THE FORTIETH MEETING OF THE  
IFORMAL PACIFIC ATC CO-ORDINATING GROUP  
(IPACG/40)

THE TWENTY-SEVENTY MEETING OF THE  
FANS INTEROPERABILITY TEAM (FIT/27)

(Washington DC, USA, 11 September 2014)

Agenda Item 3: Reports on the relevant activities

# The Effect of Media Transitions on Actual Surveillance Performance

(Presented by the Federal Aviation Administration)

SUMMARY

This paper investigates how aircraft data link systems transitioning between various data link media types affects the actual surveillance performance (ASP). The archived ADS-C downlink reports from the Ocean21 systems at New York and Oakland air route traffic control centers (ARTCCs) from the period of July to December 2013 were utilized for this analysis.

# Introduction

## There are three media types available for aircraft utilizing data link in the oceanic environment: satellite (SAT), very high frequency (VHF) and high frequency (HF). Associated with each of the media types are ground stations with varying regions of coverage. For the SAT media, there are 4 separate satellite constellations with corresponding ground stations. Therefore, there are multiple different “paths” that a data link message may take during the course of an oceanic flight.

## The purpose of this paper is to summarize an investigation of how the actual surveillance performance (ASP) is affected when aircraft transition between media types as well as when they transition between the coverage areas associated with different ground stations within the same media type. The ADS-C downlink reports were extracted from the Ocean21 archived data from New York and Oakland for the six-month period from July to December 2013.

## The attached power point presentation, Attachment A contains charts illustrating the difference in performance between the various media transition combinations.

# Discussion

## The ADS-C downlink reports received by the Ocean21 systems at New York and Oakland ARTCCs during the period from July to December 2013 were extracted from the archived data. These reports were first categorized based on media transition type. For each ADS-C downlink report, an attempt was made to match it to a previous ADS-C downlink report within 30 minutes. If a match was made, the media transition type was assigned based on the media type of the previous and current ADS-C downlink reports.

## If the same media type was observed for both the previous and current reports, the associated station ids were then compared to determine whether or not there was a transition between stations within the same media type.

## The ASP was then calculated for all ADS-C downlink reports having a match to a previous ADS-C downlink report within 30 minutes and filtered by media transition type. The delay used for the analysis was only that associated with the “current” report. The delay associated with the matched previous report was not included.

## Based on the ASP associated with the various media transitions, as illustrated in Attachment A, the following observations were made.

## For the transitions to and from VHF:

## similar behavior is observed for media transitions to and from VHF in New York and Oakland FIRs;

## all media transitions from VHF exhibit significantly lower ASP than transitions to VHF;

## consecutive messages sent via the same VHF station exhibit slightly better ASP than when they are sent via different VHF stations; and

## both I3 to VHF and I4 to VHF show better ASP than VHF to same VHF in New York.

## For the transitions to and from HF:

## consecutive messages sent via the same HF station exhibit the lowest ASP;

## transitions from HF to all other media show better ASP than transitions to HF; and

## while transitions from all other media to HF are lowest they still appear to have better ASP than HF to HF transitions, therefore positively affecting the ASP for HF.

## For the transitions to and from Iridium:

## similar behavior is observed for media transitions to and from Iridium in New York and Oakland FIRs;

## transitions from Iridium to VHF exhibit better ASP than VHF to Iridium, thus VHF to Iridium transitions adversely affect Iridium ASP (similar to I3 and I4);

## transitions from Iridium to VHF exhibit better ASP in New York than in Oakland; and

## transitions from Iridium to HF exhibit considerably lower ASP than HF to Iridium, thus Iridium to HF transitions adversely affect HF ASP (similar to I3 and I4).

## For the transitions to and from Inmarsat I-3:

## similar behavior is observed for media transitions to and from I3 in New York and Oakland FIRs;

## consecutive messages sent via the same I3 station exhibit better ASP than those sent via different I3 stations;

## transitions between I3 and I4 show similar performance both directions;

## transitions from I3 to VHF exhibit considerably better ASP than from VHF to I3, thus VHF to I3 transitions adversely affect I3 ASP;

## transitions from I3 to HF exhibit considerably lower ASP than from HF to I3, thus I3 to HF transitions adversely affect HF ASP; and

## transitions from I3 to MTSAT exhibit considerably lower ASP than from MTSAT to I3, thus I3 to MTSAT transitions adversely affect MTSAT ASP.

## For the transitions to and from Inmarsat I-4:

## similar behavior is observed for media transitions to and from I4 in New York and Oakland FIRs;

## consecutive messages sent via the same I4 station exhibit better ASP than those sent via different I4 stations, with a more significant difference observed for Oakland;

## transitions between I3 and I4 show similar performance both directions;

## transitions from I4 to VHF exhibit considerably better ASP than VHF to I4, thus VHF to I4 transitions adversely affect I4 ASP;

## transitions from I4 to HF exhibit considerably lower ASP than HF to I4, thus I4 to HF transitions adversely affect HF ASP; and

## poor ASP for transitions between I4 and MTSAT but the relatively small data set is noted.

## For the transitions to and from MTSAT:

## the ASP for consecutive messages sent via MTSAT meets both 95% and 99.9% criteria for RSP180;

## transitions from VHF to MTSAT exhibit considerably lower ASP than MTSAT to VHF, thus VHF to MTSAT transitions adversely affect MTSAT ASP;

## transitions from I3 to MTSAT exhibit considerably lower ASP than MTSAT to I3, thus I3 to MTSAT transitions adversely affect MTSAT ASP; and

## poor ASP for transitions between I4 and MTSAT but the relatively small data set is noted.

## The attached power point presentation, Attachment A, provides charts detailing the observed ASP for the various media transition combinations. There are separate charts for each media type showing the ASP for the transition combinations associated with that respective media type only. There are separate sets of charts for VHF transitions, HF transitions, Iridium transitions, Inmarsat I-3 transitions, Inmarsat I-4 transitions and MTSAT transitions. There is logical overlap between the sets of charts, e.g. the transitions between VHF and HF appear on both the charts associated with VHF transitions as well as the charts associated with HF transitions.

# Conclusion

## The meeting is invited to:

1. Note the information in the paper.

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