International Civil Aviation Organization

Tenth Meeting of the FANS Interoperability Team – Asia (FIT-Asia/10)

Video Teleconference, 03 – 06 August 2020

Agenda Item 3: PBCS Developments and Implementation

LATENCY MONITOR REJECT ANALYSIS

(Presented by Airways New Zealand)

SUMMARY

This paper presents an analysis of Latency Monitor reject messages received from Airbus aircraft operating in NZZO during the period January 2019 to June 2020.

1. INTRODUCTION

1.1 Airways implemented the latency monitor on 21 June 2018 to support PBCS safety requirement #15 and mitigate the effects of late CPDLC uplink messages received at the aircraft.

1.2 On receipt of a CPDLC uplink message whose latency exceeds the 300 second monitored value Airbus aircraft do not present the uplink to the flight crew and send a reject message to ATC.

1.3 This paper provides an analysis of latency reject messages received at NZZO during the period January 2019 to June 2020.

2. DISCUSSION

2.1 With our normal pre-pandemic traffic levels NZZO was averaging 4627 set latency monitor uplinks a month. With significantly reduced traffic levels during the pandemic since March 2020 we are now averaging 1115 uplinks a month.

2.2 During the review period a total 345,049 CPDLC uplinks were initiated by NZZO, with 116,377 sent to Airbus aircraft. A total of 101 latency reject messages were received from these aircraft. This is a latency failure rate of 1 in 1152 messages or 0.09%. An analysis of the number of reject messages and the delays observed is shown in **Figure 1**. We were observing an average of seven rejects a month in the pre-pandemic period Jan-19 to Feb-20. However, during the reduced traffic levels experienced in the pandemic from Mar-20 through Jun-20 we have not observed any latency reject messages.

2.3 **Table 1** provides a monthly breakdown of the number of reject messages and their classification. Forty-three messages (43%) are sent by HFDL. Eleven of these were sent when aircraft was operating in Oceanic airspace with no Satcom, the remaining thirty-two were sent by HFDL when the aircraft was operating Inmarsat Satcom. Twenty-five messages (25%) were sent via Inmarsat Satcom, twenty-one (21%) were sent by Iridium Satcom. Ten messages (10%) were attributed to an aircraft time source error.

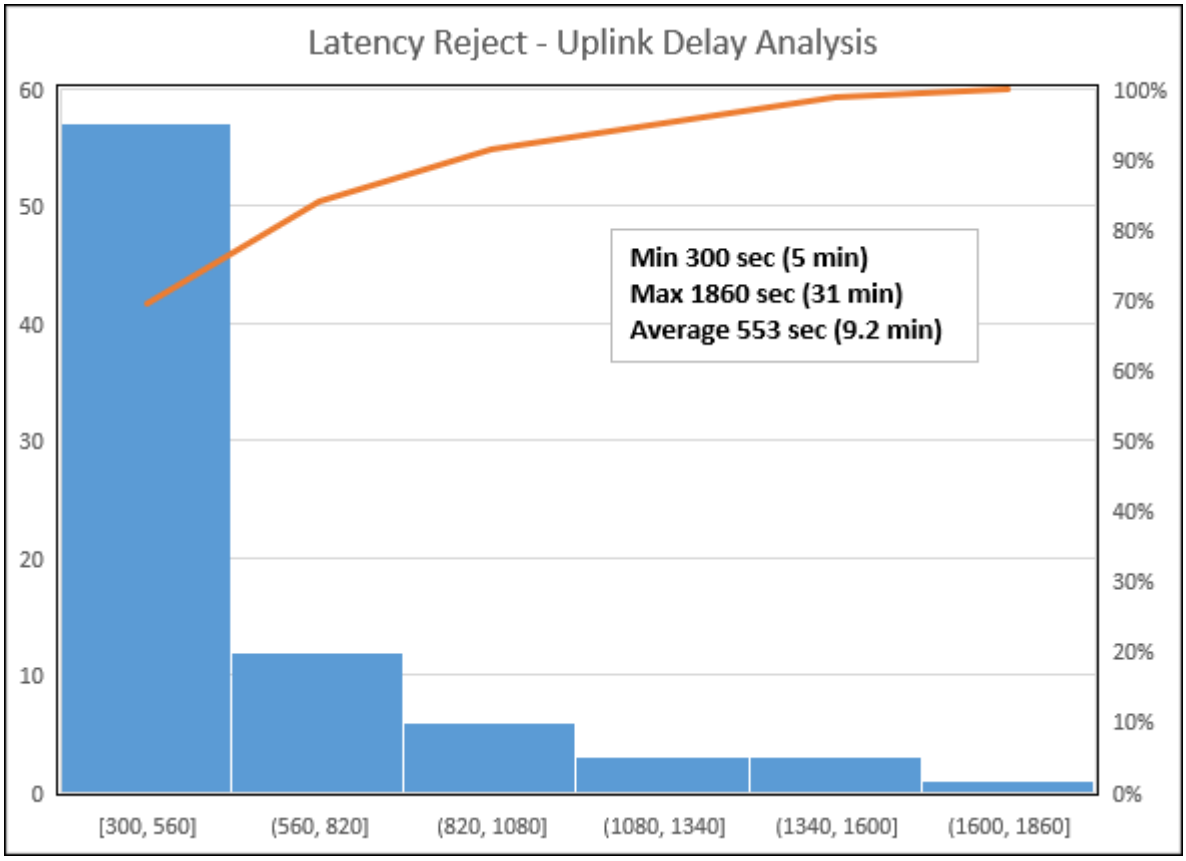

Figure 1: Uplink Delay Analysis

2.4 The number and percentage of CPDLC uplink messages sent via different RGS types in NZZO during the review period is illustrated in **Figure 2**. The latency reject message rate for CPDLC uplinks via HFDL is 4%, via Iridium is 0.07% and via Inmarsat 0.03%.

Jan-19 to Jun-20		
CPDLC Uplink RGS Type	# and % CPDLC Uplink RGS Type	
Unknown	1,142 0.4%	
VHF Datalink	42,364 14.8%	
HF Datalink	1,577 0.5%	
Iridium Satcom	37,118 11.4%	All Satcom 299,966 84.4%
Inmarsat Satcom	205,964 67.6%	
MTSAT Satcom	56,884 5.4%	
total	345,049	

Figure 2: NZZO CPDLC uplink by RGS type

Month	# Rejects	Classification						
		Unknown	Time Source	Inmarsat	Iridium	HFDL no SATCOM	Inmarsat sent HFDL	Unable SATCOM via VDL
Jan-19	22	0	0	5	0	0	16	1
Feb-19	5	0	0	2	0	0	3	0
Mar-19	9	0	0	2	4	1	2	0
Apr-19	8	0	0	2	2	1	3	0
May-19	17	1	0	4	3	6	3	0
Jun-19	1	0	0	0	0	0	1	0
Jul-19	5	0	4	1	0	0	0	0
Aug-19	1	0	0	1	0	0	0	0
Sep-19	4	0	2	0	2	0	0	0
Oct-19	14	0	4	0	8	2	0	0
Nov-19	3	0	0	2	1	0	0	0
Dec-19	6	0	0	0	4	0	2	0
Jan-20	3	0	0	2	0	0	1	0
Feb-20	3	0	0	0	1	1	1	0
Mar-20	0	0	0	0	0	0	0	0
Apr-20	0	0	0	0	0	0	0	0
May-20	0	0	0	0	0	0	0	0
Jun-20	0	0	0	0	0	0	0	0
Totals	101	1	10	21	25	11	32	1

Table 1: Latency rejects by month and classification.

2.5 Airways has now started a monthly review of latency monitor rejects. A summary of all reject messages observed during the review period is attached .

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.

Attachment 1: Latency monitor reject summary Jan-19 to Jun-20

NZZO LATENCY TIMER REJECT ANALYSIS 2019_01 – 2020_06 - SUMMARY

2019

3/01 10:11:15 B-301D UM121 timed out CSP unable to deliver via SATCOM and eventually delivered by VDL

3/01 10:20:26 B-301D aircraft was operating I4 XXA until 0930 then uplinks via HFDL and VGS NLK1 when in coverage until 1045 when XXA back in use. UM160, UM121, UM147 time out. UM121 reject repeated three times

9/01 21:52:36 DQ-FJV UM20 timed out via Inmarsat I4 APK2

12/01 10:37:51 DQ-FJW Aircraft is operating on Inmarsat APK2 UM118 sent via HFDL RGS H16 and timed out.

12/01 23:47:41 9V-SMJ UM160 timed out via Inmarsat I4 APK1.

17/01 12:59:10 RPC8783 Aircraft operating APK2 UM121 sent via HFDL RGS H05 and timed out.

17/01 14:51:25 DQ-FJV Aircraft operating Inmarsat APK2 and HFDL. UM0 sent via HFDL and timed out.

19/01 12:23:35 DQ-FJW Aircraft operating Inmarsat APK2 UM160 sent via HFDL RGS H02 and timed out.

21/01 03:41:00 9V-SKG Aircraft is operating Inmarsat APK1. UM160 is sent via HFDL RGS H05 and timed out. Reject message is resent.

22/01 03:29:54 9V-SKG Aircraft operating Inmarsat I4 APK1 UM121 timed out

22/01 11:45:49 DQ-FJV Aircraft operating Inmarsat I4 AME2 and VDL APW1. UM169 timed out via Inmarsat I4 AME2 (VHF-SATCOM transition?) Reject message is resent.

25/01 00:13:27 9V-SMB Aircraft operating Inmarsat I4 APK1, UM160 and UM26 sent via HFDL RGS H05 and timed out.

26/01 00:09:05 9V-SMB Aircraft operating Inmarsat I4 APK1 UM160 timed out.

27/01 00:13:06 9V-SMF Aircraft operating Inmarsat I4 APK1. UM160 and UM26 sent via HFDL RGS H05 and timed out.

27/01 03:18:02 9V-SKJ Aircraft operating Inmarsat I4 APK1 UM169 sent via HFDL RGS H05 and timed out. Reject message resent.

28/01 23:59:05 9V-SMA aircraft operating APK1 but many uplinks via HFDL RGS H05. UM169, UM26, UM160 sent via HFDL and timed out. All rejects sent twice. Multiple MAS (F) after 0015 reporting aircraft not logged on.

NZZO LATENCY TIMER REJECT ANALYSIS 2019_01 – 2020_06 - SUMMARY

9/02 03:36:49 9V-SKF Aircraft operating Inmarsat I4 APK1 UM160 sent via HFDL RGS H02 and timed out.

12/02 23:59:13 9V-SMG Aircraft operating Inmarsat APK1. UM26, UM121 sent via HFDL RGS H05 and timed out. Both reject messages resent.

25/02 15:27:11 DQ-FJT Aircraft operating Inmarsat I4 APK2 UM121 timed out. Reject message is resent.

28/02 03:42:29 9V-SKH Aircraft operating Inmarsat I4 APK1 UM121 timed out

10/03 ZK-NND 04:26:49 UM121 timed out via Iridium IGW1

13/03 ZK-NND 04:32:39 UM82 timed out via Iridium IGW1

14/03 ZK-NNA 08:14:22 UM121 timed out via Iridium IGW1

14/03 08:32:08 DQ-FJU Aircraft is operating Inmarsat APK2. UM82 timed out via APK2, reject message repeated.

14/03 23:05:13 9V-SKF Aircraft operating Inmarsat APK1. UM118 timed out via HFDL RGS H05.

19/03 23:44:31 9V-SMJ Aircraft operating Inmarsat APK1. UM1 timed out via HFDL RGS H05.

22/03 00:55:02 RPC8786 aircraft was operating No SATCOM on this sector. UM123 sent via HFDL RGS H05 and timed out. Reject message repeated.

30/03 03:45:58 9V-SKI UM121 timed out via Inmarsat APK1

30/03 ZK-NNC 04:35:39 UM121 timed out via Iridium IGW1

4/04 11:56:40 DQ-FJT Aircraft operating Inmarsat I4 AME1. UM169 sent via VDL RGS APW1 and timed out.

12/04 ZK-NNA 05:33:26 Aircraft operating Iridium IGW1. UM121 timed out

13/04 23:43:59 9V-SMC Aircraft operating Inmarsat APK1. UM160 NDA sent via HFDL RGS H05 and timed out

18/04 ZK-NNC 22:52:31 Aircraft operating Iridium IGW1 UM121 timed out.

18/04 23:55:12 9V-SMD Aircraft is operating Inmarsat APK1 UM20 delivered by HFDL RGS H05 and timed out.

19/04 12:10:43 DQ-FJU UM118 delivered via HFDL RGS H06 aircraft is operating Inmarsat APK1

NZZO LATENCY TIMER REJECT ANALYSIS 2019_01 – 2020_06 - SUMMARY

28/04 15:49:38 DQ-FJT Aircraft operating no SATCOM UM121 timed out via HFDL RGS H05

30/04 08:52:06 B-18906 UM121 timed out via Inmarsat I4 APK1. Reject resent.

2/05 23:42:49 9V-SMI UM160 NDA timed out via Inmarsat I4 APK1. Reject resent.

5/05 12:05:02 DQ-FJT aircraft had been operating Inmarsat APK1 and VDL APW1 UM160 NDA sent via HFDL H05 RGS timed out. No MRN in reject message.

5/05 23:44:15 9V-SMP UM20 and UM160 timed out via Inmarsat I4 APK1. One reject message duplicated and one reject message resent.

7/05 14:59:36 DQ-FJT One reject unable to access records for analysis

8/05 23:36:51 9V-SMP UM169 SIGMET timed out via Inmarsat APK1. Reject message resent.

9/05 12:28:54 DQ-FJT UM118 timed out sent via HF RGS H02 aircraft is operating Inmarsat I4 APK1

12/05 14:41:21 DQ-FJP operating no SATCOM, six rejects one UM169 timeout other five not classified as no MRN included in the downlink reject to identify them.

17/05 05:25:02 ZK-NNE UM121 timed out via Iridium IGW1

24/05 21:58:44 N913TK aircraft operating Iridium IG1. Two UM169 timed out. One rejected uplink where the operational response had already been received (but with no MAS), one uplink resent twice.

31/05 23:41:16 9V-SMR aircraft operating Inmarsat APK1 UM160 NDA sent via HFDL RGS H05 timed out.

26/06 08:17:32 B-18909 UM20 timed out – uplink sent via HFDL RGS H05 (in SAT-VDL transition?)

4/07 23:33:17 9V-SMJ UM160 NDA timeout sent via Inmarsat APK1 – two rejects of same uplink

25/07 22:14 – 26/07 02:18 F-OZNC Four uplink timeouts due aircraft time source error

10/08 08:39:33 B-18915 UM169 timed out via Inmarsat APK1

3/09 00:50:40 QFA119 VH-EBR One timeout due aircraft time source error

3/09 05:45:40 QFA126 VH-EBR Four timeouts due aircraft time source error with one message resent.

NZZO LATENCY TIMER REJECT ANALYSIS 2019_01 – 2020_06 - SUMMARY

04/09 ZK-NNF 00:03:03 aircraft operating Iridium. one reject under investigation missing uplink MIN 4

18/09 ZK-NNG 15:58:42 UM118 timed out – aircraft time source error

18/09 ZK-NNG 16:02:19 UM118 timed out – aircraft time source error

21/09 ZK-NHC 00:20:38 Aircraft operating Iridium IGW1. One message timed out. No message reference in the reject message.

2/10 05:10:33 DQ-FJP FJI410 Four timeouts due aircraft time source error, first latency reject DM67 has no MRN.

12/10 ZK-NNF 00:15:36 Aircraft operating Iridium IGW1 UM118 timed out.

21/10 02:46:59 DQ-FJO Aircraft operating HFDL only via RGS H05. Two UM121 timed out.

26/10 19:06:55 N913TK Aircraft operating Iridium IGW1 free-text UM169 timed out

26/10 23:22:34 N913TK Aircraft operating Iridium IG1. Significant communication issues period 26/2322 - 27/0005 with six latency rejects and one reject re-sent.

01/11 ZK-NNF 08:04:42 UM121 timed out via Iridium IGW1

3/11 03:45:08 34S167E 9V-SKI UM121 timed out via Inmarsat APK1

10/11 09:43:42 B18918 UM160 NDA timed out sent by Inmarsat APK1

15/12 9V-SMA 23:42:09 aircraft operating Inmarsat UM169 timed out via HFDL RGS H05

21/12 9VSKH 23:25:29 aircraft operating Inmarsat UM118 timed out via HFDL RGS H05

23/12 ZK-NNC 21:18:46 UM121 timed out via Iridium IGW1

27/12 ZKNNA 05:17:06 UM121 timed out via Iridium IGW1

27/12 ZK-NNA 21:04:05 UM121 timed out via Iridium IGW1

29/12 ZK-NHA 05:10:17 UM121 timed out via Iridium IGW1

2020

22/01 VHOQH 0316 – 2745S 16907E UM160 NDA timed out via Inmarsat I4 APK1

23/01 DQFAJ 1533 – 0657S 16942W UM160 NDA timed out via Inmarsat I4 APK1

NZZO LATENCY TIMER REJECT ANALYSIS 2019_01 – 2020_06 - SUMMARY

27/01 DQFJT 2217 aircraft operating Inmarsat. UM121 Contact instructions timed out via HFDL RGS H05

09/02 9VSMH 2343 aircraft operating Inmarsat UM160 NDA timed out sent via HFDL RGS H05

19/02 ZKNNA 0427 UM121 timed out via Iridium RGS IGW1

19/02 A6EVG 0710 UM169 timed out via HFDL RGS H04
Note: Aircraft operating HFDL only – no SATCOM

March 2020 – No latency monitor rejects

April 2020 – No latency monitor rejects

May 2020 – No latency monitor rejects

June 2020 - No latency monitor rejects