



International Civil Aviation Organization

**SECOND SATELLITE DATA LINK OPERATIONAL CONTINUITY
MEETING TO REVIEW THE PERFORMANCE AND PROVISION OF
SATELLITE COMMUNICATIONS IN THE ASIA AND PACIFIC
REGIONS**

(Bangkok, Thailand, 8-10 February 2012)

**Agenda Item 2: Review planning and implementation programs involving satellite
communications (SATCOM) data-link services (Update since SOCM/1)**

2.2 Communication infrastructure

**POST-IMPLEMENTATION ANALYSIS OF DATA LINK PERFORMANCE FOLLOWING
RELEASE 15 (R15) GROUND EARTH STATION SOFTWARE UPGRADE**

(Presented by the United States of America)

SUMMARY

This paper presents the data link performance related to the four ground earth stations (GES) receiving the most recent system software release, Release 15 (R15). The actual communication technical performance (ACTP) and the ADS-C downlink latency performance are presented for the two months prior to the month of the upgrade, the two months following the month of the upgrade and the two most recent months to assess the effect of the upgrade on overall data link performance at the GES level.

1 INTRODUCTION

1.1 Between January and July of 2010, four of the main ground earth stations (GES) interfacing with the Inmarsat-3 Classic Aero satellites received an upgrade with the latest system software, Release 15 (R15). The purpose of the R15 upgrade was to improve the GES data link delivery capability and the aircraft log-on management subsystems, as well as to enhance the GES traffic handling and monitoring subsystems.

1.2 Table 1 lists the four GES that received the R15 upgrade, their locations, the associated data link service provider (DSP) and the date on which it was received.

1.3 This paper presents the data link performance for the four GES receiving the R15 upgrade. Charts are shown for two of the technical performance measures prescribed in the Global Operational Data Link

Agenda Item 2

08/02/12

Document (GOLD) for post-implementation monitoring of data link system performance - the actual communication technical performance (ACTP) for controller pilot data link communication (CPDLC) and the ADS-C downlink latency. The purpose of the analysis is to assess the effect of the upgrades on the overall data link performance at the GES level.

Table 1. R15 Upgrade Summary

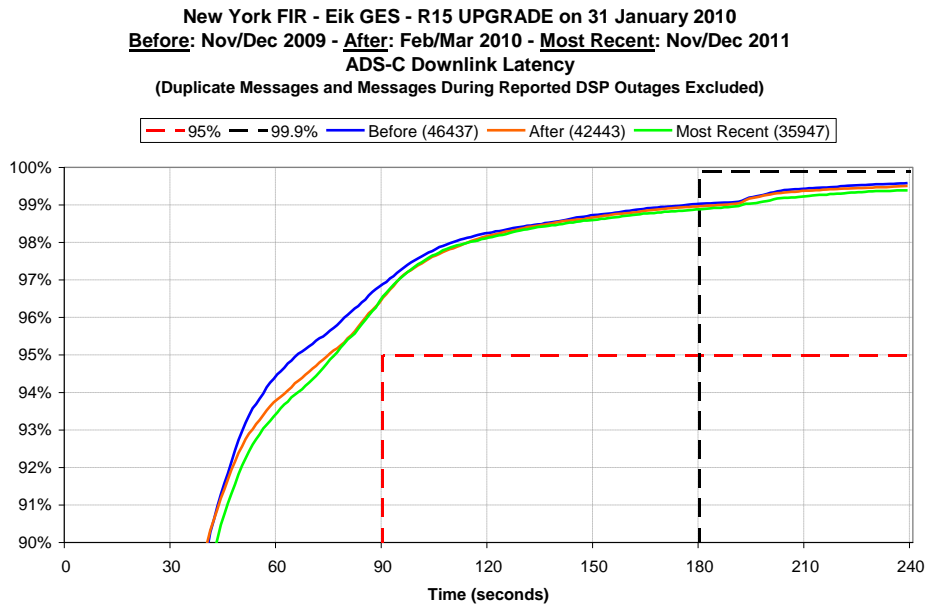
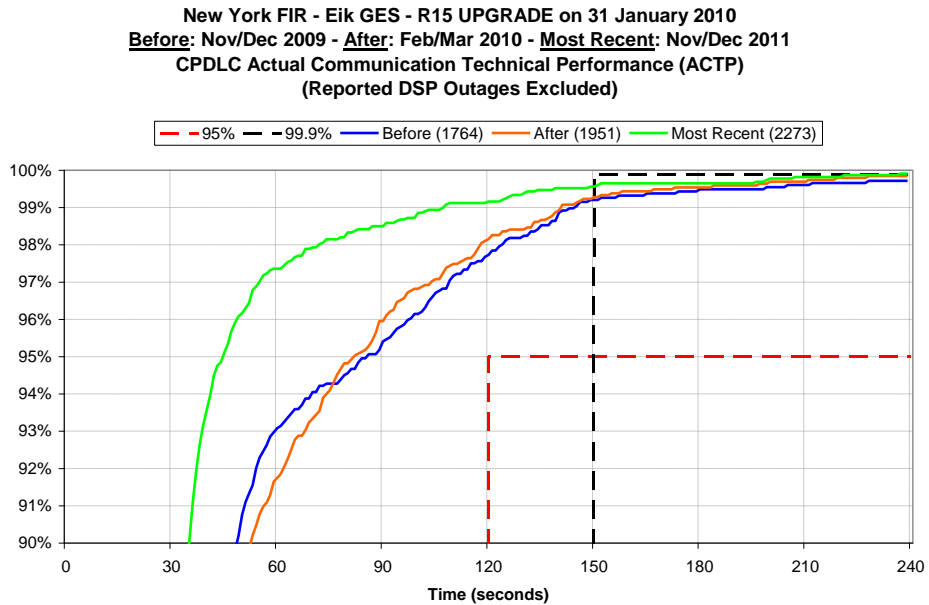
GES Identifier and Location	Associated DSP	Date of R15 Upgrade
XXE – Eik, Norway	ARINC	31 January 2010
XXC – Santa Paula, California, USA	ARINC	16 February 2010
AOW2 – Aussaguel, France	SITA	31 May 2010
POR1 – Perth, Australia	SITA	6 July 2010

1.4 The accompanying power point presentation provides the information contained in this paper as well as additional charts with the full cumulative distributions for the ACTP and ADS-C downlink latency for each of the four GES.

2 DISCUSSION

2.1 The following charts present the ACTP and ADS-C downlink latency for each of the four GES receiving the R15 upgrade. The data link performance for the two months prior to the month of the upgrade, the two months following the month of the upgrade and the two most recent months are compared on each chart.

2.2 As shown in Table 1, the R15 upgrade was installed first at the GES in Eik, Norway (XXE) on 31 January 2010. Figures 1 and 2 show the performance comparison charts for the ACTP and the ADS-C downlink latency for the Eik GES.



2.3 While improvement in the ACTP was not observed immediately following the R15 upgrade, the most recent data does show a noticeable improvement in performance for CPDLC transactions through Eik GES, as illustrated in Figure 1. However, the ADS-C downlink latency performance is observed to have degraded in the period immediately following the upgrade as well as in the most recent period shown in Figure 2.

2.4 The R15 upgrade was next installed at the GES in Santa Paula, California, USA (XXC) on 16 February 2010. Figures 3 and 4 show the performance comparison charts for the ACTP and the ADS-C downlink latency for the Santa Paula GES.

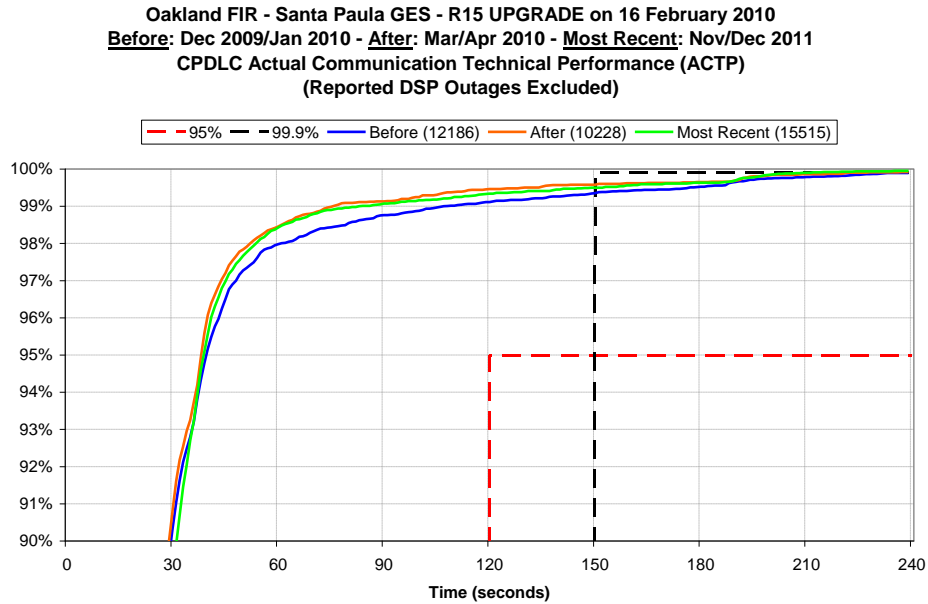


Figure 3. ACTP for Santa Paula GES

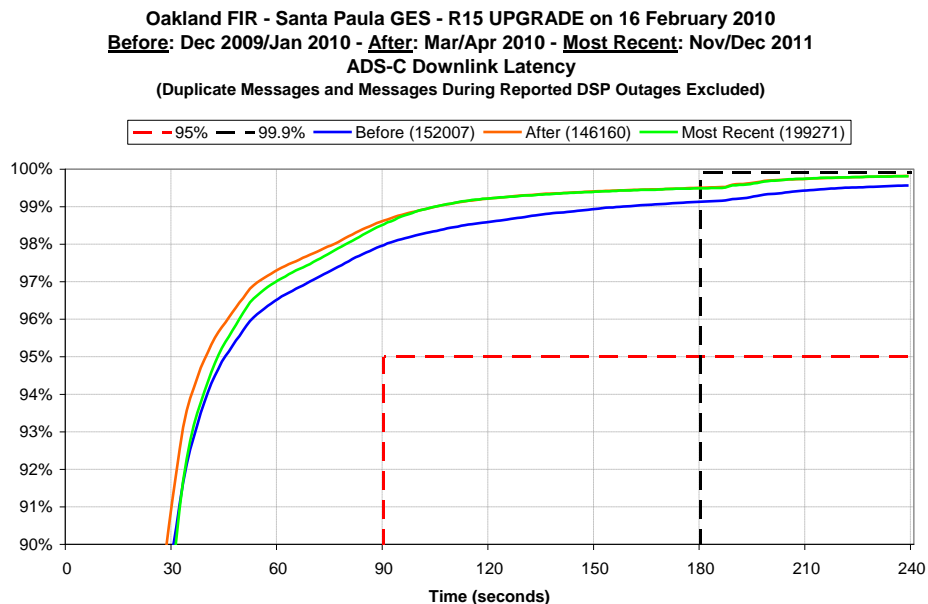


Figure 4. ADS-C Downlink Latency for Santa Paula GES

2.5 Improvement can be observed for both the ACTP for CPDLC transactions through Santa Paula GES and ADS-C downlink latency performance for ADS-C downlink messages through Santa Paula

GES, illustrated in Figures 3 and 4, respectively. The improvement is shown to be stable between the period immediately following the upgrade and the most recent period of observation for both performance measures.

2.6 The R15 upgrade was next installed at the GES in Aussaguel, France (AOW2) on 31 May 2010. Figures 5 and 6 show the performance comparison charts for the ACTP and the ADS-C downlink latency for the Aussaguel GES.

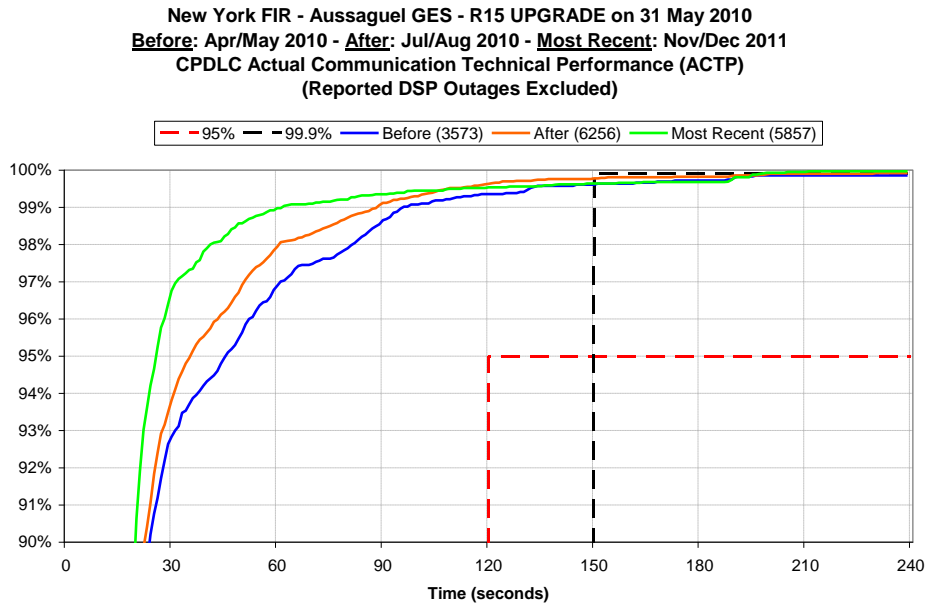


Figure 5. ACTP for Aussaguel GES

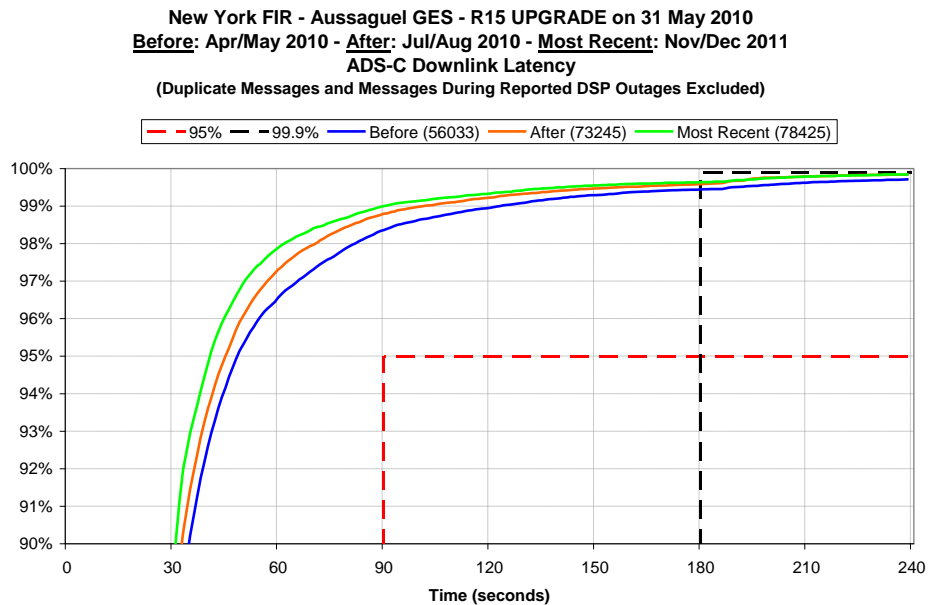


Figure 6. ADS-C Downlink Latency for Aussaguel GES

2.7 Improvement can be observed for both the ACTP for CPDLC transactions through Aussaguel GES and ADS-C downlink latency performance for ADS-C downlink messages through Aussaguel GES, illustrated in Figures 5 and 6, respectively. Continued improvement is shown between the period immediately following the upgrade and the most recent period of observation for both performance measures.

2.8 The R15 upgrade was installed last at the GES in Perth, Australia (POR1) on 31 May 2010. Figures 7 and 8 show the performance comparison charts for the ACTP and the ADS-C downlink latency for the Perth GES.

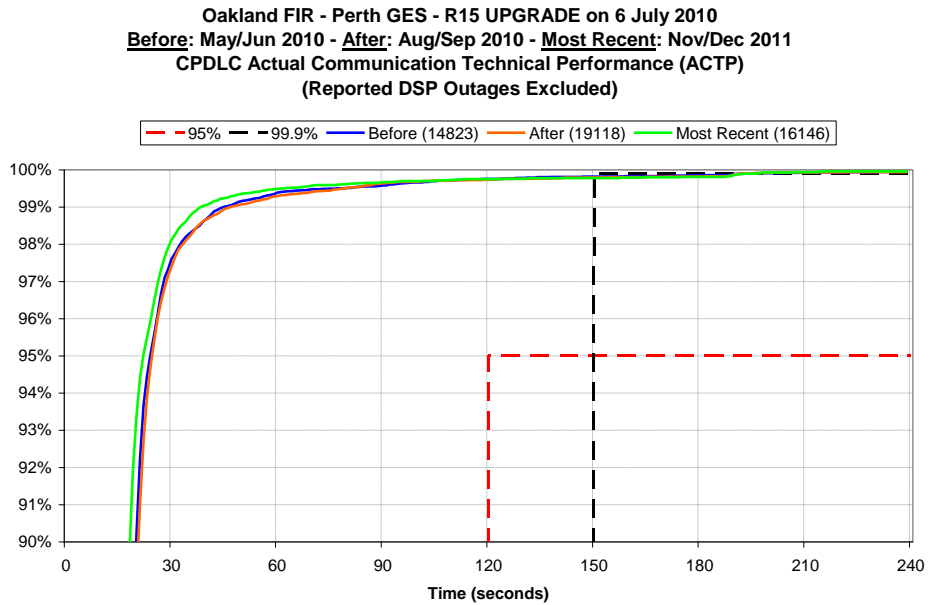


Figure 7. ACTP for Perth GES

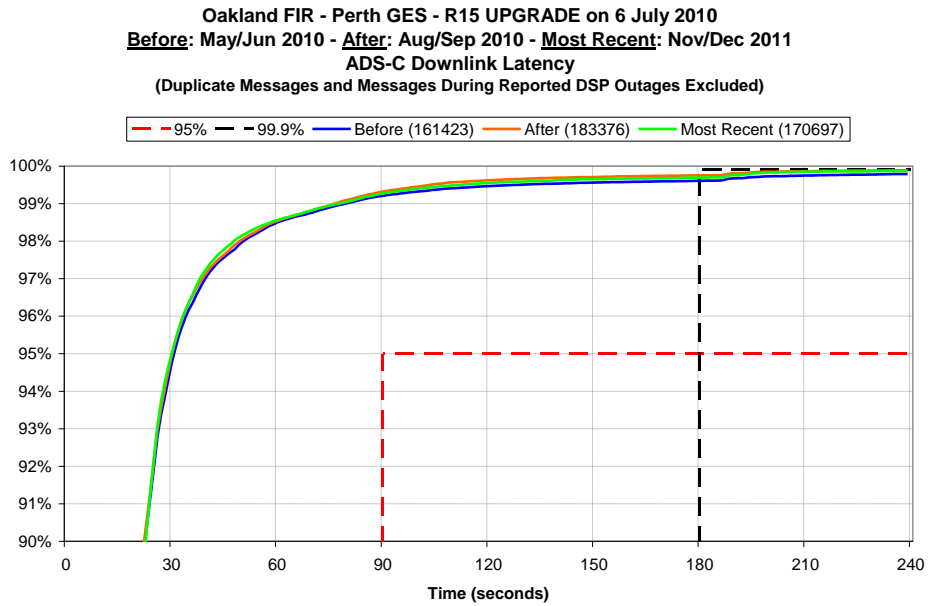


Figure 8. ADS-C Downlink Latency for Perth GES

2.9 Slight improvement can be observed for both the ACTP for CPDLC transactions through Perth GES and ADS-C downlink latency performance for ADS-C downlink messages through Perth GES, illustrated in Figures 7 and 8, respectively. Continued improvement in the ACTP is shown between the period immediately following the upgrade and the most recent period of observation. The improvement in the ADS-C downlink latency is shown to be stable between the period immediately following the upgrade and the most recent period of observation.

Agenda Item 2

08/02/12

2.10 Overall, the R15 software upgrade at the four GES interfacing with the I-3 Classic Aero satellites appears to have improved the data link performance at the GES level. The improvement is most noticeable at the Santa Paula and Aussaguei stations. In general the upgrade appears to have more of an impact on the ACTP than on the ADS-C downlink latency performance.

2.11 Attachment A contains power point slides with the information included in this paper as well as additional charts showing the full cumulative distributions for the ACTP and ADS-C downlink latency for all four GES.

3 ACTION BY THE MEETING

3.1 The Meeting is invited to:

- a) Note the information in this paper and the accompanying power point presentation;

**Attachment A. Post-Implementation Analysis of Data Link Performance Following Release 15
(R15) Ground Earth Station Software Upgrade**

[Provided as a separate file]

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