International Civil Aviation Organization

Tenth Meeting of the Surveillance Implementation Coordination Group (SURICG/10)

Bangkok, Thailand, 21 - 23 April 2025

Agenda Item 8: Update on surveillance activities and explore potential cooperation opportunity

SURVEILLANCE ACTIVITIES IN SINGAPORE

(Presented by Singapore)

SUMMARY

This paper provides information on surveillance activities in Singapore.

1. INTRODUCTION

1.1 This paper provides a summary on the Surveillance activities in Singapore

2. DISCUSSION

2.1 Surveillance Activities in Singapore

Radars

2.1.1 The Civil Aviation Authority of Singapore (CAAS) has two terminal radars and one long range radar. Each of the radars comprises of primary and secondary antennae. All three radars are Mode S radars. Currently, all three radars are using II codes. CAAS is planning to replace the long range radar and one of the terminal radars by 2029/2030. CAAS will take the opportunity of the replacement to migrate from II to SI codes for these two radars.

A-SMGCS

2.1.2 Singapore Changi Airport has an A-SMGCS to support aerodrome operations. The surveillance sensors of the A-SMGCS include three X-band surface movement radars (SMRs) and the surface Multilateration (MLAT) system. They provide surveillance coverage for the three runways and the manoeuvring areas between them. Routing and guidance capabilities are included within the A-SMGCS system.

ADS-B

2.1.3 Recognizing the improved safety and operational benefits from the use of ADS-B, CAAS embarked on data-sharing collaborations with counterparts in Brunei, Indonesia, Philippines and Viet Nam. Under such arrangements, neighbouring States share the data from their ADS-B facilities with Singapore. The ADS-B coverage from the data-sharing collaboration helped to provide surveillance coverage for most of Singapore FIR.

2.1.4 Space-based ADS-B was introduced in 2019 to provide an additional surveillance source. With the expanded surveillance coverage from these collaborations, the overall situation awareness and safety is enhanced within the Singapore FIR.

ADS-C/CPDLC

2.1.5 ADS-C and CPDLC services are available to suitably equipped aircraft operating on selected ATS routes outside radar cover and not in ADS-B exclusive airspace within the Singapore FIR.

Use of Mode S Downlinked Aircraft Parameters (DAPS)

2.1.6 The ATM automation system was upgraded in mid-2018 with the capability to display the following DAPS information to controllers:

a) Aircraft Identification (BDS code 2, 0).
b) ACAS Resolution Advisory notification (BDS code 3, 0)
c) Final State Selected Altitude (FSSA) (part of Selected Vertical Intention, BDS code 4, 0)
d) Indicated Airspeed (part of Heading and Speed report, BDS code 6, 0)
e) Mach Number (part of Heading and Speed report, BDS code 6, 0)
f) Magnetic Heading (part of Heading and Speed report, BDS code 6, 0)

2.1.7 This enhancement adds the capability to process DAPs by the multi-sensor tracking system and safety net functions.

2.1.8 An alert will be presented to the controller via the aircraft label for aircraft with Executive Flight Level – Final State Selected Altitude (FSSA) mismatch. A preset timeout is applied to allow for the new levels to be set and validated in the cockpit to prevent unwanted alerts.

2.1.9 On receipt of ACAS Resolution Advisory notification, a prominent notification is displayed in a field which may be acknowledged. The indication is removed when the ACAS RA is resolved.

2.1.10 Indicated airspeed, Mach number and magnetic heading downlinked information can be retrieved by the controller via deliberate selection of the extended aircraft label. This is to avoid increasing the size of the aircraft label unnecessarily.

2.2 Equipage Requirements

Requirements for ADS-B out exclusive airspace

2.2.1 With the implementation of ADS-B services along selected ATS routes in the Singapore FIR, reduced longitudinal separation is applied in conjunction with Direct Controller Pilot Communication (DCPC)/VHF capabilities.

2.2.2 The ADS-B equipment for aircraft using the ADS-B out exclusive airspace must meet the following standard:

a) *European Aviation Safety Agency - Certification Considerations for the Enhanced ATS in Non-Radar Areas using ADS-B Surveillance (ADS-B-NRA) Application via 1090 MHZ Extended Squitter (AMC 20-24), or*

b) *European Aviation Safety Agency - Certification Specifications and Acceptable Means of Compliance for Airborne Communications, Navigation and Surveillance (CS-ACNS) Subpart D – Surveillance (SUR) (CS-ACNS.D.ADS-B), or*

c) *Federal Aviation Administration – Advisory Circular No: 20-165A (or later versions) Airworthiness Approval of Automatic Dependent Surveillance – Broadcast (ADS-B) Out Systems, or*

d) *An 'approved ADS-B-Out equipment configuration' as specified in Part 91 (General Operating and Flight Rules) Manual of Standards 2020, issued by the Civil Aviation Safety Authority of Australia.*

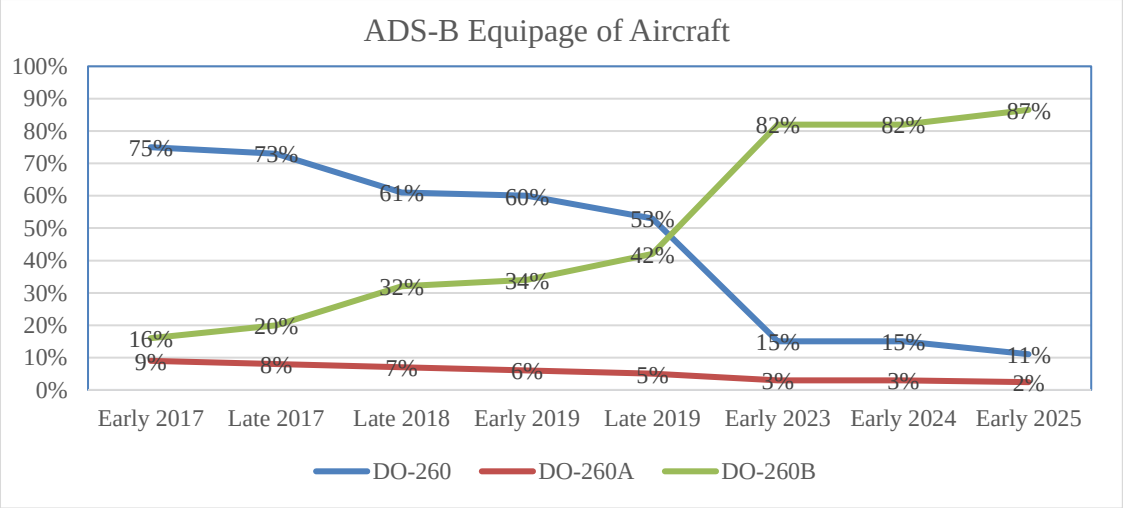
Requirements for Airport Surface

2.2.3 As Changi Airport is using the surface MLAT system, aircraft operating at Changi Airport must be equipped with Mode S transponders. The requirement is as follows:

2.2.4 Carriage and operation of Mode-S is required for all civil aircraft operating at Singapore Changi Airport. The Mode-S transponder shall comply, at least, to the requirement of Level 2 as prescribed in ICAO Annex 10 Volume IV (Amendment 77 or later) Standards and Recommended Practices.

2.3 ADS-B Equipage of Aircraft

2.3.1 ADS-B equipage was monitored over the last few years. The distribution of DO-260, D0-260A2 and DO-260B avionics equipage of the aircraft are as shown in the Figure 1 below.



2.3.2 The share of DO-260B aircraft continued to increase as old aircraft with DO-260 or DO-260A are being replaced with new aircraft equipped with DO-260B.

2.3.3 A study was also conducted on the equipage status of Singapore registered operators and the results are tabulated below:

[1] 2020 to 2022 data not available due to low traffic during COVID-19 period.

Aircraft Type	Avionics Type		
	DO-260	DO-260A	DO-260B
A320	25	0	2
A321	0	0	8
A350	0	0	65
A380	0	0	10
B737	7	0	16
B747	0	0	6
B777	0	0	27
B787	0	0	46
E190	0	0	5
Total	31	0	185
Grand Total	**216**		

Table 1: Status of Singapore registered operators as of January 2025

Avionics Type	Number of aircraft	Percentage
DO-260	31	14%
DO-260A	0	0%
DO-260B	185	86%
Total	**216**	**100%**

Table 2: Distribution of avionics type for Singapore registered operators

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper; and

b) discuss any relevant matter as appropriate

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