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

DIRECT ADS-B SAFETY BENEFITS

SUMMARY

Early deployment of ADS-B in areas which currently have no radar can bring immediate safety benefits.

(Presented by Australia)

1. Background

1.1 Modern air traffic control systems are used for both radar and non radar environments. In non radar environments there are many possible errors that can impact safety.

1.2 In a radar and ADS_C environments automated detection of errors is used as follows:

- Route adherence monitoring (RAM) detects when an aircraft is operating outside the planned route/clearance
- Cleared level adherence monitoring (CLAM) detects when an aircraft is operating at a different level to that expected by the ATC system
- Danger area infringement warning (DAIW) detects when an aircraft is predicted to infringe a an active restricted or dangerous area .
- Short Term Conflict Alerts detects when aircraft are prediected to infringe the defined separation standard
- Minimum safe altitude warning (MSAW) detects when aircraft are predicted to conflict with mountains or high objects such as towers.
- Estimated time over alerts (ETO) detects when the estimates provided by pilots are at variance with the aircraft performance and associated wind models taking into account the known aircraft position. Estimates are used in procedural control and are used in the coordination between FIRs to assure separation.

- Missed position report (MPR) alerts detect when an aircraft has not reported over a reporting point or has not been automatically detected overflying a defined reporting point.
- ADS Route Conformance Warning (ARCW) or FLIPCY detects mismatches between avionics route data and ATC held flight plan route data.

ADS-B can also be used to support the above alerting mechanisms.

2. A sample of ATS Incidents in Australia

2.1 Airservices Australia collects data on air traffic incidents reports. The number of these incidents is not comparable to the incident counts used by other agencies due to the different methods of collecting and cataloguing these events.

2.2 The data from 1/8/2001 to 1/8/2002 regarding ATC & pilot attributable incidents was analysed. The data was imported into a database and categorised depending on whether the incident would have been likely detected using ADS-B.

2.3 Data relating to incidents at foreign FIR boundaries was treated separately.

2.4 Incidents on the high ocean outside of possible ADS-B coverage have been categorised non ADS-B because ADS_B coverage would not have been possible. Incidents inside existing radar coverage have also been treated the same way. The incidents were categorised as shown in the results below.

3. Domestic ATS Incident reports

The following details the incident reports attributable to the domestic ATC environment.

Not relevant to ADS-B	118
Aircraft at wrong level [detectable by CLAM]	19
Aircraft co-ordinated with wrong time estimate [detectable with ETO]	5
Aircraft on wrong route or not on planned route [detectable by RAM and/or ARCW-FLIPCY]	2
Aircraft not coordinated with another controller within the agreed rules eg: no coordination received [detectable by position display]	5
TOTAL	149

4. Foreign FIR boundary ATS Incidents

The following details the incident reports attributable to the boundary between the domestic and foreign ATC providers.

Aircraft at wrong level [detectable by CLAM]	27
Aircraft co-ordinated with wrong time estimate [detectable with ETO]	10
Aircraft on wrong route or not on planned route [detectable by RAM and/or ARCW-FLIPCY]	7
Aircraft not coordinated at all : ie no coordination received [detectable by position display]	21
Aircraft not coordinated with another controller within the agreed rules eg: late [detectable by position display]	12
Total	120

5. Pilot attributed Incidents

The following details the incident reports attributable to pilots in the Australian FIR indicating where ADS_B may have allowed identification of the error earlier.

Not relevant to ADS-B	88
Aircraft at wrong level [detectable by CLAM]	16
Aircraft with wrong time estimate [detectable with ETO]	12
Aircraft on wrong route or not on planned route [detectable by RAM and/or ARCW-FLIPCY]	13
Aircraft hadn't advised presence ie no departure call etc [detectable by position display]	3
Aircraft didn't coordinate change in required time [detectable by position display]	2
Total	134

6. Discussion

The results suggest that ADS-B deployment could have a significant impact on the safety of operations in airspace that is currently non radar.

In addition, it is possible that additional "incidents" could be occurring in this airspace and are not reported since no systematic surveillance is available.

Early detection of "disconnects" between pilot and controller can be achieved through surveillance.

In addition, at FIR boundaries, "disconnects" between FIR1 and FIR2 can also be detected.
The boundary is characterised by the fact that the region is managed by two independent ATC systems each with their own "flight plan databases" leading to the possibility of different data being held.

ADS-B could be particularly advantageous at the FIR boundaries. The ability to detect misunderstandings where this discontinuity exists could improve safety significantly.

7. Recommendations

The meeting note the importance and capability of ADS-B to detect potential ATC or pilot errors and hence significantly improve safety.

It is recommended that ADS-B deployment be expedited to bring this safety benefit to aircraft operations as soon as possible.

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