NORTH ATLANTIC COMMUNICATIONS, NAVIGATION AND SURVEILLANCE GROUP (NAT CNSG)

TENTH MEETING

(Paris, France, 24-28 March 2014)

Agenda Item 2: Data Link performance monitoring and analysis, including trials and operations. Reports by States, industry and DLMA

a) FANS 1/A performance by FIR, media type, operator, aircraft type, GES

IMPACT OF VHF TRANSITIONS ON DATA LINK PERFORMANCE

(presented by the United States of America)

SUMMARY

This paper describes a test conducted by the United Parcel Service (UPS) to modify the VHF scan tables in their fleets operating in the North Pacific region in order to eliminate the latencies related to VHF media transitions.

1. Introduction

1.1. In response to discussions within the Performance-based operations Aviation Rulemaking Committee Communications Working Group (PARC CWG) about the negative effect that aircraft transitioning to and from the very high frequency (VHF) coverage regions has on data link performance, representatives from the United Parcel Service (UPS) agreed to participate in a test to determine the actual impact.

1.2. In October 2012, UPS removed all VHF frequencies from the scan tables in their aircraft fleets operating in the North Pacific region. The purpose was to test the theory that the media transitions, particularly those to and from VHF, negatively impact the transit times of ADS-C and CPDLC messages due to the VHF scan delay.

1.3. This paper presents a comparison of the data link performance in Anchorage flight information region (FIR) for the UPS fleets before and after the change was implemented.

2. Discussion

2.1. The following charts illustrate the variation in actual surveillance performance (ASP), which measures the latency of ADS-C downlink reports, observed between the 3-month period before (July to September 2012) and the 3-month period after (November 2012 to January 2013) the scan table change was made. The performance is measured against the required surveillance performance (RSP) 180 specifications defined in the Global Operational Data Link Document (GOLD).

2.2. The performance for the B744 fleet is split into two categories because part of the fleet is configured to use Inmarsat I-3 (**B744**) and the other is configured to use Iridium (**B744-I**). The performance for the B763 fleet, which uses only Iridium, is split into two categories representing the older aircraft (**B763**) and the newer aircraft (**B763-N**) due to the difference in avionics between the two groups of aircraft. The avionics of the B763-N is the same as the B744-I. The MD11 fleet uses only Inmarsat I-3 for satellite data link. It is important to note the difference in satellite systems used by each fleet due to the variation in the associated paths travelled by the data link messages. It is also important to note any differences in the avionics of a particular fleet.

2.3. Figures 1 and 2 illustrate the cumulative distribution of the ASP for the 3-month periods before and after the scan table change was made, at the 90 to 100% level and the 0 to 100% level, respectively. The lines corresponding to the before and after periods are the same colour for each feet, with the before period having a solid line and the after period having a dashed line.

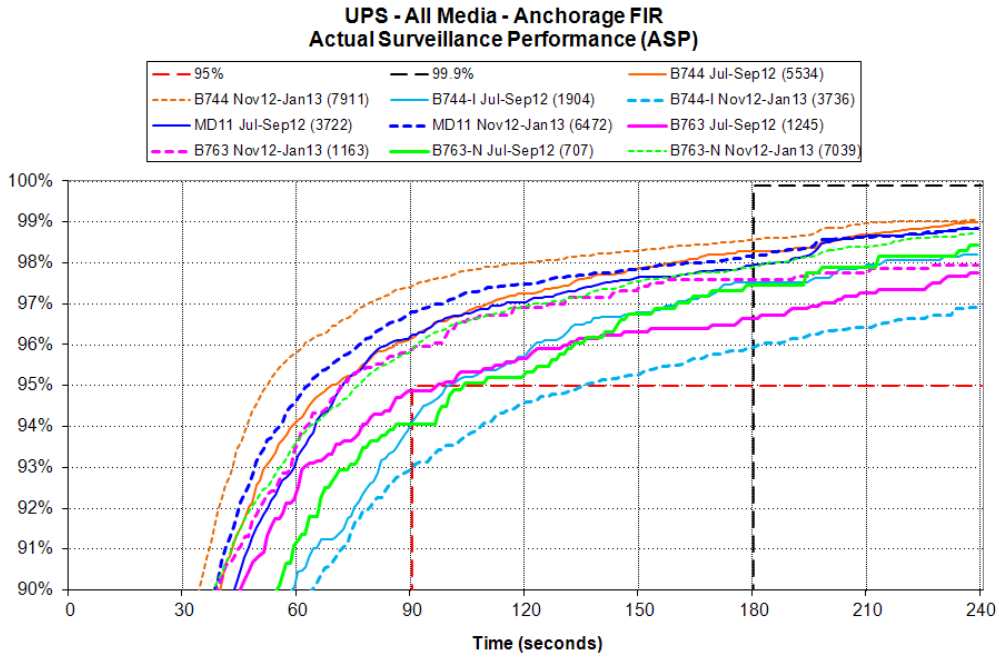

Figure 1. Cumulative ASP by fleet before and after change – 90 to 100%

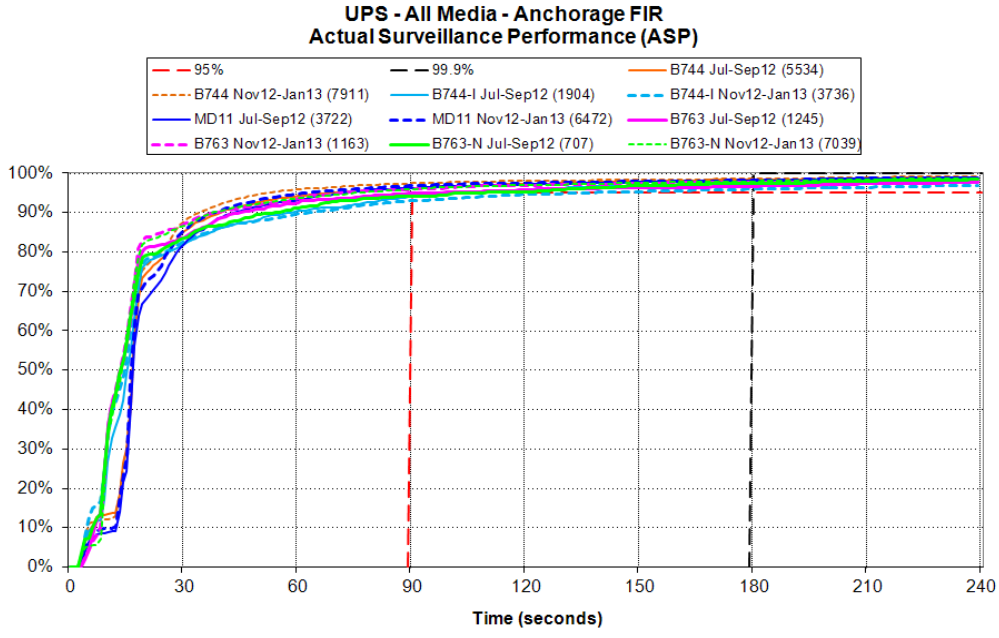

Figure 2. Cumulative ASP by fleet before and after change – 0 to 100%

2.4. Improvement in the cumulative ASP at the 90-100% level is observed between the before and after periods for all fleets except for the B744 fleet using Iridium (B744-I). While there is a decrease in performance observed for the B744-I at the 90-100% level of the cumulative ASP distribution, there is an improvement evident around the 10-20% level of the distribution.

2.5. Most notable is the performance improvement for the B763 fleet, both the old (B763) and new (B763-N) groups. The performance does not meet the 95% RSP180 criteria for ASP before the change and improves to meet the 95% criteria after the change.

2.6. Figure 3 illustrates the relative frequency distribution of the ASP for the periods before and after the change for all 4 fleets. The after performance for each fleet is shown as a black dashed line.

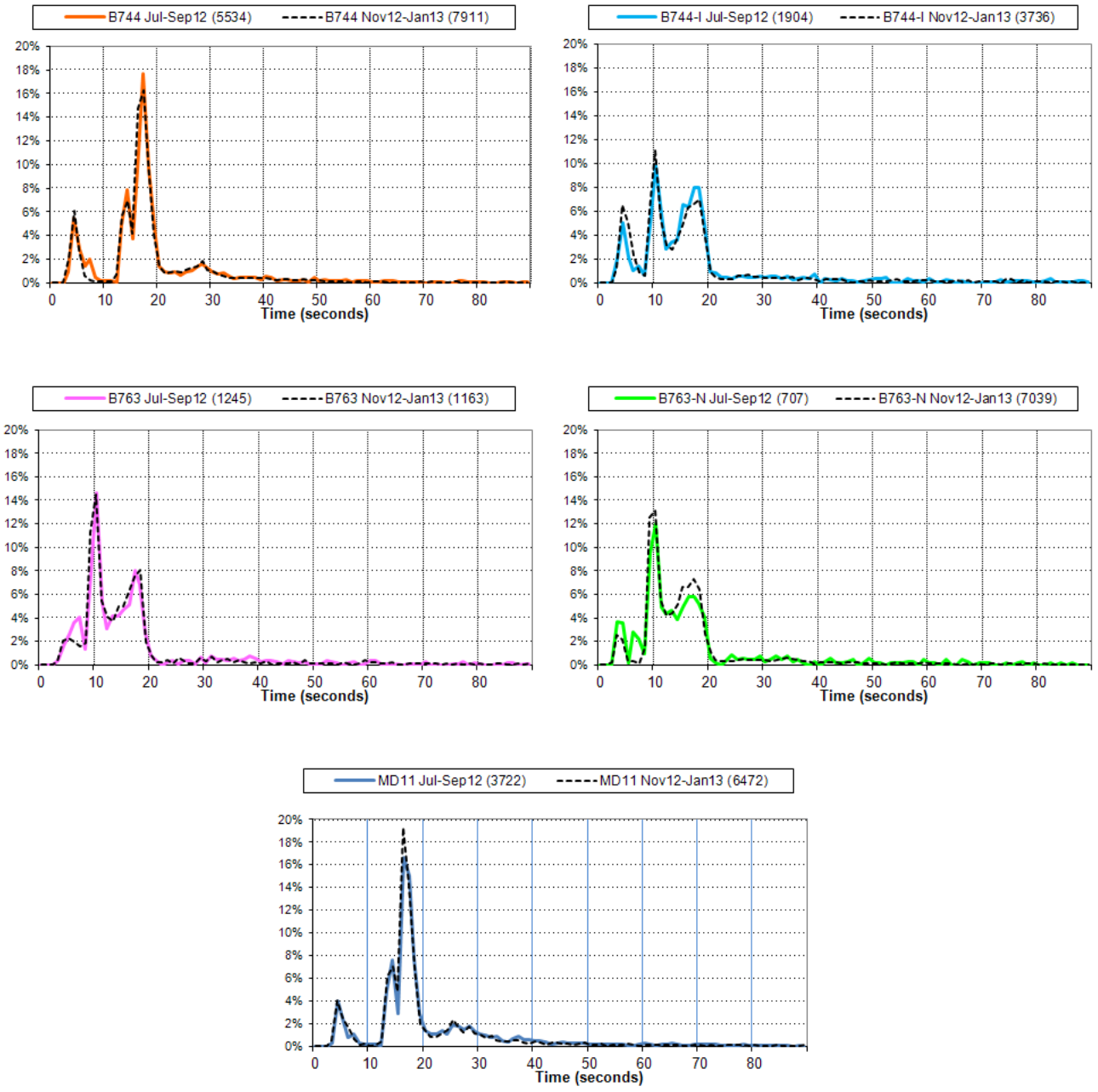

Figure 3. Relative ASP by fleet before and after change

2.7. In all cases there is observed to be an increase in the peak at the earlier part of the distribution (a larger percentage with smaller latencies) with a corresponding decrease in one or more of the peaks in the latter part of the distribution (a smaller percentage with larger latencies). In addition, the peak observed around the 7-second point of the distribution is no longer present in the distribution of the ASP after the scan table change was made in any of the fleets. Thus, the latencies in that 7-second peak appear to be associated with messages sent via VHF.

3. Conclusion

3.1. UPS, in conjunction with PARC CWG, conducted a test to validate the theory that the media transitions to and from VHF negatively affect the data link performance. By removing the VHF frequencies from the scan tables in their aircraft, it was theorized that the delays associated with the VHF scanning would be removed, thus decreasing the message latencies and improving ASP.

3.2. A comparison was made of the ASP associated with the UPS fleet in the North Pacific before and after the VHF frequencies were removed from the scan tables. The ASP was observed to improve in the period after the change. It is concluded that the improvement in performance was related to the change and that the elimination of VHF transitions does positively impact the data link performance.

4. Action by the meeting

4.1. The NAT CNSG is invited to note the content of this information paper.

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