



International Civil Aviation Organization

Automatic Dependent Surveillance – Broadcast (ADS-B)

Study and Implementation Task Force

Brisbane, Australia, 24-26 March 2003

Agenda Item 4: Cost Benefit Studies

- b) Identify factors to be considered in the analysis and sources of information.

OPERATIONAL FLEXIBILITY PROVIDED BY “ADS-B OUT” IN CONTROLLED AIRSPACE

SUMMARY

This paper describes some benefits that may be derived from “ADS-B out” in airspace currently not supported by radar.

(Presented by Australia)

1. Introduction

1.1 The following describes the benefits that could be expected by airlines that equip with suitable “ADS-B out” avionics and operate in an area of ADS-B surveillance coverage. ADS-B out is the broadcast of positional and other data without necessarily providing the ability to receive the transmissions on-board the aircraft.

2. Clearances

- a. Higher probability of providing requested altitude or user preferred route clearances
 - Equipped aircraft could be expected to more often receive their preferred level (and receive it earlier) since the controller has definitive knowledge of aircraft position and may be able to establish an ADS-B separation standard in lieu of a more restrictive standard.
 - Equipped aircraft could expect increased **flexibility** of operation since the controller will be able to solve ATC separation problems by different means compared to existing procedural control
- b. Provides the opportunity to separate aircraft using radar like separation services when conflicting aircraft are both equipped.
 - Radar like separation reduces the lateral and longitudinal separation compared to today’s procedural standards and will increase controller flexibility and reduce operating restrictions on aircraft.

- The ability to issue “climb through” clearances when one aircraft has been observed to pass another. Facilitate climb/descent by observation of a passing and not delaying the approval until a procedural standard has been achieved.
- c. Procedural separation tolerances could be reduced for one aircraft when separating one equipped and one non equipped aircraft
- d. Reduced distances flown
- e. Reduced flight delays and increased predictability of flight times where existing delays are the result of application of restrictive procedural standards.

The level of benefit is significantly higher when both conflicting aircraft are equipped with ADS-B. As the percentage of equipped aircraft rises, the overall benefit rises exponentially since the chance of conflicting pairs of aircraft both being equipped has risen exponentially.

3. Cockpit Workload benefit

3.1 For the equipped aircraft, within the coverage area, there will be no requirement for pilots to issue position reports to ATC because ADS-B reports to ATC automatically.

4. User Preferred Routes

4.1 User Preferred routes are flight planned routes which are optimised for the characteristics of the individual aircraft, its payload and the wind environment of the day.

4.2 In today’s environment the expected lateral conflict points, where routes cross, can be calculated at the time of the design of the route structure. However, when aircraft are flying UPRs, the lateral separation limit points need to be calculated or assessed for each pair of aircraft. This required “on the spot” calculation by the controller is workload intensive.

4.3 ATC can manage UPRs today if there are very few aircraft. However, as the number of aircraft flying UPRs increases tools are required to provide situational awareness, detect conflict and manage the resolution of conflict and relieve controller workload.

4.4 Surveillance, whilst not providing the entire answer, can significantly support ATC in this environment through provision of “current position” data and in some cases, the next/next +1 waypoint data. The workload is significantly decreased compared to procedural control and this in turn supports the introduction of UPR.

4.5 In addition, once conflicting aircraft are not flying the same trajectory, longitudinal separation standards will not be able to be applied (the aircraft aren’t flying to/from the same point). Without surveillance, the loss of ability to apply longitudinal standards will bring operational restrictions.

5. Flow management benefit

5.1 Additional surveillance coverage near major airports could provide marginally better estimates for flow management systems due to the ability for feeder fix estimates to be automatically updated. Better estimates will improve the performance of the ATC system in allocating and defining the arrival sequence and minimising lost “slots” into those locations served by a dynamic flow management system. It assists maintaining maximum acceptance capacity.

5.2 ADS-B updates of the flight plan estimates could flow into a flow management system.

6. Cockpit display safety benefit

6.1 Once aircraft are equipped with ADS-B out, the potential exists for the display of ADS-B tracks on TCAS displays. Equipage of TCAS enhancements is NOT required at the same time as ADS-B out. The presentation of ADS-B data to pilots has some advantages because:

- a) The position of aircraft at greater ranges than already displayed by TCAS is possible
- b) track intent (velocity vector) is available in ADS-B
- c) aircraft identity is available in ADS-B
- d) TCAS traffic display “range” is enhanced for ADS-B tracks (because TCAS cannot measure position very well). In addition, TCAS filters based upon altitude.

7. Remote airport benefits

7.1 If equipped aircraft operate into remote airports, there is the potential for increased arrival and departure rates if existing procedural standards do not need to be applied.

8. Operational control Benefit

8.1 Some ATC providers provide a display to Airlines of the position of the airline’s aircraft. The objective of this tool is to improve operational control particularly the airport servicing and management of flights. The capabilities of this system would be enhanced by ADS-B allowing the displayed Air Traffic situation of company flights when outside radar coverage.

9. Recommendation

9.1 The meeting is invited to note the benefits that may accrue to national and international aircraft with the deployment of ADS-B out and ADS-B ground stations in areas not currently served by radar.

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