

**FANS Interoperability Team Meeting
(FIT/20)****Auckland, New Zealand
26 – 27 February 2013**

Agenda Item 5 – Working Papers**CPDLC and ADS-C Data Link Performance Monitoring for the Oakland Flight
Information Region (FIR)****Presented by U.S. Federal Aviation Administration****SUMMARY**

This paper provides observed performance of the data link operations conducted in Oakland FIR using the Controller Pilot Data Link Communication (CPDLC) and Automatic Dependent Surveillance – Contract (ADS-C) systems. The performance is measured against the criteria specified in the Global Operational Data Link Document (GOLD). Performance is presented for 2010, 2011 and 2012.

1. INTRODUCTION

1.1 This paper provides observed data link performance of the Controller Pilot Data Link Communication (CPDLC) and Automatic Dependent Surveillance – Contract (ADS-C) systems used in the Oakland oceanic flight information region (FIR). The purpose of this paper is to assess the most recent performance as well as to review the performance during the past three years.

1.2 The performance data observed from the CPDLC and ADS-C systems are measured against the appropriate Required Communication Performance (RCP) and Required Surveillance Performance (RSP) specifications to demonstrate that safety objectives which rely on the communications infrastructure can be met by the aircraft and the ground systems in the respective airspace.

1.3 This paper presents the performance values by media type for the recent six-month period from July to December 2012. In addition, the aggregate data link performance for Oakland FIR over all media types, i.e. satellite, VHF and HF, during the past three years, 2010, 2011 and 2012, is shown.

1.4 The corresponding power point presentation (Attachment A) contains the tables and charts shown within this paper as well as additional charts illustrating the full cumulative distributions for each performance measure. In addition the performance is shown by station identifier and by operator. For the purpose of comparison, there are also slides showing the datalink performance in Anchorage and New York FIRs.

2. DISCUSSION

2.1 The Global Operational Data Link Document (GOLD) provides the guidance material describing the required ADS-C and CPDLC data points to be extracted from the operational data. The GOLD describes the calculation process for the prescribed performance measures – the actual communication performance (ACP), the actual communication technical performance (ACTP), the pilot operational response time (PORT), and the surveillance latency – and specifies the requirements for each performance measure at the 95% and 99.9% levels.

2.2 According to the guidance in the GOLD, the ACP, ACTP and PORT for applicable CPDLC transactions are required to meet RCP240 criteria when sent via satellite and VHF, and are required to meet RCP400 criteria when sent via HF. Similarly, the ADS-C downlink latency is required to meet RSP180 criteria for ADS-C downlink messages sent via satellite and VHF, and is required to meet RSP400 criteria when sent via HF.

2.3 **Table 1** outlines the requirements for these performance measures at the 95% and 99.9% levels.

Table 1
Summary of performance requirements

Performance Measure	Percent of Messages Required to Meet Criteria	RSP180 Criteria (sec)	RSP400 Criteria (sec)	RCP240 Criteria (sec)	RCP400 Criteria (sec)
ADS-C Latency	95.0%	90	300	--	--
	99.9%	180	400	--	--
ACTP	95.0%	--	--	120	260
	99.9%	--	--	150	310
ACP	95.0%	--	--	180	320
	99.9%	--	--	210	370
PORT	95.0%	--	--	60	60

Observed Data Link Performance by Media Type

2.4 **Table 2** presents a summary of the observed performance for the ADS-C downlink messages and applicable CPDLC transactions within the Oakland FIR during the combined period from **July to December 2012**. Only the CPDLC transactions in which the same media type was used for both the uplink and downlink portion of the transaction are included in the counts shown in Table 2. Approximately 0.5% of the transactions occurred using mixed media.

2.5 The performance is measured against the RSP180 and RCP240 specifications for the aggregate, SAT and VHF. The ADS-C performance over HF media is measured against the RSP400 specifications. The observed RCP performance for messages sent via HF media are not shown as only 31 CPDLC transactions occurred using pure HF media.

Media Type	Count of ADS-C Downlink Messages	ADS-C 95%	ADS-C 99.9%	Count of CPDLC Transactions	ACTP 95%	ACTP 99.9%	ACP 95%	ACP 99.9%	PORT 95%
SAT	1,424,123	98.5%	99.5%	117,206	99.5%	99.7%	99.3%	99.6%	97.3%
VHF	197,608	99.2%	99.6%	2,127	100.0%	100.0%	99.7%	99.8%	97.3%
HF	5,576	88.6%	91.3%	31	--	--	--	--	--
Aggregate	1,627,307	98.5%	99.5%	119,980	99.5%	99.6%	99.3%	99.5%	97.2%

2.6 The cells colored in gray highlight where the performance measures are met for observed performance in Oakland FIR during the aggregate period from July to December 2012. The cells with bold text highlight where the performance is close to meeting the 99.9 percent criteria, with the rule-of-thumb being 95 percent and above. The 95 percent criteria for RSP180 ADS-C and RCP240 ACTP, ACP and PORT are met for the aggregate as well as for satellite and VHF. In addition, the 99.9 percent criteria for RCP240 ACTP is met for VHF. The 95% criteria for RSP400 ADS-C is not met for HF during this period.

Trends in Observed Data Link Performance – 2010, 2011, 2012

2.7 Figure 1, Figure 2 and Figure 3 present the aggregate ACP, ACTP and ADS-C performance over all media types in Oakland FIR for 2010, 2011 and 2012. The numbers of messages observed in each respective year are shown in the legend key of each figure.

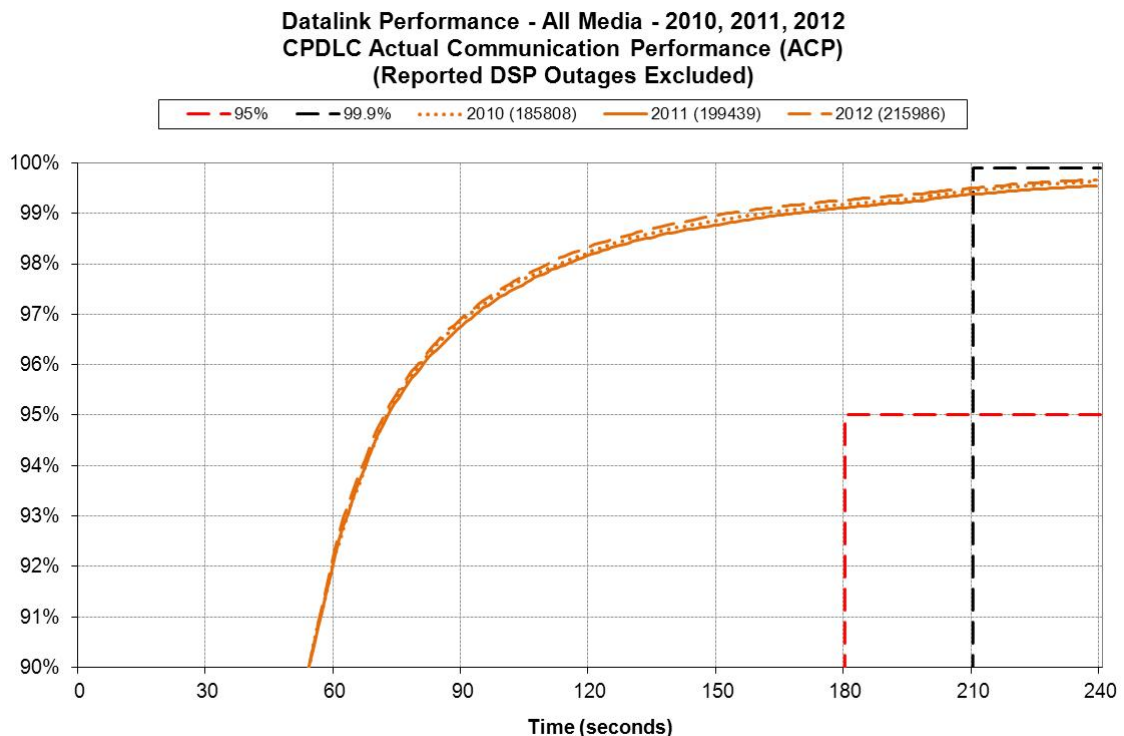
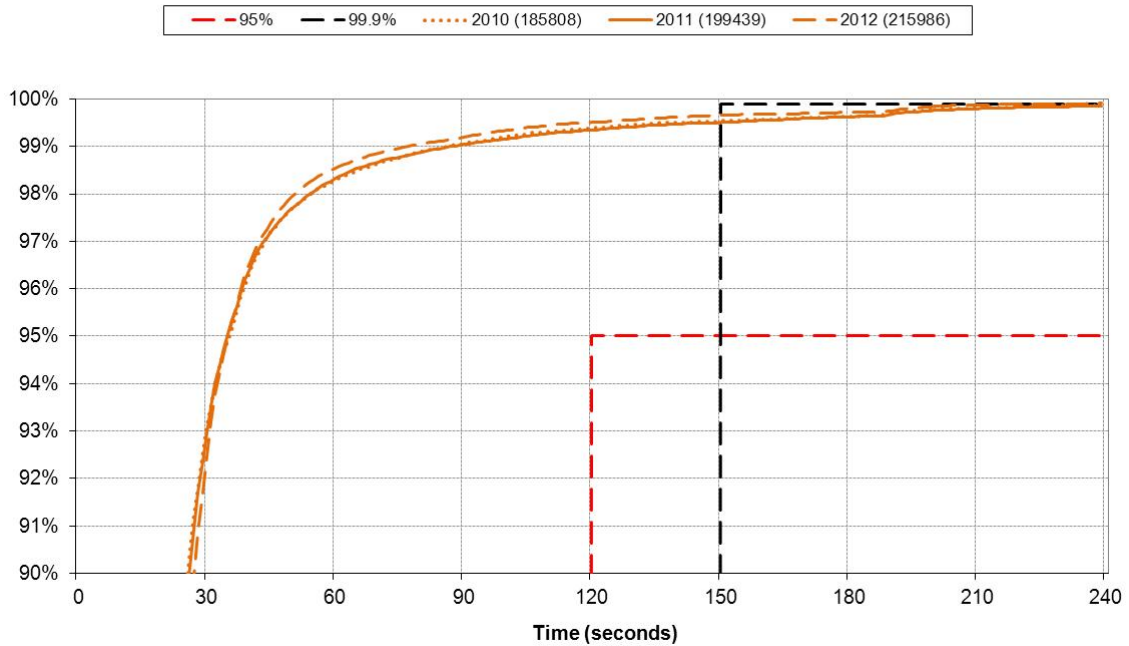


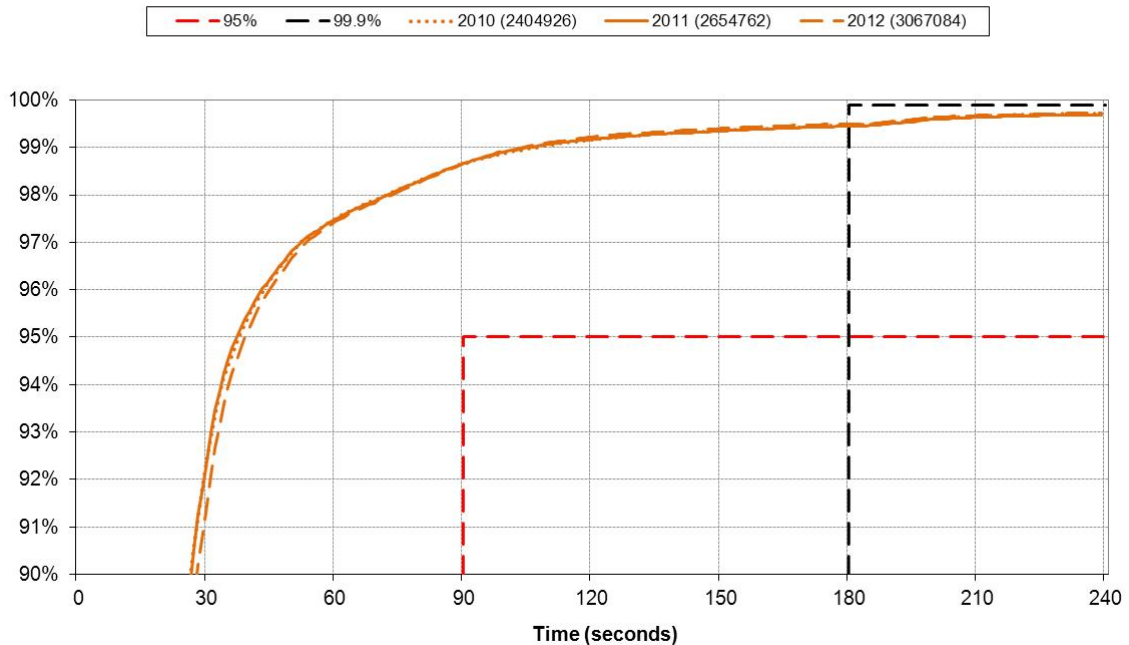
Figure 1. ACP (RCP 240) – Aggregate data link performance – all media types

**Datalink Performance - All Media - 2010, 2011, 2012
 CPDLC Actual Communication Technical Performance (ACTP)
 (Reported DSP Outages Excluded)**



ACTP (RCP 240) – Aggregate data link performance – all media types

**Datalink Performance - All Media - 2010, 2011, 2012
 ADS-C Downlink Latency
 (Reported DSP Outages Excluded)**



2.8 Figures 1, 2 and 3 show that the 95% criteria has been met for RCP240 ACP and ACTP and for RSP180 ADS-C downlink latency in Oakland FIR in all of the past 3 years. A

slight improvement is observed for the ACP and ACTP in 2012. The ADS-C performance is observed to be relatively stable from 2010 to 2012.

2.9 **Attachment A** contains additional charts related to the data link performance in the Oakland FIR including charts with performance by station identifier (for satellite operations) and by operator in Oakland as well Anchorage and New York FIRs. In addition, VHF performance is compared for POA (plain old ACARS) and AOA (ACARS over AVLC - VDL Mode 2).

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

- a) Note the information in the paper and the accompanying presentation; and
- b) Review and comment on the observed performance.



Attachment A.GOLD Data Link Analysis

[Provided as a separate file]

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