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Agenda Item 5: **NAM/CAR Regional Safety/Air Navigation/Aviation Security Implementation Matters**

5.2 Effectiveness of air navigation implementation mechanisms

AUTOMATIC DEPENDENT SURVEILLANCE – BROADCAST (ADS-B) OUT; ENSURING PREPAREDNESS FOR THE 2020 EQUIPAGE MANDATE

(Presented by United States)

EXECUTIVE SUMMARY

In 2010, the United States (U.S.) Federal Aviation Administration (FAA) published a regulatory requirement for all aircraft operating within certain airspace to be equipped with Automatic Dependent Surveillance – Broadcast (ADS-B) Out technology by January 1, 2020, according to Title 14 of the U.S. Code of Federal Regulations (14 CFR) sections 91.225 and 91.227. This requirement will affect all flights in the designated airspace. To prepare the aviation community and prevent any operational disruptions, the FAA is promoting the new mandate to the international community so that foreign aircraft intended to be operated within the affected airspace will be sufficiently equipped with ADS-B Out technology by the compliance date.

Strategic Objectives:	• Safety
References:	• Automatic Dependent Surveillance – Broadcast (ADS-B) Out Performance Requirements to Support Air Traffic Control (ATC) Service Final Rule (75 FR 30160, May 28, 2010; Docket No. FAA-2007-29305) • 14 CFR §91.225 and §91.227***

1. Introduction

1.1 Automatic Dependent Surveillance – Broadcast (ADS-B) is one of the most important underlying technologies in the United States' (U.S.'s) Federal Aviation Administration's (FAA's) plan to transform air traffic control from the current radar-based system to the Next Generation Air Transportation System (NextGen), a satellite-based system. ADS-B is bringing the precision and reliability of satellite-based surveillance to the U.S. National Airspace System (NAS).

1.2 ADS-B is part of the International Civil Aviation Organization (ICAO) Global Air Navigation Plan (GANP) and was endorsed by the ICAO Member States during the ICAO 38th Assembly in 2013. The U.S. presented a working paper at the ICAO 39th Assembly highlighting the January 1, 2020 mandate to equip all aircraft with ADS-B Out that will use the affected airspace in the U.S. NAS.

1.3 In 2010, the FAA published a regulatory requirement for all aircraft operating within certain airspace to be equipped with ADS-B Out technology by January 1, 2020, in accordance with Title 14 of the U.S. Code of Federal Regulations (14 CFR) sections (§) 91.225 and 91.227.

1.4 This requirement will affect all flights within the designated airspace. To prepare the aviation community and prevent any operational disruptions, the FAA is promoting the new mandate so that that foreign aircraft intending to operate within the affected airspace will be sufficiently equipped with ADS-B Out technology by the compliance date.

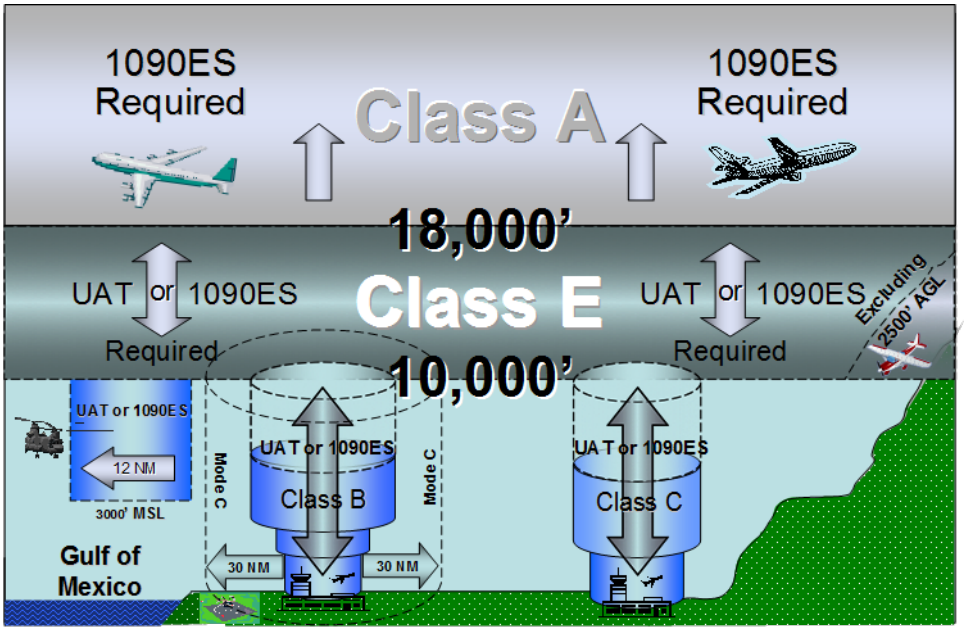
2. Discussion

2.1 ADS-B Out uses Global Positioning System (GPS) technology to determine specific aircraft information, which is then broadcast directly to other equipped aircraft and via a nationwide network of ground stations to air traffic controllers. Its numerous performance benefits include the ability to provide more frequent position update-rates than radar, deliver more precise location and velocity information for the aircraft, and offer critical in-cockpit traffic and weather information.

2.2 The improved accuracy, integrity, and reliability of satellite signals over radar means controllers will be able to safely reduce the mandatory separation between aircraft. This will increase capacity in the U.S. NAS. ADS-B also provides greater surveillance coverage, since ADS-B ground stations are much easier to place than radars. Remote areas without radar coverage, such as the Gulf of Mexico and parts of Alaska, are now covered by ADS-B.

2.3 The FAA published Automatic Dependent Surveillance – Broadcast (ADS-B) Out Performance Requirements to Support Air Traffic Control (ATC) Service Final Rule (75 FR 30160, May 28, 2010; Docket No. FAA-2007-29305) 14 CFR §91.225 and §91.227 for ADS-B Out equipage after January 1, 2020. This final rule mandates performance requirements for ADS-B Out avionics that will be required to fly in certain airspace. The final rule does not preclude other position source methods, nor does it mandate ADS-B In equipage. Sections 91.225 and 91.227 do not apply to any aircraft that was not originally certificated with an electrical system or that has not subsequently been certified with such a system installed, including balloons and gliders.

2.4 ADS-B in the U.S. NAS operates on two frequencies (links): 1090 MHz and 978 MHz. Equipment choices include either a Mode S transponder-based 1090 Extended Squitter (ES) or a Universal Access Transceiver (UAT) operating on 978 MHz. Aircraft operating above Flight Level 180 must be equipped with a Mode S-transponder-based ADS-B Out transmitter. Aircraft operating below 18,000 feet and within the U.S. NAS must be equipped with either a Mode S 1090ES transponder or UAT equipment. The graphic below illustrates these requirements.



2.5 The FAA has completed the deployment of ADS-B ground radios and has called on aviation users to equip their aircraft in advance of the January 1, 2020 mandate.

2.6 The FAA is collaboratively working with commercial operators, the avionics industry and the general aviation community in the U.S. to ensure awareness of this mandate. On October 28, 2014, FAA senior officials met with pilots and operators, manufacturers and suppliers at an "ADS-B Call to Action" meeting to identify and address barriers to equipping with ADS-B Out by January 1, 2020. Formed as a result of the Call to Action, Equip 2020 first met in November 2014 and has met 14 times since then. Tasked with moving forward significantly on implementation of ADS-B Out, Equip 2020 was given 32 tasks, reflecting barriers to implementation, to resolve. Approximately 100 representatives from industry and the FAA regularly attend Equip 2020 meetings and have developed into a well led and effective working organization, consisting of originally five, now four major working groups. Equip 2020 has become a valuable tool for developing and implementing solutions towards meeting the 2020 mandate.

2.7 The current Equip 2020 working groups are:

- Air Carrier Equipage Working Group: This working group coordinates and monitors the equipage of ADS-B Out in the 14 CFR parts 121 and 135 community, tackling issues relevant to availability of equipment and its installation. The group also has engaged in issues regarding the implementation of the FAA Service Availability Prediction Tool (SAPT) with regards to ATC operations and flight planning systems. The group has begun to monitor ongoing efforts regarding development of dual frequency multi-constellation equipment standards. Finally, the group reviews the status of Exemption 12555 and air carrier equipage plans.

- General Aviation Equipage Working Group: This working group coordinates and monitors the equipage of ADS-B Out in the general and corporate aviation communities, tackling issues relevant to availability of equipment and its installation. A significant amount of effort has been put into coordinating outreach efforts between FAA and GA interest groups to promote equipage. Additionally, the group has helped oversee a number of issues that have emerged as a result of the ADS-B Out mandate such as privacy for corporate and domestic sensitive missions and performance monitoring of aerobatic aircraft.

- Education and Benefits Working Group: This working group coordinated education and outreach to the community concerning ADS-B Out requirements and benefits. They also identified additional benefits that could be implemented for equipped aircraft, and supported an initial community-wide survey of GA operators conducted by Embry-Riddle Aeronautical University. This group shifted their focus in 2016 and is now the ADS-B In Benefits Working Group. Their aim is to build a business case that examines the difference between ADS-B In and other programs, specifically with regards to interval spacing.

- Installation and Approvals Working Group: This working group addresses all of the issues associated with ensuring efficient and consistent installations and approvals. The group is turning its focus to reducing call sign mismatch errors as well as undertaking efforts to reduce non-performing (bad install) equipment.

- The GPS Receiver and Performance-Based Rule Implications Working Group: This group defined the opportunities for sharing the risks of using un-augmented GPS equipment that does not always meet the rule performance requirements. This will allow additional time for certain operators to equip with satellite-based augmentation system (SBAS) or multi-constellation receivers which will fully meet rule performance requirements.

2.8 Accomplishments thus far in Equip 2020 include:

- Published the Final Rule Technical Amendment (80 FR 6899, February 9, 2015; FAA Docket No. FAA-2010-15853) to change the ADS-B Out technical standard order (TSO) from “meet requirements” to “meet performance requirements”. This change eliminates the implication that experimental or light sport aircraft needed to obtain design or production approval for their ADS-B out solutions.

- Updated advisory circulars to address such issues as use of a ground test in lieu of a flight test for new installations if the compatibility of the equipment and wiring has been validated; aligning altimeter systems requirements with 14 CFR § 91.217; and clarifying the ADS-B Out and transponder failure annunciation requirements.

- Published the ADS-B Out GPS receiver transition period Exemption 12555. This is a limited grant of exemption from specific performance requirements of the ADS-B Out rule during certain periods of GPS satellite constellation performance. Exemption 12555 is a one-time exemption from 14 CFR § 91.227(c) (1)(i) and (iii) for aircraft that are ADS-B Out equipped using qualifying GPS receivers when their performance falls below the requirement and backup surveillance is available. There are certain conditions and limitations for each type of receiver, and it expires December 31, 2024.

- Developed a database to help track equipage trends, to promote awareness of available solutions and focus industry resources on those aircraft that do not already have solutions available. Equipage solutions are now searchable on the FAA web site (http://www.faa.gov/nextgen/equipadsb/adsb_ready/)
- Obtained commitment from the FAA Aircraft Certification Service to prioritize ADS-B Out system certifications.
- Completed two surveys of GA aircraft owners on equipping with ADS-B Out, helping the FAA and industry shape outreach efforts.
- Regularly review the status of major air carrier equipage plans and numbers of equipped aircraft through analysis of the ADS-B Performance Monitor data.
- Conducting outreach to operators, installers and equipment manufacturers. Centralized and standardized all ADS-B information and outreach efforts into a single repository, a central location on the web for all ADS-B information and events. Developed comprehensive communication plans for Sun N Fun and AirVenture garnering millions of impressions on various FAA social media outlets supporting ADS-B awareness.

2.9 Many airlines equipped early on with GPS as part of the transition to satellite-based navigation, however this early equipage does not include the latest GPS receivers. Early-generation GPS receivers may experience brief outages of the FAA's required performance for ADS-B Out. Airplane manufacturers are upgrading GPS receivers across airplane models, but have said the upgraded receivers will not be available until 2018 to 2020. Operators must install ADS-B Out by January 1, 2020 using earlier-generation GPS equipment that has been qualified for ADS-B. The FAA approved a five-year limited exemption (Exemption 12555), applicable only from § 91.227(c)(1)(i) and (iii) requirements, under the following conditions:

- Each operator seeking exemption must notify the FAA.
- Operators covered under the exemption must develop and execute a plan to equip their aircraft to meet the requirements of § 91.227(c) prior to January 1, 2025.
- Operators of Selective Availability (SA)-Aware equipped aircraft are not required to conduct pre-flight verification. They are exempted from the performance requirements in § 91.225 when the ADS-B Out equipment is not predicted to meet the requirements of § 91.227(c)(1)(i) and (iii).
- Operators of SA-On equipped aircraft must conduct pre-flight verification. They may operate in airspace specified in § 91.225 when the ADS-B Out equipment does not meet the requirements of § 91.227(c)(1)(i) and (iii) and the FAA determines there is a backup means of surveillance. The FAA plans to make this determination available through SAPT

2.10 Exemption 12555 is not an extension of the requirement stated in § 91.227, but rather an acknowledgement that these operators were prepared to equip early and their efforts should be recognized and lauded. The exemption has been granted with conditions and limitations to aircraft operators, on a time-limited basis from January 1, 2020 through December 31, 2024, from 14 CFR § 91.227(c)(1)(i) and (iii). This exemption is applicable to both U.S. and foreign operators. Further details

of both the exemption requests and the FAA's decision (Exemption No. 12555) can be found in FAA Docket No. FAA-2015-0971 at https://www.regulations.gov/.

3. Conclusion

3.1 The safety and operational benefits of ADS-B Out are significant and the U.S. aviation community is collaboratively working to identify the specific requirements and timelines that would allow for effective implementation into the U.S. NAS.

3.2 States with operators that intend to operate within the U.S. affected airspace are encouraged to promote awareness of this upcoming requirement. Timely installations will allow the approving authority to ensure that the equipage installations are compliant with the requirements; will allow the operators sufficient preparation to account for the expense and time needed to complete the installation; and will ensure that aircraft can operate in all U.S. airspace on January 1, 2020.

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