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 4: Review States' activities and interregional issues on implementation of ADS-B and multilateration

ADS-B BLACKLISTING – A RISK MANAGEMENT APPROACH

(Presented by Australia and Canada)

SUMMARY

Australia and Canada both conducted risk assessments associated with Boeing B787 ADS-B operations (IP/04 refers).

This paper discusses the approaches taken and outcomes for each ANSP.

1. Introduction

1.1 The identification of the extrapolation defect in the B787, leading to credible but wrong position data being transmitted to ATC and other aircraft, caused both Airservices Australia and NAV CANADA to consider the impact to ATS operations. This involved the application of each organisations' risk management framework to the issue, with consideration of both operational risk and service impacts.

2. The Australian situation

2.1 Airservices Australia first became aware of the B787 extrapolation defect on 29th October 2014, when a Jetstar B787 exhibited a significant track jump after appearing to deviate from planned route. Subsequent investigations showed this airframe had exhibited similar, unreported events in Australian airspace, as well as a similar, reported event in the Singapore FIR.

2.2 In discussions with the aircraft operator, the immediate response was to ensure a changeover of aircraft transponder, and a few days later, a swap out of the "faulty" transponder. Airservices Australia continued to monitor the aircraft each day over the next 2 weeks, without seeing a recurrence of the problem. In the absence of a root cause being determined, we reverted to normal operations, though investigations into the root cause were ongoing.

2.3 As more information became available, and more aircraft (internationally) were seen to exhibit the problem, we became concerned that there was a random, infrequent but somehow systematic defect within the B787 fleet. The root cause remained unknown, but there was enough information to prompt Airservices to undertake a risk assessment associated with B787 operations; this would inform a decision regarding "blacklisting" or not the B787 fleet from receiving ADS-B services.

2.4 The Airservices Australia Risk Management framework is based around the identification of hazards, assessing the likelihood and consequence associated with the hazard, and then assigning a risk rating. Risks are rated from A (unacceptable) through to D (acceptable).
The residual risk is then accepted at the appropriate management level, once applicable risk controls are implemented.

Airservices had previously identified a Hazard associated with ADS-B operations:
Incorrect ADS-B data used to maintain separation contributes to a Loss of Separation or ATC coordination error.

This had previously been assessed as a Class C operational risk, which would be reduced to Class D through implementation of ADS-B Blacklist procedures for aircraft known to exhibit ADS-B avionics defects.

2.5 Any decision to "blacklist" the B787 fleet would have had significant service impacts in Australia. The majority of the Australian continental airspace (beyond SSR coverage) has an ADS-B mandate for operations at/above FL290. Aircraft subject to the ADS-B Blacklist are considered as "not equipped", as their data is not displayed to ATC, and therefore would be required to operate FL280 or below. At the time of the risk assessment, the following arguments were considered against blacklisting:

- *The issue is currently seen as random, and not necessarily predictable, but is typically transient in nature.*
- *The majority of the time, and for the majority of B787 aircraft (defect has been reported on 5 out of 210 delivered aircraft), the ADS-B data is accurate.*
- *Route adherence safety net alerts exist within Eurocat to detect deviations from flight planned track beyond defined thresholds. Thus ATC would be alerted to the deviation.*
- *Blacklisting all B787 aircraft would remove the safety benefits of ATC surveillance and safety nets from all operators. These benefits are significant and valid the majority of the time for all operators.*
- *Essentially the decision requires balancing of cost/benefit associated with blacklisting. The costs being service and economic impacts imposed on B787 operators through confining operations to below FL290, as well as the loss of valid ADS-B safety net alerting to ATC for the aircraft; the benefits being an ALARP safety outcome through a reduction in the risk of a loss of separation due to erroneous ADS-B data (from Class C to Class D).*
- *The defect can be managed by the aircraft operator by swapping out the faulty ISSPU.*

Knowledge gained since conducting the risk assessment suggests the last statement is not correct, but the core message remains consistent.

In addition, the area of ADS-B only airspace is low - medium traffic density, however ADS-B based separation standards (5nm minimum) are routinely applied.

2.6 The risk assessment concluded that although the likelihood of the hazard occurring due to this defect, and therefore the operational risk, was increased, it remained at the "Class C" level, and the Chief Air Traffic Controller accepted the risk associated with NOT blacklisting B787 aircraft for ADS-B airspace. Air Traffic Controllers were notified of the issue via an "Operational Circular", so that if they observed the extrapolation error, they would have some background context and be able to respond to it.

2.7 Airservices Australia did, however, blacklist B787 aircraft within the A-SMGCS systems at Brisbane, Sydney and Melbourne airports. In these environments, there would be no operational or service impact, as the multilateration function provided the surveillance input.

3. The Canadian situation

3.1 On July 1st 2014, in the Gander Flight Information Region, NAV CANADA observed a B787 transmit a series of valid ADS-B positions, indicating that the aircraft was deviating from the flight plan route. The ADS-B reports continued on a diverging course to a point some 38 NM from the flight plan route. At this point, the aircraft was operating in the ADS-B coverage volume of Prins Christian Sund, beyond the range of secondary surveillance radar.

3.2 Just prior to exiting the ADS-B coverage area, the aircraft was observed jumping back to the flight plan route, and the subsequent ADS-C report matched that position. While the aircraft was observed deviating on ATC's situational display, the flight crew insisted to the controller that they were in fact on course.

3.3 The airline was notified and they removed what was suspected to be a faulty Integrated Surveillance System (ISS) processor. This anomaly was deemed a single occurrence, and no further incidences had been detected in Canadian airspace.

3.4 During ADS-B coordination meetings on December 3rd 2014, it was discovered that Airservices Australia observed a similar incident, and following that meeting the FAA uncovered additional cases of B787 position reporting anomalies.

3.5 NAV CANADA signed a proprietary information agreement with Boeing on December 4th 2014, to allow the release of data associated with the observed position reporting anomaly.

3.6 Boeing was initially unable to duplicate the anomaly, and they provided an update on January 14th 2015, stating they would require several months of cooperative data-gathering and analysis to source and provide a rectification.

3.7 ADS-B is not currently mandated anywhere in Canadian airspace but, after installing a number of ground stations to increase surveillance coverage beyond the limits of secondary surveillance radar, NAV CANADA was granted permission to apply reduced separation for aircraft appropriately equipped with ADS-B.

3.8 NAV CANADA's permission to provide reduced separation using ADS-B is based on the premise that ADS-B position reports contain integrity values (NIC, NAC, NUC, SIL) that provide assurances for their use by ATC. The position anomalies generated by the B787 ISS are the first of their kind, and appeared to be a critical failure in the system; the provision of data with false integrity.

3.9 NAV CANADA reviewed the nature of this error source against the assessment process which permitted ADS-B to be used as a surveillance source. This particular scenario of an aircraft continuing to report position with the required integrity values when it is in fact not in that position, was never imagined, nor covered, during any of NAV CANADA's hazard identification and risk analysis work.

3.10 Based on this, NAV CANADA decided to exclude all B787s from ADS-B surveillance separation services and took the necessary actions, including notification of stakeholders. Canada's regulator was notified, and all B787 aircraft on NAV CANADA's eligibility list were removed until the anomaly could be corrected.

3.11 Fortunately, the customer impact in Canada was limited. Out of 3977 aircraft on the eligibility list, NAV CANADA was only providing reduced separation services using ADS-B to approximately 71 B787 airframes, operated by 12 different airlines. This represented less than two percent of known ADS-B airframes.

3.12 At the time, the operational impact with respect to having procedural separation standards applied to these 71 airframes had not been fully assessed. If the customer impact was determined to be significant, NAV CANADA had committed to investigate alternative mitigations.

4. Summary

4.1 In the process of managing the B787 ADS-B extrapolation defect, both Australia and Canada conducted risk assessments regarding the continued use of the ADS-B data for Air Traffic Control services. Both organisations balanced the service impacts and operational risks, and due to the different operating environments came to different, but equally valid, conclusions. Canada decided to blacklist the B787 fleet, while continuing to provide non-surveillance separation services to aircraft at preferred flight levels in non-mandate airspace, while Australia chose to continue to provide ADS-B services in it's mandatory airspace.

5. Action by the meeting

5.1 The meeting is invited to:

a) note the information contained in this IP; and

b) discuss any relevant matters as appropriate.

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