



DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 43 and 91

[Docket No. FAA-2023-1836; Amdt. Nos. 43-53 and 91-371]

RIN 2120-AL70

Inclusion of Additional Automatic Dependent Surveillance-Broadcast (ADS-B) Out Technical Standard Orders; Incorporation by Reference

AGENCY: Federal Aviation Administration (FAA), U.S. Department of Transportation (DOT).

ACTION: Direct final rule; request for comments.

SUMMARY: This rulemaking amends the Automatic Dependent Surveillance-Broadcast (ADS-B) Out requirements to allow aircraft meeting the performance requirements in Technical Standard Order (TSO)-C166c (Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Service – Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)), or TSO-C154d, (Universal Access Transceiver (UAT) ADS-B Equipment Operating on the Radio Frequency of 978 Megahertz (MHz)) to meet the regulations. Aircraft equipped with ADS-B Out that meets the performance requirements of either TSO-C166c or TSO-C154d will provide additional information to pilots and air traffic control, including weather information, spectrum monitoring, and airspeed. They will also enable new wake turbulence applications, enhance weather forecasting, and enable or enhance ADS-B In applications such as Flight Interval Management.

DATES: This direct final rule is effective [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

Send comments on or before [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. If the FAA receives an adverse comment, the FAA will advise the public by publishing a document in the *Federal Register* before the effective date of this direct final rule. That document may withdraw the direct final rule in whole or in part.

Incorporation by reference: The incorporation by reference of certain publications listed in this rule is approved by the Director of the Office of the Federal Register as of [INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]. The incorporation by reference of certain other publications listed in this rule was approved by the Director of the Office of the Federal Register as of August 11, 2010.

ADDRESSES: Send comments identified by docket number FAA-2023-1836 using any of the following methods:

- Federal eRulemaking Portal: Go to <https://www.regulations.gov/> and follow the online instructions for sending your comments electronically.
- Mail: Send comments to Docket Operations, M-30; U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, DC 20590-0001.
- Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- Fax: Fax comments to Docket Operations at (202) 493-2251.

Docket: Background documents or comments received may be read at <https://www.regulations.gov> at any time. Follow the online instructions for accessing the docket or Docket Operations in Room W12-140 of the West Building Ground Floor at

1200 New Jersey Avenue, SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Juan Sebastian Yanguas, Airspace Rules & Regulations, AJV-P21, Federal Aviation Administration, 800 Independence Avenue SW, Washington, DC 20591; telephone (202) 267-8783; e-mail Juan.S.Yanguas@faa.gov.

SUPPLEMENTARY INFORMATION:

List of Abbreviations and Acronyms Frequently Used In This Document

ADS-B -- Automatic Dependent Surveillance – Broadcast
ATC -- Air Traffic Control
ICAO -- International Civil Aviation Organization
MHz -- Megahertz
MOPS -- Minimum Operating Performance Standards
NTSB -- National Transportation Safety Board
TCAS -- Traffic Collision Avoidance System
TIS-B -- Traffic Information Service - Broadcast
TSO -- Technical Standard Order
UAT -- Universal Access Transceiver

I. Executive Summary

As of January 1, 2020, Federal Aviation Administration (FAA) regulations, codified in title 14 Code of Federal Regulations (14 CFR), §§ 91.225 and 91.227, require aircraft to equip with Automatic Dependent Surveillance-Broadcast (ADS-B) Out to operate in expressly identified airspace areas.¹ ADS-B Out equipment must meet the performance requirements in § 91.227 along with those in Technical Standard Orders (TSO)-C166b or TSO-C154c. This rulemaking revises §§ 91.225 and 91.227 to allow aircraft with equipment that meets the performance requirements in the new TSOs, TSO-C166c and TSO-C154d, to also operate in compliance with the regulations. Specifically,

¹ Section 91.225(h), as redesignated in this rule, requires unmanned aircraft (UA) to equip with ADS-B Out and broadcast when they are operating under a flight plan and in two-way radio communication with air traffic control (ATC). The ADS-B Out equipment must meet the performance requirements in § 91.227 along with those in TSO-C166b or TSO-C154c. Section 91.225(h), as redesignated in this rule, is updated to include the two new TSOs.

to allow use of these new TSOs, the FAA is incorporating by reference TSO-C166c, TSO-C154d, section 2 of RTCA DO-260C, RTCA DO-260C Change 1, and section 2 of RTCA DO-282C into 14 CFR 91.225 and 91.227. Brief summaries of each document being incorporated by reference can be found in section IV.B. of this preamble. These new performance requirements enable new wake turbulence applications, incorporate functionality for high-altitude and high-velocity vehicles, and enhance weather forecasting. The addition of TSO-C166c and TSO-C154d to the list of permitted TSOs will not negatively affect current users because TSO-C166b and TSO-C154c will remain as acceptable performance requirements.

This rulemaking also makes minor changes to other regulatory sections of part 91. It revises § 91.215 to remove the requirement that transponders reply to intermode interrogations, as International Civil Aviation Organization (ICAO) prohibited those replies in ICAO Annex 10 Volume IV Standards and Recommended Practices and new transponder certifications do not include the capability to reply to intermode interrogations. This rulemaking also removes the requirement in part 43, appendix F, to verify response to an intermode interrogation.

II. Direct Final Rule

An agency typically uses direct final rulemaking when it anticipates that a proposed rule is unnecessary as the rule is considered noncontroversial.² The FAA has determined that this rule is suitable for direct final rulemaking as the rule provides an additional means of compliance with ADS-B Out rule requirements developed in conjunction with new industry standards. This amendment will not impose any additional burden on operators whose aircraft are currently equipped with ADS-B Out equipment

² 14 CFR 11.13.

meeting the performance requirements of TSO-C166b or TSO-C154c. Additionally, this change will increase the ADS-B Out rule compliance options with additional collateral benefits such as new wake turbulence applications, increased functionality for high-altitude and high-velocity vehicles, and enhanced weather forecasting. Moreover, the FAA previously published the TSOs being incorporated by reference in this direct final rule for public comment and addressed the comments received.³ Any remaining changes adopted by this rulemaking are technical, clarifying, or conforming with current legal interpretations or international requirements. As such, the FAA has determined that this rule is suitable for direct final rulemaking as these changes are noncontroversial.

The FAA is providing notice and seeking comment prior to effectuating changes to the regulation.⁴ If the FAA receives an adverse comment during the comment period, the FAA will advise the public by publishing a document in the *Federal Register* before the effective date of the direct final rule. This document may withdraw the direct final rule in whole or in part. If the FAA withdraws a direct final rule because of an adverse comment, the FAA may incorporate the commenter's recommendation into another direct final rule or may publish a notice of proposed rulemaking (NPRM).⁵

For purposes of this direct final rule, an adverse comment is one that explains (1) why the rule is inappropriate, including challenges to the rule's underlying premise or approach; or (2) why the direct final rule will be ineffective or unacceptable without a change.⁶ In determining whether an adverse comment necessitates withdrawal of this

³ The published TSOs and the adjudication of all public comments received for TSO-C166c and TSO-C154d can be found alongside each TSO in the FAA Dynamic Regulatory System (refer to <https://drs.faa.gov>).

⁴ See *Adoption of Recommendations*, 60 FR 43109, 43110-43111 (Aug. 18, 1995) (describing Administrative Conference of the United States, Recommendation 95-4, Procedures for Noncontroversial and Expedited Rulemaking).

⁵ 14 CFR 11.31(c).

⁶ 14 CFR 11.31(a).

direct final rule, the FAA will consider whether the comment raises an issue serious enough to warrant a substantive response had it been submitted in response to publication of an NPRM. A comment recommending additional provisions to the rule will not be considered adverse unless the comment explains how this direct final rule would be ineffective without the added provisions.⁷

Under the direct final rule process, the FAA does not consider a comment to be adverse if that comment recommends an amendment to a different regulation beyond the regulation(s) in the direct final rule at issue. The FAA also does not consider a frivolous or insubstantial comment to be adverse.⁸

If the FAA receives no adverse comments, the FAA will publish a confirmation notification in the *Federal Register*, generally within 15 days after the comment period closes. The confirmation notification announces the effective date of the rule.⁹

III. Authority for this Rulemaking

The FAA's authority to issue rules on aviation safety is found in title 49 of the United States Code (U.S.C.). Subtitle I, section 106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in subtitle VII, part A, subpart I, section 40103 (Sovereignty and use of airspace), and subpart III, section 44701 (General requirements). Under section 40103, the FAA is charged with prescribing regulations on the flight of aircraft (including regulations on safe altitudes) for navigating, protecting, and identifying aircraft, and the efficient use of the navigable

⁷ 14 CFR 11.31(a)(1).

⁸ 14 CFR 11.31(a)(1) and (2).

⁹ 14 CFR 11.31(b).

airspace. Under section 44701, the FAA is charged with promoting safe flight of civil aircraft in air commerce by prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce.

This regulatory action is within the scope of both sections 40103 and 44701 because it prescribes aircraft performance requirements to meet advanced surveillance needs to accommodate increases in national airspace system operations. As more aircraft operate within United States (U.S.) airspace, the FAA needs improved surveillance performance to accommodate the increased traffic safely and efficiently.

IV. Discussion of the Direct Final Rule

Effective January 1, 2020, 14 CFR 91.225 requires aircraft operators to comply with §§ 91.225 and 91.227 when the aircraft is operated in designated classes of airspace (whereas unmanned aircraft must comply with § 91.225(h), as redesignated by this rule, when in two-way radio communication with air traffic control (ATC) and operating under a flight plan). To comply, the ADS-B Out equipment must meet the performance requirements of § 91.227 and either TSO-C166b or TSO-C154c.¹⁰ Moreover, TSO-C166b and TSO-C154c reference and require compliance with RTCA DO-260B or

¹⁰ The following documents were incorporated by reference into 14 CFR 91.225 and 91.227 as of August 11, 2010 by the final rule, Automatic Dependent Surveillance-Broadcast (ADS-B) Out Performance Requirements To Support Air Traffic Control (ATC) Service, 75 FR 30159 (May 28, 2011):

Technical Standard Order (TSO)-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz) (Dec. 2, 2009);

TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Frequency of 978 MHz (Dec. 2, 2009);

Section 2, Equipment Performance Requirements and Test Procedures, of RTCA DO-260B, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B), December 2, 2009 (referenced in TSO-C166b); and

Section 2, Equipment Performance Requirements and Test Procedures, of RTCA DO-282B, Minimum Operational Performance Standards for Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B), December 2, 2009 (referenced in TSO-C154c).

RTCA DO-282B, respectively, which are minimum operational performance standards (MOPS).

Specifically, § 91.225 states no person may operate an aircraft in Class A airspace unless the aircraft has equipment installed that meets the performance requirements in TSO-C166b and § 91.227. Additionally, no person may operate an aircraft below 18,000 feet mean sea level and in certain airspace described in the regulation unless the aircraft meets either the performance requirements in § 91.227 and either TSO-C166b or TSO-C154c.

A TSO is a minimum performance standard for specified materials, parts, and appliances used on civil aircraft. These standards provide industry with the minimum requirements they must meet to certify an ADS-B Out system. The FAA may recognize certain TSOs as a means of compliance with regulatory requirements, or the regulation may explicitly incorporate the TSO requirements. For §§ 91.225 and 91.227, the FAA has specifically incorporated the TSOs into the regulations. This process ensures a harmonized approach for equipment functionality across equipment manufacturers.

Currently, aircraft with equipment that meet the performance requirements in TSO-C166b or TSO-C154c are in compliance with the regulations. This rulemaking revises §§ 91.225 and 91.227 to include the use of equipment compliant with TSO-C166c (Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz)) or TSO-C154d (Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Radio Frequency of 978 Megahertz (MHz)) as options to meet the ADS-B Out regulations. These new TSOs increase information available (e.g., weather information or spectrum monitoring); enable new wake turbulence applications; incorporate

functionality for high-altitude and high-velocity vehicles; and enhance weather forecasting. They also enable and enhance ADS-B In applications such as Flight Interval Management. These additions will not negatively affect current users, as there is no mandate for users to change from existing ADS-B Out rule-compliant equipment to meet the performance requirements in TSO-C166c or TSO-C154d. Persons using equipment meeting the performance requirements in either TSO-C166b or TSO-C154c may continue to use that equipment after the adoption of this rule.

This rulemaking also revises §§ 91.225 and 91.227 to clearly associate each Technical Standard Order with its associated RTCA document. While Section 2 of RTCA DO-260B and Section 2 of RTCA DO-282B were previously incorporated by reference into §§ 91.225 and 91.227, they were not clearly associated with the TSOs to which they related. With the addition of two new TSOs and three new RTCA documents, it is important each TSO be clearly associated with its referenced RTCA document(s).

A. Addition of TSO-C166c and TSO-C154d Performance Standards

TSO-C166c, which is a subject of this rulemaking, is largely based on RTCA's Minimum Operating Performance Standards (MOPS) for ADS-B Out systems. RTCA is an independent standards development organization comprised of representatives from industry, government, associations, and academia. Representatives from these entities collaborated on the development of an updated standards document for ADS-B Out systems titled RTCA DO-260C, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B). The same committee subsequently published RTCA DO-260C Change 1 as a supplemental document to correct errors and add clarifications. RTCA made both RTCA DO-260C and RTCA DO-260C Change 1

available to the public through the RTCA website, and the responsible committee adjudicated all comments received.

Specifically, the FAA requires compliance with Section 2 of RTCA DO-260C as modified by Change 1 as part of TSO-C166c. Section 2 establishes equipment performance requirements for 1090 MHz ADS-B systems. Compliance with the TSO, including Section 2 of RTCA DO-260C as modified by Change 1, allows industry to show the FAA that their system is designed and manufactured as required by FAA regulations.

RTCA DO-260C as modified by Change 1, updates the previous RTCA DO-260B performance standard to provide additional capabilities enhancing areas such as safety, equipment performance, airspace efficiency, and data reporting. The substantive changes from the previous MOPS include:

- Changes to support ICAO requirements that Autonomous Distress Tracking automatically provide position information at least once per minute when in distress. Although current § 91.227(c) already requires the position information, the RTCA revision provides a means to initiate broadcast announcing that the aircraft is in distress.
- Additional elements in ADS-B Out messages, including wind and temperature data, to support more precise spacing of aircraft by air traffic control (ATC). In addition, the avionics will be able to support capability for ground radars to extract Flight Interval Management data from the aircraft.
- The broadcast of aircraft-derived weather data for applications such as Flight Interval Management, wake vortex avoidance and surfing, hazardous weather detection and avoidance, and aviation weather forecasting.

- The broadcast of pilot-observed weather during flight, including temperature, wind, turbulence, and hazardous weather information.
- The broadcast of an unmanned aircraft system (UAS)/Remotely Piloted Aircraft System (RPAS) lost link condition. In this condition, the UAS/RPAS may broadcast its contingency plan, identifying the course of action the UAS/RPAS is following.
- Increased the reporting range of altitude and velocity to support commercial space and hypersonic aircraft operations.
- Inclusion of new capabilities for Airborne Collision Avoidance System (ACAS)-X, Detect and Avoid (DAA), as well as future Collision Avoidance Systems (CAS). The new capabilities include expanded information-laying framework for future passive CAS and alternate coordination techniques.
- Improved Geometric Altitude reporting by increasing the reportable difference between geometric and barometric altitude when information for both is available. Additionally, minimized the reporting of no integrity by expanding the Navigation Integrity Category (NIC) reporting when solely geometric altitude is available.
- Provisions for Phase Overlay (PO) techniques enhancing future capacity and efficiency of the 1090 MHz frequency. PO allows for transmission of additional data within existing ADS-B Out messages without the need for additional messages.
- Enhanced requirements for selection of transmission of airborne or surface message formats for aircraft without an automatic means of determining on-the-ground status (e.g., a landing gear weight on wheels switch).
- The broadcast of Interrogation/Reply Monitor data, including measurements of transponder interrogation and reply rate activity.

- Improved emitter category classifications and descriptions to prevent misuse by future applications.
- Transmission of transponder antenna offset information improving tracking of aircraft and vehicles operating on the airport surface by the airport surface detection systems.

TSO-C154d, which is also the subject of this rulemaking, is largely based on RTCA DO-282C, Minimum Operational Performance Standards (MOPS) for Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B). RTCA made RTCA DO-282C available to the public through the RTCA website, and the responsible committee adjudicated all comments received.

Specifically, the FAA requires compliance with Section 2 of RTCA DO-282C as part of TSO-C154d. Section 2 establishes equipment performance requirements for UAT ADS-B systems. Compliance with the TSO, including Section 2 of RTCA DO-282C, allows industry to show the FAA that their system is designed and manufactured as required by FAA regulations.

RTCA DO-282C updates the previous RTCA DO-282B performance standard to provide additional capabilities enhancing areas such as safety, equipment performance, airspace efficiency, and data reporting. The substantive changes to the previous performance standard include:

- Changes to support ICAO requirements that Autonomous Distress Tracking automatically provide position information at least once per minute when in distress. Although current § 91.227(c) already requires the position information, the RTCA revision provides a means to initiate broadcast announcing that the aircraft is in distress.

- Additional elements in ADS-B Out messages, including wind and temperature data, to support more precise spacing of aircraft by ATC. In addition, the avionics will be able to support capability for ground radars to extract Flight Interval Management data from the aircraft.
- The broadcast of aircraft-derived weather data for applications such as Flight Interval Management, wake vortex avoidance and surfing, hazardous weather detection and avoidance, and aviation weather forecasting.
- The broadcast of pilot-observed weather during flight, including temperature, wind, turbulence, and hazardous weather information.
- The broadcast of a UAS/RPAS lost link condition. In this condition, the UAS/RPAS may broadcast its contingency plan, identifying the course of action the UAS/RPAS is following.
- Increased the reporting range of altitude and velocity to support commercial space and hypersonic aircraft operations.
- Enhanced requirements for selection of transmission of airborne or surface message formats for aircraft without an automatic means of determining on-the-ground status (e.g., a landing gear weight on wheels switch).
- Improved emitter category classifications and descriptions to prevent misuse by future applications.

This rule will allow aircraft with equipment compliant with the performance requirements of TSO-C166c and RTCA DO-260C as modified by Change 1, and TSO-C154d and RTCA DO-282C to operate in the airspace areas identified in § 91.225.

Importantly, this rulemaking does not impact any operators currently in compliance with §§ 91.225 and 91.227.

Including TSO-C166c and TSO-C154d in §§ 91.225 and 91.227 allows the use of updated technology to meet ADS-B Out requirements and enables improvements in the ADS-B environment, such as the ability to transmit additional data; and to include ADS-B Out for high-altitude and high-velocity vehicles.

B. Incorporation by Reference

Incorporation by reference (IBR) is a mechanism that allows Federal agencies to comply with the requirements of the Administrative Procedure Act to publish rules in the *Federal Register* and the CFR by referring to material published elsewhere.¹¹ Material that is incorporated by reference has the same legal status as if it were published in full in the *Federal Register* and the CFR. The standards referenced in this rule include technical information and specifications for equipment and capabilities required to meet FAA ADS-B Out requirements.

The standards referenced in §§ 91.225 and 91.227 of this rule are incorporated by reference with the approval of the Director of the Office of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. In accordance with 5 U.S.C. 552(a) and 1 CFR part 51,¹² all approved materials are available for inspection at the FAA's Office of Rulemaking, 800 Independence Avenue, SW, Washington, DC 20590 (telephone (202) 267-9677). This material is also available from the sources indicated in paragraphs

¹¹ 5 U.S.C. 552(a).

¹² 5 U.S.C. 552(a) requires that matter incorporated by reference be "reasonably available" as a condition of its eligibility. Further, 1 CFR 51.5(b)(2) requires that agencies seeking to incorporate material by reference discuss in the preamble of the final rule the ways that the material it is incorporating by reference is reasonably available to interested parties and how interested parties can obtain the material.

(i)(1) and (2) of § 91.225, as redesignated by this rule, and paragraphs (g)(1) and (2) of § 91.227 and as follows:

1. Copies of the following Technical Standard Orders (TSOs) may be obtained from the U.S. Department of Transportation, Subsequent Distribution Office, DOT Warehouse M30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785; telephone (301) 322-5377. Copies are also available on the FAA's website at www.faa.gov/aircraft/air_cert/design_approvals/tso/. Select the link "Search Technical Standard Orders."

a. TSO-C166c, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service - Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz) (March 10, 2023);

i. This TSO contains the minimum performance standards that 1090 MHz ADS-B and TIS-B equipment must meet for approval and identification with the applicable TSO marking.

b. TSO-C154d, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Radio Frequency of 978 Megahertz (MHz) (March 10, 2023).

i. This TSO contains the minimum performance standards that UAT ADS-B equipment and/or UAT duplexers must meet for approval and identification with the applicable TSO marking.

2. Copies of the following documents may be obtained from RTCA, Inc., 1150 18th St NW Suite 910, Washington, DC 20036, telephone (202) 833-

9339. Copies are also available on the RTCA Inc. website at

<https://www.rtca.org/products>.

a. RTCA DO-260C, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B), Section 2, Equipment Performance Requirements and Test Procedures, December 17, 2020; and Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B) Change 1, January 25, 2022 (referenced in TSO-C166c);

i. Section 2 of RTCA DO-260C contains the equipment performance requirements and test procedures for 1090 MHz ADS-B and TIS-B equipment.

ii. DO-260C Change 1 contains updates, corrections, and additional material to support the implementation of RTCA DO-260C.

b. RTCA DO-282C, Minimum Operational Performance Standards (MOPS) for Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS B), Section 2, Equipment Performance Requirements and Test Procedures, June 23, 2022 (referenced in TSO-C154d).

i. Section 2 of RTCA DO-282C contains the equipment performance requirements and test procedures for UAT ADS-B equipment.

The following standards appear in the amendatory text of this document and were previously approved for the locations in which they appear: TSO-C166b, TSO-C154c, RTCA DO-260B, Section 2, and RTCA DO-282B, Section 2.

C. Advisory Circulars Updated as part of this Rulemaking

As part of this rulemaking, the FAA is updating FAA Advisory Circular (AC) 90-114B, Automatic Dependent Surveillance – Broadcast Operations, to modify references to the TSOs listed for ADS-B Out equipment that complies with title 14 of the Code of Federal Regulations part 91, §§ 91.225 and 91.227.

D. Miscellaneous Amendments

This rule also includes a number of minor miscellaneous changes to §§ 91.215, 91.225, and 91.227 to incorporate updated ICAO requirements, clarify ambiguities identified in past requests for legal interpretations, clarify vague requirements, correct previous typographical errors, change a physical location address, and ensure valid website links.

The FAA amends §§ 91.215 and 91.227 by replacing the term “Mode 3/A” with “Mode A” in both § 91.215(b) and § 91.227(d)(7). Mode A is a civilian mode intended to elicit transponder replies for identity and surveillance. Mode 3 is a military mode also used to elicit transponder replies for identity and surveillance. Mode 3 contains all the functionality of Mode A along with additional military-specific capability. For this reason, the military community often uses the term “Mode 3/A,” a term the civil community does not widely use. This editorial change will properly emphasize that the regulation requires the Mode A functionality and not the military-specific functionality of Mode 3. In addition, using the term Mode A is consistent with the language used by ICAO and RTCA documents.

This rule also removes the requirement in § 91.215(b) to reply to intermode interrogations, and removes the requirement in part 43, appendix F, to verify response to an intermode interrogation. Currently, § 91.215(b) requires aircraft equipped with a Mode S capability to reply “to Mode 3/A interrogations with the code specified by ATC and intermode and Mode S interrogations in accordance with the applicable provisions specified in TSO C-112.” Additionally, part 43, appendix F, paragraph (h), requires verification that an ATC transponder respond to an Air Traffic Control Radar Beacon System (ATCRBS)/Mode S all-call interrogation. ICAO Annex 10 Volume IV establishes two types of intermode interrogations: Mode A/C/S all-call and Mode A/C-only all-call. Mode A/C/S all-call interrogations were designed to produce a Mode S reply in Mode S capable transponders and a Mode A or C reply in non-Mode S capable transponders. Mode A/C-only all-call interrogations were designed to not produce a reply by Mode S capable transponders and to produce a Mode A or C reply in non-Mode S transponders. Therefore, the only type of intermode interrogation that a Mode S transponder was intended to reply to per § 91.215(b) was a Mode A/C/S all-call interrogation. However, ICAO now prohibits replies to Mode A/C/S all-call interrogations in new equipment certifications.¹³ Mode A/C/S all-call interrogations were never implemented in U.S. ground radar systems, but the inclusion of this capability within existing transponders led to an increase in what is known as False Replies Un-synchronized In Time (FRUIT). Radio Frequency (RF) propagation effects often result in a Mode A/C-only all-call interrogation appearing to be a Mode A/C/S all-call interrogation at the receiver of a transponder. When a Mode S transponder decodes a Mode A/C/S all-call interrogation, an undesired reply is transmitted by the transponder, resulting in the increase of FRUIT. Removal of the requirement to reply to intermode

¹³ See ICAO Annex 10 Vol IV sec. 3.1.2.4.1.3.2.1.

interrogations ensures compliance with ICAO requirements and reduces the number of unsolicited replies, thus reducing 1090 MHz spectrum congestion. RTCA DO-181F, referenced by TSO-C112f, also prohibits Mode S transponders from responding to Mode A/C/S all-call interrogations. Equipment certified to TSO-C112 versions prior to TSO-C112f will retain the capability to reply to Mode A/C/S all-call interrogations and will continue to be compliant with § 91.215(b).

Accordingly, this rule removes the requirement in 14 CFR part 43, appendix F, paragraph (h), to verify response to an intermode interrogation, specifically the ATCRBS/Mode S all-call formats (1.6 microsecond P4 pulse), which is another name for the Mode A/C/S all-call interrogation. This conforming amendment aligns the inspection and test requirements in part 43 with the ICAO prohibition to reply to Mode A/C/S all-call interrogations.

This rule also amends part 43, appendix F, paragraph (j), which requires verification that the Mode S transponder generates a correct squitter approximately once per second, by clarifying the squitter is an acquisition squitter.

Additionally, the FAA amends § 91.225(e) by adding the term “engine-driven” before “electrical system.” This amendment will clarify that the relief described in § 91.225 applies to aircraft whose electrical system was not originally or subsequently certificated to be powered by the aircraft’s engine. This rephrasing is consistent with the phrase used in § 91.215(b)(3) to describe the same category of aircraft. The difference in language has led to confusion among regulated entities, as evidenced by the FAA’s legal interpretation sent to David Schober on January 5, 2017.¹⁴ Mr. Schober requested

¹⁴ Available at https://www.faa.gov/about/office_org/headquarters_offices/agc/practice_areas/regulations/interpretations.

clarification on the applicability of § 91.225(e) to aircraft that had not been originally certificated with an electrical system but which have subsequently had batteries or electric starters installed. The FAA determined that the intent of the language was to cover the same types of aircraft as in the transponder regulation. This amendment will make it clear that both regulatory provisions refer to the same category of aircraft.

The FAA is revising the definitions for “Navigation Accuracy Category for Position (NACP)”, “Navigation Accuracy Category for Velocity (NACV)”, “Navigation Integrity Category (NIC)”, “Source Integrity Level (SIL)”, and “System Design Assurance (SDA)” in § 91.227(a) to remove the references to TSO-C166b and TSO-C154c. The FAA has determined that including references to these standards in the definitions themselves is unnecessary and could lead to confusion as more Technical Standard Orders are added to this regulation. The FAA notes that references to the Technical Standard Orders appear in the actual regulatory requirements of § 91.227.

Further, the FAA also amends the way it describes the System Design Assurance (SDA) reporting requirements in § 91.227(c)(1)(iv) and the Source Integrity Level (SIL) reporting requirement in § 91.227(c)(1)(v) without changing the underlying substantive requirement itself. Under the FAA’s current regulation, the FAA codified numerical values used by RTCA to represent probability values. That is, per DO-260B, an SDA value of 2 represents “the probability of a position transmission chain fault causing false or misleading position information to be transmitted” to be $\leq 1 \times 10^{-5}$ per flight hour. This action revises § 91.227(c)(1)(iv) to require an SDA of $\leq 1 \times 10^{-5}$ per flight hour instead of the equivalent RTCA DO-260B value of 2. A SIL of 3 represents “the probability of the reported horizontal position exceeding the radius of containment (R_C) defined by the NIC, without alerting, assuming no avionics faults” to be $\leq 1 \times 10^{-7}$ per flight hour or per sample. Therefore, § 91.227(c)(1)(v) will require a SIL value of $\leq 1 \times 10^{-7}$ per flight hour

or per sample instead of the equivalent RTCA DO-260B value of 3. This change does not alter the underlying performance requirements. Instead, it codifies the actual probability requirement rather than the equivalent conversion used by RTCA DO-260B. This editorial change makes the regulation's performance requirements clear within the regulation without having to consult RTCA DO-260B. It also ensures that this performance standard remains constant in case RTCA revises SDA and SIL.

Additionally, this rule amends § 91.227(d)(13) to conform to the FAA's intent that the element indicate that the aircraft has the capability to receive ADS-B In services, not necessarily that this capability be installed. The revised regulatory text will replace the current word "installed" with the word "available." After the amendment's effective date, § 91.227(d)(13) will require "[a]n indication of whether ADS-B In capability is available." The FAA became aware of the confusion after John D. Collins' September 20, 2012 letter requesting an interpretation of § 91.227(d)(13).¹⁵ Mr. Collins explained that some aircraft operators use portable ADS-B In receivers without installing the equipment. By using the word "installed" in the regulatory language, some aircraft operators and installers believed that an aircraft could not indicate ADS-B In capability if the appropriate equipment was not physically installed on the aircraft.

Per the preamble to the Automatic Dependent Surveillance-Broadcast (ADS-B) Out Performance Requirements to Support Air Traffic Control (ATC) Service published on May 28, 2010,¹⁶ the ADS-B In capability is meant to provide ADS-B ground stations with an indication of what, if any, FAA ADS-B services should be provided to the aircraft. In a legal interpretation sent to John D. Collins on August 23, 2013, the FAA

¹⁵ Available at www.faa.gov/about/office_org/headquarters_offices/agc/practice_areas/regulations/interpretations.

¹⁶ 75 FR 30159.

explained that the intent was for this message element to indicate that the aircraft has the capability to receive ADS-B In services, not necessarily that this capability is installed. Therefore, this change clarifies that aircraft are to indicate that ADS-B reception capability is available, even if the system receiving the data is not installed on the aircraft. The FAA ground stations will provide ADS-B In services to all eligible aircraft indicating an ADS-B In capability.

The FAA also clarifies § 91.227(d)(5) by revising “TCAS II or ACAS” to “collision avoidance system.” While the FAA often uses the term TCAS in various rules and regulations, other nations and ICAO generally use the term ACAS. For this reason, § 91.227 used the term “TCAS II or ACAS” in an attempt to reduce confusion. Since the initial publication of § 91.227, the FAA published a new TSO (TSO-C219) for an additional collision avoidance system: ACAS Xa/Xo. TSO-C219 was published by the FAA on February 28, 2020.¹⁷ Additionally, various other collision avoidance systems are currently in development. Due to the long-standing confusion with the terminology, RTCA, ICAO, and international regulators all use the generic term “collision avoidance system (CAS).” This editorial change provides enhanced clarity but does not alter the existing broadcast requirements.

Further, the FAA clarifies § 91.227(d)(8) by changing the required broadcast information from “an indication of the aircraft’s call sign that is submitted on the flight plan, or the aircraft’s registration number” to “an indication of the aircraft identification that is submitted on the flight plan or used for communicating with ATC.” The change will clarify, not alter, the substantive meaning of the paragraph. On July 27, 2017, the FAA sent an internal request for legal interpretation of § 91.225(d)(8). Some

¹⁷ Available at <https://drs.faa.gov/browse>.

manufacturers and operators interpreted the existing language to mean that the aircraft registration number could be programmed into the aircraft identification field of the ADS-B avionics and yet a different aircraft call sign could be filled in the flight plan. The FAA legal interpretation sent to Jere Hayslett on August 3, 2017, stated that in the preamble to the final rule, to satisfy § 91.227(d)(8) a pilot would have to provide the same call sign on their flight plan as they transmit out using ADS-B to avoid ATC confusion. This amendment makes clear that the aircraft identification included on the flight plan must match the aircraft identification transmitted via ADS-B Out. Furthermore, the change also clarifies that for those aircraft that do not file a flight plan, the aircraft identification transmitted via ADS-B Out must match the aircraft identification used for communicating with ATC and ensures ATC can correlate flight plan information with information displayed on the radar display.

In addition, the FAA is undertaking the following purely clerical changes:

- Corrects typographical errors in §§ 91.225(i)(1), as redesignated by this rule, and 91.227(c) and (g)(1) and (2). These include removing of extra spaces, correcting capitalizations, and correcting placement of dash marks.
- Updates website addresses in §§ 91.225(i) introductory text and (i)(1) and (2), as redesignated by this rule, and 91.227(g) introductory text and (g)(1) and (2).
- Updates the RTCA physical address in §§ 91.225(i)(2), as redesignated by this rule, and 91.227(g)(2).

V. Regulatory Notices and Analyses

Federal agencies consider impacts of regulatory actions under a variety of executive orders and other requirements. First, Executive Order 12866 and Executive

Order 13563, as amended by Executive Order 14094 (“Modernizing Regulatory Review”), direct that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify the costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96-354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96-39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate that may result in the expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of \$100 million or more (adjusted annually for inflation) in any one year. The current threshold after adjustment for inflation is \$177 million using the most current (2022) Implicit Price Deflator for the Gross Domestic Product. This portion of the preamble summarizes the FAA's analysis of the economic impacts of this rule.

In conducting these analyses, the FAA has determined that this rule has benefits that justify its costs; is not significant as defined in section 3(f)(1) of Executive Order 12866; will not have a significant economic impact on a substantial number of small entities; will not create unnecessary obstacles to the foreign commerce of the United States; and, will not impose an unfunded mandate on State, local, or tribal governments, or on the private sector.

A. Regulatory Evaluation

ADS-B enhances safety and efficiency and directly benefits pilots, controllers, airports, airlines, and the public. This rule enables additional features of ADS-B Out as an option to meet all ADS-B requirements by revising §§ 91.225 and 91.227. Since this

direct final rule maintains the performance standards by providing aircraft operators the option, on a voluntary basis, to implement additional features into the ADS-B equipment, the direct final rule will not incur any costs to the operators and the public. Revising § 91.215 adds no new cost to the public because it removes the requirement to support a capability that has no operational use. By increasing the information available, enabling new wake turbulence applications, incorporating functionality for high-altitude and high-velocity vehicles, and enhancing weather forecasting, this direct final rule has unquantifiable benefits to aircraft operators.

B. Regulatory Flexibility Determination

The Regulatory Flexibility Act (RFA), Public Law 96-354, (5 U.S.C. 601-612), as amended by the Small Business Regulatory Enforcement Fairness Act (Pub. L. 104-121) and the Small Business Jobs Act (Pub. L. 111-240), requires Federal agencies to consider the effects of the regulatory action on small business and other small entities and to minimize any significant economic impact. The term “small entities” comprises small businesses and not-for-profit organizations that are independently owned and operated and are not dominant in their fields, and governmental jurisdictions with populations of less than 50,000.

Agencies must perform a review to determine whether a rulemaking would have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA. However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify, and a regulatory flexibility analysis is not required.

This direct final rule adds an option for aircraft operators to incorporate additional features into ADS-B equipment described in §§ 91.225 and 91.227 and allows for the removal of an unused capability in § 91.215. This direct final rule will not require additional reporting, recordkeeping, and other compliances for small businesses.

Therefore, as provided in section 605(b), the head of the FAA certifies that this direct final rule does not result in a significant economic impact on a substantial number of small entities.

C. International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96-39), as amended by the Uruguay Round Agreements Act (Pub. L. 103-465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such as the protection of safety, and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this rule and determined that it will impose no costs on either domestic or international entities and thus has a neutral trade impact.

D. Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of \$100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a “significant

regulatory action.” The FAA currently uses an inflation-adjusted value of \$177.0 million in lieu of \$100 million.

This rule does not contain such a mandate. Therefore, the requirements of title II of the Act do not apply.

E. Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. The FAA has determined that there is no new requirement for information collection associated with this direct final rule.

F. International Compatibility and Cooperation

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs) to the maximum extent practicable. ICAO plans to update its current SARPs to reflect harmonized changes to both RTCA and EUROCAE minimum performance standards, as appropriate, for ADS-B Out operations. The FAA also will continue to work with the international community to ensure harmonization.

G. Environmental Analysis

FAA Order 1050.1F identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 5-6.6f for regulations and involves no extraordinary circumstances.

VI. Executive Order Determinations

A. Executive Order 13132, Federalism

The FAA has analyzed this direct final rule under the principles and criteria of Executive Order 13132, Federalism. The agency determined that this action will not have a substantial direct effect on the States, or the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among the various levels of government, and, therefore, does not have federalism implications.

B. Executive Order 13211, Regulations that Significantly Affect Energy Supply, Distribution, or Use

The FAA analyzed this direct final rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use. The agency has determined that this rule is not a “significant energy action” under the Executive order and the rule is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

C. Executive Order 13609, International Cooperation

Executive Order 13609, Promoting International Regulatory Cooperation, promotes international regulatory cooperation to meet shared challenges involving health, safety, labor, security, environmental, and other issues and to reduce, eliminate, or prevent unnecessary differences in regulatory requirements. The FAA analyzed this action under the policies and agency responsibilities of Executive Order 13609 and has determined that this action would have no effect on international regulatory cooperation.

VII. Additional Information

A. Comments Invited

The FAA invites interested persons to participate in this rulemaking by submitting written comments, data, or views. The most helpful comments reference a specific

portion of the rule, explain the reason for any recommended change, and include supporting data. To ensure the docket does not contain duplicate comments, commenters should send only one copy of written comments, or if comments are filed electronically, commenters should submit only one time.

The FAA will file in the docket all comments it receives, as well as a report summarizing each substantive public contact with FAA personnel concerning this rulemaking. Before acting on this rulemaking, the FAA will consider all comments it receives on or before the closing date for comments. The agency may change this rule in light of the comments it receives.

Privacy: In accordance with 5 U.S.C. 553(c), DOT solicits comments from the public to better inform its rulemaking process. DOT posts these comments, without edit, including any personal information the commenter provides, to www.regulations.gov, as described in the system of records notice (DOT/ALL-14 FDMS), which can be reviewed at www.dot.gov/privacy.

B. Confidential Business Information

Confidential Business Information (CBI) is commercial or financial information that is both customarily and actually treated as private by its owner. Under the Freedom of Information Act (FOIA) (5 U.S.C. 552), CBI is exempt from public disclosure. If your comments responsive to this direct final rule contain commercial or financial information that is customarily treated as private, that you actually treat as private, and that is relevant or responsive to this direct final rule, it is important that you clearly designate the submitted comments as CBI. Please mark each page of your submission containing CBI as “PROPIN.” The FAA will treat such marked submissions as confidential under the FOIA, and they will not be placed in the public docket of this direct final rule.

Submissions containing CBI should be sent to the person in the **FOR FURTHER INFORMATION CONTACT** section of this document. Any commentary that the FAA

receives which is not specifically designated as CBI will be placed in the public docket for this rulemaking.

C. Electronic Access and Filing

A copy of this direct final rule, all comments received, any confirmation document, and all background material may be viewed online at <https://www.regulations.gov> using the docket number listed above. A copy of this direct final rule will be placed in the docket. Electronic retrieval help and guidelines are available on the website. It is available 24 hours each day, 365 days each year. An electronic copy of this document may also be downloaded from the Office of the Federal Register's website at <https://www.federalregister.gov> and the Government Publishing Office's website at <https://www.govinfo.gov>. A copy may also be found on the FAA's Regulations and Policies website at https://www.faa.gov/regulations_policies.

Copies may also be obtained by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM-1, 800 Independence Avenue SW, Washington, DC 20591, or by calling (202) 267-9677. Interested persons must identify the docket or amendment number of this rulemaking.

All documents the FAA considered in developing this rule, including economic analyses and technical reports, may be accessed in the electronic docket for this rulemaking.

D. Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires the FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. A small entity with questions regarding this document may contact its local FAA official or the person listed under the **FOR FURTHER INFORMATION CONTACT** heading at the beginning of

the preamble. To find out more about SBREFA on the Internet, visit

https://www.faa.gov/regulations_policies/rulemaking/sbre_act/.

List of Subjects

14 CFR Part 43

Aircraft, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 91

Air traffic control, Aircraft, Airports, Aviation safety, Incorporation by reference, Transportation.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends chapter I of title 14, Code of Federal Regulations as follows:

PART 43—MAINTENANCE, PREVENTIVE MAINTENANCE, REBUILDING, AND ALTERATION

1. The authority citation for part 43 continues to read as follows:

Authority: 42 U.S.C. 7572; 49 U.S.C. 106(f), 106(g), 40105, 40113, 44701–44702, 44704, 44707, 44709, 44711, 44713, 44715, 45303.

2. Amend appendix F to part 43 by revising paragraphs (h) and (j) to read as follows:

Appendix F to Part 43—ATC Transponder Tests and Inspections

* * * * *

(h) Mode S All-Call Interrogations: Interrogate the Mode S transponder with the Mode S-only all-call format UF = 11 and verify that the correct address and capability are reported in the replies (downlink format DF = 11).

* * * * *

(j) Squitter: Verify that the Mode S transponder generates a correct acquisition squitter approximately once per second.

* * * * *

PART 91—GENERAL OPERATING AND FLIGHT RULES

3. The authority citation for part 91 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40101, 40103, 40105, 40113, 40120, 44101, 44111, 44701, 44704, 44709, 44711, 44712, 44715, 44716, 44717, 44722, 46306, 46315, 46316, 46504, 46506-46507, 47122, 47508, 47528-47531, 47534, Pub. L. 114-190, 130 Stat. 615 (49 U.S.C. 44703 note); articles 12 and 29 of the Convention on International Civil Aviation (61 Stat. 1180), (126 Stat. 11).

4. Amend § 91.215 by revising the introductory text of paragraph (b) to read as follows:

§ 91.215 ATC transponder and altitude reporting equipment and use.

* * * * *

(b) *All airspace.* Unless otherwise authorized or directed by ATC, and except as provided in paragraph (e)(1) of this section, no person may operate an aircraft in the airspace described in paragraphs (b)(1) through (5) of this section, unless that aircraft is equipped with an operable coded radar beacon transponder having either Mode A 4096 code capability, replying to Mode A interrogations with the code specified by ATC, or a Mode S capability, replying to Mode A interrogations with the code specified by ATC and Mode S interrogations in accordance with the applicable provisions specified in TSO-C112, and that aircraft is equipped with automatic pressure altitude reporting equipment having a Mode C capability that automatically replies to Mode C interrogations by transmitting pressure altitude information in 100-foot increments. The requirements of this paragraph (b) apply to –

* * * * *

5. Amend § 91.225 by:

a. Revising paragraphs (a)(1), (b), and (e) introductory text.

b. Redesignating paragraphs (h) and (i) as set out in the following redesignation table.

Old paragraph	New paragraph
paragraph (h)	paragraph (i)
paragraph (i)	paragraph (h)

c. Revising newly redesignated paragraphs (h)(1)(i) and (i).

The revisions read as follows:

§ 91.225 Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment and use.

(a) * * *

(1) Meets the performance requirements in—

(i) TSO-C166b and Section 2 of RTCA DO-260B (as referenced in TSO-C166b);

or

(ii) TSO-C166c and Section 2 of RTCA DO-260C as modified by DO-260C –

Change 1 (as referenced in TSO-C166c); and

* * * * *

(b) After January 1, 2020, except as prohibited in paragraph (h)(2) of this section or unless otherwise authorized by ATC, no person may operate an aircraft below 18,000 feet MSL and in airspace described in paragraph (d) of this section unless the aircraft has equipment installed that—

(1) Meets the performance requirements in—

(i) TSO-C166b and Section 2 of RTCA DO-260B (as referenced in TSO-C166b);

(ii) TSO-C166c and Section 2 of RTCA DO-260C as modified by DO-260C – Change 1 (as referenced in TSO-C166c);

(iii) TSO-C154c and Section 2 of RTCA DO-282B (as referenced in TSO-C154c); or

(iv) TSO-C154d and Section 2 of RTCA DO-282C (as referenced in TSO-C154d);

(2) Meets the requirements of § 91.227.

* * * * *

(e) The requirements of paragraph (b) of this section do not apply to any aircraft that was not originally certificated with an engine-driven electrical system, or that has not subsequently been certified with such a system installed, including balloons and gliders. These aircraft may conduct operations without ADS-B Out in the airspace specified in paragraph (d)(4) of this section. These aircraft may also conduct operations in the airspace specified in paragraph (d)(2) of this section if those operations are conducted -

* * * * *

(h) * * *

(1) * * *

(i) That aircraft has equipment installed that meets the performance requirements in TSO-C166b (including Section 2 of RTCA DO-260B, as referenced in TSO-C166b), TSO-C166c (including Section 2 of RTCA DO-260C as modified by DO-260C – Change 1, as referenced in TSO-C166c), TSO-C154c (including Section 2 of RTCA DO-282B, as referenced in TSO-C154c), or TSO-C154d (including Section 2 of RTCA DO-282C, as referenced in TSO-C154d); and

* * * * *

(i) The standards required in this section are incorporated by reference with the approval of the Director of the Office of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. This incorporation by reference (IBR) material is available for inspection at the FAA and the National Archives and Records Administration (NARA). Contact the FAA at: Office of Rulemaking (ARM-1), 800 Independence Avenue, SW., Washington, DC 20590 (telephone 202-267-9677). For information on the availability of this material at NARA, visit <https://www.archives.gov/federal-register/cfr/ibr-locations.html> or email fr.inspection@nara.gov. This material is also available from the following sources in this paragraph (i).

(1) U.S. Department of Transportation, Subsequent Distribution Office, DOT Warehouse M30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785; telephone (301) 322-5377; website: www.faa.gov/aircraft/air_cert/design_approvals/tso/ (select the link “Search Technical Standard Orders”).

(i) TSO-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz), December 2, 2009.

(ii) TSO-C166c, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service - Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz), March 10, 2023.

(iii) TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Frequency of 978 MHz, December 2, 2009.

(iv) TSO-C154d, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Radio Frequency of 978 Megahertz (MHz), March 10, 2023.

(2) RTCA, Inc., 1150 18th St NW Suite 910, Washington, DC 20036; telephone (202) 833-9339; website: www.rtca.org/products.

(i) RTCA DO-260B, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B), Section 2, Equipment Performance Requirements and Test Procedures, December 2, 2009.

(ii) RTCA DO-260C, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B), Section 2, Equipment Performance Requirements and Test Procedures, December 17, 2020.

(iii) RTCA DO-260C, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B), Change 1, January 25, 2022.

(iv) RTCA DO-282B, Minimum Operational Performance Standards for Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B), Section 2, Equipment Performance Requirements and Test Procedures, December 2, 2009.

(v) RTCA DO-282C, Minimum Operational Performance Standards (MOPS) for Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B), Section 2, Equipment Performance Requirements and Test Procedures, June 23, 2022.

6. Amend § 91.227 by:

a. In paragraph (a), revising definitions for “Navigation Accuracy Category for Position (NAC_P)”, “Navigation Accuracy Category for Velocity (NAC_V)”, “Navigation Integrity Category (NIC)”, “Source Integrity Level (SIL)”, and “System Design Assurance (SDA)”; and

b. Revising paragraphs (b)(1), (b)(2)(i) and (ii), (c)(1)(iv) and (v), (d) introductory text, (d)(5) through (8), (11), and (13), and (g).

The revisions read as follows:

§ 91.227 Automatic Dependent Surveillance-Broadcast (ADS-B) Out equipment performance requirements.

(a) * * *

Navigation Accuracy Category for Position (NAC_P) specifies the accuracy of a reported aircraft's position.

Navigation Accuracy Category for Velocity (NAC_V) specifies the accuracy of a reported aircraft's velocity.

Navigation Integrity Category (NIC) specifies an integrity containment radius around an aircraft's reported position.

* * *

Source Integrity Level (SIL) indicates the probability of the reported horizontal position exceeding the containment radius defined by the NIC on a per sample or per hour basis.

System Design Assurance (SDA) indicates the probability of an aircraft malfunction causing false or misleading information to be transmitted.

* * * * *

(b) * * *

(1) Aircraft operating in Class A airspace must have equipment installed that meets the antenna and power output requirements of Class A1S, A1, A2, A3, B1S, or B1 equipment as defined in TSO-C166b and Section 2 of RTCA DO-260B (as referenced in TSO-C166b), or TSO-C166c and Section 2 of RTCA DO-260C as modified by DO-260C – Change 1 (as referenced in TSO-C166c).

(2) * * *

(i) Class A1S, A1, A2, A3, B1S, or B1 as defined in TSO-C166b and Section 2 of RTCA DO-260B (as referenced in TSO-C166b) or TSO-C166c and Section 2 of RTCA DO-260C as modified by DO-260C – Change 1 (as referenced in TSO-C166c); or

(ii) Class A1S, A1H, A2, A3, B1S, or B1 equipment as defined in TSO-C154c and Section 2 of RTCA DO-282B (as referenced in TSO-C154c), or TSO-C154d and Section 2 of RTCA DO-282C (as referenced in TSO-C154d).

(c) * * *

(1) * * *

(iv) The aircraft's SDA must be less than or equal to 10^{-5} per flight hour; and

(v) The aircraft's SIL must be less than or equal to 10^{-7} per flight hour or per sample.

* * * * *

(d) *Minimum Broadcast Message Element Set for ADS-B Out.* Each aircraft must broadcast the following information, as defined in TSO-C166b (including Section 2 of RTCA DO-260B, as referenced in TSO-C166b), TSO-C166c (including Section 2 of RTCA DO-260C as modified by DO-260C – Change 1, as referenced in TSO-C166c), TSO-C154c (including Section 2 of RTCA DO-282B, as referenced in TSO-C154c), or TSO-C154d (including Section 2 of RTCA DO-282C, as referenced in TSO-C154d). The pilot must enter information for message elements listed in paragraphs (d)(7) through (10) of this section during the appropriate phase of flight.

* * * * *

(5) An indication if a collision avoidance system is installed and operating in a mode that can generate resolution advisory alerts;

(6) If an operable collision avoidance system is installed, an indication if a resolution advisory is in effect;

(7) An indication of the Mode A transponder code specified by ATC;

(8) An indication of the aircraft identification that is submitted on the flight plan or used for communicating with ATC, except when the pilot has not filed a flight plan, has not requested ATC services, and is using a TSO-C154c or TSO-C154d self-assigned temporary 24-bit address;

* * * * *

(11) An indication of the aircraft assigned ICAO 24-bit address, except when the pilot has not filed a flight plan, has not requested ATC services, and is using a TSO-C154c or TSO-C154d self-assigned temporary 24-bit address;

* * * * *

(13) An indication of whether an ADS-B In capability is available;

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(g) *Incorporation by reference.* The standards required in this section are incorporated by reference with the approval of the Director of the Office of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. This incorporation by reference (IBR) material is available for inspection at the FAA and the National Archives and Records Administration (NARA). Contact the FAA at: Office of Rulemaking (ARM-1), 800 Independence Avenue, SW., Washington, DC 20590 (telephone 202-267-9677). For information on the availability of this material at NARA, visit www.archives.gov/federal-register/cfr/ibr-locations.html or email fr.inspection@nara.gov. This material is also available from the following sources indicated in this paragraph (g).

(1) U.S. Department of Transportation, Subsequent Distribution Office, DOT Warehouse M30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785; telephone (301) 322-5377; website:

www.faa.gov/aircraft/air_cert/design_approvals/tso/ (select the link “Search Technical Standard Orders”).

(i) TSO-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz), December 2, 2009.

(ii) TSO-C166c, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Service-Broadcast (TIS-B) Equipment Operating on the Radio Frequency of 1090 Megahertz (MHz), March 10, 2023.

(iii) TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Frequency of 978 MHz, December 2, 2009.

(iv) TSO-C154d, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on the Radio Frequency of 978 Megahertz (MHz), March 10, 2023.

(2) RTCA, Inc., 1150 18th St NW Suite 910, Washington, DC 20036; telephone (202) 833-9339; website: www.rtca.org/products.

(i) RTCA DO-260B, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B), Section 2, Equipment Performance Requirements and Test Procedures, December 2, 2009.

(ii) RTCA DO-260C, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and

Traffic Information Services-Broadcast (TIS-B), Section 2, Equipment Performance Requirements and Test Procedures, December 17, 2020.

(iii) RTCA DO-260C, Minimum Operational Performance Standards for 1090 MHz Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B), Change 1, January 25, 2022.

(iv) RTCA DO-282B, Minimum Operational Performance Standards for Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B), Section 2, Equipment Performance Requirements and Test Procedures, December 2, 2009.

(v) RTCA DO-282C, Minimum Operational Performance Standards (MOPS) for Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B), Section 2, Equipment Performance Requirements and Test Procedures, June 23, 2022.

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Polly E. Trottenberg,
Acting Administrator.

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