FANS Interoperability Team Meeting (FIT/18)

Honolulu, Hawaii, USA, 22-23 March 2011

Agenda Item 4 – Working Papers

Ground System Improvements and Ongoing Issues

Presented by Airways New Zealand

SUMMARY

This paper reviews FANS1/A interoperability problems caused by similar alignment of UPR routes between Australia and the USA with the Nadi Auckland common OCA boundary. The paper also reviews recent OCS FANS1/A software improvements associated with FANS1/A, discusses future enhancements that have been identified, and also identifies ongoing interoperability issues that we would like to resolve.

1. INTRODUCTION

1.1. This paper reviews OCS problems arising through the similar alignment of the common Nadi (NFFF) and Auckland (NZZO) Oceanic Control Area (OCA) boundary with User Preferred Routes (UPR) operating between the USA and Australia.

1.2. System enhancements to overcome some of these problems are reviewed, as are other FANS1/A related enhancements that have been implemented and are planned by Airways.

1.3. An ongoing interoperability problem is identified between NFFF and NZZO that is causing failures in the FANS1/A communication transfer process. The paper also describes an unidentified software bug in the OCS system that is causing very intermittent failures of the communication transfer process.

2. DISCUSSION

Environmental factor affecting interoperability

2.1. User Preferred Routes (UPR) operate between KLAX and KSFO in the USA and YSSY and YMMM in Australia. The axis of the common boundary between the Nadi (NFFF) and Auckland (NZZO) Oceanic Control Areas (OCA) is aligned with the general direction of a large number of UPR routes and these routes often fall close to the common boundary between the two OCA. Although the common boundary is aligned along a general NE/SW axis one portion of the boundary runs

directly E/W across 25S latitude. This causes the common boundary to cut across the general axis of many flights and we see large numbers of short sector transits between the OCA as a result. On these short sector transits the aircraft may typically only spend 5-30 minutes in one OCA before leaving and re-entering the other OCA again. This can occur more than once on the same flight. Figure 2-1 below illustrates the southbound traffic on March 17 and areas where short sector transits commonly occur.

2.2. Short sector transits have been the root cause of a large number of Automated Interfacility Data Communication (AIDC) co-ordination failures and FANS1/A communication transfer failures.

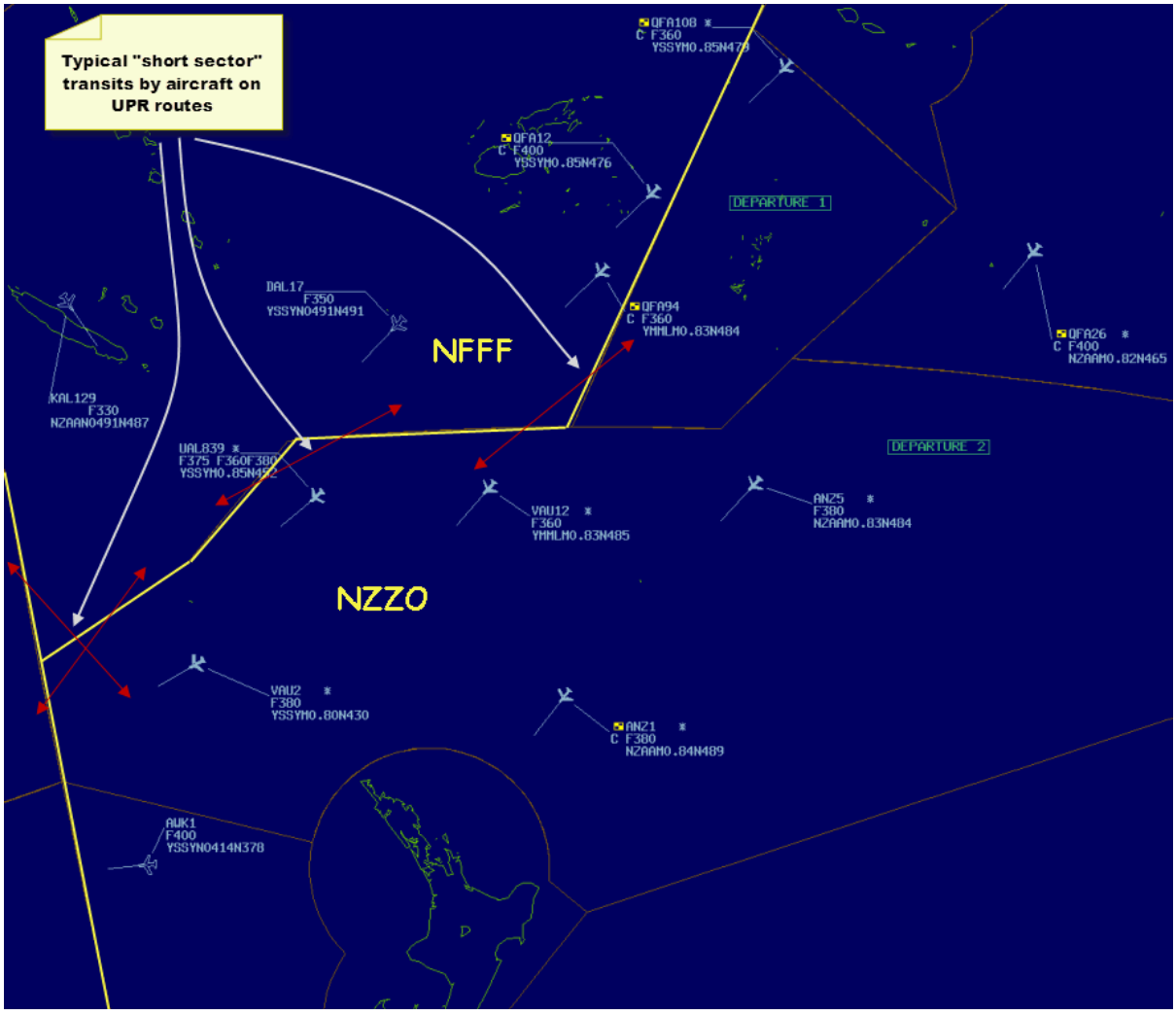

Figure 2-1 Typical Early Morning Southbound UPR March 17 2011

Short Sector Issue #1 - Dueling Center Syndrome

2.3. Airways New Zealand raised a FANS problem report in 2010 on ground system automation during investigation of message latency issues. We believe the same problem was identified and raised as a problem report in the North Pacific in 2009

and we believe a similar issue is under problem report investigation in the NAT. The ISPACG CRA has given the problem an apt description by identifying it as the "Dueling Centre Syndrome". The problem is identified by rapid looping of the AFN address forwarding messages between two ground systems. The problem is depicted in Figure 2-1 below and described in the following paragraph.

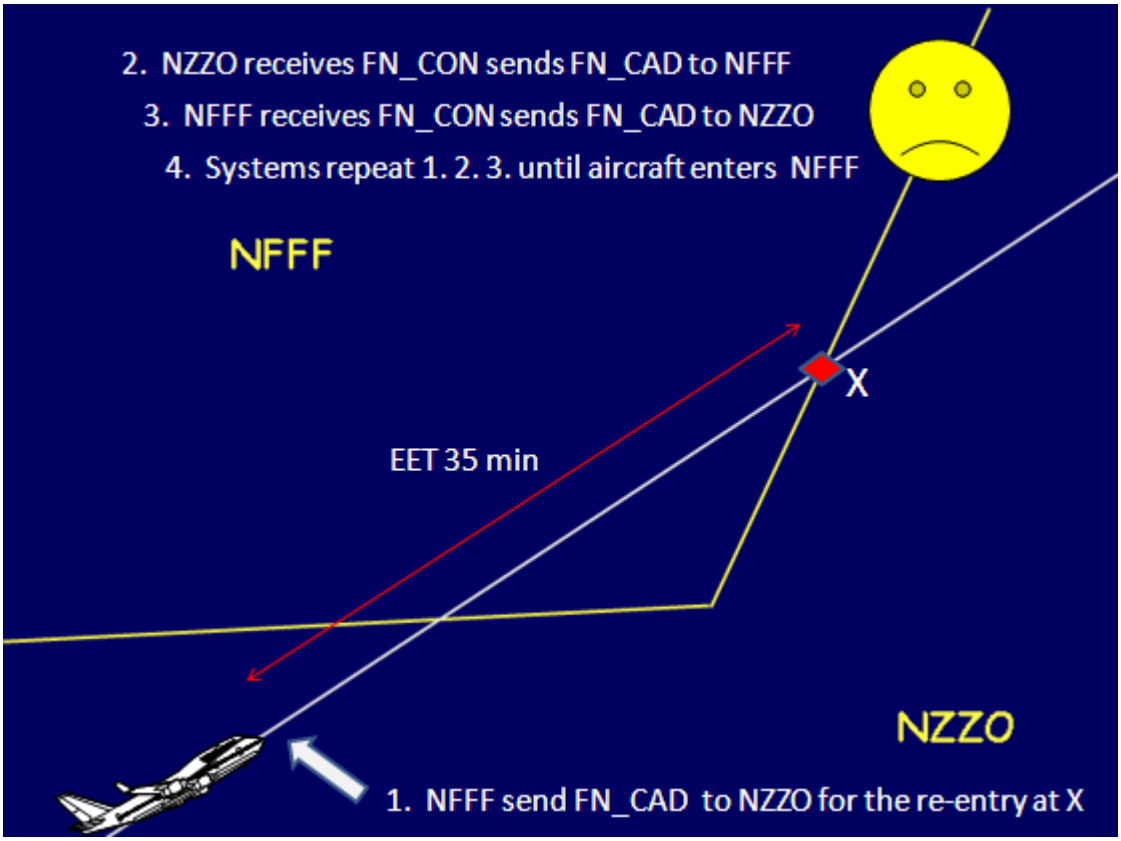

Figure 2-2 Dueling centres –AFN address forward looping

2.4. The aircraft depicted in Figure 2-2 is tracking northbound in the NZZO OCA. It has flight planned to enter the NFFF OCA at 25S and then some 20 minutes later re-enter the NZZO OCA. The CPDLC Next Data Authority (NDA) message has been sent to NFFF and the AFN address forwarding sequence (FN_CAD, FN_ACK, FN_COMP) has been completed successfully. Nadi has established an inactive CPDLC connection through the CR1/CC1 message process and has established ADS-C contracts with the aircraft. At an adapted time (35 minutes) before the aircraft is scheduled to re-enter NZZO at point X Nadi initiates an AFN address forwarding sequence to Auckland for the re-entry into NZZO OCA. At this time the aircraft is still 15 minutes away from leaving the NZZO OCA.

2.5. The original design of the OCS and Aurora ground systems is such that if a new AFN logon (FN_CON) is received from an aircraft then any existing CPDLC connection and any ADS-C contract is re-established and a new NDA, AFN address forwarding process is initiated. When Nadi receive the second FN_CON after Auckland initiates the address forwarding for the second time they also re-initiate

their address forwarding process again. This continuous looping soon results in a significant volume of message traffic and the FMS soon becomes overloaded. Significant message delays result. The looping continues until the aircraft leaves NZZO some 15 minutes later.

2.6. The problem has been fixed in OCS by simply modifying the software to retain the AFN address forwarding status when any subsequent AFN log-on (FN_CON) is received. This ensures that the address forwarding process is not repeated and has prevented any further occurrence of the duelling centres syndrome.

Short Sector Issue #2 – Intermittent Failure to send NDA to next downstream OCA after a short sector transit.

2.7. The OCS was not designed to CPDLC reconnection during a short sector transit unless a new FN_CON logon was received. The FN_CON was used in OCS software to re-initialise the CPDLC session and re-evaluate downstream NDA requirements. Intermittently, we found that we were not receiving a new FN_CON during a short sector transit and the CPDLC transfer of communications to the next downstream OCA would then fail because OCS would not send the required NDA message to the next OCA. This was occurring because the software flag indicating that the NDA process was complete remained set. While the AFN address forwarding process would be completed the NDA message would not be sent and the next communications transfer would fail.

2.8. This issue was fixed by clearing all status information for a CPDLC session when that connection terminated after the end-service message.

Short Sector Issue #3 – Sending NDA to next downstream OCA when not Current Data Authority (CDA).

2.9. The design of OCS was such that the transmission of the CPDLC NDA and then the AFN address forwarding process was initiated automatically at an adapted variable system parameter (VSP) time prior to the next OCA boundary. We see many short sector transits around 30S163E where the Auckland, Brisbane (YBBB), and Nadi OCA boundary intersect.

2.10. Aircraft operating on the USA-Australia UPR routes would often plan a short sector westbound transit from the Nadi OCA into the Auckland OCA for a short time then exit to the Brisbane OCA. Many communication transfer failures occurred between Auckland and Brisbane on these routes. The cause of the failures was because the original OCS design failed to check the status of the CPDLC connection before sending the NDA, and it was often sent before NZZO was current data authority (CDA). If an aircraft receives a NDA from anyone but the CDA it is rejected. This saw the attempted CPDLC connection by Brisbane fail because they were not the designated NDA. This issue was fixed in OCS by not initiating the NDA AFN address forwarding process until the aircraft was inside the Auckland OCA.

2.11. This problem continues to exist on short sector transits through the Nadi OCA around 30S163E by aircraft operating UPR on the Japan – New Zealand routes. This is illustrated in Figure 2-3 below. The figure depicts a southbound aircraft that has planned a short sector transit of 20 minutes through the NFFF FIR. Nadi has received the address forwarding from YBBB and has connected CPDLC as the designated next data authority (NDA). At a VSP from the boundary (usually 40 minutes) NFFF initiate the NDA to NZZO. Because Nadi is not the CDA when they send the NDA the aircraft rejects the message. The CPDLC transfer process between NFFF and NZZO has now failed.

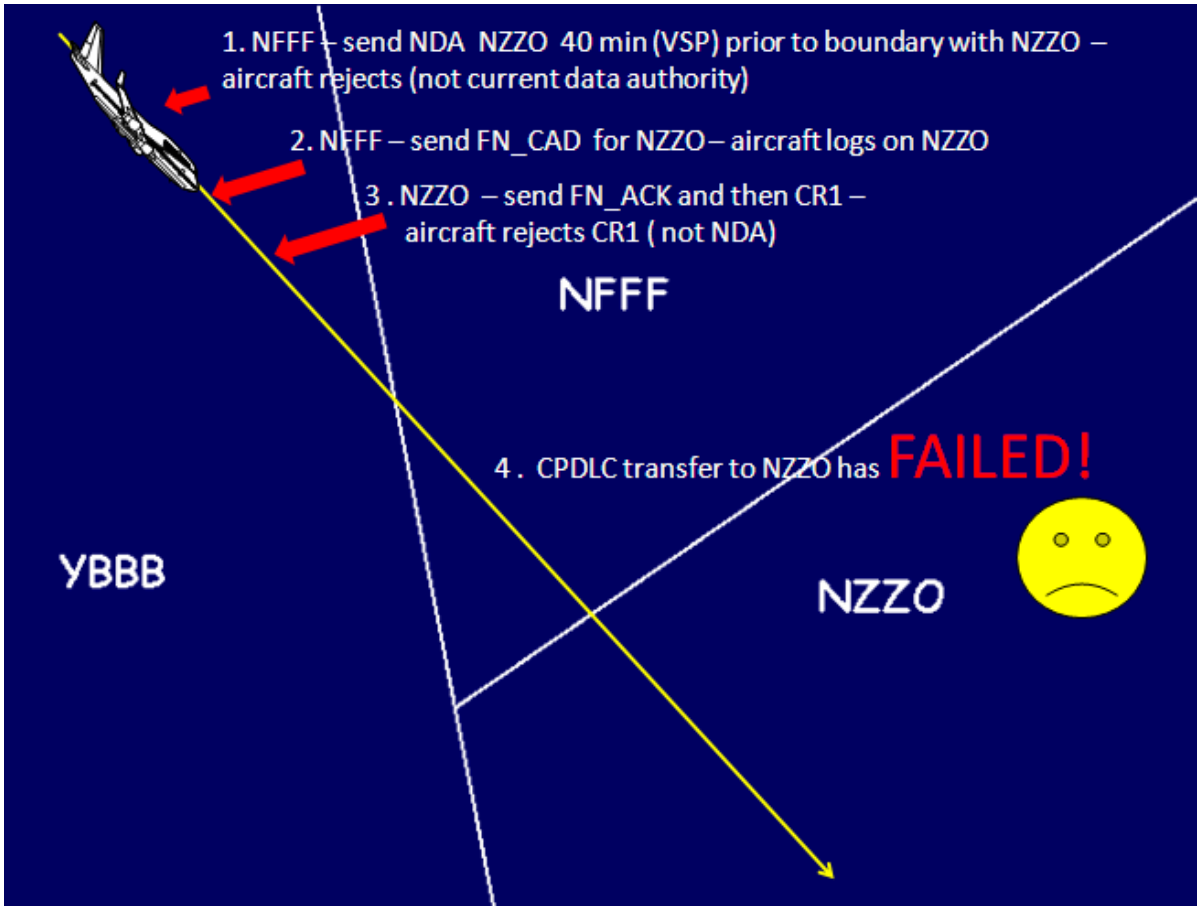

Figure 2-3 Sending NDA when not current data authority

2.12. The Nadi Aurora system requires a software modification similar to that implemented by Airways in the OCS to resolve this ongoing issue. The issue is causing continual CPDLC transfer failures on these UPR routes.

2.13. There is an ongoing intermittent bug in the OCS software that results in the NDA message not being sent on occasion. While we continue work to identify this problem we have been unsuccessful to date. While the frequency of this failure is low (estimated in the order of 1 failure per month) it is still an issue that needs to be resolved. We live in hope.

FANS1/A OCS Enhancement #1 – Monitoring CPDLC connection status and confirming CDA.

2.14. With the FANS1/A CPDLC application there is no way that an ANSP can confirm they are the Current Data Authority (CDA) until they receive a CPDLC downlink from the aircraft. In the SOPAC we require flight crews to send DM48 Position Report when they see the flight deck indication of CDA change at the boundary to ensure that the receiving ANSP has confirmation they are actually CDA and the transfer has completed successfully.

2.15. In the OCS we have implemented a software check to monitor the CDA status, enhanced the HMI to provide a status indication to the controller, and the system will automatically generate a position report request if the required DM48 position report or other CPDLC downlink has not been received within a defined time of entering the OCA. If a report has been requested and not received within the normal timeout appropriate to the RCP in use for the aircraft then the controller is advised they have not had CDA confirmation.

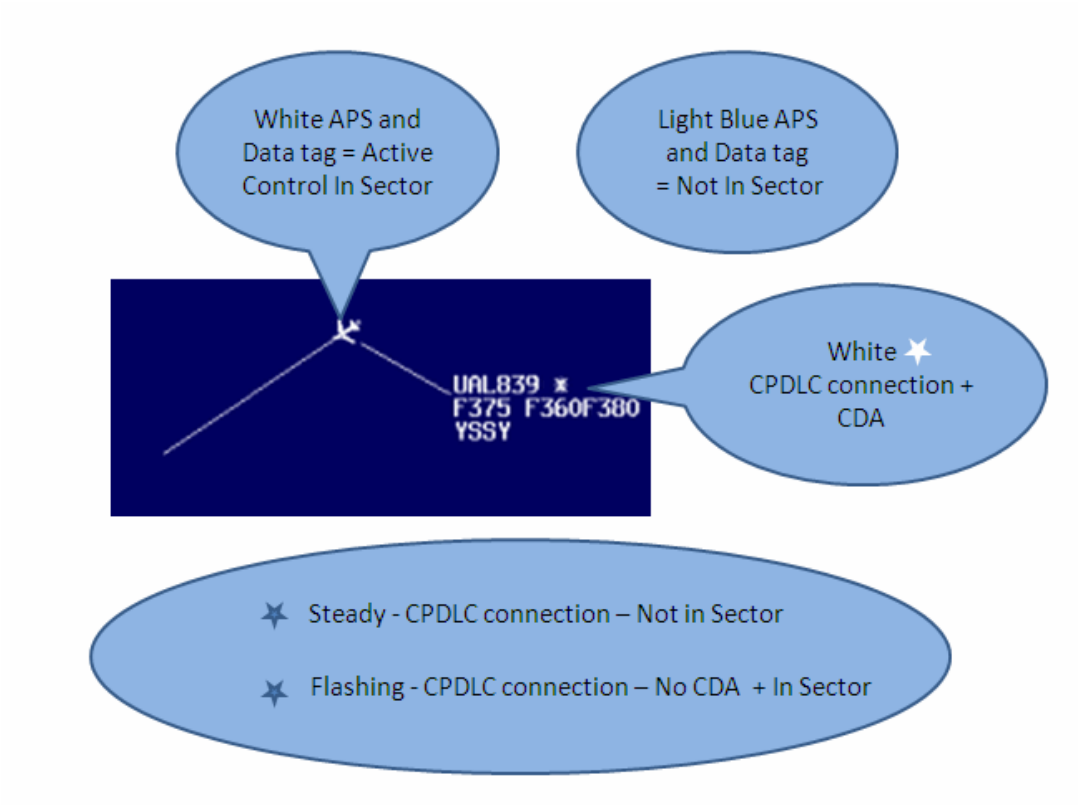

Figure 2-4 CPDLC Current Data Authority status indications

2.16. Figure 2-4 above summarises the new CPDLC CDA status indications available to the controller. The controller is currently made aware of aircraft that have a CPDLC connection by using a * on the aircraft data tag on the situation display. This indication has been modified so that the * will only display white when confirmation

of CDA has been received. If no CDA confirmation has been received the * will stay blue and if the flight is in the NZZO OCA it will flash.

2.17. OCS does not automate the CPDLC connection. This is a controller manual action. A check has been added to verify that the CPDLC connection is established before entering the OCA. If no CPDLC connection has been made by 5 minutes prior to entry the controller is advised.

FANS1/A OCS Enhancement #2 – Application of Mach Number from ADS-C reports.

2.18. To improve the accuracy of our aircraft profiling and the accuracy of downstream estimates any mach speed received in an ADS-C report is now conformance checked and if in conformance is automatically added to profile. If not in conformance the controller is advised and they will determine if the reported speed is applied. Additional software checks are made to prevent the nuisance reporting of out of conformance speeds reported in the climb after any departure.

FANS1/A OCS Enhancement Required – Optional Latitude Longitude

2.19. Recent interoperability testing with the Airbus A350 test bench saw a number of DARP procedures fail because the aircraft FMS could not auto load the uplink.

2.20. The failure was caused because the OCS does not uplink the optional latitude longitude with any waypoint name. While we had always intended to implement this it has to date received low priority. This priority has been reviewed and we are hopeful that the enhancement required will be implemented this year.

2.21. The difficulty for us is that we do not maintain a global data base of waypoint names. While we can identify duplicates within our area of interest in the SOPAC we have no knowledge of points outside that area and no interest in gaining that knowledge. The proposed implementation we are looking at for OCS will look at the optional latitude longitude appended to any waypoint name in an aircraft route request and retain this to be uplinked back to the aircraft.

3. ACTION BY THE MEETING

3.22. The meeting is invited to:

a) Note and provide comment on the enhancements detailed in this paper.

b) Note the interoperability issues that have been identified with short sector transits and provide feedback on the Airways resolutions implemented in the OCS.

c) Note the future work required in OCS to ensure continued FANS1/A interoperability.