International Civil Aviation Organization

**TWELFTH MEETING OF THE SOUTH EAST ASIA
AND BAY OF BENGAL SUB-REGIONAL ADS-B
IMPLEMENTAITON WORKING GROUP
(SEA/BOB ADS-B WG/12)**

Guangzhou, China, 08 – 10 November 2016

Agenda Item 4:   **Report on ground system and avionics performance monitoring and improvement in compliance**

**POSITION CHECKING OF ADS-B TRACKS
BASED ON PRECISE TIMING AND MULTILATERATION ALGORITHM**

(Presented by China)

SUMMARY

This paper presents an approach of position checking of ADS-B tracks based on precise timing and multilateration algorithm. The requirements and feasibility are discussed to implement this approach.

1.   INTRODUCTION

There are some security risks in the application of ADS-B techniques. For example, erroneous squitter position messages from airborne equipment may be received by ground stations. And it's possible for some false targets to be modulated and reported by illegal devices.

It's necessary to calculate the WAM position to identify false targets and estimate the deviation between the squitter position and WAM position.

2.   GENERAL PRINCIPLES

2.1   ADS-B ground stations record the Time Of Arrival (TOA) of squitter position message, and send it to the data processing center.

2.2   The data processing center calculates the real position of an aircraft using multilateration algorithms according to the TOA of airborne squitter position messages which are transmitted by the same aircraft at the same time and received by different ground stations.

2.3   By comparing the position calculated and that in the data reports, the data processing center can identify whether the target is real and whether the position is reasonable.

3.   REQUIREMENTS

3.1   ADS-B ground stations has been time synchronized.

3.2   ADS-B ground stations can record and output precise TOA of squitter position messages.

3.3   ADS-B squitter messages from one aircraft can be received by multiple ADS-B ground stations.

3.4   Data processing center should be established to verify the track positions.

4.   FEASIBILITY

4.1   At present, ADS-B ground stations provided by main manufacturers in China have the ability to record and output precise time stamp. Generally, a Global Navigation Satellite System (GNSS) can be used to provide a common timing reference for each of ground station receivers. It is therefore possible to synchronize the receivers to within 10-20ns by using a GPS disciplined oscillator at each site. The precision of recorded TOA depends on the GNSS precision and the time-recording precision of the processing module of ADS-B ground stations. We have tested some ground stations of Chinese manufacturers recently. The ADS-B ground station processing accuracy varies from 100 to 500 ns.

4.2   ADS-B ground stations pack TOA data into reports in the format of Asterix Category 021 immediately when receiving the messages, then transmit the reports to data processing center. Item I021/074 (Time of Message Reception of Position-High Precision) is supported in ASTERIX Category 21 after Version 1.4. The Least Significant Bit (LSB) of this item is about 0.9313 ns.

4.3   We have been proceeding the implementation of ADS-B in China. In fact, hundreds of ground stations are about to be set up. With a suitable distribution of ADS-B ground stations and a guarantee of TOA precision, the precision of Wide Area Multilateration (WAM) based on GNSS can be achieved.

5.   ACTION BY THE MEETING

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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