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AMENDMENTS

Amendments are announced in the supplements to the *Publications Catalogue*; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

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FOREWORD

Airborne surveillance is rapidly evolving with a number of new capabilities planned for introduction into the flight deck. The ICAO Global Air Navigation Plan (GANP) (Doc 9750) requires that these be interoperable in order to allow aircraft to achieve the same levels of safety and efficiency globally. Airborne surveillance represents a shift in surveillance functionality from traditional ground-based sensors to a comprehensive suite of avionics which will support a range of new, demanding surveillance capabilities and applications. Aircraft position and other airborne parameters are/will be provided by the basic airborne surveillance capability, known as ADS-B OUT. This information is/will be used directly by other aircraft equipped with an advanced capability, known as ADS-B IN, to support both existing applications and some yet to be developed.

This manual introduces several airborne surveillance capabilities such as Basic Airborne Situational Awareness (AIRB), Visual Separation on Approach (VSA) and Basic Surface Situational Awareness (SURF) along with the In-Trail Procedure (ITP) application, which were introduced in the aviation system block upgrades (ASBUs) supporting GANP (fourth edition).

The ASBUs contain modules which rely on ADS-B Standards, both for ADS-B OUT (B0-ASUR: Initial capability for ground surveillance) and for ADS-B IN, which are the key enablers for airborne surveillance. Their evolution is described in specific threads related to Airborne Surveillance Applications (ASA) (B0-ASEP: Air traffic situational awareness (ATSA), to B2-ASEP: Airborne Separation (ASEP)), as well as airborne collision avoidance (B0-ACAS: ACAS improvements and B2-ACAS: new collision avoidance system).

Future airborne ADS-B IN applications which involve separation minima less than current radar separation standards may require changes in the Airborne Collision Avoidance System (ACAS). Therefore, implementations of various airborne ADS-B IN applications are expected to be dependent on the availability for implementation of a new collision avoidance system.

For surface applications, it is pointed out that SURF and SURF-IA (B1-SURF: Enhanced safety and efficiency of surface operations – SURF, SURF-IA and enhanced vision systems (EVS)) are expected to complement A-SMGCS levels 1 and 2 (B0-SURF: Safety and efficiency of surface operations (A-SMGCS Levels 1-2)) and A-SMGCS levels 3 and 4 (B2-SURF: Optimized surface routing and safety benefits (A-SMGCS Levels 3-4 and synthetic vision systems (SVS))).

This manual has been developed by the Airborne Surveillance Task Force (ASTAF) that was established by ICAO in 2010 as a multidisciplinary team of experts for the timely development of ICAO provisions to ensure global uniformity and interoperability of operations based on the use of ADS-B on the flight deck. Three main objectives of this manual are as follows:

- a) to support the implementation of ASA and the initial airborne surveillance capabilities for which some industrial solutions are already available and in operational use;
- b) to present guidance material and references related to the standards and recommended practices (SARPs), the procedures for air navigation services (PANS) and relevant industry standards documents, i.e. safety, performance and interoperability requirements (SPR) and minimum operational performance standards (MOPS); and

- c) to summarize and recapitulate within an ICAO document the main results of the work carried out in the air traffic management (ATM) community supported by ADS-B, which is recognized as an essential enabler of the ICAO global concept of operations.

The manual will be updated to incorporate additional ASA when they are made available to the global ATM community.

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Glossary

ABBREVIATIONS

ACAS	Airborne collision avoidance system
ACID	Aircraft identification
ADS-B	Automatic dependent surveillance–broadcast
AIRB	Basic Airborne Situational Awareness
ANSP	Air navigation service provider
ASA	Airborne surveillance application(s)
ASBU	Aviation System Block Upgrade
ASSAP	Airborne surveillance and separation assurance processing
ASTAF	Airborne Surveillance Task Force
ATC	Air traffic control
ATM	Air traffic management
ATS	Air traffic services
ATSA	Air traffic situational awareness
CAA	Civil aviation authority
CAVS	CDTI assisted visual separation
CDTI	Cockpit display of traffic information
CPDLC	Controller pilot data link communications
CRM	Crew resource management
EASA	European Aviation Safety Agency
EUROCAE	European Organization for Civil Aviation Equipment
FIM	Flight-deck based interval management
FMS	Flight management system
FUA	Flexible use of airspace
GBAS	Ground-based augmentation system
GNSS	Global navigation satellite system
HMI	Human machine interface
ICAO	International Civil Aviation Organization
IFR	Instrument flight rules
IM	Interval management
IMC	Instrument meteorological conditions
ITP	In-trail procedure
MLAT	Multilateration (systems)
MOPS	Minimum operational performance standards
NAC	Navigation accuracy category
NIC	Navigation integrity category
NUC	Navigation uncertainty category
OEM	Original equipment manufacturer
OSA	Operational safety assessment
RSI	Runway status indication
SBAS	Satellite-based augmentation system
SESAR	Single European Sky ATM Research
SIL	Source integrity level (ADS-B version 2)
SIL	Surveillance integrity level (ADS-B version 1)
SOP	Standard operating procedures

SPR	Safety, performance and interoperability requirements
SSR	Secondary surveillance radar
SURF	Basic Surface Situational Awareness
TIS-B	Traffic information service—broadcast
TLS	Target Level of Safety
VFR	Visual flight rules
VMC	Visual meteorological conditions
VSA	Visual separation on approach
WAM	Wide Area Multilateration

DEFINITIONS

Accuracy (for position and velocity information). Accuracy is the degree of conformance between a platform's true position and/or velocity and its estimated or reported position and/or velocity.

Airborne surveillance and separation assurance processing (ASSAP). The processing of surveillance and other data in support of ASA. ASSAP Function that processes surveillance data using ADS-B reports from the ADS-B receive function, and performs application-specific processing.

Airborne surveillance application (ASA). A set of operational procedures for controllers and pilots that makes use of the capabilities of airborne surveillance to meet a clearly defined operational goal.

Airborne surveillance capability. An installation into a flight deck that receives/processes surveillance data. and displays relevant information to the pilot.

Airborne traffic situational awareness applications. These applications are aimed at enhancing the pilots' knowledge of the surrounding traffic situation, both in the air and on the airport surface, and thus improving the pilots' decision process for the safe and efficient management of their flight.

Aircraft address. A unique combination of 24 bits available for assignment to an aircraft for the purpose of air-ground communications, navigation and surveillance.

Aircraft identification (ACID). A group of letters, figures or a combination thereof which is either identical to, or the coded equivalent of, the aircraft call sign to be used in air-ground communications, and which is used to identify the aircraft in ground-ground air traffic services communications.

Automatic dependent surveillance–broadcast (ADS-B) OUT. A function on an aircraft or vehicle that periodically broadcasts its state vector (position and velocity) and other information derived from on-board systems in a format suitable for ADS-B IN capable receivers.

Automatic dependent surveillance–broadcast (ADS-B) IN. A function that receives surveillance data from ADS-B OUT data sources.

Closing ground speed. The difference between the ITP aircraft's ground speed and a reference aircraft's ground speed, used to determine the reduction in ITP distance.

Closing Mach speed. The difference between the ITP aircraft's Mach speed and a reference aircraft's Mach speed, used to determine the reduction in ITP distance.

Cockpit display of traffic information (CDTI). The pilot interface portion of the aircraft surveillance applications system. This interface includes traffic display(s) and all the controls that interact with such a display.

Conflict. A predicted violation of parameterized minimum separation criteria for adverse weather, aircraft traffic, special use airspace, other airspace, turbulence, noise sensitive areas, terrain and obstacles, etc.

Essential traffic. Essential traffic is that controlled traffic to which the provision of separation by ATC is applicable, but which, in relation to a particular controlled flight is not, or will not be, separated from other controlled traffic by the appropriate separation minimum.

Free text message element. A message element used to convey information not conforming to any standardized message element in the CPDLC message set.

Ground speed. The speed of an airborne aircraft relative to the ground.

Hazard. Any real or potential condition that can cause injury, illness, or death to people; damage to or loss of a system, equipment, or property; or damage to the environment.

Horizontal velocity. The horizontal component of velocity relative to a ground reference.

IM aircraft. An aircraft that is equipped with FIM Equipment that is instructed to perform an IM Operation.

Interval. The horizontal along-path spacing between the IM and target aircraft. The interval may be specified in time or distance.

ITP aircraft. An aircraft approved by the State of the Operator to conduct in-trail procedure (ITP).

ITP distance. The distance between the ITP aircraft and a reference aircraft as defined by:

- a) for aircraft on the same track, the difference in distance to an aircraft calculated common point along a projection of each other's track; or
- b) for aircraft on parallel tracks, the distance measured along the track of one of the aircraft using its calculated position and the point abeam the calculated position of the other aircraft.

Note.— Reference aircraft refers to one or two aircraft with ADS-B data that meet the ITP criteria described in paragraph 5.4.2.7 in the Procedures for Air Navigation Services — Air Traffic Management (PANS ATM) and are indicated to ATC by the ITP aircraft as part of the ITP clearance request.

ITP equipment. All avionics which are involved in the execution of ITP functions needed to support or perform the ADS-B in-trail procedure (ITP).

ITP separation minimum. As described in 5.4.2.7.3 in the PANS-ATM, Longitudinal separation between a climbing or descending ITP aircraft and reference aircraft shall be applied in accordance with 5.4.2.7.3.1, 5.4.2.7.3.2 and 5.4.2.7.3.3 in the PANS-ATM (Doc 4444).

Own aircraft. From the perspective of a flight crew, or of the ASSAP and CDTI functions used by that flight crew, the own aircraft is the ASA participant that carries that flight crew and those ASSAP and CDTI functions.

Partial equipage. An environment where not all aircraft are equipped with avionics system which is certified to support the airborne surveillance applications / capabilities under consideration.

Performance requirements. Minimum requirements needed for the application to function properly under nominal (no fault) conditions, and are generally quantitative in nature.

Preceding aircraft. The aircraft ahead of the one performing the VSA.

Pre-formatted free text message element. A free text message element that is stored within the aircraft system or ground system for selection.

Procedural control. Term used to indicate that information derived from an ATS surveillance system is not required for the provision of air traffic control service.

Procedural separation. The separation used when providing procedural control.

Runway status indication (RSI). Runway Status Indications (RSIs) are provided if the flight crew should verify runway status prior to proceeding.

Safety requirement. A safety requirement is a risk mitigation means that when implemented will help the system meet the safety objective.

Secondary surveillance radar (SSR). A surveillance radar system which uses transmitters/receivers (interrogators) and transponders.

Separation. The generic term used to describe action on the part of ATC in order to keep aircraft, operating in the same general area, at such distances from each other that the risk of their colliding with each other is reduced.

Standardized free text message element. A message element that uses a defined free text message format, using specific words in a specific order.

Note.— Standardized free text message elements may be manually entered by the user or pre-formatted.

State (vector). An aircraft's current horizontal position, vertical position, horizontal velocity, vertical velocity, and navigational accuracy and integrity.

Succeeding aircraft. The aircraft performing VSA and maintaining own visual separation from the Preceding Aircraft.

Surveillance radar. Radar equipment used to determine the position of an aircraft in range and azimuth.

Target aircraft. A designated aircraft from which the IM aircraft achieves and/or maintains an assigned spacing goal.

Target level of safety (TLS). A generic term representing the level of risk which is considered acceptable in particular circumstances.

Track. (1) A sequence of reports from the ASSAP function that all pertain to the same traffic target. (2) Within the ASSAP function, a sequence of estimates of traffic target state that all pertain to the same traffic target.

Traffic Display. The graphical plan-view (top down) traffic display of the CDTI.

Traffic indication (TI). Traffic indications are provided by SURF-IA if there could be a collision hazard in the immediate future.

Traffic information. Information issued by an air traffic services unit to alert a pilot to other known or observed air traffic which may be in proximity to the position or intended route of flight and to help the pilot avoid a collision.

Traffic information service – broadcast (TIS-B). A function on ground systems that broadcasts an ADS-B-like message that includes current position information of aircraft/vehicles within its surveillance volume.

Note.— This technique can be achieved through different data links. The requirements for Mode S extended squitters are specified in Annex 10, Volume IV, Chapter 5. The requirements for VHF digital link (VDL) Mode 4 and universal access transceiver (UAT) are specified in Annex 10, Volume III, Part I.

Traffic symbol. A depiction on the traffic display of an aircraft or vehicle other than the own aircraft.

Vertical direction. An indication whether the traffic is climbing, descending or maintaining the altitude/level.

PUBLICATIONS REFERRED TO IN THIS DOCUMENT***International Civil Aviation Organization (ICAO)***

Annex 2 — Rules of the Air

Annex 6 — Operation of Aircraft

- *Part I — International Commercial Air Transport — Aeroplanes*
- *Part II — International General Aviation — Aeroplanes*
- *Part III — International Operations — Helicopters*

Annex 10 — Aeronautical Telecommunications

- *Volume I — Radio Navigation Aids*
- *Volume II — Communications procedures including those with PANS status*
- *Volume III — Communications Systems*
- *Volume IV — Surveillance Radar and Collision Avoidance Systems*
- *Volume V — Aeronautical Radio Frequency Spectrum Utilization*

Annex 11 — Air Traffic Services

Annex 14 — Aerodromes

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Safety, Performance and Interoperability Requirements Document for Enhanced Traffic Situational Awareness during Flight Operations (ATSA-AIRB), RTCA DO-319 / EUROCAE ED-164

Safety, Performance and Interoperability Requirements Document for Enhanced Visual Separation on Approach (ATSA-VSA), RTCA DO-314 / EUROCAE ED-160

Safety, Performance and Interoperability Requirements Document for ATSA-SURF Application, RTCA DO-322 / EUROCAE ED-165

Safety, Performance and Interoperability Requirements Document for the In-Trail Procedure in Oceanic Airspace (ATSA-ITP) Application, RTCA DO-312 / EUROCAE ED-159 and their supplement

Safety Performance and Interoperability Requirements Document for Enhanced Traffic Situational Awareness on the Airport Surface with Indications and Alerts (SURF IA), RTCA DO-323

Safety, Performance and Interoperability Requirements Document for Airborne Spacing - Flight deck Interval Management (ASPA-FIM), RTCA DO-328 / EUROCAE ED-195

Safety, Performance and Interoperability Requirements Document for Traffic Situation Awareness with Alerts (TSAA), RTCA DO-348 / EUROCAE ED-232

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