series of meetings between Airways and Air New Zealand technical and operational staff over 6 months. These meetings:

- Captured scenarios
- Defined use case scenarios, confirming message sets, process, and function
- Identified gaps needing further use cases or technical/regulatory confirmation

2.8 Scenario work confirmed the following processes/message dialogues for development:

- Logon and CPDLC Connection
- Transfer of Radio Guard (Contact)
- Cleared Flight Level (Controller initiated or Pilot Request)
- STAR/RTA (TTO) passing
- GOTO (track direct)
- Pilot initiated STANDBY
- CPDLC Emergency messages

Function - CFL	HMI	ATM Message	Aircraft Message
Controller Instruction - Initiated	FL350 FL340 FL330 FL320 CPDLC PASS FL320	UM20 – CLIMB AND MAINTAIN FL340	
Controller Instruction – In progress	FL320 FL340		
Controller Instruction – Crew Accept	FL340		DM0 - WILCO
Controller Instruction – Crew Reject	FL320 FL340 ATC ACK and RTV		DM1 – UNABLE RTV on controller contact
Aircrew Request – Initiated/In progress	FL340 FL320		DM10 – REQUEST DESCENT TO FL320
Aircrew Request – ATC Accept	FL340 FL320 ACCEPT REJECT	UM23 – DESCEND TO AND MAINTAIN FL320	
Aircrew Request – ATC Accept – Crew accept	FL320		DM0 - WILCO
Aircrew Request – ATC Accept – Crew reject	FL340 FL320 ATC ACK and RTV		DM1 – UNABLE RTV on controller contact
Aircrew Request – ATC Reject	FL340 FL320 ACCEPT REJECT and RTV FL340	UM0 – UNABLE or potentially UM169 REQUEST RECEIVED EXPECT VOICE RESPONSE	RTV on controller contact
Controller instruction/Aircrew request – timeout in response	FL340 FL320 Then after 130 seconds FL340 FL320 ATC ACK and RTV		RTV on controller contact
2nd Aircrew Request when 1st CFL in progress/error in message	FL340 FL320 FL340 FL320 ATC ACK and RTV	UM0 UNABLE	
2nd ATC initiation when 1st CFL in progress	FL320 FL340 FL340 FL330 FL320 FL310 Greyed out Un-selectable		

Fig. 3 – An example of a scenario driven process flow for CFL messaging

2.9 Requirements drafting is currently taking place and involves Airways Requirements, Software and Operational representatives. Requirements incorporate:

- Functional needs derived from scenarios
- Safety needs (Airways Safety Management System and DO-350A derived)
- Post-implementation monitoring as prescribed by the PBCS manual (Doc 9869)

2.10 Software development and testing will commence in the second half of 2023. Airways Domestic Software and Requirements teams will work with operational representatives to iteratively develop functionality through prototyping, unit, functional and integration testing.

2.11 Development and testing will focus on:

- Sky-X CPDLC messaging function – Confirming system management of dialogues can support controller/pilot-initiated actions
- The Human Machine Interface (HMI) – The D-CPDLC HMI concept is built around retaining controller focus on the situation display. Interaction will be primarily via the data block (including dialog state indications), with an Agenda supporting overall D-CPDLC situational awareness and prioritisation based on flight progress or message type, e.g., emergency

2.12 A crucial aspect of the validation process is the involvement of Air New Zealand. As development matures, the expectation is that Air New Zealand will support end-to-end testing. Beyond validation, the airline's involvement also supports aligning operational process, training, and implementation plans.

2.13 End-to-end testing will also include the Regulator (CAA NZ). This will support their regulatory oversight requirements and facilitate any Advisory Circular or AIP amendments required to facilitate wider industry notification and participation.

Training and Implementation

2.14 Airways will use its Operational Training resource to commence building the training package once development is finalised. This will most likely be a combination of classroom and simulator based and will highlight the discretion required when using D-CPDLC, particularly its non-time critical application and RTV process.

2.15 With the go-live of Sky-X anticipated within the year, D-CPDLC is forecast for implementation approximately 6-12 months later. Airways envisages subsequent tranches of message implementation as operational experience increases.

2.16 D-CPDLC will represent the first major functional implementation of the system's development roadmap. Future roadmap items include Medium Term Conflict Detection (MTCD), Time based Flow Management (TBFM), and FIXM/FF-ICE.

3 ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matter as appropriate

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