Automatic Dependent Surveillance-Broadcast (ADS-B) Out

White Paper

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AC	Advisory Circular
ADS-B	Automatic Dependent Surveillance-Broadcast
AIC	Aircraft Information Circular
AIP	Aeronautical Information Publication
ATC	Air Traffic Control
ATS	Air Traffic Service
CofA	Certificate of Airworthiness
Corp.	Corporation
DO	Direct Order
EASA	European Union Aviation Safety Agency
FAA	Federal Aviation Administration
FIR	Flight Information Region
FL	Flight Level
FMS	Flight Management System
ft	feet
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
Global	Global Aerospace Design Corporation
knots	nautical mile
LOA	Letter of Authorization
MTOW	Max Takeoff Weight
NM	Nautical mile
RTCA	Radio Technical Commission for Aeronautics
STC	Supplemental Type Certificate
SUP	Supplement
TAS	True Airspeed
TSO	Technical Standard Order

REFERENCES

Document	Rev / Date	Title
RTCA/DO-282B	02-December 2009	Minimum Operational Performance Standards for Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B)
RTCA/DO-260B	17-December 2020	Minimum Operational Performance Standards for 1090 MHz Automatic Dependent Surveillance-Broadcast (ADS-B)
TSO C-154c	02-December 2009	Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz
TSO C-166b	02-December 2009	Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 MHz
TSO C-195a	12-April 2015	Avionics Supporting Automatic Dependent Surveillance-Broadcast (ADS-B) Aircraft Surveillance Applications
AC 20-165a	11-July 2012	Airworthiness Approval of Automatic Dependent Surveillance-Broadcast (ADS-B)
AC 20-138C	08-May 2012	Airworthiness Approval of Positioning and Navigation Systems
AC 20-172B	20-May 2015	Airworthiness Approval of ADS-B in Systems and Applications
AC 90-114	30-December 2019	Automatic Dependent Surveillance-Broadcast (ADS-B) Operations
WHTP-2013-14-05	Feb 2014	Understanding Compliance with Automatic Dependent Surveillance-Broadcast (ADS-B) Out

Document	**Rev / Date**	**Title**
----------	11-March 2021	ADS-B Update 2021 – Where Are We Now
AIC 01/19	01-May 2019	Aeronautical Information Circular, Edward Bodden Airfield – Little Cayman (MWCL)
AIC 10/20	18-May 2020	Aeronautical Information Circular

1 ABOUT GLOBAL AEROSPACE DESIGN CORP.

Global Aerospace Design Corporation (Global) is a technical services organization comprised of a highly experienced engineering staff focused on meeting your aircraft certification needs both in front of and behind the cockpit door. Our depth of experience with projects, ranging from full interior modification projects to complete cockpit upgrades, permits Global to provide technical solutions from nose-to-tail on any aircraft.

Comprised entirely of aircraft engineers, Global has the dedicated focus of maintaining positive cash flow while keeping overhead costs extremely low. This permits direct cost savings to our customers and maximizes our ability to outperform other integration services competitors.

2 AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST (ADS-B) OUT

2.1 Overview

Automatic Dependent Surveillance-Broadcast (ADS-B) Out is an aircraft ground and satellite-based transmission system. This system is a key part of the Federal Aviation Administration's (FAA) and European Union Aviation Safety Agency (EASA) NextGen program. ADS-B Out is intended to increase the safety and efficiency of shared commercial airspace. This system makes aircraft visible in-real-time to Air Traffic Control (ATC) by updating with greater frequency and accuracy. This white paper discusses the system requirements, mandates, and Global's ADS-B Out solution.

2.2 Required Components

The minimum required equipment to support ADS-B Out for FAA approval includes:

- **Extended Squitter Mode S Transponder** – the FAA requires the ADS-B Out transmission or receiving equipment to be approved using either TSO-C154c (UAT) or TSO-C166b (1090Mhz Extended Squitter Transponder). To operate in Class A airspace in accordance with FAR 91.225 extended squitter transponder equipment compliant with TSO-C166b is required. ADS-B Out standards are documented in RTCA DO-260B.
- TSO-C146c approved Flight Management System (FMS)
- TSO-145c and TSO-C190 approved Global Positioning System (GPS)
- ADS-B Out Failure Annunciator

2.3 Mandates

The following table details the ADS-B Out mandates by country:

Country	Mandate Information
United States	As of January 1, 2020, ADS-B Out is required for all aircraft at or above FL100 (excluding airspace from 2,500ft AGL). ADS-B Out is required for aircraft operation below FL100 while: ➢ Operating within class B or C airspace ➢ Operating within 12NM of the coastline of the Gulf of Mexico, at or above, 3,000ft MSL
Europe	European Union Implementing Regulation 1207/2011 has been amended to grant the following extensions: ➢ December 7, 2020 for aircraft being issued with first individual Certificate of Airworthiness on or after December 7, 2020. ➢ June 7, 2023 for aircraft being issued with first individual Certificate of Airworthiness between June 6, 1995 and June 6, 2020. ➢ Aircraft with first individual Certificate of Airworthiness issued before June 6, 1995 will be exempt. Aircraft that have been granted an extension until June 7, 2023 must have a retrofit program established by December 7, 2020 demonstrating compliance prior to June 7, 2023. Certain aircraft are exempt from the mandate, is they meet the following criteria: ➢ Aircraft with individual CofA issued before June 7, 1995. ➢ Aircraft's flight purpose is for maintenance or export. ➢ Aircraft will cease operations by October 31, 2025.
Canada	Space based ADS-B Out is used for surveillance in Class A airspace. Starting January 27, 2022, this will be expanded to Class B airspace.
United Arab Emirates (UAE)	ADS-B Out is mandated in the Emirates FIR for all IFR aircraft, per U.A.E. AIP GEN 1.5 and CAR Part IV Aircraft Operations, CAR OPS 1.867. The ADS-B Out mandate has been delayed until December 2, 2021.

South Africa	A decision regarding a South African ADS-B mandate has been delayed until 2022.
Mexico	Starting January 1, 2022, ADS-B Out will be required for all Mexican airspace IFR Operations.
Australia	ADS-B Out is required for all IFR operations at all flight levels over the following: ➢ Continental Australia ➢ The Arafura Sea ➢ The Great Australian Bight ➢ The Bass Strait
Hong Kong	ADS-B Out is required for all operations above FL285
Saudi Arabia	Starting January 1, 2023, ADS-B Out will be required around major airports in class A, E, and B/C/D airspace.
Indonesia	ADS-B Out is required for all aircraft operating within Jakarta and Ujung Padang FIRs at and above FL245. Additionally, below FL245, ADS-B Out is required in multiple TMA and CTR airspaces; as well as parts of Class D and E airspace.
Seychelles	The initial mandate was supposed to be in effect as of June 7, 2020; however, it has been indefinitely delayed. It is to be applied in the future as follows: All flights within the Seychelles (FSSS) FIR will require ADS-B Out. Some exemptions apply, see AIC 01-19 and AIC 10/20 for more information.

Singapore	ADS-B Out is required for all operations at FL290 and above within the area bounded by: 073605N 1090045E — 040713N 1063543E — 041717N 1061247E (MABLI) 044841N 1052247E (DOLOX) — 045223N 1041442E (ENREP) — 045000N 1034400E North along the Singapore FIR boundary to 070000N 1080000E This area includes the following airways: L642 L644 M753 M771 M904 N891 N892 Q801 Q802 Q803 T611
Sri Lanka	ADS-B Out is required in a certain area, see AIP SUP 02/20 for more information. Aircraft manufactured before January 1, 2020, must be equipped with ADS-B Out in accordance with RTCA DO-260, DO-260A, or DO-260B. Aircraft manufactured on or after January 1, 2020 and have a MTOW exceeding 12,566 lbs. (5,700 kgs.) or has a maximum cruising TAS greater than 250 knots must be equipped with ADS-B Out in accordance with RTCA DO-260B.
Vietnam	ADS-B Out is required for all flights above FL290 within the VVTS FIR whose MTOW is 12,566 lbs. (5,700 kgs.) or greater. ADS-B Out is required for all flights operating above FL290 along airways L625, L628, M765, M768, M771, N500, and N892.
Taiwan	ADS-B Out is required for all aircraft operating within the Taipei FIR at or above FL290.
China	ADS-B Out is required for all flights at or above FL290 if operating in one of the following Urumqi CTA sectors: ZWWWAR02, ZWWWAR03, ZWWWAR05, or ZWWWAR06.

Colombia	The Colombian ADS-B Out mandate has been delayed until April 30, 2022.
India	ADS-B Out is required for aircraft operating at or above FL285 on ATS routes withing continental Indian airspace with designators: L, M, N, P, Q, T, and routes: A201 A347 A465 A474 A791 B211 B466 G450 R457 R460 R461 W15 W19 W20 W29 W41 W46 W45 W47 W56S/N W67 W111 W112 W114 W115 W118 W153
Malaysia	The Malaysian ADS-B Out mandate is being implemented in phases. Phase 2 began on March 25, 2021 Currently, ADS-B Out is required for aircraft operating from FL290 to FL410 within a specified area that will affect the following airway segments: B466 (ANOKO-TOSOK) L510 (EMRAN-GIVAL) L645 (SAMAK-SAPAM) N571 (IGOGU-VAMPI) P574 (NOPEK-ANSAX) P627 (POVUS-RUSET) P628 (IGREX-GIVAL)
New Zealand	ADS-B Out is required for all flights operating at or above FL245 within Transponder Mandatory Controller Airspace. Phase 2 of New Zealand's mandate implementation will begin on December 31, 2021.
French Polynesia/Tahiti	ADS-B Out is required for all aircraft operating at or above FL200. Starting January 1, 2022, the mandate will expand to include the entire NTTT FIR.
Curacao	ADS-B Out is required for all aircraft operating at or above FL290. Starting January 1, 2023, this requirement will extend all the way to the surface.

Mongolia	Starting June 17, 2021, all aircraft operating at or above FL207 must be equipped with ADS-B Out.
New Caledonia	Staring January 1, 2022, all aircraft operating within the New Caledonia sector of Nandi (NFF) FIR must be equipped with ADS-B Out.

2.4 Upgrade Path

Global is the owner of two FAA Supplemental Type Certificates (STC) ST04298CH and ST04298CH; as well as European Union Aviation Safety Agency (EASA) STC 10071068 for the installation of ADS-B Out.

- FAA STC ST04298CH/EASA STC 10071068
  - Rockwell Collins TPR-901 Mode S Transponders
  - Rockwell Collins GLU-920/-925

- FAA STC ST04299CH
  - ACSS XS-950 Mode S Transponders
  - Rockwell Collins GLU-920/-925 or FreeFlight 1203C GNSS

2.5 Certification

In accordance with AC 90-114, ADS-B Out equipment compliant with TSO-C166b or TSO-C143c shall only be installed on OEM production equipment, OEM service bulletin, or Supplemental Type Certificate (STC).

AC 20-165A states that all ADS-B Out complaint systems must include the transmitter/receiver and interfacing equipment in the STC.

Furthermore, in addition to the STC an FAA Letter of Authorization (LOA) will be required for approval to operate outside of U.S. airspace upon STC issuance.

3 CONCLUSION

The ADS-B Out mandate in conjunction with the FAA's NextGen program aims to create a safer, more efficient airspace by reducing ground holds and improving flight times, ultimately, creating a safer and more enjoyable form of transportation for the millions of travelers flying every day. Global is continually working on expanding our ADS-B Out solution offerings. For more information regarding our ADS-B Out solutions contact us at info@gadc.aero or by visiting www.gadc.aero.

4 GLOBAL EXPERIENCE

ABOUT US

Located in Cincinnati, Ohio and established in 2012, by a group of talented ex-airline professionals with over 30 years of industry experience, *GLOBAL* is a highly talented engineering team dedicated to meeting all aircraft certification and modification needs.

WHY CHOOSE US

GLOBAL will always treat our customers as though our business depends on it! Our team is known for being highly reactive and responsive to any and all customer needs. We are dedicated to supporting our customers to the highest standard.

AVIONICS

GLOBAL has experience on the flight deck as well as in the cabin. Our team can integrate any system on every type of aircraft.

CABIN INTERIORS

GLOBAL has gone on to complete several interior programs for a wide variety of customers. These programs ranged from minor LOPA changes to complete interior retrofits.

CABIN ELECTRONICS

GLOBAL is able to provide cabin electronics solutions as well. The *GLOBAL* team can provide system integration solutions for all cabin equipment and ensure that everything is fully qualified to be on the airplane.

T-PED TESTING

Transmitting Portable Electric Device testing demonstrates that an aircraft is tolerant to the use of portable electric devices from gate to gate. This testing is a necessary step for the integration of Wi-Fi and wireless in-flight entertainment.

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