International Civil Aviation Organization

The Fifth Meeting of the Future Air Navigation Systems Interoperability Team-Asia (FIT-Asia/5)

Bangkok, Thailand, 05 – 06 May 2016

Agenda Item 3: Review of ADS/CPDLC Operations

DATA LINK PERFORMANCE REPORT FOR SINGAPORE FIR

(Presented by Singapore)

SUMMARY

This paper presents data link performance data for Singapore FIR for 2015.

1. INTRODUCTION

1.1 This paper presents the data link performance for Singapore (WSJC) FIR from January 2015 to December 2015.

1.2 The performance data for Controller Pilot Data Link Communications (CPDLC) and Automatic Dependent Surveillance - Contract (ADS-C) is measured against the appropriate Required Communication Performance (RCP) and Required Surveillance Performance (RSP) respectively.

1.3 CPDLC performance is measured by Actual Communication Performance (ACP), Actual Communication Technical Performance (ACTP) and Pilot Operational Response Time (PORT). This paper presents CPDLC performance differentiated by media type, operator and monthly performance.

1.4 ADS-C performance is measured by Downlink Latency, differentiated by media type and monthly performance.

2. DISCUSSION

WSJC FIR CPDLC Actual Communications Performance (ACP)

2.1 This section covers the ACP measurement for CPDLC messages sent within WSJC FIR for the period of January 2015 to December 2015, categorized by data link media type. The ACP for messages sent via Satellite and VHF meet the 95 percent criterion but marginally fall below the 99.9 percent criterion.

2.2 **Table 1** summarizes the overall CPDLC Actual Communications Performance (ACP) for messages sent within the WSJC FIR. **Figure 1** presents the ACP measurement by media type (Satellite, VHF and the combined total) from January 2015 to December 2015.

WSJC FIR CPDLC ACP by Data Link Media Type			
Messages		**% > 180 sec (Target 95%)**	**%> 210 sec (Target 99.9%)**
Satellite	19,517	97.82	98.64
VHF	39,489	99.48	99.60
Total	59,006	98.93	99.28

Table 1: WSJC FIR CPDLC ACP by Data Link Media Type

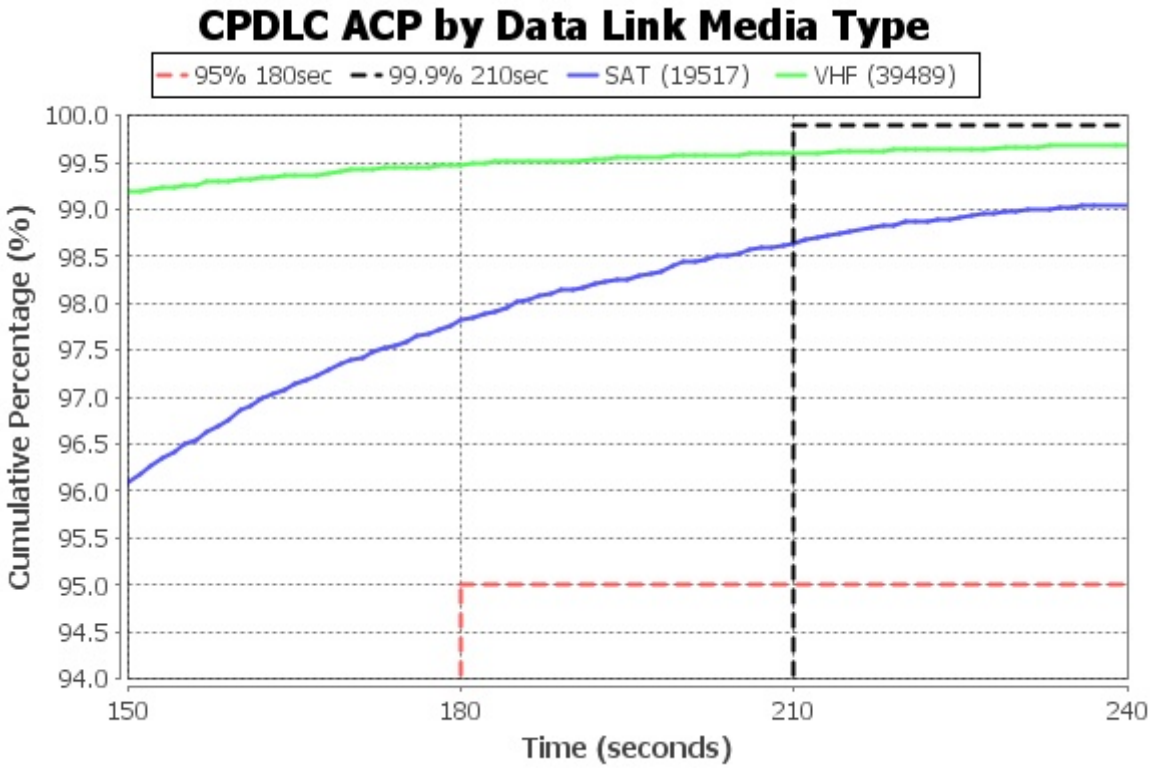

Figure 1: WSJC FIR CPDLC ACP by Data Link Media Type

2.3 **Table 2 to 3** summarizes the overall CPDLC Actual Communications Performance (ACP) per month by data link media type for messages sent within the WSJC FIR. **Figure 2 to 3** presents the ACP measurement per month by media type from January 2015 to December 2015.

WSJC FIR CPDLC ACP per Month - Satellite			
Month	**Messages**	**% > 180 sec (Target 95%)**	**%> 180 sec (Target 99.9%)**
Jan 2015	439	98.63%	99.32%
Feb 2015	1,715	97.08%	98.72%
Mar 2015	2,419	97.93%	98.68%
Apr 2015	1,248	97.84%	98.48%
May 2015	1,314	99.01%	99.39%
Jun 2015	1,606	98.01%	98.88%
Jul 2015	1,591	97.42%	98.43%
Aug 2015	1,824	97.53%	98.41%
Sep 2015	1,673	97.43%	97.97%
Oct 2015	1,787	97.82%	98.60%
Nov 2015	2,152	97.91%	98.75%
Dec 2015	1,749	98.06%	98.68%

Table 2: WSJC FIR CPDLC ACP per Month - Satellite

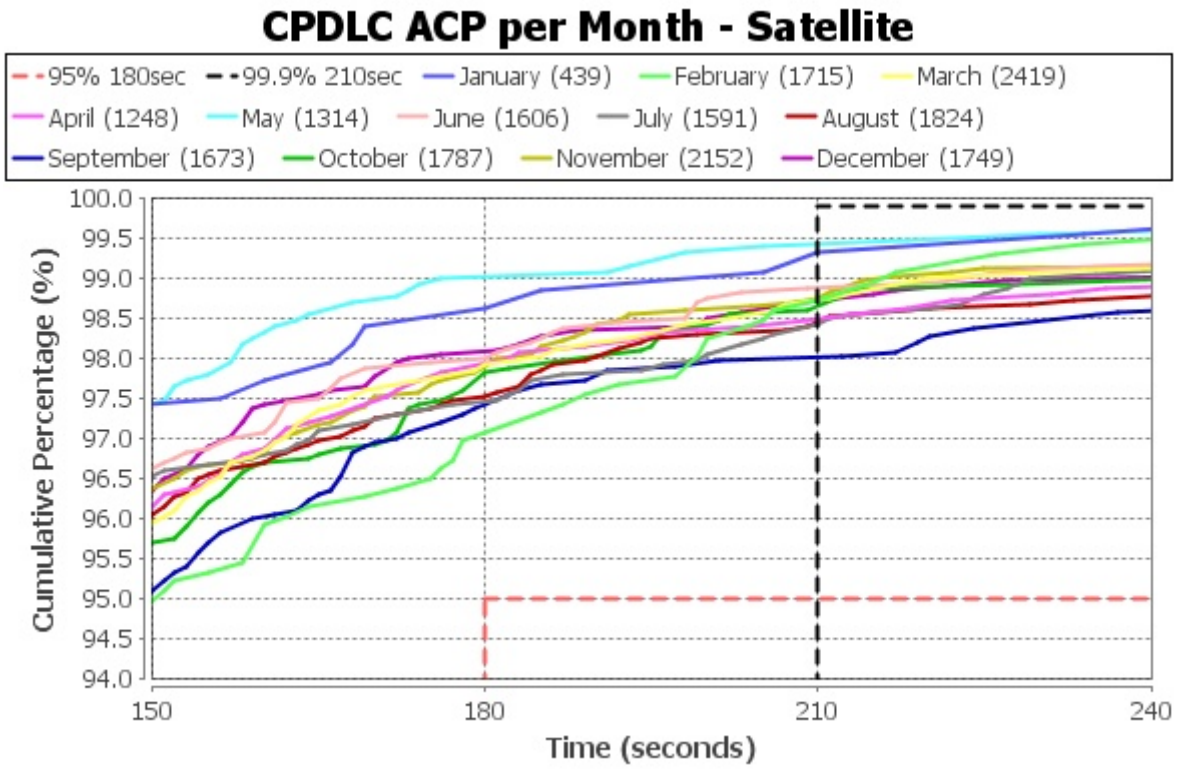

Figure 2: WSJC FIR ACP per Month – Satellite

WSJC FIR CPDLC ACP per Month - VHF			
Month	**Messages**	**% > 180 sec (Target 95%)**	**%> 180 sec (Target 99.9%)**
Jan 2015	1,195	99.41%	99.41%
Feb 2015	2,667	99.55%	99.63%
Mar 2015	4,292	99.63%	99.72%
Apr 2015	2,496	99.60%	99.72%
May 2015	3,115	99.52%	99.58%
Jun 2015	3,430	99.50%	99.68%
Jul 2015	3,428	99.04%	99.24%
Aug 2015	3,377	99.53%	99.67%
Sep 2015	3,259	99.23%	99.32%
Oct 2015	4,066	99.58%	99.75%
Nov 2015	4,535	99.49%	99.60%
Dec 2015	3,629	99.56%	99.72%

Table 3: WSJC FIR CPDLC ACP per Month – VHF

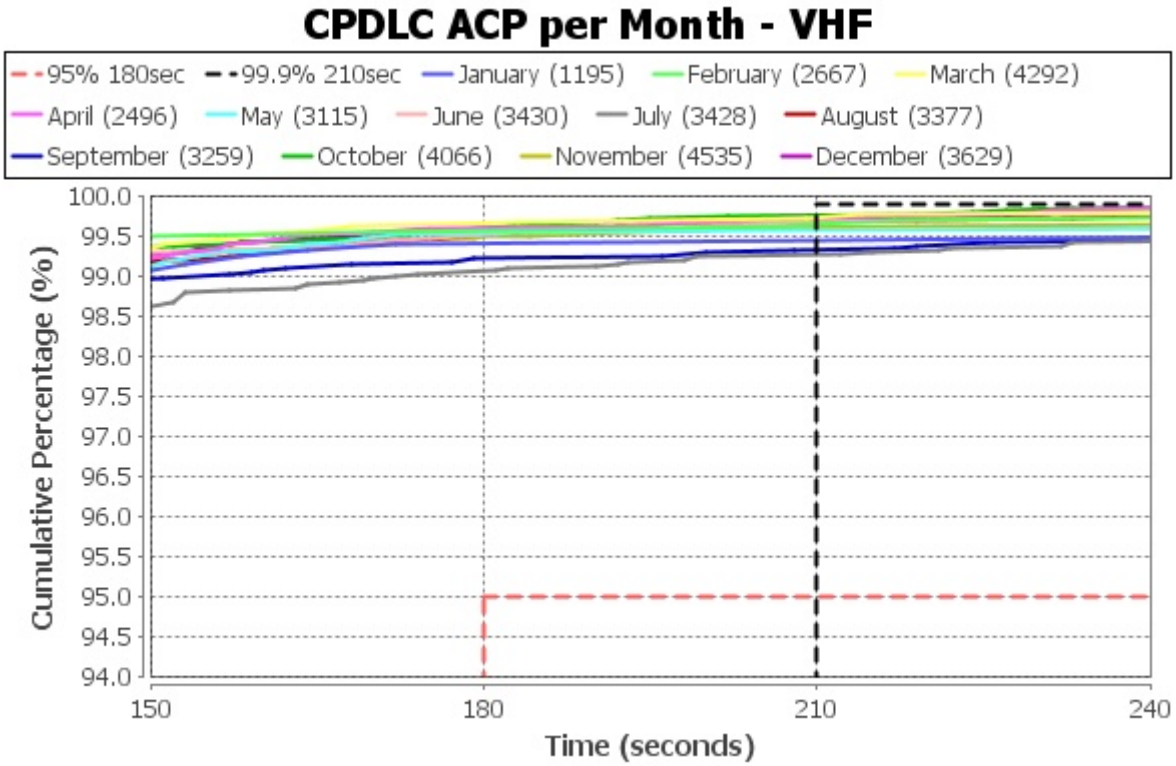

Figure 3: WSJC FIR ACP per Month – VHF

2.4 **Table 4** summarizes the CPDLC Actual Communications Performance per Operator (de-identified) for messages sent within the WSJC FIR. **Figure 4** presents the CPDLC Actual Communications Performance per Operator from January 2015 to December 2015. The performance is presented only for the top 10 operators by message count.

WSJC FIR CPDLC ACP per Operator (de-identified)			
Operator (de-identified)	**Messages**	**% > 180 sec (Target 95%)**	**%> 210 sec (Target 99.9%)**
OP0	16,888	99.53%	99.73%
OP1	11,603	98.39%	98.89%
OP2	4,882	98.85%	99.08%
OP3	4,282	99.09%	99.44%
OP4	3,606	99.39%	99.61%
OP5	1,769	98.25%	99.10%
OP6	1,664	99.34%	99.58%
OP7	1,572	99.75%	99.75%
OP8	1,452	98.55%	99.10%
OP9	1,312	99.54%	99.70%

Table 4: WSJC FIR CPDLC ACP per operator

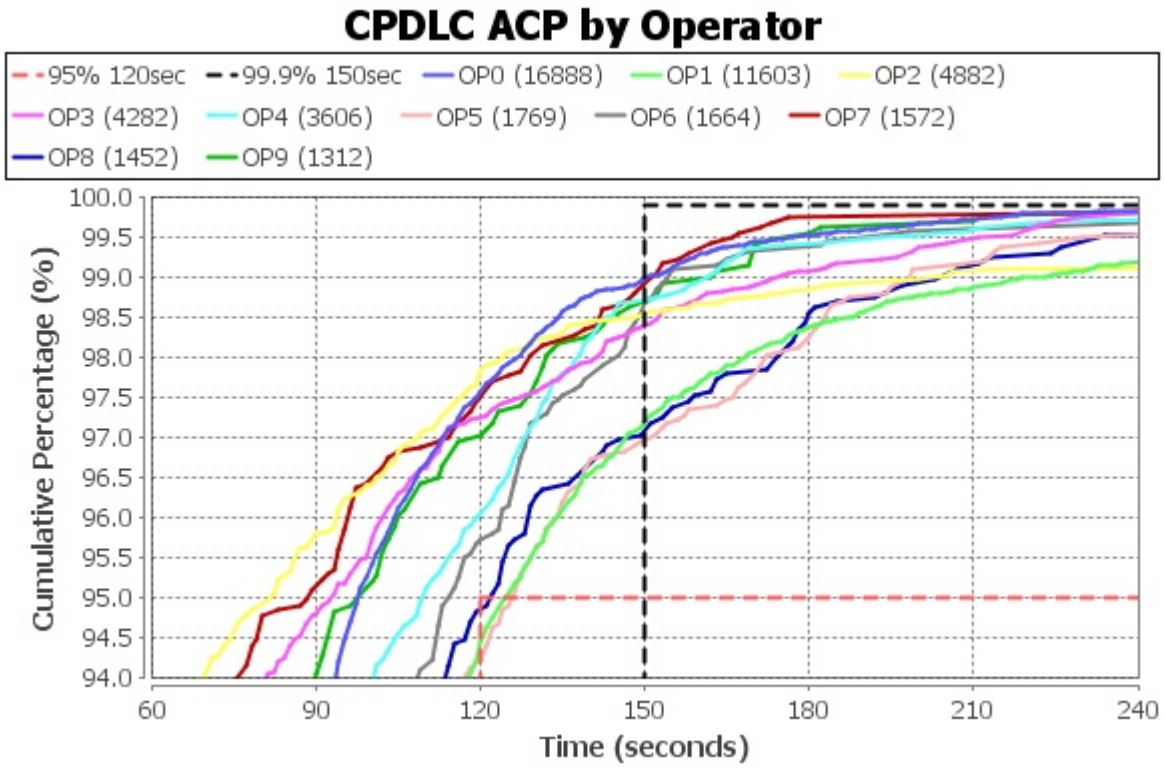

Figure 4: WSJC FIR CPDLC ACP per Operator

WSJC FIR CPDLC Actual Communications Technical Performance (ACTP)

2.5 This section covers the ACTP measurement for CPDLC messages sent within WSJC FIR from January 2015 to December 2015, categorized by data link media type. The ACTP for messages sent via Satellite and VHF meet the 95 percent criterion but marginally fall below the 99.9 percent criterion.

2.6 **Table 5** summarizes the overall CPDLC Actual Communications Technical Performance (ACTP) for messages sent within the WSJC FIR. **Figure 5** presents the ACTP measurement by media type (Satellite, VHF and the combined total of both) from January 2015 to December 2015.

WSJC FIR CPDLC ACTP			
Messages		**% > 120 sec (Target 95%)**	**%> 150 sec (Target 99.9%)**
Satellite	19,517	98.01%	98.94%
VHF	39,489	99.70%	99.83%
Total	59,006	99.14%	99.54%

Table 5: WSJC FIR CPDLC ACTP

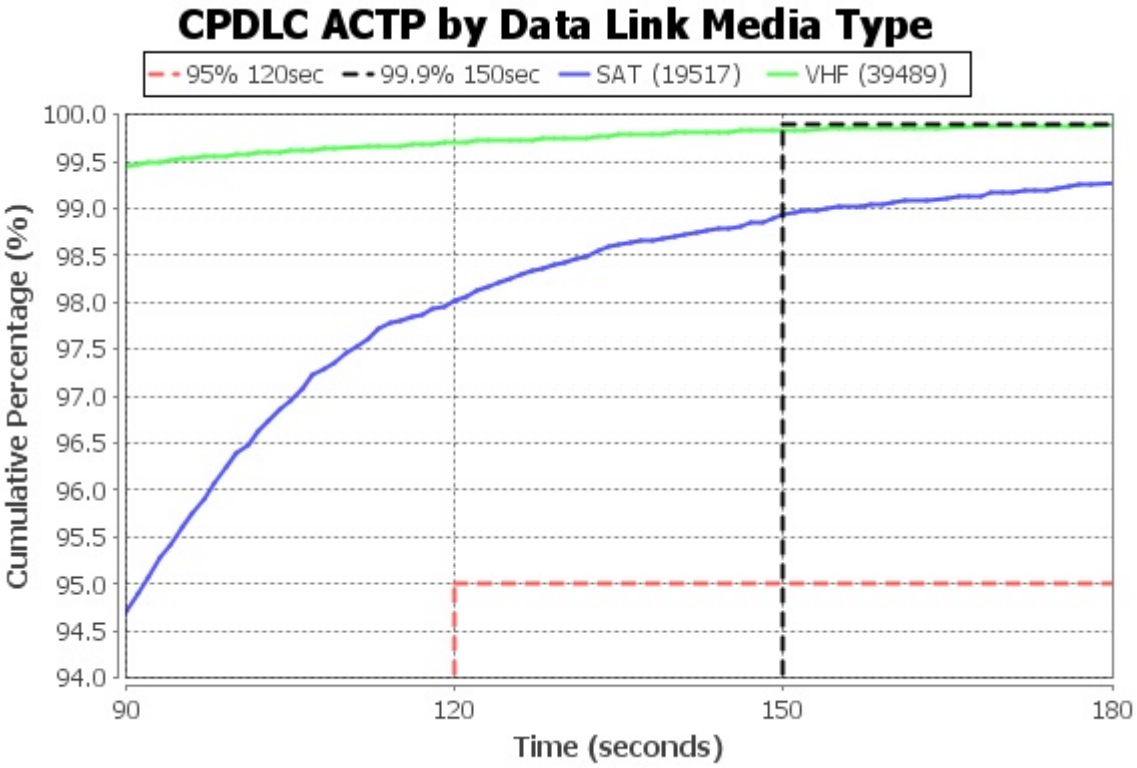

Figure 5: WSJC FIR ACTP by Data Link Media Type

2.7 **Table 6 to 7** summarizes the overall CPDLC Actual Communications Technical Performance (ACTP) per month by data link media type for messages sent within the WSJC FIR. **Figure 6 to 7** presents the ACTP measurement per month by data link media type from January 2015 to December 2015.

WSJC FIR CPDLC ACTP - Satellite			
Month	**Messages**	**% > 120 sec (Target 95%)**	**%> 150 sec (Target 99.9%)**
Jan 2015	439	99.09%	99.32%
Feb 2015	1,715	97.78%	99.07%
Mar 2015	2,419	97.68%	98.93%
Apr 2015	1,248	98.16%	99.12%
May 2015	1,314	98.86%	99.62%
Jun 2015	1,606	98.13%	98.94%
Jul 2015	1,591	97.99%	98.68%
Aug 2015	1,824	98.41%	98.96%
Sep 2015	1,673	97.61%	98.68%
Oct 2015	1,787	97.59%	98.77%
Nov 2015	2,152	97.91%	98.98%
Dec 2015	1,749	98.11%	98.68%

Table 6: WSJC FIR CPDLC ACTP per Month - Satellite

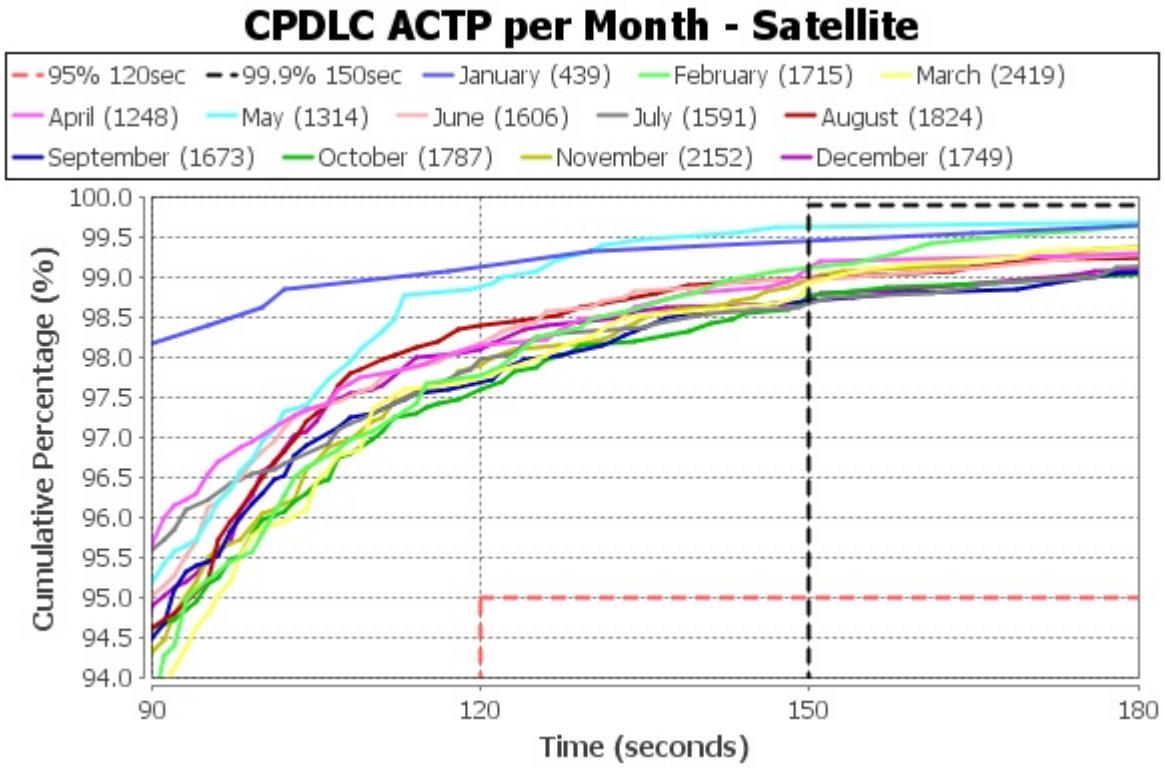

Figure 6: WSJC FIR ACTP per Month – Satellite

WSJC FIR CPDLC ACTP - VHF			
Month	**Messages**	**% > 120 sec (Target 95%)**	**%> 150 sec (Target 99.9%)**
Jan 2015	1,195	99.67%	99.92%
Feb 2015	2,667	99.70%	99.93%
Mar 2015	4,292	99.77%	99.81%
Apr 2015	2,496	99.72%	99.84%
May 2015	3,115	99.78%	99.87%
Jun 2015	3,430	99.65%	99.83%
Jul 2015	3,428	99.45%	99.71%
Aug 2015	3,377	99.70%	99.73%
Sep 2015	3,259	99.48%	99.69%
Oct 2015	4,066	99.78%	99.95%
Nov 2015	4,535	99.80%	99.87%
Dec 2015	3,629	99.81%	99.86%

Table 7: WSJC FIR CPDLC ACTP per Month – VHF

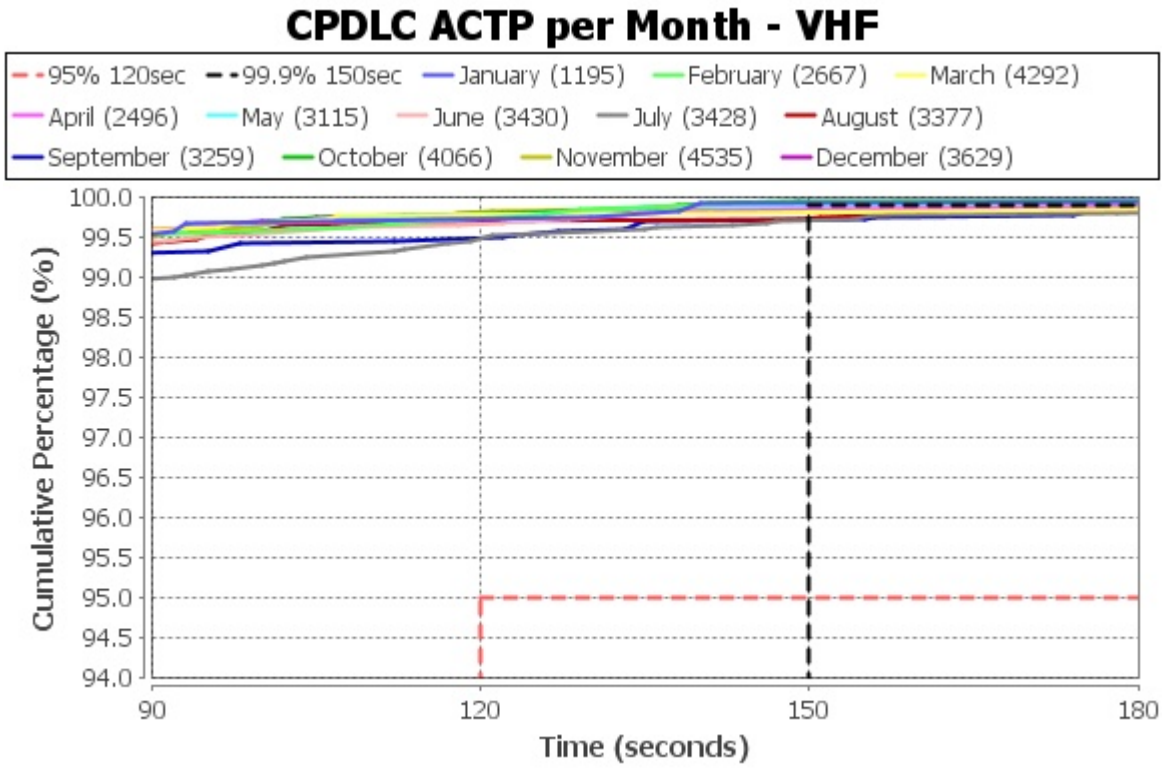

Figure 7: WSJC FIR ACTP per Month – VHF

2.8 **Table 8** summarizes the CPDLC Actual Communications Technical Performance per Operator for messages sent within the WSJC FIR. **Figure 8** presents the CPDLC Actual Communications Technical Performance per Operator from January 2015 to December 2015. The performance is presented only for the top 10 operators by message count.

WSJC FIR CPDLC ACTP per Operator (de-identified)			
Operator (de-identified)	**Messages**	**% > 180 sec (Target 95%)**	**%> 210 sec (Target 99.9%)**
OP0	16,888	99.60%	99.79%
OP1	11,603	98.79%	99.44%
OP2	4,882	98.81%	99.02%
OP3	4,282	98.88%	99.51%
OP4	3,606	99.42%	99.72%
OP5	1,769	98.47%	99.49%
OP6	1,664	99.64%	99.76%
OP7	1,572	99.62%	99.87%
OP8	1,452	98.83%	99.52%
OP9	1,312	99.70%	99.92%

Table 8: WSJC FIR CPDLC ACTP per operator

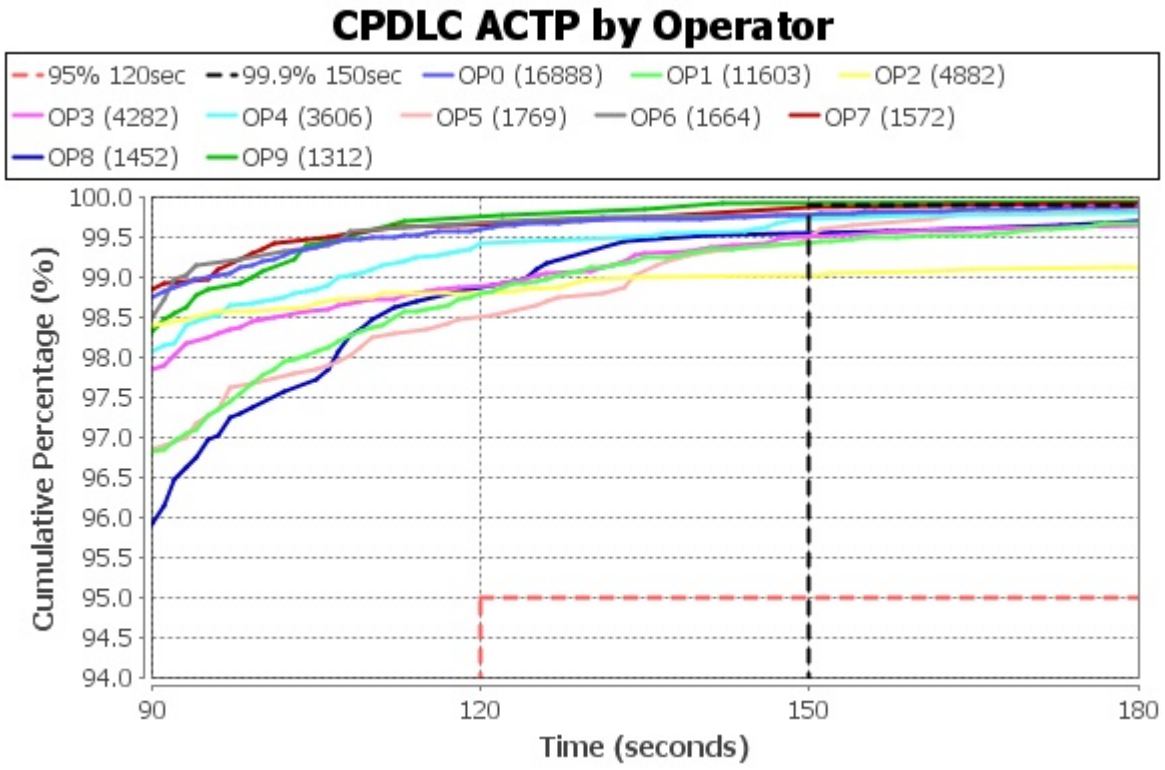

Figure 8: WSJC FIR CPDLC ACTP per operator

WSJC FIR CPDLC Pilot Operational Response Time (PORT) per Operator (de-identified)

2.9 **Table 9** summarizes CPDLC Pilot Operational Response Time per Operator for messages sent within the WSJC FIR. **Figure 9** presents the CPDLC Pilot Operational Response Time per Operator from January 2015 to December 2015.

WSJC FIR CPDLC PORT per Operator		
Operator (de-identified)	**Messages**	**% > 60 sec (Target 95%)**
OP0	16,888	99.63%
OP1	11,603	99.08%
OP2	4,882	98.96%
OP3	4,282	99.65%
OP4	3,606	99.69%
OP5	1,769	99.10%
OP6	1,664	99.52%
OP7	1,572	99.68%
OP8	1,452	99.52%
OP9	1,312	98.93%

Table 9: WSJC FIR CPDLC PORT per Operator

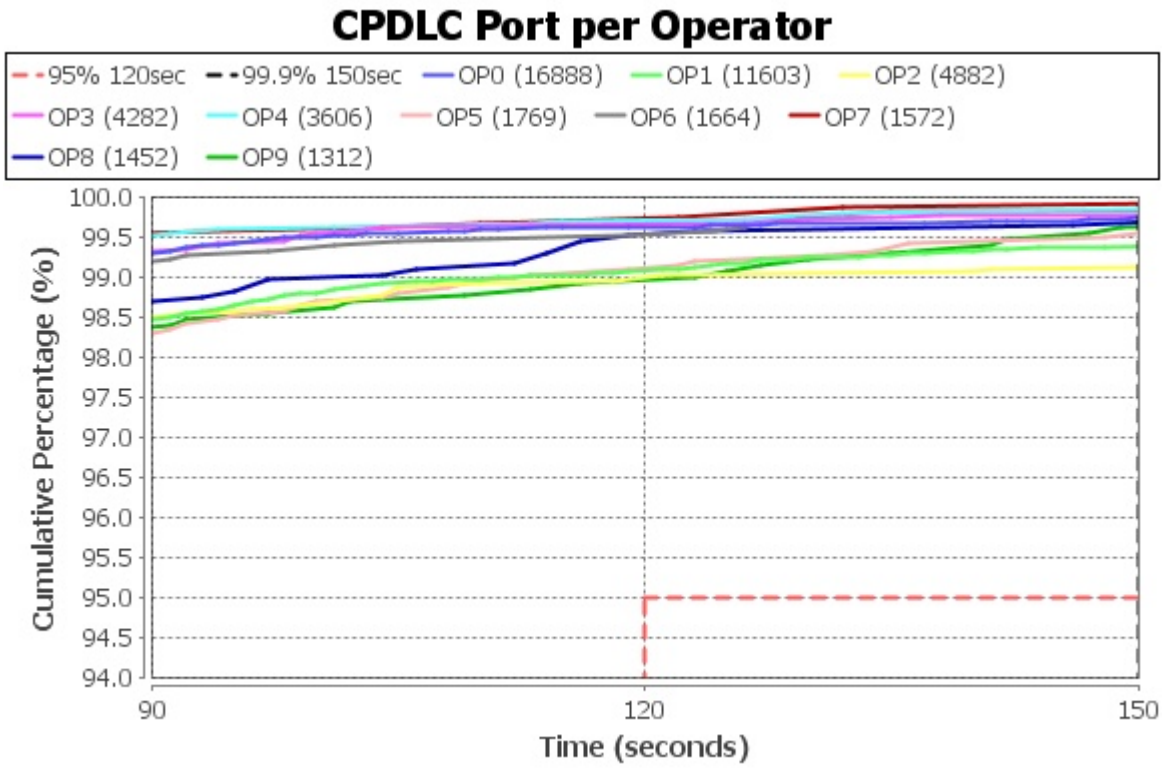

Figure 9: WSJC FIR CPDLC PORT per Operator

WSJC FIR ADS-C Downlink Latency

2.10 This section covers the Downlink Latency measurement for ADS-C messages sent within WSJC FIR from January 2015 to December 2015, categorized by data link media type. The Downlink Latency for messages sent via Satellite and VHF meet the 95 percent criterion but falls marginally below the 99.9 percent criterion.

2.11 **Table 10** summarizes ADS-C Downlink Latency for messages sent within the WSJC FIR. **Figure 10** presents the ADS-C Downlink Latency per media type (Satellite, VHF and the combined total) from January 2015 to December 2015.

WSJC FIR ADS-C Downlink Latency			
Messages		**% > 90 sec (Target 95%)**	**%> 180 sec (Target 99.9%)**
Satellite	24,544	96.40%	99.36%
VHF	45,799	99.40%	99.80%
Total	70,343	98.36%	99.65%

Table 10: WSJC FIR ADS-C Downlink Latency by Data Link Media Type

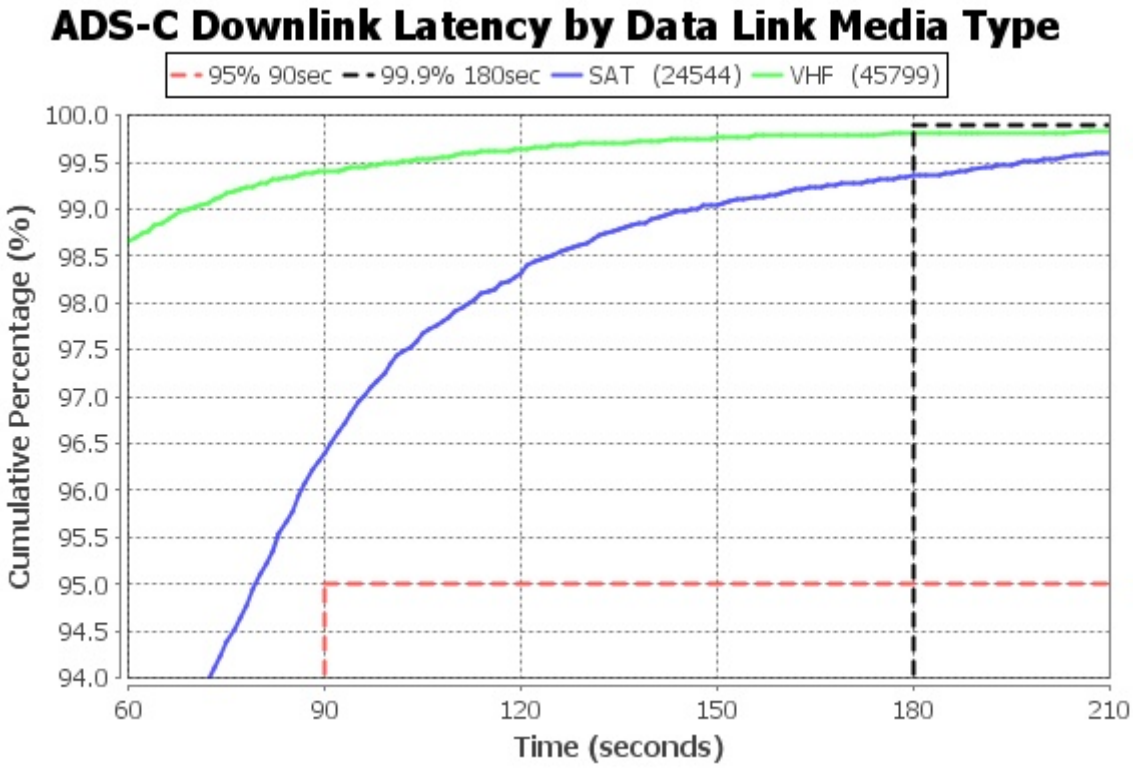

Figure 10: WSJC FIR ADS-C Downlink Latency

2.12 **Table 11 - 12** summarizes ADS-C Downlink Latency measurements per month by data link media type for messages sent within the WSJC FIR. **Figure 11 - 12** presents the ADS-C Downlink Latency measurement per month by data link media type from January 2015 to December 2015.

WSJC FIR ADS-C Downlink Latency - Satellite			
Month	**Messages**	**% > 90 sec (Target 95%)**	**%> 180 sec (Target 99.9%)**
Jan 2015	1,878	96.38%	99.15%
Feb 2015	1,581	96.96%	99.24%
Mar 2015	1,899	96.10%	99.10%
Apr 2015	1,872	96.15%	99.47%
May 2015	1,906	96.48%	99.21%
Jun 2015	2,001	96.25%	99.20%
Jul 2015	2,253	96.14%	99.51%
Aug 2015	2,055	96.74%	99.42%
Sep 2015	2,129	95.82%	99.25%
Oct 2015	2,184	96.57%	99.59%
Nov 2015	2,265	97.17%	99.74%
Dec 2015	2,521	96.15%	99.29%

Table 11: WSJC FIR ADS-C Downlink Latency per Month – Satellite

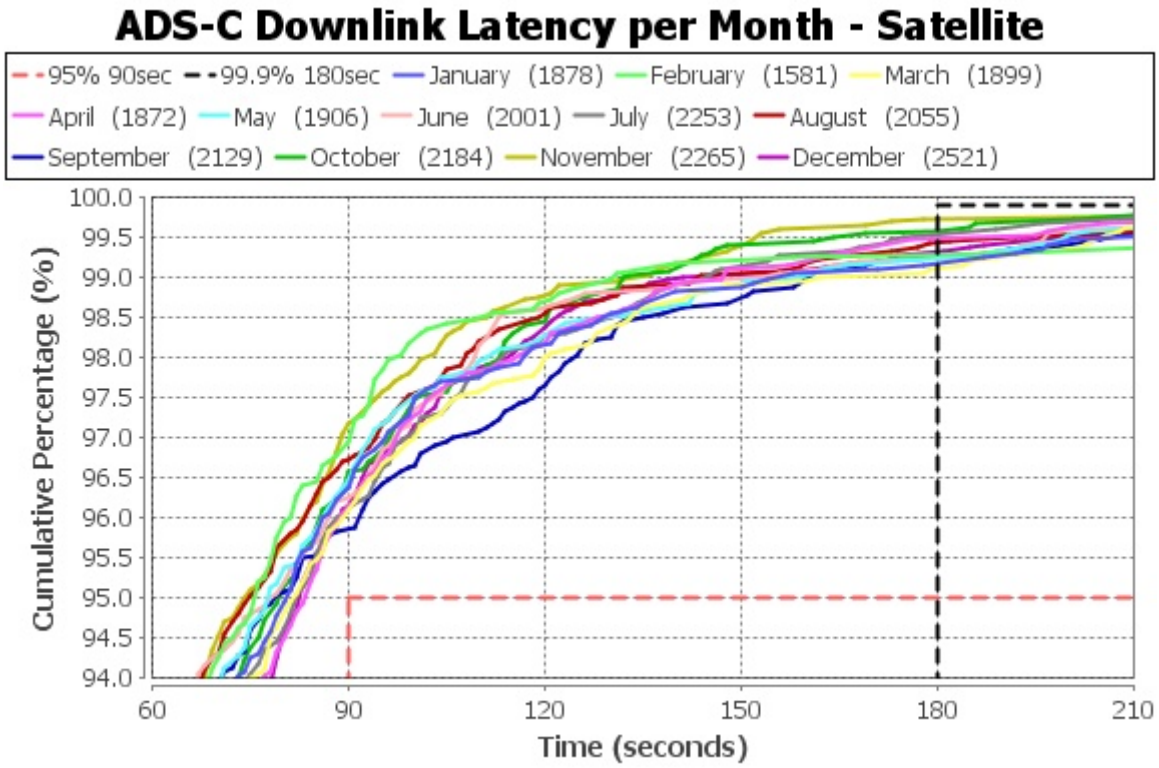

Figure 11: WSJC FIR ADS-C Downlink Latency per Month – Satellite

WSJC FIR ADS-C Downlink Latency - VHF			
Month	**Messages**	**% > 90 sec (Target 95%)**	**%> 180 sec (Target 99.9%)**
Jan 2015	3,746	99.33%	99.84%
Feb 2015	3,197	99.50%	99.84%
Mar 2015	3,545	99.04%	99.72%
Apr 2015	3,613	99.70%	99.89%
May 2015	3,794	99.34%	99.60%
Jun 2015	3,955	99.42%	99.77%
Jul 2015	4,289	99.37%	99.77%
Aug 2015	3,832	99.40%	99.84%
Sep 2015	3,801	99.32%	99.79%
Oct 2015	3,990	99.55%	99.85%
Nov 2015	3,834	99.58%	99.84%
Dec 2015	4,203	99.31%	99.88%

Table 12: WSJC FIR ADS-C Downlink Latency per Month - VHF

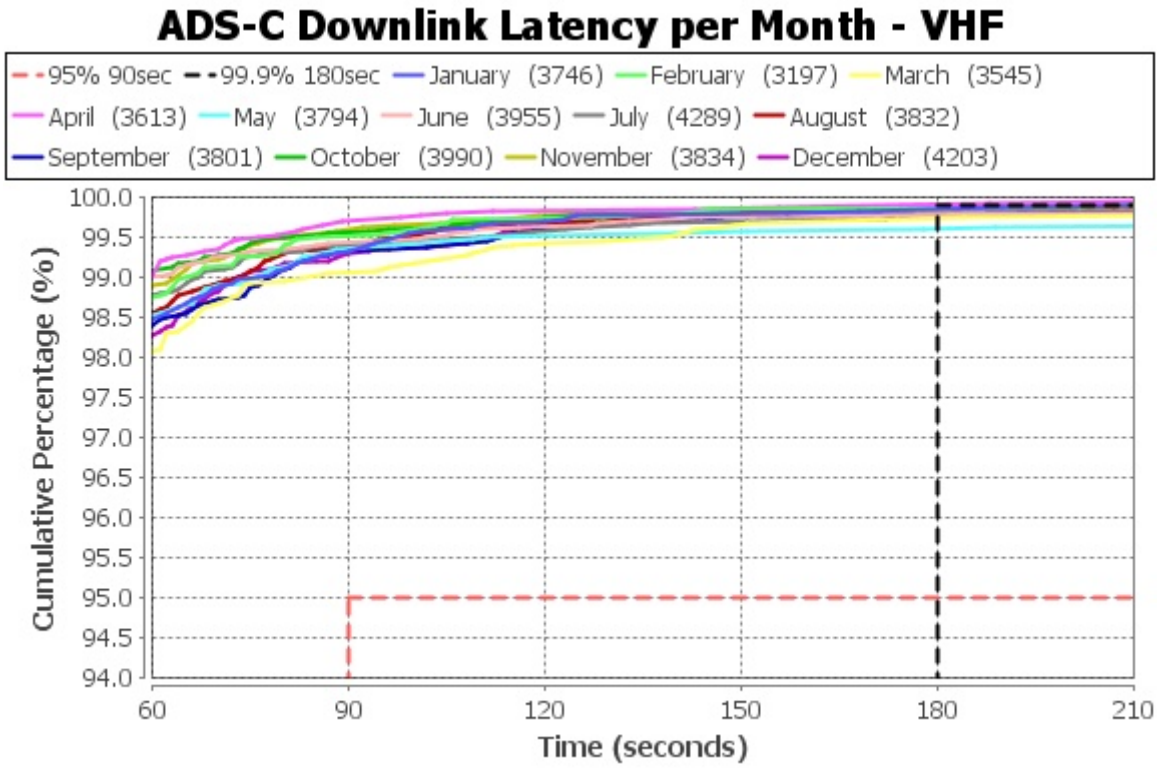

Figure 12: WSJC FIR ADS-C Downlink Latency per Month - VHF

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.

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