

Fortieth Meeting of the Informal South Pacific ATS Coordinating Group (ISPACG/40)

Brisbane, Australia
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Agenda Item 4: AIDC Performance monitoring

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SUMMARY

This Working Paper presents an analysis of AIDC messaging between YBBB and ISPACG neighbouring ATSUs. The paper also proposes possible future work between YBBB and KZAK/NFFF associated with the exchange of weather information in AIDC messages.

1. Introduction

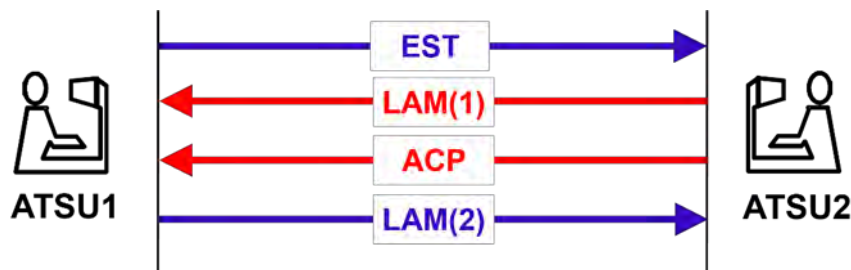
1.1 Version 5 of the ICAO document “Guidance Material for End-to-End Safety and Performance Monitoring of Air Traffic Service (ATS) Data link systems in the Asia Pacific Region” issued by the Asia/Pacific Regional Office in Bangkok in November 2024, describes the need to conduct performance monitoring of data link applications such as ADS-C, CPDLC and AIDC, in accordance with ICAO Annex 11.

1.2 Appendix A to this ICAO Performance monitoring document provides the recommended process to measure the AIDC performance of an ATSU:

“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)”.

1.3 This working paper provides an analysis of AIDC messaging between YBBB and its’ ISPACG neighbours. Because routine AFTN AIDC message logs do not include FDP message “receipt times”, and it is not always easy to extract data that includes the FDP receipt time of an AIDC message, the method described in the Guidance Material document was not used in this analysis.

1.4 As an alternative, the time stamps of the transmitted AIDC message and the time stamp of the automated response (LAM or LRM) were compared to calculate message transit times (one way, and round trip). The following diagram, explains the methodology used.



1.5 Referring to the above diagram:

- The one-way transit time for the EST message is calculated by comparing the transmission time stamp in the EST with the transmission time stamp in the associated LAM(1) response;
- The one-way transit time for the ACP message is calculated by comparing the transmission time stamp in the ACP with the transmission time stamp in the LAM(2) response;
- The round-trip transit time for the EST message is calculated by comparing the transmission time stamp in the EST with the transmission time stamp in the LAM(2) response

Note. *Using this methodology, it is not possible to measure the message transit time of a single LAM.*

1.6 Although this methodology is not strictly in accordance with the Guidance material, it fully meets the intent of the document. Because the ACP (in response to the EST message) and LAM are automated system responses (i.e. there are no operator delays), it should provide an accurate measurement of transit times.

2 Analysis

2.1 An analysis of AIDC messages transmitted and received between YBBB and neighbouring ISPACG ATSUs between 0000 UTC 1st April 2026 and 2359 UTC 5th April was conducted. This analysis considered the following items:

- Number of AIDC messages exchanged for various message types;
- AIDC message transit times;
- Number of operational and application responses;
- Missing responses;
- Number of LRMs;
- Delayed AIDC messages;

2.2 A table containing a summary of all data generated for the analysis is included at the end of this working paper.

2.3 Number of AIDC messages exchanged

2.3.1 The following tables summarise the number of AIDC messages exchanged by YBBB with its ISPACG neighbours.

Number of AIDC Messages transmitted by YBBB				
YBBB →	NZZO	NFFF	KZAK	AYPM
ABI	539	269	6	215
EST	449	210	4	138
ACP	588	191	8	160
CDN	81	21	0	0
PAC	0	0	0	0
CPL	11	59	0	4
TOC	452	204	3	139
AOC	467	199	0	157

Number of AIDC Messages received by YBBB				
YBBB ←	NZZO	NFFF	KZAK	AYPM
ABI	551	268	9	277
EST	465	197	9	163
ACP	538	273	4	138
CDN	128	14	0	0
PAC	3	2	0	0
CPL	0	0	0	0
TOC	469	199	0	167
AOC	446	200	2	134

2.4 AIDC message transit times

2.4.1 One way transit times were in the order of 1 second, and round trip transit times (excluding manually processed CDN messages) were generally under 2 seconds, which is considered acceptable.

2.4.2 One issue that was initially noted, however, was the extremely rapid transit times for messages from NFFF to YBBB (averaging “zero seconds”). This appeared to be a little fast!

2.4.3 Initial investigations into the anomaly indicated the possibility of a time stamp issue in NFFF – e.g NFFF’s clocks being a second or so ahead of UTC. The following message exchange highlights the problem.

FF YBBBZQZF
010011 NFFFZQZF 2.000797-3.YBBB135341-4.260401001055-5.8340-
(ACP-ASY480/A1032-AGGH-NGTA)

FF NZZZZQZF
010011 YBBBZQZF 2.135342-3.NFFF000797-4.260401001054-5.CF71-
(LAM)

2.4.4 The ACP message sent by NFFF is time stamped 0010:55. The LAM response sent by YBBB is time stamped one second earlier at 0010:54. There were 652 such discrepancies identified with messages from NFFF during the analysis period.

2.4.5 However, when the AIDC data was further scrutinized, similar discrepancies were noted with a smaller number of messages from NZZO (102 messages) and KZAK (5 messages). This pointed to the possibility of our own FDP time being incorrect.

2.4.6 This discrepancy was investigated by Airservices technicians, and it was determined that our ATM system is operating to within 0.122 milliseconds of UTC time.

2.4.7 Other ATSUs are encouraged to ensure that the time being used by their FDP is synchronized with UTC.

2.5 Number of Operational and Application Responses

2.5.1 The Application response is the automatically generated LAM/LRM response to an AIDC message. This assessment can be used to assess the reliability of the link between the two ATSUs.

Percentage Application responses received in response to all messages transmitted by YBBB			
NZZO	NFFF	KZAK	AYPM
99.6%	99%	100%	99.9%

Percentage Application responses transmitted in response to all messages received by YBBB			
NZZO	NFFF	KZAK	AYPM
100%	100%	100%	100%

Note. *Delayed messages were included in this analysis*

Note. *The percentage of Application responses sent in response to messages received by YBBB may be considered a little misleading, because the analysis is comparing messages that have actually received by YBBB with the YBBB response. It is not actually a measure of the reliability of the link with other ATSUs.*

2.5.2 For the analysis of Operational responses, only the ACP response to the EST message was considered.

Percentage Operational responses received in response to EST messages transmitted by YBBB			
NZZO	NFFF	KZAK	AYPM
100%	98%	100%	99%

Percentage Operational responses transmitted in response to EST messages received by YBBB			
NZZO	NFFF	KZAK	AYPM
99.7%	92%	89%	98%

2.6 Missing responses

2.6.1 The analysis revealed 24 missing Application responses (i.e. no LAM or LRM). The majority of these were for messages sent to NZZO and NFFF, but given that these are ATSUs to which the majority of our messages are sent, this was not considered particularly relevant.

2.6.2 AIDC messages for which no Application response was received made up 0.5% of all AIDC messages transmitted by YBBB (and 0.26% of all AIDC messages exchanged during the analysis period).

2.7 Logical Rejection Messages (LRMs)

2.7.1 The expected response to a syntactically correct AIDC message is a Logical Acknowledgement Message (LAM). If the received message is syntactically incorrect, the response should be an Logical Rejection Message (LRM). LRMs can provide an indication of any interoperability issues between two ATSUS.

2.7.2 The analysis identified 50 LRMs, many of which indicated an interoperability problem.

2.7.3 An LRM can also contain a description of an error. There were four types of errors identified during the analysis.

2.7.4 “INVALID MESSAGE SEQUENCE”

2.7.5 21 LRMs containing this INVALID MESSAGE SEQUENCE error were received from NFFF in response to AIDC messages generated by YBBB. It is believed that this LRM is generated by an FDP if an AIDC message is received when the aircraft status does not support that type of message (e.g. receiving an EST message for a flight that is already controlled).

2.7.6 Many of the flights for which this LRM was generated were for “hemstitch flights” which accounts for this problem.

2.7.7 “Field 18 too long”

2.7.8 The Asia Pacific AIDC ICD does not prescribe any maximum length for various fields within an AIDC message. As a result, different ATM software suppliers have used their own “best guess” when implementing a maximum field length.

2.7.9 YBBB is limited to 250 characters (including spaces) in Field 18 of an AIDC message – it is this limitation that has triggered these LRMs. As a result of this limitation, YBBB sent an LRM in response to 17 ABIs from NFFF and 2 from KZAK.

Note. *It was identified that many of the rejected ABIs contained lengthy RIF/ information in Field 18 which increased the Field 18 character count beyond the maximum supported.*

2.7.10 “INVALID HEADER”

2.7.11 On three occasions, YBBB received an ICAO message addressed to the YBBB AIDC address (YBBBZQZF). Eurocat considers this invalid, and because the ICAO message does not contain a Header, an LRM containing an INVALID HEADER is generated.

2.7.12 In addition, two LRMs containing an INVALID HEADER were sent by YBBB in response to an AIDC message from AYPM. This is a problem known to Thales, where AYPM includes Field 3 in an AIDC message, on an occasion where Field 3 should not be included.

2.005089-3.152965-4.260402152556-5.54E4-
(AOC-ANZ289/A0253-NZAA-ZSPD)

2.153057-3.AYPM005089-4.260402152557-5.8839-
(LRM-RMK/5/HEADER/152965)

2.7.13 “INVALID CRC”

2.7.14 An LRM with error “INVALID CRC” was received by YBBB on three occasions. Each of these was in response to an LRM with error INVALID HEADER sent by YBBB (described above)

Note. A CRC (Cyclic Redundancy Check) is a checksum used to confirm that an AIDC message has not been corrupted en route.

2.7.15 More investigation on this idiosyncrasy is required.

2.8 Delayed AIDC messages Optional data in Field 14

2.8.1 For the purpose of this analysis, a “delayed message” was considered to be a message where the one way transit exceeded 45 seconds.

2.8.2 The analysis of AIDC message responses detected 22 occurrences of one way message transit times exceeding 45 seconds. With one exception, these delays ranged from 46 to 74 seconds. The exception was a CPL message that must have taken a wrong turn, taking 598 seconds to finally reach its destination.

2.8.3 Of these 22 delayed messages, 19 were messages exchanged between YBBB and AYPM. The cause for these delays is not known.

2.8.4 Given the overall low percentage of delayed messages (0.2%) and the reasonable average transit times, these delayed messages are not considered to be significant. However, the higher percentage of delayed messages between YBBB and AYPM does warrant further monitoring..

2.9 Optional data in Field 14

2.9.1 Optional data in Field 14, introduced in AIDC V3 includes block levels and Off Track Deviation information (weather deviations and offsets). This paragraph summarises the frequency of use of these optional fields.

Note. The inclusion of weather deviation information in AIDC messaging between YBBB and KZAK and NFFF is not currently enabled.

Number of occurrences of optional Field 14 in AIDC message sent by YBBB								
YBBB →	NZZO		NFFF		KZAK		AYPM	
	BLK	OTD	BLK	OTD	BLK	OTD	BLK	OTD
ABI	13	15	6	0	0	0	1	56
EST	9	12	6	0	0	0	2	41
CDN	5	19	1	0	0	0	0	0
PAC	0	0	0	0	0	0	0	0
CPL	0	1	0	0	0	0	0	3

Number of occurrences of optional Field 14 in AIDC message received by YBBB								
YBBB ←	NZZO		NFFF		KZAK		AYPM	
	BLK	OTD	BLK	OTD	BLK	OTD	BLK	OTD
ABI	18	33	8	0	0	0	1	119
EST	15	26	7	0	0	0	0	60
CDN	13	31	0	0	0	0	0	0
PAC	0	0	0	0	0	0	0	0
CPL	0	0	0	0	0	0	0	0

3. Action by the meeting

3.1 The meeting is requested to consider:

- The need for ATSUs to check the accuracy of the times used by their ATM system against UTC
- NFFF and KZAK to consider the exchange of weather deviation information in AIDC messaging with YBBB, subject to LOA update
- In addition, while not directly related to the content of this working paper, could NFFF and KZAK discuss their ability to not include route information in CDN messages used to update estimates and levels.

-- END --

AIDC message summary for 01/04/26 to 05/04/26

YBBB ==> NZZO		Additional formats				Application responses			>45 sec transit		Operational Responses				
Type	Total	Blk level	Xing	OTD (W)	OTD (O)	LAM	LRM	1way (sec)	LAM	LRM	ACP	REJ	CDN	NIL	2way (sec)
ABI	539	13	0	15	0	537	0	1.4	1	0	-	-	-	-	-
EST	449	9	0	12	0	449	0	0.9	0	0	449	-	-	0	1.2
ACP	588	-	-	-	-	588	0	1.0	0	0	-	-	-	-	-
CDN	81	5	15	19	0	81	0	1.0	0	0	77	0	0	4	37.0
PAC	0	0	0	0	0	0	0	N/A	0	0	0	-	-	0	-
CPL	11	0	0	1	0	11	0	1.6	0	0	11	0	0	0	1.7
TOC	452	-	-	-	-	446	0	0.7	0	0	-	-	-	-	-
AOC	467	-	-	-	-	464	0	0.9	0	0	-	-	-	-	-

YBBB ==> NFFF		Additional formats				Application responses			>45 sec transit		Operational Responses				
Type	Total	Blk level	Xing	OTD (W)	OTD (O)	LAM	LRM	1way (sec)	LAM	LRM	ACP	REJ	CDN	NIL	2way (sec)
ABI	269	6	0	0	0	260	7	0.9	1	0	-	-	-	-	-
EST	210	6	0	0	0	205	5	0.6	0	0	205	-	-	5	0.4
ACP	191	-	-	-	-	190	1	1.0	0	0	-	-	-	-	-
CDN	21	1	3	0	0	21	0	0.6	0	0	19	0	0	2	34.1
PAC	0	0	0	0	0	0	0	N/A	0	0	0	-	-	0	-
CPL	59	0	1	0	0	50	7	0.9	1	0	49	0	0	10	0.6
TOC	204	-	-	-	-	200	0	0.6	0	0	-	-	-	-	-
AOC	199	-	-	-	-	193	0	0.7	0	0	-	-	-	-	-

YBBB ==> KZAK		Additional formats				Application responses			>45 sec transit		Operational Responses				
Type	Total	Blk level	Xing	OTD (W)	OTD (O)	LAM	LRM	1way (sec)	LAM	LRM	ACP	REJ	CDN	NIL	2way (sec)
ABI	6	0	0	0	0	6	0	1.7	0	0	-	-	-	-	-
EST	4	0	0	0	0	4	0	1.8	0	0	4	-	-	0	22.3
ACP	8	-	-	-	-	8	0	1.6	0	0	-	-	-	-	-
CDN	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-
PAC	0	0	0	0	0	0	0	N/A	0	0	0	-	-	0	-
CPL	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-
TOC	3	-	-	-	-	3	0	1.3	0	0	-	-	-	-	-
AOC	0	-	-	-	-	0	0	-	0	0	-	-	-	-	-

YBBB ==> AYPM		Additional formats				Application responses			>45 sec transit		Operational Responses				
Type	Total	Blk level	Xing	OTD (W)	OTD (O)	LAM	LRM	1way (sec)	LAM	LRM	ACP	REJ	CDN	NIL	2way (sec)
ABI	215	1	0	56	0	212	0	1.7	3	0	-	-	-	-	-
EST	138	2	0	41	0	137	0	2.1	1	0	137	-	-	1	4.1
ACP	160	-	-	-	-	160	0	1.0	0	0	-	-	-	-	-
CDN	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-
PAC	0	0	0	0	0	0	0	N/A	0	0	0	-	-	0	-
CPL	4	0	0	3	0	3	0	1.0	0	0	0	0	0	4	-
TOC	139	-	-	-	-	136	0	2.4	3	0	-	-	-	-	-
AOC	157	-	-	-	-	156	0	0.6	1	0	-	-	-	-	-

NZZO ==> YBBB		Additional formats				Application responses			>45 sec transit		Operational Responses				
Type	Total	Blk level	Xing	OTD (W)	OTD (O)	LAM	LRM	1way (sec)	LAM	LRM	ACP	REJ	CDN	NIL	2way (sec)
ABI	551	18	31	33	0	550	1	0.2	0	0	-	-	-	-	-
EST	465	15	8	26	0	465	0	0.0	0	0	464	-	-	1	1.1
ACP	538	-	-	-	-	538	0	0.2	0	0	-	-	-	-	-
CDN	128	13	11	31	0	128	0	0.1	0	0	121	5	0	2	31.1
PAC	3	0	3	0	0	3	0	0.0	0	0	3	-	-	0	1.0
CPL	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-
TOC	469	-	-	-	-	468	0	0.0	0	0	-	-	-	-	-
AOC	446	-	-	-	-	446	0	0.0	0	0	-	-	-	-	-

NFFF ==> YBBB		Additional formats				Application responses			>45 sec transit		Operational Responses				
Type	Total	Blk level	Xing	OTD (W)	OTD (O)	LAM	LRM	1way (sec)	LAM	LRM	ACP	REJ	CDN	NIL	2way (sec)
ABI	268	8	55	0	0	251	17	0.0	0	0	-	-	-	-	-
EST	197	7	30	0	0	197	0	0.0	0	0	182	-	-	15	0.0
ACP	273	-	-	-	-	273	0	0.0	0	0	-	-	-	-	-
CDN	14	0	3	0	0	14	0	0.0	0	0	9	0	0	5	35.3
PAC	2	0	0	0	0	2	0	0.0	0	0	0	-	-	2	-
CPL	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-
TOC	199	-	-	-	-	199	0	0.0	0	0	-	-	-	-	-
AOC	200	-	-	-	-	200	0	0.0	0	0	-	-	-	-	-

KZAK ==> YBBB		Additional formats				Application responses			>45 sec transit		Operational Responses				
Type	Total	Blk level	Xing	OTD (W)	OTD (O)	LAM	LRM	1way (sec)	LAM	LRM	ACP	REJ	CDN	NIL	2way (sec)
ABI	9	0	0	0	0	7	2	0.2	0	0	-	-	-	-	-
EST	9	0	0	0	0	9	0	0.2	0	0	8	-	-	1	1.6
ACP	4	-	-	-	-	4	0	0.3	0	0	-	-	-	-	-
CDN	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-
PAC	0	0	0	0	0	0	0	N/A	0	0	0	-	-	0	-
CPL	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-
TOC	0	-	-	-	-	0	0	-	0	0	-	-	-	-	-
AOC	2	-	-	-	-	2	0	0.5	0	0	-	-	-	-	-

AYPM ==> YBBB		Additional formats				Application responses			>45 sec transit		Operational Responses				
Type	Total	Blk level	Xing	OTD (W)	OTD (O)	LAM	LRM	1way (sec)	LAM	LRM	ACP	REJ	CDN	NIL	2way (sec)
ABI	277	1	0	119	0	272	0	2.2	5	0	-	-	-	-	-
EST	163	0	0	60	0	162	0	1.7	1	0	160	-	-	3	3.1
ACP	138	-	-	-	-	138	0	1.5	0	0	-	-	-	-	-
CDN	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-
PAC	0	0	0	0	0	0	0	N/A	0	0	0	-	-	0	-
CPL	0	0	0	0	0	0	0	-	0	0	0	0	0	0	-
TOC	167	-	-	-	-	162	0	2.4	5	0	-	-	-	-	-
AOC	134	-	-	-	-	132	2	0.6	0	0	-	-	-	-	-