International Civil Aviation Organization

AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST SEMINAR AND FOURTEENTH MEETING OF AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) STUDY AND IMPLEMENTATION TASK FORCE (ADS-B SITF/14)

Christchurch, New Zealand, 14 – 17 April 2015

Agenda Item 8: Any other business

REVIEW OF COST BENEFITS FOR THE INITIAL PHASE OF ADS-B IMPLEMENTATION OVER THE SOUTH CHINA SEA

(Presented by Singapore and CANSO)

SUMMARY

With the completion of the initial phase of ADS-B implementation over the South China Sea and the subsequent reduction in aircraft longitudinal separation from 80-50 NM to 30NMl in July 2014 a request was made at the last ADS-B SEA/BOB Working Group meeting (SEA/BOB ADS-B WG/10) for a review of the cost benefits study presented to ADS-B SITF/8 in 2009. This paper presents the outcome of the review conducted by Singapore and CANSO.

1. INTRODUCTION

1.1 In 2009, CANSO and IATA presented a cost benefit analysis at the ADS-B SITF/8 for the initial phase of ADS-B implementation over the South China Sea involving two trunk routes L642 and M771 (See Fig 1). The study concluded that there was a strong business case for the project taking into account the economic savings in fuel burnt, carbon emissions, Aircraft Direct Operating Costs (ADOC) and Passenger Value of Time (PVT).

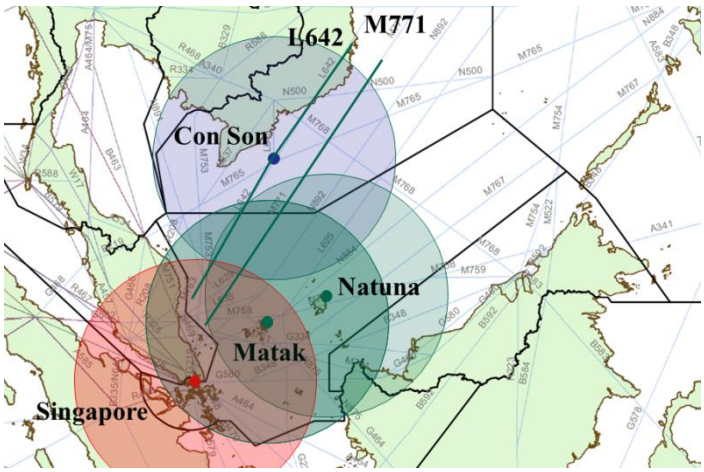

Fig 1: Initial Phase of ADS-B collaboration project over the South China Sea

1.2 The initial phase covering the South China Sea area was identified for the study as it contained some of the highest traffic density routes that would benefit most from ADS-B implementation. The project involved the sharing of ADS-B data and VHF communications among Indonesia, Vietnam and Singapore to cover gaps in radar surveillance and VHF communications over the two trunk routes L642 and M771.

1.3 At the last ADS-B SEA/BOB Working Group meeting (SEA/BOB ADS-B WG/10), Singapore reported on the completion of the initial phase of ADS-B implementation over the South China Sea and the subsequent reduction in aircraft longitudinal separation from 80-50 NM to 30NM in July 2014. The meeting requested that a review of the cost benefits be conducted following the successful completion of the project.

2. DISCUSSIONS

2.1 ADS-B operations commenced in the designated airspace in Dec 2013 and as such it would be useful to conduct a quick review based on the experience gained over a full year in 2014. The objective of this review is therefore not to replicate the full Cost Benefit Analysis conducted in 2009 given the extensive effort required but to focus essentially on the cost benefits in 2014.

Airborne Efficiency Savings

2.2 The implementation of the ADS-B exclusive airspace has led to enhancement in the allocation of cruising levels for flights that operate on the two trunk routes. Statistical samples of flight level allocation after implementation of ADS-B showed that approximately 5% of the flights achieved a more optimum level of between 1,000 to 5,000 feet above their assigned cruising levels prior to ADS-B implementation (See Annex A).

2.3 With the use of the ICAO Fuel Savings Estimation Tool (IFSET), the projected fuel savings achieved by these flights over the period of 1 year in 2014 amounts to 1.5 million kilograms of fuel. At an average fuel price of S$2.72 per US gallon, this amounts to about $2 million worth of fuel savings for the airlines.

2.4 In addition to fuel saved from the optimum cruising level allocation, the previous study also took into account benefits from reduction of airborne delay from cruising at the optimum flight level. This equates to savings in passenger value of time (PVT) and aircraft direct operating cost (ADOC). The total PVT and ADOC savings is about $1 million. Overall the benefit yield amounts to about $3 million. Please see Table 1.

Airborne Efficiency	
Fuel Burn Savings	1,567,920 kg
Fuel Burn Savings (2014 US$)	$1,966,694
Flight time savings (hours)	138
Airborne ADOC w/o fuel savings	$411,499
PVT savings	$576,513
CO2 Emission Savings	4,938,948 kg
CO2 Savings	$44,451
Total Economic Savings	**$2,999,156**

Table 1: Airborne Efficiency Savings

Ground Delay Savings

2.5 The previous study also took into account potential reduction in ground delays arising from the elimination of queuing time for optimum levels. However, in reality the estimation of ground delay savings is complicated by many other factors contributing to ground delays at the airport. If we exclude these other factors the estimated economic benefits from ground delay savings is about to $1 million from savings in PVT, ADOC and fuel burn. Please see Table 2.

Ground Delay Savings	
Fuel Burn Savings	275,700 kg
Fuel Burn Savings (2014 US$)	$345,820
Flight time savings (hours)	128
Ground ADOC w/o fuel savings	$95,236
PVT savings	$534,737
CO2 Emission Savings	868,455 kg
CO2 Savings	$7,816
Total Economic Savings	**$981,992**

Table 2: Ground Delay Savings

Costs

2.6 The cost incurred in 2014 is based on the depreciation and recurrent cost of equipment used to support the ADS-B operations but excludes sunk costs of existing facilities prior to the project. These include the ADS-B stations in Singapore and Con Son, VHF radios in Con Son, Matak and Natuna, as well as the various telecommunications links. As with the original Cost Benefit Analysis, the costs exclude the ATC system cost and the ADS-B stations in Matak and Natuna which were already installed prior to the project and therefore considered as sunk cost. Avionics and aircraft equipage were also not included as the aircraft operate beyond the airspace concerned. The total cost incurred in 2014 amounts to about $3.5m.

Facilities	**Cost incurred in 2014**
ADS-B stations in Singapore and Vietnam	$310,000
VHF radios in Indonesia and Vietnam	$1,030,000
Communication links to bring the ADS-B signals from Con Son and Jakarta to Singapore	$1,000,000
Communication links to bring the VHF signals from Con Son, Matak and Natuna to Singapore	$1,110,000
Total	**$3,450,000**

Table 3: Cost items

2.7 Overall, the economic savings in 2014 exceeded the total cost by about $0.5m. In the 2009 cost benefit study, it was assumed that aircraft separation in the airspace concerned would be reduced to 5NM with the commencement of ADS-B operations. Based on this current study, it can be seen that even with 30NM separation, the annual benefits in 2014 already outweigh the cost. According to ACI, air traffic has been growing strongly in the region with Singapore and Hong Kong chalking up average growth rates of 9.1% and 7.4% per annum over the period 2009-2013. For the region as a whole, the average growth rate during the same period is 6.4%. Clearly, as air traffic continues to grow coupled with further reduction in aircraft separation one can expect the overall economic benefits to increase further.

Other Benefits

2.8 It should also be noted that there are other benefits apart from economic savings and these include improved safety with enhanced tracking of aircraft and safer and more efficient weather deviations; enhanced aircraft surveillance with increased situational awareness for ATC and the facilitation of search and rescue as well as enhanced flight data collection for better analysis and planning.

Other Areas for ADS-B Collaboration

2.9 The successful implementation of the initial phase of the South China Sea should provide a strong impetus for similar collaborative arrangements in the Bay of Bengal and the rest of the South China Sea and indeed for the the region as a whole. Potential projects highlighted at past ADS-B SITF meetings include ADS-B data sharing between Myanmar and India over the Bay of Bengal and among Singapore, Brunei Darussalam and the Philippines in the South China Sea.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the positive cost benefits analysis for the initial phase of ADS-B implementation over the South China Sea;

b) encourage States with ADS-B implementation plans to explore ADS-B data sharing arrangements with their neighbours; and

c) urge States concerned to expedite implementation of similar ADS-B collaboration over the Bay of Bengal and the rest of the South China Sea.

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Annex A

Derivation of fuel savings

1. In the year of 2014, aircraft can be seperated at 40NM from the beginning of the year and 30NM from July 2014.

2. Based on the current traffic, we attempted to assign flight levels to aircraft assuming that ATC is only allowed to separate aircraft at 80NM apart.

3. The result is that some aircraft got assigned flight levels that is less optimal and has to burn more fuel. These additional fuel burnt and the carbon dioxide emitted are considered as 'savings'.

4. The graph below shows the distribution of traffic assigned the various flight levels, before and after the implementation of ADS-B services.

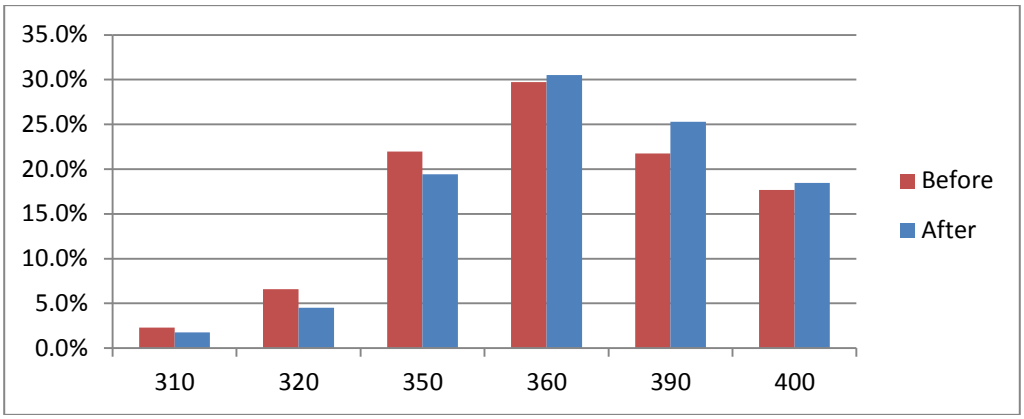
5. 

Fig 2: Distribution of traffic over the various flight levels.

6. With the use of the ICAO Fuel Savings Estimation Tool (IFSET), the projected fuel savings achieved by these flights over a period of 1 year amounts to 1.5 million kilograms of fuel. With the average fuel price of $2.72 per US gallon, this equates to a total of close to $2 million worth of fuel savings for the airlines.

7. It was also estimated that the excess fuel burnt would create 4,938,948 kg of carbon dioxide. With the cost of $9 per ton, this equates to about $44,451.

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