



**Twenty First Meeting of the
Informal South Pacific ATS Co-ordinating Group (ISPACG/21)**

Auckland, New Zealand, 6-8 March 2007

Agenda Item 4: Review progress on Open Action Items
AI 17-11

AIDC performance monitoring

(Presented by Airservices Australia)

SUMMARY

This working paper provides information concerning AIDC performance monitoring by Airservices Australia

1. INTRODUCTION

1.1 Version 1 of the document “Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data link systems in the Asia Pacific Region” was issued by the ICAO Asia/Pacific Regional Office in Bangkok during 2006. This document describes the necessity to conduct performance monitoring of data link applications such as ADS-C, CPDLC and AIDC, in accordance with Annex 11.

1.2 Appendix A to this Guidance material document provides the recommended process to measure the AIDC performance of an ATSU.

2. AIDC ANALYSIS

2.1 Whilst no formal AIDC monitoring programme has yet been implemented by Airservices Australia, some ad hoc statistical analysis has been conducted. Information regarding this analysis is included below.

2.2 Methodology

2.2.1 The Guidance material document suggests that “*Delivery times can best be measured in terms of the end-to-end round trip time*”, and that “*The end-to-end round trip message time may be measured as the time difference between the transmission of an AIDC message and the reception of the corresponding Logical Acknowledgement Message (LAM) or Logical Rejection Message (LRM)*”. Due to the nature of the AIDC data that was available during this study, only one-way transit times were measured:- the time stamp of the transmitted AIDC message was compared with the transmission time stamp of the corresponding LAM/LRM.

2.2.2 The AIDC performance for each AIDC message type transmitted between each ATSU pair was calculated. The sample results for a single days' data are shown in Appendix A.

2.3 Results

2.3.1 Several observations resulting from the analysis are included below.

2.3.2 "Rogue messages"

2.3.2.2 Because of the relatively low transit times for the majority of AIDC messages, a small number of messages with a much larger transit time can significantly alter the calculated performance. The Guidance Material warns of possible situations where no Application Response (LAM/LRM) is received, which will "result in a distortion of the true round-trip time and success rate" (Appendix A, para 6.2), but there is no mention of the effect of messages that may have atypical transit times.

2.3.2.3 ATSUs should be aware of this and consider taking steps to filter 'rogue messages' to gain a truer appreciation of the overall AIDC performance. In addition, the reason for the extended transit time should be investigated.

2.3.3 Individual monitoring should be in place for each ATSU pair

2.3.3.1 During the analysis, variances in the message delivery times between different pairs of ATSUs were noted. It is suggested that separate AIDC performance monitoring be conducted for each ATSU pair, rather than an overall performance.

2.3.4 Interoperability issues noted during the analysis

2.3.4.1 As a result of the analysis, a number of interoperability problems were recorded. The main problems that were observed during this data analysis are listed below:

DOF/

TAAATS does not currently support the DOF/ indicator in Field 18. Receipt of this indicator will result in an LRM application response being transmitted to the ATSU sending the original message. A software enhancement for TAAATS to support DOF/ is expected to be delivered Q3-Q4 2007.

Field 10

TAAATS currently supports a limited number of characters in Field 10. If more than this number of characters are received in an AIDC message, an LRM application response (due syntax) will be transmitted to the ATSU sending the original message. A software enhancement for TAAATS to increase the number of characters supported in Field 10 is expected to be delivered Q3-Q4 2007.

Field 18

An adjacent ATSU only supports a limited number of characters in Field 18. Receipt of an AIDC message from TAAATS containing more than this number of characters results in an LRM application response being transmitted back to TAAATS.

2.4 Comment regarding the Guidance Material document

2.4.1 The message delivery success rate is described in Appendix A of the Guidance Material document as follows:

"4. Message Delivery Success Rate

4.1 The Message Delivery Success Rate may be expressed as the percentage of messages successfully delivered to the destination ATSU.

4.2 Unsuccessful delivery is indicated by either the reception of an LRM or a time-out due to non-reception of a LAM within a specified time.

4.3 Case-1: LRM Received

4.3.1 When an AIDC system detects an error in a received message, it responds with a Logical Reject Message (LRM) to the originating system. Receipt of the LRM indicates that the original message was not successfully delivered.

4.4 Case-2: Time out

4.4.1 The time-out indicates non-delivery of the message (and initiates various actions within the AIDC system).

$$\text{Message Delivery Success Rate} = 1 - (\text{LRM} + \text{TO})/\text{TOT}$$

Where:

LRM = number of received LRMs

TO = number of Time Outs

TOT = total number of messages”

2.4.2 It should be noted that the receipt of the majority of LRMs indicates that the AIDC message was in fact successfully delivered – it just wasn't *processed* by the receiving system. So depending on what performance is actually being measured, should the receipt of a Logical Rejection Message really be counted towards a “failure” of the system?

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) Note the interoperability issues that were recorded during this performance analysis;
- b) Note the performance data presented in Attachment A;
- c) Consider the issues raised in paragraph 2, i.e.
 - i) filtering “rogue messages”;
 - ii) individual monitoring of performance for each ATSU, and
 - iii) inclusion of LRMs as an ‘unsuccessful delivery’

for possible inclusion in any future update to the “Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data link systems in the Asia Pacific Region” document.

Attachment A

A.1 The following Table(s) provide AIDC performance information concerning messages sent to and received by Brisbane (YBBB) and Melbourne (YMMM) during a single day.

YBBB ==> YMMM		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	668	668	0	0.7	-	-	-	-	-
EST	380	380	0	0.5	377	-	-	3	0.6
ACP	380	380	0	0.6	-	-	-	-	-
CDN	0	0	0	-	0	0	0	0	-
TOC	383	383	0	0.5	-	-	-	-	-
AOC	386	386	0	0.5	-	-	-	-	-

YBBB ==> NZZO		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	58	58	0	4.4	-	-	-	-	-
EST	55	55	0	1.9	55	-	-	0	1.9
ACP	65	65	0	2.6	-	-	-	-	-
CDN	2	2	0	3.5	2	0	0	0	62.0
TOC	55	55	0	3.1	-	-	-	-	-
AOC	66	66	0	1.9	-	-	-	-	-

YBBB ==> NFFF		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	24	24	0	1.5	-	-	-	-	-
EST	24	24	0	0.3	23	-	-	1	0.5
ACP	23	23	0	1.2	-	-	-	-	-
CDN	0	0	0	-	0	0	0	0	-
TOC	28	28	0	0.3	-	-	-	-	-
AOC	29	29	0	0.6	-	-	-	-	-

YBBB ==> KZAK		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	2	2	0	7.0	-	-	-	-	-
EST	2	2	0	6.5	2	-	-	0	24.0
ACP	1	1	0	7.0	-	-	-	-	-
CDN	0	0	0	-	0	0	0	0	-
TOC	0	0	0	-	-	-	-	-	-
AOC	0	0	0	-	-	-	-	-	-

Attachment A

NZZO ==> YBBB		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	62	62	0	1.0	-	-	-	-	-
EST	56	56	0	0.4	56	-	-	0	0.6
ACP	48	48	0	1.6	-	-	-	-	-
CDN	0	0	0	-	0	0	0	0	-
TOC	56	56	0	0.4	-	-	-	-	-
AOC	43	43	0	0.6	-	-	-	-	-

NFFF ==> YBBB		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	28	24	4	1.8	-	-	-	-	-
EST	23	23	0	0.6	23	-	-	0	0.7
ACP	23	23	0	1.0	-	-	-	-	-
CDN	0	0	0	-	0	0	0	0	-
TOC	27	27	0	0.4	-	-	-	-	-
AOC	23	23	0	0.9	-	-	-	-	-

KZAK ==> YBBB		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	3	3	0	2.3	-	-	-	-	-
EST	1	1	0	1.0	1	-	-	0	1.0
ACP	2	2	0	2.5	-	-	-	-	-
CDN	0	0	0	-	0	0	0	0	-
TOC	0	0	0	-	-	-	-	-	-
AOC	0	0	0	-	-	-	-	-	-

YMMM ==> YBBB		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	676	676	0	0.7	-	-	-	-	-
EST	382	382	0	0.6	376	-	-	6	0.8
ACP	378	378	0	0.6	-	-	-	-	-
CDN	0	0	0	-	0	0	0	0	-
TOC	390	390	0	0.5	-	-	-	-	-
AOC	376	376	0	0.5	-	-	-	-	-

Attachment A

YMMM ==> FIMM		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	8	6	2	16.4	-	-	-	-	-
EST	8	8	0	11.0	5	-	-	3	11.2
ACP	9	9	0	11.0	-	-	-	-	-
CDN	0	0	0	-	0	0	0	0	-
TOC	7	7	0	9.9	-	-	-	-	-
AOC	9	9	0	8.4	-	-	-	-	-

FIMM ==> YMMM		Application response			Operational Response				
	#	LAM	LRM	Ave Resp (sec)	ACP	REJ	CDN	NIL	Ave Resp (sec)
ABI	10	7	3	11.3	-	-	-	-	-
EST	9	9	0	6.4	9	-	-	0	6.4
ACP	5	5	0	7.0	-	-	-	-	-
CDN	0	0	0	-	0	0	0	0	-
TOC	9	9	0	5.8	-	-	-	-	-
AOC	5	5	0	5.0	-	-	-	-	-