International Civil Aviation Organization

NINETEENTH MEETING OF THE COMMUNICATIONS/NAVIGATION AND SURVEILLANCE SUB-GROUP (CNS SG/19) OF APANPIRG

Bangkok, Thailand, 20 – 24 July 2015

Agenda Item 3: Aeronautical Fixed Service (AFS)

DCL IMPLEMENTATION IN THE NEW ZEALAND DOMESTIC FIR: IMPLEMENTATION AND TEST RESULTS

(Presented by Airways New Zealand)

SUMMARY

This paper presents a summary of the issues encountered while designing and implementing Digital Clearance delivery (DCL) in the New Zealand domestic FIR. It is intended to assist States with current or future implementation plans and highlight issues they may encounter and ways to resolve them

1. INTRODUCTION

1.1 At CNS SG/18 (Beijing), Airways presented information on its plan to introduce domestic datalink applications, namely Digital Clearance Delivery (DCL) and Digital-AIS (D-ATIS). Since then steady progress has been made on DCL design, testing and integration to the point where the system is due to go live on the 23rd of July

1.2 In the process of conducting the above work, a number of technical issues were encountered. These issues range from limitations in the scope of the governing message formats through to airframe equipment limitations and variations

1.3 This paper is intended to highlight the main issues that were encountered during the design and test phase and provide States with some guidance on the processes that were used to resolve such issues, issues that may affect their own application

2. DISCUSSION

2.1 DCL is designed to provide a datalink based means of passing a flights initial clearance before departure. It requires suitably equipped ground and airborne systems for aircraft to participate.

2.2 Airways enhanced its Electronic Flight Strips system (EFS) to support DCL and embarked on a collaborative approach to design and testing with airspace users particularly the major jet operators. In carrying out this process a number of key issues were identified:

- CLD message format conflicting with domestic initial clearance content
- Avionics issues with message format or content
- Exposure to real request messages during live ‘end-to-end’ testing

- ED-85A/AIRINC622 non-compliant airspace users who wished to participate

2.3 **CLD Message format vs. domestic initial clearance:** DCL message formats and content are prescribed in ED-85A. These include Request, Clearance, Readback and Flight System messages. Primary concern for the project was the Clearance message or (CLD). Clearance elements in the CLD message are limited and were unable to replicate the in use clearance content. See table below.

DCL CLD message clearance elements	Verbal clearance message clearance elements
Destination	Destination
	Route
	Cleared Altitude/Flight Level
SID	SID
	Transition

Table 1

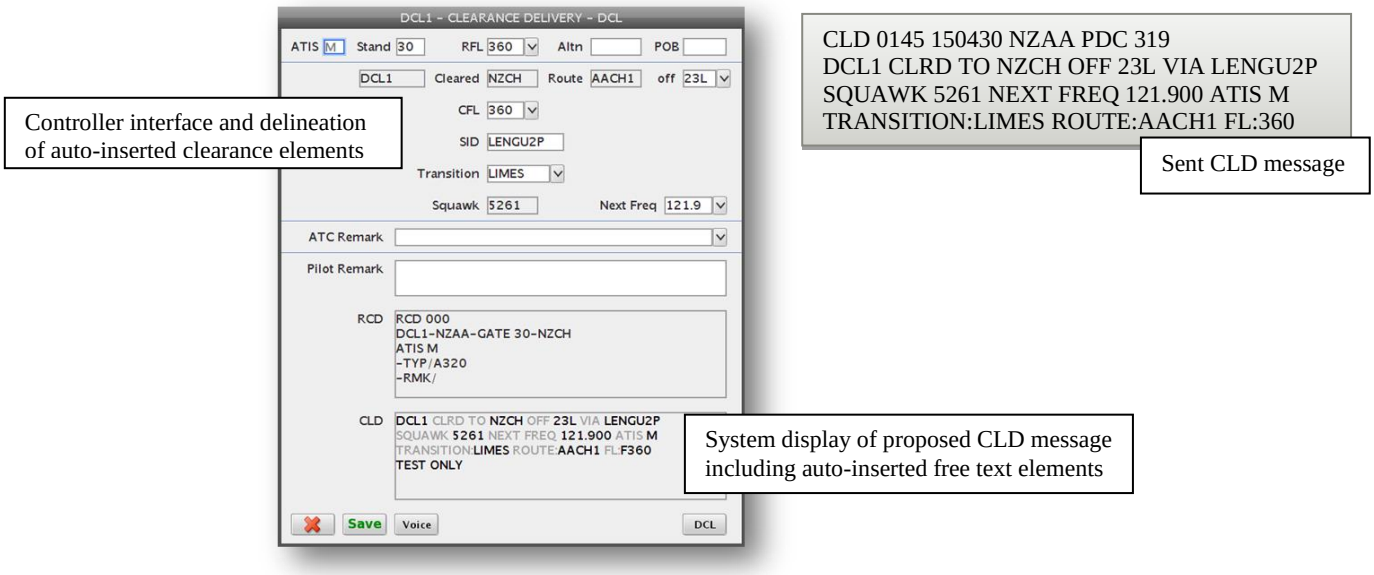
2.3.1 Safety case review of the project identified the content issue and was expanded to consider the implications of either changing operational processes/responsibilities to accommodate only the ED-85A content or the feasibility/security of using the Optional Free Text field of the CLD message to convey the additional elements – namely Route/CFL/Transition.

2.3.2 The latter option was identified as more feasible given project timeframe and the relatively small scope of change required. Issues with this option included:

- Free text field character limit (80 max)
- Delineating the additional clearance content in the free text field
- Providing reliability and validity in the delivery/readback/confirmation exchange that the system would carry out

2.3.3 Solutions to the issues identified in 2.3.2 were:

- Delineating clearance elements in the CLD template provided to controllers
- Auto-inserting clearance elements into the delineated fields
- Defining at the system level that the transition/Route and CFL would always be the first text groups auto-inserted into the free text field and in a standard format. This process is aligned with the system check for these elements and their format and highlighting omission, error or excess characters in the field and withholding transmission until the content is valid



- Limiting route eligibility to flights that file either Standard Route Clearances (a NZ applied short form coding of routes that would normally be defined by points and route designators) or international departures (in which case the route was replaced with Flight Plan Route (FPR))
- Determination that the readback (CDA) will always match the CLD message as part of the ED-85A application. End 2 end testing confirmed that modification of the CLD content was not possible by aircrew when compiling the CDA
- AIP notification and direct consultation with airline operational representatives

2.4 **Avionics issues:** As part of the test regime, end to end testing was conducted between Airways DCL test platform and participating airspace users via the Datalink Service Provider (DSP) networks. Issues encountered were:

- Omission of supplementary address
- Use of symbols in free text messages
- Cockpit display of clearance message (CLD) detail

2.4.1 **Omission of Supplementary address:** This field, which is voluntary for applicable uplink messages (FSM/CLD) in accordance with AIRINC 620, appears to be mandatory in B777/B787 avionics applications. The effect during testing was, although an RCD message was received the resulting FSM message (STANDY) was not received at the aircraft thus terminating the DCL transaction. The solution was to always include the supplementary address

FSM message (STANDBY sent in receipt of RCD) format without supplementary address	FSM message (STANDBY sent in receipt of RCD) format with supplementary address
<SOH>QU QXSXMXS .CHCCLYA 032005 <STX>FSM AN ZK-NZG - FS1/FSM 2005 150503 NZAA ANZ99 RCD RECEIVED REQUEST BEING PROCESSED STANDBY 8FD1 <ETX>	<SOH>QU QXSXMXS .CHCCLYA 042106 <STX>FSM AN ZK-OKM - /CHCCLYA.FS1/FSM 2106 150504 NZAA ANZ135 RCD RECEIVED REQUEST BEING PROCESSED STANDBY AC2E <ETX>

2.5 **Use of symbols in free text messages:** ED-85A Appendix C details the Character set for ATS messages. The A380 tested would not accept some of the characters. The effect in the A380 was to reject the message without any indication being provided to the crew via the Multi-Function Display (MFD). This would leave the DCL transaction 'hanging' until the ground system timed out the DCL transaction and sent a FSM message (REJECTED REVERT TO VOICE). Unfortunately limited time in the cockpit restricted testing to the sending of a group of characters (e.g. **$%^89;;;hsdjk ***)@? <>**.) so specific identification of the characters involved could not be identified. The best solution to this problem was to keep character use to within those identified in ED-85A as displayable on an AIRINC 739 MCDU/printable on a AIRINC 740 printer.

2.6 **Cockpit display of clearance message (CLD) detail:** Two issues were encountered here:

- As result of the additional clearance elements included in the NZ CLD message, some clearance elements appear on page 2 of the cockpit MFD/MCDU. The potential problem - aircrew could accept/readback a CLD by only reading the 1st page. This issue was resolved with crew training by the airspace user groups
- B789 aircraft transposing of the gate number and the ATIS designator when a printout of the CLD was made. This will not be an issue as long as gates are always defined numerically

2.7 **Exposure to real RCD requests during live end to end testing:** Although DCL was not promulgated as available at any New Zealand airport during testing, RCD requests were received. This appears to habit for some international crews who are exposed to DCL availability at many major hubs. The result was the potential for an invalid clearance message (CLD) to be sent to the crew from the test lab equipment. Though not likely during manual use of the system, the risk increased when we were testing the ground system in automatic mode (no ATC interaction with RCD/CLD/CLA). The solution to this was to automatically append all sent CLD messages with 'TEST MESSAGE ONLY', advise operational staff of the potential for aircraft to call for start but which had not received an initial clearance and contact applicable airlines to advise crews that DCL testing was taking place and to not send RCD messages.

2.8 **ED-85A and AIRINC622 non-compliant airspace users who wished to participate:** This issue had the potentially to limit the availability of DCL to the target group. Therefore Airways was keen for solutions to be found. Many airspace users are AIRINC 620 capable to facilitate datalink communication between the aircraft and its parent Airline Operations Centre (AOC) but have no specific capability to cater for ATS datalink applications generally and the DCL application specifically. The solution to this issue has been resolved in two ways:

- Some airframes use an onboard emulator to give ED85A/AIRINC623 capability. This emulator, though presented on the same interface as the FMC sits remote from the FMC in software terms.
- The adaptation of an on ground emulator to act as an intermediary between the ED-85A/AIRINC622 ground–ground communication and the AIRINC 620 air-ground-air communication. This emulator was most commonly an AIRCOM server located at the AOC and along with formatting the aircraft messages into a compliant format also had to carry out correct Cyclical Redundancy Checking (CRC) of the applicable message part

2.8.1 Both solutions meant that RCD data must be entered manually by crew before transmission and the reverse for received clearance information into the FMC compared to a ED-85A capable airframe where, for transmission, fields auto-populate from the FMC and, for reception, can be 'accepted' for automatic input.

2.8.2 CRC checking did cause to main issues:

- An uplink message CRC not being stripped before parsing a downlink message thus resulting in error and cessation
- The translator calculating the CRC on the wrong portion of the message thus getting an inconsistency in values and cessation

2.8.3 Successful solutions to the issues mentioned was greatly enhanced by the close cooperation of both Airways and airline technical staff reviewing message transactions after successive rounds of coordinated end-to-end tests.

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 matters as appropriate.

– – – – – – – – – – – – –