



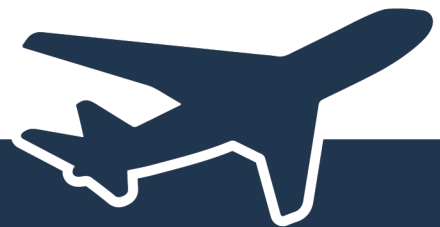
U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF INSPECTOR GENERAL

**NextGen Equipage: ADS-B Out Equipage
Rates Are Increasing, but FAA Must
Address Airspace Access Issues**

FAA

Report No. AV2020014

December 18, 2019





NextGen Equipage: ADS-B Out Equipage Rates Are Increasing, but FAA Must Address Airspace Access Issues

Requested by Chairman Bill Shuster and Frank LoBiondo of the House Committee on Transportation and Infrastructure and its Subcommittee on Aviation

Federal Aviation Administration | AV2020014 | December 18, 2019

What We Looked At

The Federal Aviation Administration's (FAA) Next Generation Air Transportation System (NextGen) is a multibillion-dollar transportation infrastructure project that requires airspace users to purchase and install new avionics on their aircraft. This includes Automatic Dependent Surveillance–Broadcast (ADS-B) *Out*, which FAA has mandated all operators who intend on flying in most controlled domestic airspace install by January 1, 2020. Citing concerns about whether operators will meet the 2020 deadline, the then-Chairmen of the House Committee on Transportation and Infrastructure and its Aviation Subcommittee requested that we provide information regarding equipage rates for ADS-B and other NextGen technologies on air carrier and general aviation aircraft. Accordingly, our audit objectives were to (1) determine the equipage rates for ADS-B and other NextGen-enabling technologies on commercial and general aviation aircraft, (2) ascertain the reasons behind aircraft operators' decisions to equip or not equip with these technologies, and (3) assess FAA and aircraft operators' plans to meet the 2020 ADS-B *Out* equipage deadline.

What We Found

We found that ADS-B *Out* equipage rates are increasing as the 2020 deadline approaches with other equipage rates varying depending on the NextGen technology. In addition, operators are installing ADS-B *Out* primarily due to the mandate but also consider financial and operational factors when equipping with NextGen technologies, such as potential benefits. Finally, most commercial and turbine-powered general aviation operators who will fly in ADS-B *Out* airspace plan on meeting the 2020 deadline. However, FAA has not finalized procedures needed by non-equipped operators to access ADS-B *Out* airspace.

Our Recommendations

We made three recommendations to FAA concerning having the necessary systems and procedures in place so operators can access ADS-B *Out* required airspace. FAA concurred with two of our recommendations and provided appropriate planned actions and completion dates. It did not concur with one recommendation to analyze the feasibility of developing automated systems to provide operators with more timely information regarding GPS outages or degradation. The Agency concluded that developing these additional systems is redundant and an inefficient use of resources. Based on its response, we believe that FAA has assessed the feasibility of developing automated systems as noted in recommendation 2. We consider this recommendation closed.

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Memorandum

Date: December 18, 2019

Subject: ACTION: NextGen Equipage: ADS-B *Out* Equipage Rates Are Increasing, but FAA Must Address Airspace Access Issues | Report Nc

From: Matthew E. Hampton
Assistant Inspector General for Aviation Audits 

To: Federal Aviation Administrator

The Federal Aviation Administration's (FAA) Next Generation Air Transportation System (NextGen) is a multibillion-dollar transportation infrastructure project intended to modernize our Nation's aging air traffic system and provide safer and more efficient air travel. Implementing NextGen is a complex undertaking and requires joint investments from FAA (for new ground systems for controllers) and airspace users (for new avionics and displays for pilots) to realize expected benefits.

There are several key NextGen technologies that require airspace users to purchase and install new avionics on their aircraft, including one effort that has been mandated by FAA, the Automatic Dependent Surveillance–Broadcast (ADS-B),¹ and others that are optional, such as Data Communications (DataComm).² FAA has mandated that aircraft operating in most controlled domestic airspace be equipped with ADS-B *Out*³ technology by January 1, 2020.⁴

Citing concerns about whether operators will meet the 2020 deadline, then-Chairmen of the House Committee on Transportation and Infrastructure and its Aviation Subcommittee⁵ requested that we provide information regarding

¹ ADS-B technology uses the satellite-based Global Position System (GPS) and is intended to allow FAA to transition from ground-based radar to a satellite-based system for improving surveillance and management of air traffic.

² DataComm provides a 2-way digital communications link between controllers and flight crews, improving accuracy and safety. FAA has implemented data link technology at towers and is in the process of implementing the system at facilities that monitor high-altitude air traffic.

³ *ADS-B Out* is the current stage of the program and refers to an aircraft broadcasting its position and other information to ground systems so the information can be seen on controller displays.

⁴ 14 CFR § 91.225 and 14 CFR § 91.227 (May 2010).

⁵ Chairman Bill Shuster of the U.S. House of Representatives Committee on Transportation and Infrastructure and Chairman Frank A. LoBiondo of the Subcommittee on Aviation requested this audit on November 21, 2017.

equipage rates for ADS-B and other NextGen technologies on air carrier and general aviation aircraft as well as the reasons operators decide to equip their aircraft. In addition, they requested that we assess FAA's and operators' plans for meeting the 2020 ADS-B *Out* deadline.

Accordingly, our audit objectives were to (1) determine the equipage rates for ADS-B and other NextGen-enabling technologies on commercial and general aviation aircraft,⁶ (2) ascertain the reasons behind aircraft operators' decisions to equip or not equip with these technologies, and (3) assess FAA and aircraft operators' plans to meet the 2020 ADS-B *Out* equipage deadline.

We conducted this audit in accordance with generally accepted Government auditing standards. We focused on installation of three NextGen technologies on commercial and general aviation aircraft: ADS-B *Out*, DataComm, and Performance Based Navigation (PBN).⁷ Exhibit A details our scope and methodology. Exhibit B lists the organizations we visited or contacted.

We appreciate the courtesies and cooperation of FAA representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-0500 or Robin Koch, Program Director, at (404) 562-3770.

cc: The Secretary
DOT Audit Liaison, M-1
FAA Audit Liaison, AAE-100

⁶ In July 2019, we provided the House Committee of Transportation and Infrastructure and its Aviation Subcommittee with a briefing regarding our preliminary results related to ADS-B *Out* equipage rates. See *Letter to Chairmen DeFazio and Larson and Ranking Members Graves and Graves Regarding ADS-B Out Equipage*, September 12, 2019. OIG reports are available on our website at <http://www.oig.dot.gov>.

⁷ PBN is a satellite-enabled form of air navigation that provides for greater route precision and accuracy. PBN procedures require various avionics capabilities depending on the level of desired navigation precision and accuracy.

Results in Brief

ADS-B *Out* equipage rates are increasing as the 2020 deadline approaches, with other equipage rates varying depending on the NextGen technology.

Over 85,000 commercial, international, and general aviation aircraft were in compliance with the ADS-B *Out* mandate as of October 1, 2019, nearly doubling the number of equipped aircraft as of May 1, 2018. While equipage rates increased for all operators, they varied among the different segments of the industry, with 89 percent of commercial aircraft, 70 percent of international aircraft, and 51 percent of general aviation aircraft being deemed compliant. Also, among general aviation operators, 71 percent of higher-end turbojet and turboprop operators have equipped with ADS-B *Out* while only 47 percent of single- and multi-engine piston operators have done so. With regard to other NextGen technologies, there are 7,800 DataComm-equipped aircraft flying in U.S. airspace as of September 2019, all of which are commercial and turbine-powered general aviation aircraft. Further, while most commercial and turbine-powered general aviation aircraft are equipped to fly less complex PBN procedures, only mainline commercial carriers' aircraft are largely equipped to fly more complex PBN routes.

Operators are installing ADS-B *Out* primarily due to the mandate but also consider financial and operational factors, such as potential benefits, when equipping with NextGen technologies.

Although the mandate is the primary driver for the decision to equip with ADS-B, deciding whether and when to equip also involves other factors. For example, one mainline operator planned to equip its aircraft in mid-2018 and throughout 2019 in stages, mostly during slower travel periods, because it did not want to affect its operations during peak flying periods. While the installation of ADS-B *Out* equipage has increased, some operators and their representatives raised concerns about not achieving anticipated benefits from ADS-B, such as reduced separation standards in high-altitude airspace. According to FAA, it has initiatives ongoing that will capitalize on the operational and safety benefits envisioned when the ADS-B program was launched. However, it is uncertain if or when these benefits will be realized. In contrast, commercial and high-end general aviation aircraft operators are equipping with DataComm mainly due to operational benefits, including decreased gate and taxi delays and reduced communication time between controllers and pilots. Likewise, aircraft operators equip with PBN technology mainly for the potential benefits it can provide, such as more direct flights and reduced fuel burn. However, similar to ADS-B, DataComm and PBN benefits for airspace users have yet to be fully realized, potentially impacting the overall expected benefits of NextGen.

While most commercial and turbine-powered general aviation operators who will fly in ADS-B Out airspace plan on meeting the 2020 deadline, several airspace access issues have not been addressed by FAA.

It is likely that most mainline and regional commercial operators along with higher-end, turbine-powered general aviation operators who intend on flying in ADS-B required airspace will meet the 2020 deadline by either installing (1) compliant equipment on their aircraft in time or (2) previously filing for an exemption,⁸ which allowed operators to install a compliant transponder by the 2020 deadline but delay updating their aircraft's position source until December 31, 2024. Further, some smaller commercial operators have not equipped their aircraft with ADS-B Out and may not meet the 2020 deadline. In addition, many piston-engine general aviation aircraft will not be equipped by the 2020 deadline, though not all of these operators will have to equip for various reasons, such as not flying in ADS-B Out airspace. In addition, FAA does not plan on completely prohibiting non-equipped aircraft from flying in this airspace. Operators without ADS-B Out on their aircraft will need to determine if back-up surveillance is available and contact air traffic control at least an hour in advance of flying for flight route approval. Without this approval, FAA may deny them access to most controlled airspace. However, FAA has not finalized procedures allowing operators to confirm the availability of back-up surveillance. Furthermore, the Agency lacks systems for timely notification regarding Global Positioning System (GPS) outages and for requesting authorization to fly in ADS-B airspace.⁹ As a result, non-equipped operators may find it difficult to access ADS-B Out airspace.

We are making recommendations to FAA concerning having the necessary systems and procedures in place so operators can access ADS-B Out required airspace.¹⁰

Background

Since fiscal year 2004, FAA has been developing NextGen, a multibillion-dollar transportation infrastructure project intended to modernize our Nation's aging air traffic system and provide safer and more efficient air traffic management. NextGen is a complex undertaking and requires stakeholders, including

⁸ Exemption Number 12555, FAA, August 20, 2015.

⁹ Non-equipped operators will have the ability to access ADS-B Out airspace in 2020 and beyond. However, they must confirm that backup surveillance services are available for their proposed route and receive authorization from FAA to fly in the airspace at least an hour in advance.

¹⁰ This encompasses most airspace where a transponder is required to operate.

commercial carriers and general aviation operators, to purchase and install new technologies on their aircraft.

These technologies¹¹ include:

ADS-B. ADS-B uses satellite-based technology, including GPS and a network of ground stations, to transmit position information more frequently and accurately than ground-based radars (see figure 1). ADS-B consists of two services:

- *Out*, which broadcasts an aircraft's flight position data to the ADS-B ground system and controller displays. It is expected to provide more accurate information to track aircraft in the air and on the ground; and
- *In*, which displays flight information in the cockpit, including the location of other aircraft. It also provides pilots with weather and other critical information.

Figure 1. ADS-B Schematic



Source: FAA

¹¹ See exhibit D for detailed explanation of each technology, including the expected benefits and required equipment.

In May 2010, FAA issued a final rule requiring all aircraft operators that fly in most controlled airspace install ADS-B *Out* by January 1, 2020. To meet the requirements, an operator must equip their aircraft with: (1) a qualified Global Navigation Satellite System position source, (2) an *Out*-capable transponder, and (3) an appropriate antenna.¹² If operators do not equip their aircraft, they must contact air traffic control at least an hour in advance for flight route approval and may be denied access to certain airspace.

DataComm. Provides a two-way digital communications link between controllers and flight crews, improving accuracy and safety. FAA has implemented the technology at 62 air traffic control towers and is in the process of implementing the system at facilities that manage high-altitude air traffic.

PBN. A satellite-enabled form of air navigation that provides for greater route precision and accuracy. There are two types of PBN procedures:

- Area Navigation (RNAV), which allow aircraft to fly any desired flight path without the limitations imposed by ground-based navigation systems; and
- Required Navigation Performance (RNP), which adds monitoring and alerting capabilities that allow aircraft to fly more precise flight paths into and out of airports.

Benefits of these routes include: saving fuel, reducing flight times, increasing traffic flow and capacity, and reducing exhaust emissions. PBN procedures require various avionics capabilities depending on the level of desired navigation precision and accuracy.

ADS-B Equipage *Out* Rates Are Increasing, With Other Equipage Rates Varying Depending on the NextGen Technology

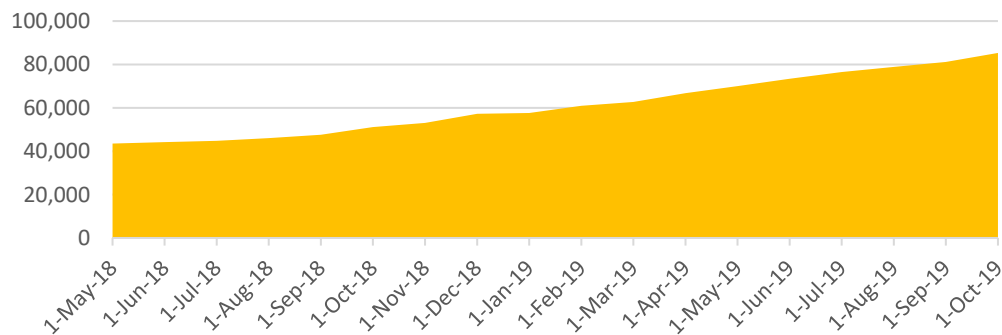
As the 2020 deadline approaches, overall ADS-B *Out* equipage rates are increasing. However, equipage rates vary among operators, with mainline and regional commercial carriers and higher-end general aviation operators equipping at a higher rate than smaller carriers and piston engine general aviation operators. In addition, DataComm and PBN equipage varies depending on the technology, though those technologies are primarily on commercial and higher-end general aviation aircraft.

¹² See exhibit E for pictures of ADS-B equipment.

ADS-B Out Equipage Rates Are Increasing but Vary by Segment of the Industry

As the 2020 deadline approaches, overall ADS-B *Out* equipage rates are increasing, with some operator segments having their fleets nearly fully equipped. According to FAA's data, 85,311 commercial, international, and general aviation aircraft were in compliance with the ADS-B *Out* mandate as of October 1, 2019, a nearly 96 percent increase in aircraft equipped since May 1, 2018 (see figure 2).

Figure 2. Total Number of Commercial, International, and General Aviation Aircraft Equipped With ADS-B *Out*: May 1, 2018 to October 1, 2019



Source: FAA/MITRE

While equipage rates increased for all operators, they varied among the different segments of the industry, with 89 percent of commercial aircraft, 70 percent of international aircraft, and 51 percent of general aviation aircraft being deemed compliant (see table 1).

Table 1. ADS-B *Out* Compliant Aircraft by Operator and Operation/Engine Type, as of October 1, 2019

Operator	Operation/Engine Type	Number of Aircraft Observed Compliant	Total Number of Aircraft	Percentage of Aircraft Observed Compliant
Commercial (Domestic)	Mainline	4,485	4,847	93%
	Regional	1,585	1,792	88%
	Other*	<u>330</u>	<u>527</u>	<u>63%</u>
	Subtotal	6,400	7,166	89%
International ¹³		6,507	9,296	70%
General Aviation	Turbojet/Turboprop	15,919	22,289	71%
	Single/Multi-Engine Piston	<u>56,485</u>	<u>120,390</u>	<u>47%</u>
	Subtotal	72,404	142,679	51%
Total		85,311	159,141	54%

*Other carriers consist of 38 commercial and cargo airlines that make up roughly 7 percent of the fleet. They are small operators, with 21 of them operating 11 aircraft or less.

Source: FAA/MITRE

FAA's data also show that equipage rates vary among operators depending on the type of operation or engine type.¹⁴

Commercial Operators. Mainline and regional commercial carriers¹⁵ are equipping at a higher rate than smaller, commercial carriers. ADS-B *Out* equipage rates at mainline (93 percent) and regional (88 percent) carriers have nearly tripled since May 1, 2018. However, while equipage at smaller, commercial operators has significantly increased since May 2018, only 63 percent of this fleet have equipped. In addition, 19 of these carriers have 50 percent or less of their

¹³ The international fleet is comprised of Part 129 aircraft along with other foreign aircraft that fly into U.S. controlled airspace. Due to the requirements of the ADS-B *Out* rule, foreign operators must meet the same equipage requirements as domestic commercial and general aviation operators.

¹⁴ See exhibit A for ADS-B *Out* equipage information by aircraft operation/type from May 2018 to July 2019.

¹⁵ Per FAA's definition, mainline carriers consist of 11 commercial airlines that make up 68 percent of the Part 121 fleet. Regional carriers consist of 14 commercial and cargo airlines that make up 25 percent of the Part 121 fleet.

fleet equipped, with 9 of them not equipping any of their aircraft with ADS-B *Out*.¹⁶

General Aviation Operators. Compared to commercial operators, general aviation operators have equipped at a lower rate, with 71 percent of higher-end turbojet and turboprop operators estimated to equip with ADS-B *Out* having done so, while only 47 percent of single- and multi-engine piston operators have equipped.

DataComm Equipage Is Limited to Commercial and Higher-End General Aviation Aircraft

According to FAA’s data, there are 7,800 DataComm-equipped aircraft flying in U.S. airspace as of October 2019. Of this total, 3,166, or 41 percent, are domestic commercial aircraft; 2,688, or 34 percent, are general aviation aircraft, and 1,946, or 25 percent, are international aircraft (see table 2). The 3,166 domestic commercial-equipped aircraft represent 72 percent of the total domestic fleet that can be equipped with DataComm and 44 percent of the total U.S. jet fleet.

Table 2. DataComm Equipage as of October 2019

Operator	Total Aircraft Equipped with DataComm	Percentage of Total Equipped Aircraft
Commercial (Domestic)	3,166	41%
International	1,946	25%
General Aviation	<u>2,688</u>	<u>34%</u>
Total	7,800	100%

Source: FAA

Commercial-equipped aircraft include most Boeing and larger Airbus models, such as the A330. Mid-sized Airbus’, such as the A300, older aircraft, and regional aircraft (both piston and turbine engine) are generally not equipped with the technology. In addition, all 2,688-equipped general aviation aircraft are business

¹⁶ According to FAA, mainline and regional commercial carriers make up 93 percent of the total commercial fleet it tracks for ADS-*Out* equipage, with smaller carriers making up the remaining 7 percent.

jets and classified as turbojets, with no turboprop or piston-powered aircraft currently equipped.

While Most Mainline Commercial Operators Are Equipped To Fly Advanced PBN Procedures, Other Operators Have Equipped at a Much Lower Rate

According to FAA's data, nearly all commercial, international, and higher-end general aviation aircraft are equipped to fly less complex PBN (Area Navigation, or RNAV) procedures as of October 1, 2019. However, while 94 percent of mainline commercial carriers' aircraft are equipped to fly more complex PBN routes (Required Navigation Performance, or RNP), only 41 percent of regional aircraft, 45 percent of other commercial aircraft, 27 percent of international aircraft, and 9 percent of higher-end general aviation aircraft are equipped to fly these routes (see table 3).

Table 3. PBN Equipage Rates by Operator and Type of Operation as of October 1, 2019

Operator ¹⁷	Type of Operation	RNAV-Capable Aircraft	Total Aircraft	% of RNAV-Capable Aircraft	RNP-Capable Aircraft	Total Aircraft	% of RNP-Capable Aircraft
Commercial (Domestic)	Mainline	4,847	4,847	100%	4,563	4,847	94%
	Regional	1,792	1,792	100%	743	1,792	41%
	Other	522	527	99%	237	527	45%
International		6,647	6,758	98%	1,837	6,758	27%
General Aviation – Turbojet/Turboprop		20,936	21,152	99%	2,009	21,152	9%

Source: FAA

The non-RNP capable mainline aircraft include MD-80s and DC-9s at passenger carriers and A300s at cargo operators. Most non-equipped regional aircraft are older regional jets while non-equipped other carriers' aircraft cover all types,

¹⁷ While FAA did not provide complete statistics regarding the number of PBN-equipped General Aviation Single/Multi-Engine aircraft, its data showed that less than 10 percent of these aircraft are equipped to fly RNAV procedures and less than 1 percent are equipped to fly RNP procedures.

ranging from Boeing 737s and 747s to regional jets to turboprops. According to FAA and industry officials, most new aircraft are equipped with the technology necessary to operate both RNAV and RNP routes.

Operators Are Installing ADS-B *Out* Due to the 2020 Mandate but Also Consider Operational and Financial Factors When Equipping With NextGen Technologies

Commercial and general aviation operators who equip with ADS-B *Out* are doing so primarily due to the 2020 mandate but also consider operational, financial, and other factors when deciding whether and when to equip. They also consider these same factors when determining whether to install DataComm and PBN. However, operators are realizing limited operational and financial benefits from installing each of these technologies.

The ADS-B *Out* Mandate Is Driving Equipage, but Additional Factors Impact Operators' Decisions

According to FAA and MITRE officials, commercial carrier representatives, general aviation operators, aviation industry groups, and other aviation stakeholders we spoke with, operators are equipping with ADS-B *Out* primarily due to the 2020 mandate. They also consider additional factors when deciding whether to equip their aircraft with the technology and when to install it. These include:

Operational Factors. Installing ADS-B *Out* requires operators to ground aircraft in order to install the necessary equipment. For commercial and higher-end general aviation operators, this requires advance planning to minimize operational impacts. For example, one mainline operator planned to equip its aircraft in late 2018 and throughout 2019 in stages, mostly during slower travel periods, because it did not want to impact its operations during peak periods.

In addition, while larger commercial operators often use in-house maintenance facilities to install ADS-B *Out* equipment, smaller commercial and general aviation operators generally schedule their installations with outside maintenance shops. This requires advance planning to reserve slots at outside maintenance facilities

in order to install the equipment, particularly at popular maintenance shops or in areas with a high concentration of aircraft, such as south Florida.

Cost Factors. While new commercial and high-end general aviation aircraft are equipped with ADS-B *Out*, retrofitting it on existing aircraft can be expensive, with MITRE estimating the costs ranging from \$98,200 to \$338,200 per aircraft. Operators consider these costs when determining whether to retrofit their fleet, especially older aircraft or aircraft they intend to replace.

For piston-engine general aviation operators, cost is the primary factor when deciding whether to equip with ADS-B *Out*. Some operators cite a poor return on investment from installing the equipment, especially on older, less expensive aircraft (\$1,500 to \$2,000 for a system on a \$25,000 to \$40,000 aircraft), as a reason for not installing the equipment. Since the mandate was announced, alternative, less expensive avionics have recently come on the market that meet the technical requirements of the mandate, making it less expensive for these operators to equip.

Timing. While FAA gave operators nearly a decade to meet the equipage mandate, commercial operator representatives we spoke with stated that their long-term business planning generally involved looking forward 2 to 3 years due to factors such as planning its operations to fit projected business cycles. Equipping aircraft long before the deadline did not match up to this planning, causing operators to equip closer to the deadline.

Obtaining/Certifying Equipment. Some operators, particularly small carriers or those with older fleets, cited difficulties obtaining ADS-B *Out* equipment as an obstacle towards meeting the mandate. For example, representatives at one carrier stated they had difficulties locating a vendor that would manufacture units for their aircraft even though they began looking for solutions 2 to 3 years before the 2020 deadline. In addition, modifying avionic equipment requires FAA approval via the Supplemental Type Certificate¹⁸ process. In some cases this process was taking a year or more to complete, delaying operators' plans for installing the required equipment.

Incentives. Starting in 2008, FAA provided incentives totaling \$48 million to commercial and general aviation operators as well as avionics manufacturers to accelerate development of ADS-B solutions. According to an FAA official, the Agency offered these incentives to help kick start development of solutions that other operators could later use to equip their aircraft. For example, in 2011, FAA provided nearly \$21 million in incentives to United Airlines, Rockwell Collins, and

¹⁸ A supplemental type certificate is an FAA-approved modification to an aeronautical product from its original design. The approval not only applies to the modification but also to how that modification affects the original design of the product.

Boeing to help develop an ADS-B solution for the Boeing 737 aircraft, which could be used by other operators to equip similar aircraft.

In September 2016, FAA began offering a \$500 rebate to owners of fixed-wing, single engine piston aircraft who purchased and successfully installed ADS-B *Out* equipment. FAA offered the rebate as a way to encourage equipage among this group of operators. FAA made 20,000 rebates available, with approximately 12,000 rebates reserved as of April 2018 before the Agency initially closed the program. However, given the general aviation community's support for the rebate, in September 2018 FAA re-opened the program for the remaining 8,000 rebates, which were all reserved by May 2019.

General Aviation Safety. Some general aviation operators and pilots cited the safety benefits the system provides when paired with ADS-B *In*, which allows the pilot to "see" the location of other aircraft flying close by, as a key reason why they equipped with *Out*. In some cases, operators equipped with the technology prior to FAA approving the *Out* equipage rule in 2010 for this reason.

Other Reasons. Operators and other stakeholders also cited other reasons that factored into equipage decisions, including privacy concerns, a belief that FAA would move the 2020 deadline, and meeting foreign equipage requirements.¹⁹

Operational and Financial Considerations Drive DataComm and PBN Equipage Decisions

Unlike ADS-B *Out*, operators are not required to install DataComm and PBN on their aircraft. Rather, operators, industry representatives, and FAA officials we spoke with cited operational and financial factors when deciding whether to equip their aircraft with the two technologies.

Operational Factors. DataComm increases operational efficiency and safety by providing equipped aircraft with benefits such as decreased gate and taxi delays and reduced communication time between pilots and controllers at equipped airports. Based on figures provided by FAA, between June 2016 and March 2019, air traffic control towers equipped with the system resulted in over 900,000 minutes of reduced delays, over 1.4 million minutes in communication

¹⁹ Other countries implemented their own ADS-B equipage requirements prior to FAA's 2020 mandate. Operators who flew in these countries were required to equip with the technology.

time saved, and over 78,000 read-back errors avoided.²⁰ While operators agreed that they realized these benefits, they could not quantify them.

Aircraft equipped with PBN technology allow operators to use procedures that improve departure/arrival routes and reduce fuel burn, resulting in operational enhancements and cost savings for its fleets.

Financial Considerations. Retrofitting aircraft with DataComm or PBN technology can be expensive. For example, MITRE estimates that it costs between \$43,000 and \$620,000 to retrofit an aircraft with DataComm. Operators consider these costs when deciding whether to retrofit their aircraft with these technologies, especially on older aircraft or aircraft they intend on retiring or otherwise disposing of. In addition, FAA offered a financial incentive to operators as a way to “jump start” DataComm equipage. As of September 2019, there were 2,510 aircraft that were equipped through the incentive, with approximately \$117 million set aside to fund the incentives.

Operators Are Realizing Limited Benefits From Installing the Three NextGen Technologies

Our interviews with operators and industry representatives, along with our related audit work, indicate that operators are not fully realizing the anticipated benefits they expected from installing three technologies, potentially impacting the overall expected benefits of NextGen.

ADS-B Out. FAA stated that implementing ADS-B would result in increased operational, cost, and safety benefits for operators and the Agency. However, these benefits have largely not materialized. For example, FAA stated that requiring operators to install ADS-B Out would allow for new procedures that would reduce separation standards between aircraft in en-route and terminal airspace, increasing capacity and operational efficiency in the nation’s skies. According to FAA, it has initiatives ongoing that will capitalize on the operational and safety benefits envisioned when the ADS-B program was launched. However, it is uncertain if or when these benefits will be realized.

DataComm. While DataComm’s program at towers has provided benefits, these benefits are limited in part because DataComm is only offered at 62 commercial and general aviation airports where FAA could justify a business case for installing the system. In addition, FAA is in the initial stages of implementing the

²⁰ We did not conduct tests to verify the accuracy of FAA’s DataComm benefit figures.

system into en-route airspace, where significant additional benefits are expected. However, technical problems, including communication and avionics issues, halted implementation in late 2018. According to FAA, these problems, along with the Government shutdown, contributed to further delays in introducing the system into en-route airspace. FAA now expects these services to be fully implemented by the summer of 2021.

PBN. Operators and industry representatives indicated that the use of high-value PBN procedures remains low, including at large airports such as Atlanta Hartsfield. According to FAA air traffic facility managers and air traffic controller representatives we spoke with, one reason for this is the difficulty in separating aircraft with varying degrees of equipage. In addition, as we reported in August 2019, the annual benefits FAA estimated for seven completed Metroplex sites²¹ fell well short of expectations, with FAA only achieving about half of the minimum amount that FAA initially expected when it first planned each site.²² However, FAA officials stated that the Agency has achieved other benefits that are difficult to quantify, such as increased safety, reduced controller/pilot task complexity, and de-conflicted air traffic routes.

While Most Operators Who Will Fly in ADS-B *Out* Airspace Will Meet the 2020 Deadline, Airspace Access Issues Remain

It is likely that most mainline and regional commercial operators along with higher-end, turbine-powered general aviation operators who intend on flying in airspace requiring ADS-B will meet the 2020 deadline. However, a sizable segment of piston-engine general aviation aircraft will not be equipped, and it is difficult to determine how many of these operators plan to equip their aircraft with ADS-B *Out*. In addition, FAA does not plan on completely prohibiting non-equipped aircraft from flying in ADS-B *Out* airspace. However, it has not finalized systems and procedures needed by non-equipped operators to access this airspace.

²¹ FAA began the Metroplex program in 2010 to increase efficiencies in congested, metropolitan areas with multiple airports. FAA and industry have since prioritized 12 locations where improvements are expected to yield near-term benefits.

²² *FAA Has Made Progress in Implementing Its Metroplex Program, but Benefits for Airspace Users Have Fallen Short of Expectations* (OIG Report No. AV2019062), August 27, 2019.

Most Commercial and Turbine-Powered General Aviation Operators Who Fly in ADS-B Out Required Airspace Plan on Meeting the 2020 Deadline

While it is likely that the majority of commercial and turbine-powered general aviation operators will equip with ADS-B *Out*, many piston-engine operators may not.

Commercial and Turbine-Powered General Aviation Operators. Based on our analysis of the equipage data to date; equipage plans filed by 33 commercial operators; and interviews with FAA, MITRE, industry representatives, and operators, it is likely that most mainline and regional commercial operators and higher-end, turbine-powered general aviation operators who intend on flying in ADS-B required airspace will meet the 2020 deadline. They will do so by accomplishing one of the following:

1. Installing compliant equipment on their aircraft. Without this technology on their aircraft, operators would need to contact air traffic control at least an hour in advance for flight route approval and may be denied access to most controlled airspace without this approval.
2. Meeting the requirements of the 12555 Exemption. In August 2015, FAA granted a one-time exemption that requires operators to install a compliant transponder by the 2020 deadline but allows them to delay updating their aircraft's position source²³ until December 31, 2024.²⁴ Operators will need to install both avionics if they intend on flying unrestricted in ADS-B *Out* required airspace.

However, some smaller commercial operators have not equipped their aircraft with ADS-B *Out*, and little is known about their equipage plans. This has raised concerns among MITRE and industry officials regarding whether these operators will meet the 2020 deadline.

Piston-Engine General Aviation Operators. The data indicate that a sizable segment of piston-engine general aviation aircraft will not be equipped with ADS-B *Out* by the 2020 deadline. FAA officials and industry representatives we spoke with stated that not all of these operators will equip for various reasons. For example,

²³ A position source is avionics equipment installed on an aircraft that allows its location to be tracked.

²⁴ Operators needed to submit a request for each aircraft covered by the Exemption by August 1, 2018. At that time they also needed to submit an equipage plan, updated annually, explaining how and when each aircraft will meet the equipage requirement by December 31, 2024.

many do not fly, or they rarely fly, in airspace requiring ADS-B *Out* or rarely fly their aircraft at all.

In addition, it is difficult to determine how many of these operators plan to equip their aircraft with ADS-B *Out*. FAA's total estimated figure for this group includes aircraft listed in the Agency's aircraft registry, yet some may not have flown in years. FAA, MITRE, and industry officials also stated that it is uncertain how many of these operators actually intend to equip, though those who fly near major metropolitan areas or in airspace requiring ADS-B *Out* will be more likely to equip.

Non-Equipped General Aviation Aircraft. For general aviation operators who have not yet equipped, they plan on:

- Equipping their aircraft either before or after the deadline,
- Not flying or rarely flying in airspace requiring ADS-B *Out*, or
- Not equipping with the technology, especially on older aircraft whose value is relatively low.

However, operators may face challenges if they intend on installing the system before the deadline. Maintenance shop operators and their representatives stated that available space to install the equipment was filling up fast, with some owners not willing to accept customers if it meant turning away other, more profitable projects such as full aircraft overhauls. As a result, operators may wait until after the deadline passes before equipping their aircraft.

FAA Has Not Finalized Systems and Procedures Needed by Non-Equipped Aircraft To Access ADS-B Airspace

In an April 1, 2019, Federal Register notice, FAA reconfirmed its policy requiring non-equipped operators to receive approval at least 1 hour prior to flying in ADS-B *Out* required airspace. The Agency stated that it does not intend to adjust its operations to accommodate non-equipped aircraft and that air traffic control is more likely to deny access to non-equipped aircraft without this approval, especially at busy slot-controlled and capacity-constrained airports. In addition, FAA intends to impose civil penalties on operators who repeatedly operate non-equipped aircraft without proper authorization.

FAA continues to work with operators, mainly through the Equip 2020 Working Group,²⁵ to address potential issues prior to the mandate taking effect. However, with the deadline approaching, the Agency has not finalized systems needed by non-equipped operators to access ADS-B *Out* airspace.

Pre-Flight Availability/Back-Up Surveillance. Operators intending to fly in ADS-B *Out* airspace with non-equipped aircraft or legacy GPS position sources²⁶ must first determine whether backup surveillance is available for their proposed route using FAA's Service Availability Prediction Tool (SAPT)²⁷ within 24 hours of departure. Once receiving approval from SAPT, operators can fly the designated route without violating the ADS-B *Out* rule even if there is a planned or unplanned GPS outage. In the event of a scheduled GPS or SAPT outage, FAA will issue a Notice to Airmen informing operators of these issues and will not initiate enforcement actions against them.

While FAA has communicated this policy to operators, it is still finalizing the guidance for using SAPT, and is not planning to issue updated guidance to operators until the beginning of 2020. In addition, some operators are concerned that they are not receiving timely notification from FAA regarding planned GPS outages or more detailed guidance regarding in-flight GPS degradation. Further, there is not a mechanism in place for FAA to detect GPS deviations automatically. Rather, it will have to review them manually, which takes longer to notify operators of any potential issues.

ADS-B Deviation Authorization Pre-Flight Tool (ADAPT). FAA is developing a web-based system called ADAPT so that non-equipped operators can request authorization to fly in ADS-B required airspace. However, FAA must successfully test and deploy the system before its planned implementation in December 2019, just before the mandate takes effect. In addition, the Agency also must develop procedures and guidance and provide it to operators so they can train their personnel on the system.

²⁵ Established in 2014, the Equip 2020 Working Group is a joint FAA/industry committee charged with addressing the challenges surrounding equipage, including its availability, cost, and policy considerations.

²⁶ This includes aircraft equipped with Selective Availability (SA)-On or SA-Aware GPS receivers, which do not meet the technical requirements called for in 14 CFR § 91.227. However, operators equipped with SA-Aware and who received a 12555 Exemption do not have to determine whether backup surveillance is available through 2024.

²⁷ SAPT provides operators with information regarding the availability of GPS services along their planned route of flight and whether back-up surveillance is available.

Conclusion

FAA's NextGen initiative has the potential to significantly enhance the efficiency and capacity of our National Airspace System. However, NextGen's success depends in part on whether aircraft will equip with the key technologies necessary to achieve advanced capabilities, including ADS-B. While operators were initially slow to equip their aircraft with ADS-B *Out*, most who intend on flying in ADS-B *Out* airspace will be equipped in time to meet the 2020 deadline. However, with the mandate fast approaching, it is critical that FAA implement the systems necessary so that operators have access to the systems and procedures they need to operate in the National Airspace System.

Recommendations

To provide operators with the necessary systems and procedures they need to access ADS-B *Out* required airspace regardless of their equipage status, we recommend that the Federal Aviation Administrator:

1. Complete publication of the FAA advisory circular that formalizes interim guidance regarding the Service Availability Prediction Tool.
2. Analyze the feasibility of developing automated systems to provide operators with more timely information regarding GPS issues, such as outages and degradations, and if feasible, implement them.
3. Identify remaining steps and target action dates for completing the ADS-B Deviation Authorization Pre-Flight Tool system, as well as contingencies if the system is not operational by the 2020 deadline.

Agency Comments and OIG Response

We provided FAA with our draft report on November 8, 2019, and received its response on December 6, 2019, which is included as an appendix to this report. FAA concurred with recommendations 1 and 3 as written and provided appropriate actions and completion dates.

The Agency did not concur with recommendation 2, stating that it already has mechanisms in place that will notify the aviation community when service outages and degradations occur. It also noted that an investment in an additional system would be redundant and an inefficient use of resources. Based on its

response, we believe that the Agency has considered the feasibility of developing automated systems as noted in recommendation 2. We consider this recommendation resolved and closed.

Actions Required

We consider recommendations 1 and 3 resolved but open pending completion of FAA's planned actions. We consider recommendation 2 resolved and closed.

Exhibit A. Scope and Methodology

We conducted this performance audit between June 2018 and November 2019 in accordance with generally accepted Government auditing standards as prescribed by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Our objectives were to: (1) determine the equipage rates for ADS-B and other NextGen-enabling technologies on commercial and general aviation aircraft; (2) ascertain the reasons behind aircraft operators' decisions to equip or not equip with these technologies; and (3) assess FAA and aircraft operators' plans to meet the 2020 ADS-B *Out* equipage deadline. We focused on installation of three NextGen technologies on commercial and general aviation aircraft: (1) ADS-B *Out*, (2) DataComm, and (3) PBN.

To determine the equipage rates for each of the technologies, we analyzed equipage data provided by FAA and MITRE for domestic commercial, international, and general aviation operators.²⁸ To determine the reliability of the data, we interviewed representatives from FAA's NextGen and Flight Standards offices, MITRE, and Harris Corporation regarding how the data are collected and analyzed for the three technologies. We reviewed documentation provided by these entities detailing the systems used to compile the data and the controls in place to ensure the integrity of the data. In addition, for the ADS-B *Out* equipage figures, we compared the data provided by FAA and MITRE with data from FAA's public ADS-B *Out* equipage website. We determined that while there are slight differences between these figures, the differences were due to different timelines and timestamps. Finally, during our site visits we asked air carriers to validate the ADS-B *Out* and PBN equipage figures for their fleets. Overall, the operators stated that the data was accurate or close to their figures. As a result, we believe this data is reliable for the purpose of this audit.

To determine the reasons behind aircraft operators' decisions to equip or not equip with the NextGen technologies, we interviewed officials from commercial carriers, individual general aviation operators, and flight schools regarding the reasons why their aircraft were or were not equipped. These interviews were done during our site visits and as well over the phone. We also spoke with organizations representing commercial carriers, general aviation operators, and

²⁸ While equipage data for other types of operators, such as government and Department of Defense operators, was available, we did not analyze it because it fell outside of the scope of our audit.

repair stations, as well as individual aircraft maintenance providers regarding their observations as to why operators were or were not equipping with these NextGen technologies. In addition, during our site visits we met with FAA representatives about the Agency's use of these NextGen technologies in its operations and how operators' equipage decisions impact their use.

To assess FAA's and aircraft operators' plans to meet the 2020 ADS-B *Out* equipage deadline, we reviewed FAA regulations and policy statements related to the ADS-B *Out* mandate, including how the Agency plans to grant airspace access to equipped and non-equipped operators. We also reviewed equipage plans for all 24 commercial air carriers that initially filed under FAA's 12555 Exemption order to determine how these commercial operators planned on meeting the 2020 mandate. In addition, we interviewed FAA officials, commercial carrier representatives, individual general aviation operators, aircraft maintenance providers, and related industry trade associations regarding operators' plans for meeting the deadline. Finally, we attended FAA forums, such as Equip 2020 meetings, to gain insights on FAA and industry concerns surrounding the mandate and FAA's plans to mitigate barriers that were identified.

For objectives 2 and 3, we spoke with or contacted 178 individuals or organizations to obtain information regarding equipage and their views on this subject. They included representatives from FAA, MITRE, commercial air carriers, individual general aviation operators, aircraft maintenance providers, and related trade associations. See exhibit B for a list of organizations visited or contacted for this audit.

We conducted a survey of 61 small commercial operators in an attempt to gain insights regarding their aircrafts' equipage status, for the 3 NextGen technologies, the reasons why they are or are not equipping, and their plans for meeting the 2020 ADS-B *Out* mandate. However, only 15 operators responded to the survey. Due to the low response rate, we did not include the results of the survey in our report but did review the responses to gather additional insights regarding operators' equipage decisions.

Exhibit B. Organizations Visited or Contacted

Federal Aviation Administration – Headquarters

Air Traffic Organization

Aviation Safety – Flight Standards Service

Aviation Safety – Aircraft Certification Service

Office of NextGen – ADS-B Program Office

Office of NextGen – Data Communications (DataComm)

Office of NextGen – Performance Based Navigation (PBN)

Office of NextGen – Technology Development and Prototyping

Federal Aviation Administration – Air Traffic Control Facilities

Dallas Love Field Airport Air Traffic Control Tower

Dallas/Ft. Worth International Airport Air Traffic Control Tower

Atlanta Terminal Radar Approach Control Facility (TRACON)

Airlines

American Airlines

AmeriJet International Airlines

Atlas Air

Delta Air Lines

JetBlue Airlines

Lynden Air Cargo

Miami Air International Airlines

Southwest Airlines
Spirit Airlines
World Atlantic Airlines

Other Organizations

Aircraft Electronics Association (AEA)
Aircraft Owners and Pilots Association (AOPA)
Airlines for America (A4A)
Aeronautical Repair Station Association (ARSA)
Atlanta Regional Airport (Falcon Field), Peachtree City, GA
Avionics 1st, Dallas, TX – Avionics Repair and Installation
Duncan Aviation, Ft. Lauderdale, FL
Experimental Aircraft Association (EAA)
Embry-Riddle Aeronautical University
General Aviation Manufacturers Association (GAMA)
Gulfstream Aerospace
Harris Corporation
Jet Center MFR, Medford, OR
Liberty University School of Aeronautics
MITRE Corporation
National Air Carrier Association (NACA)
National Business Aviation Association (NBAA)
Paulding Northwest Atlanta Airport (Silver Comet Field), Dallas, GA
Regional Airline Association (RAA)
Select Avionics, McKinney, TX – Avionics Repair and Installation
Wayman Aviation Flight School (North Perry Airport), Pembroke Pines, FL

Exhibit C. List of Acronyms

ADAPT	ADS-B Deviation Authorization Pre-Flight Tool
ADS-B	Automatic Dependent Surveillance-Broadcast
DataComm	Data Communications
DOT	Department of Transportation
FAA	Federal Aviation Administration
GPS	Global Positioning System
NextGen	Next Generation Air Traffic Transportation System
OIG	Office of Inspector General
PBN	Performance-Based Navigation
RNAV	Area Navigation
RNP	Required Navigation Performance
SAPT	Service Availability Prediction Tool

Exhibit D. Description, Expected Benefits, and Required Equipment for NextGen Technologies

NextGen Technology	Description	Expected Benefits	Equipment Mandated to Be Installed on Aircraft	Required Equipment
Automatic Dependent Surveillance-Broadcast (ADS-B)	A surveillance system that uses satellite-based technology, including global positioning systems (GPS), and a network of ground stations to transmit aircraft position information more frequently and accurately than ground-based radars. The system consists of two services: ADS-B <i>Out</i> , which aircraft broadcasts its flight position to controllers on the ground; and ADS-B <i>In</i> , which displays another aircraft's position and flight information in the cockpit.	Provide controllers and pilots with faster updates of important flight information, such as aircraft identification, position, altitude, direction, and speed. When operational, it can lead to increased safety and operational efficiencies, such as reduced separation standards.	Yes – Per Title 14, Code of Federal Regulations, Sections 91.225 and 91.227, aircraft flying in most controlled airspace must be equipped with ADS-B <i>Out</i> technology by January 1, 2020.	<p>ADS-B <i>Out</i>: A qualified Global Navigation Satellite System (GNSS) position source, an <i>Out</i>-capable transponder (1090ES or UAT depending on the aircraft), and an appropriate antenna.</p> <p>Under FAA Exemption No. 12555, operators can opt to not update their aircraft's position source until December 31, 2024 but must install an <i>Out</i>-capable transponder by the 2020 deadline. They must provide FAA with a plan for how they will meet the position source requirements.</p> <p>ADS-B <i>In</i>: Is not mandated to be installed on aircraft. It requires additional avionics, such as TCAS, and a cockpit display showing surrounding traffic.</p>
Data Communications (DataComm)	Provides a direct link between ground automation and flight deck avionics for flight clearances, traffic flow management, flight crew requests, instructions, and other communications.	Reduce the impact of ground delay programs, airport reconfigurations, convective weather, and congestion. Enables enhanced services for re-routes and changes in trajectory operations. Diminish the environmental footprint due to reduced fuel burn and emissions through delay savings. Improve safety by reducing the number of readback/hearback errors that occur today over voice.	No.	A Future Air Navigation System (FANS) 1/A compliant communication avionics system and a VHF Data Link Mode 2 (VDL Mode 2) radio to transmit messages.
Performance Based Navigation (PBN)	An advanced, satellite-enabled form of air navigation that provides for greater route precision and accuracy. There are two types of PBN procedures: Area Navigation (RNAV), which allow aircraft to fly any desired flight path without the limitations imposed by ground-based navigation systems; and Required Navigation Performance (RNP), which adds monitoring and alerting capabilities that allow aircraft to fly more precise flight paths.	Increase airspace efficiency by providing more direct flight paths, thereby increasing airspace capacity, improving airport arrival rates, enhancing controller productivity, saving fuel, and reducing aircraft noise.	No.	On-board avionics equipment, including technologies such as GNSS, which allow aircraft to fly PBN procedures. While both RNAV- and RNP-equipped aircraft must meet federal certification standards, a RNP-equipped aircraft's navigation system allows the operator to monitor the aircraft's performance in meeting the requirements to fly a RNP procedure.

Exhibit E. Photos of ADS-B Out Avionics

Figure E-1. ADS-B Out Capable Transponder



Figure E-2. GPS Position Source



Figure E-3. ADS-B Capable Antenna: Top and Bottom



Source: Photos provided to OIG by a commercial air carrier

Exhibit F. ADS-B Out Equipage by Aircraft Operation/Type: May 2018 to October 2019

Figure F-1. ADS-B Out Equipage: Commercial Mainline Aircraft

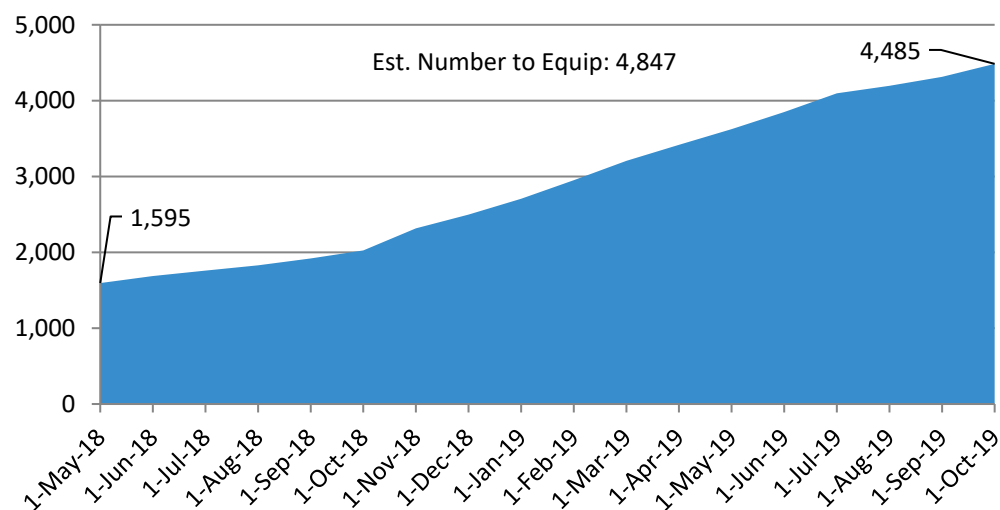


Figure F-2. ADS-B Out Equipage: Commercial Regional Aircraft

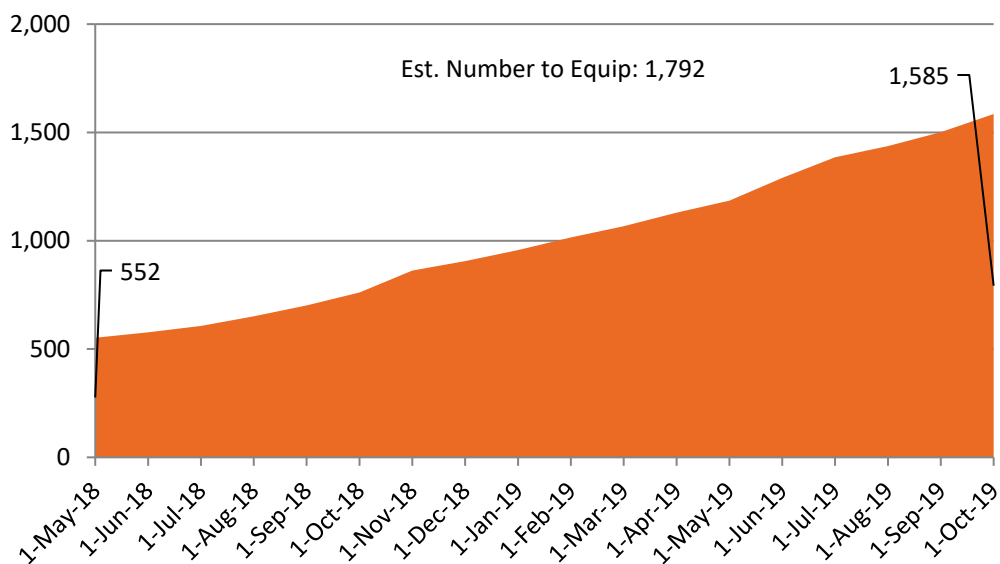


Figure F-3. ADS-B Out Equipage: Commercial Other Aircraft

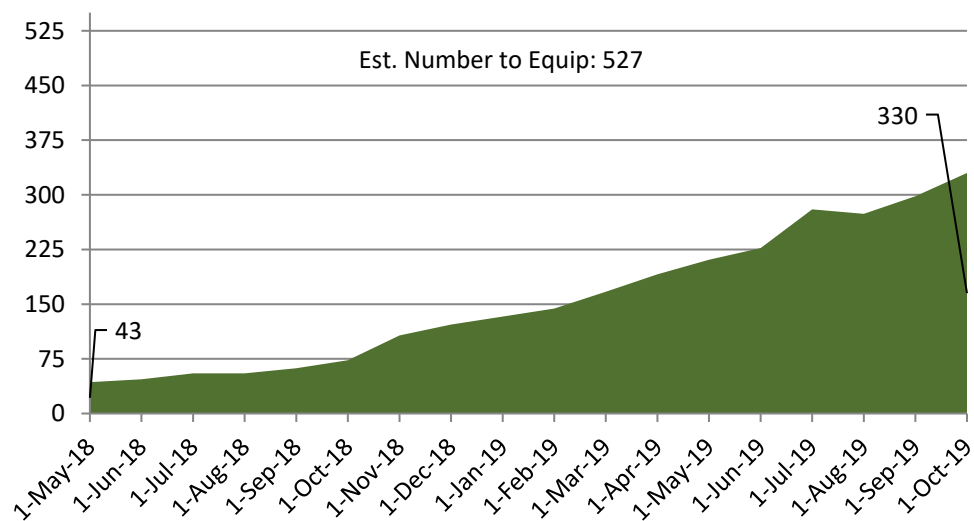
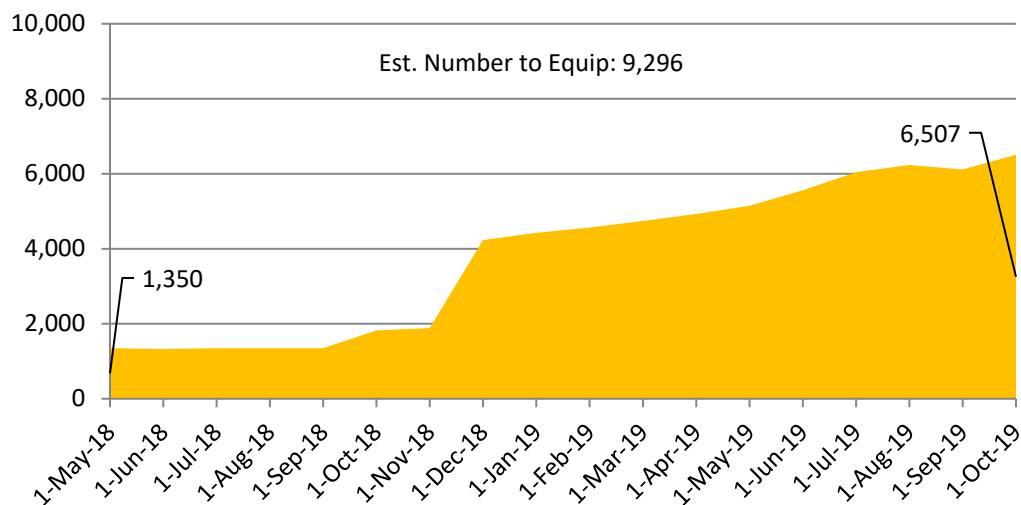


Figure F-4. ADS-B Out Equipage: International Aircraft



Note: Prior to the December 2018 reporting period, MITRE adjusted the way it reported international equipage figures to be more in-line to FAA's reporting. This change is reflected in the December 2018 figure and onward.

Figure F-5. ADS-B Out Equipage: Turbojet & Turboprop General Aviation Aircraft

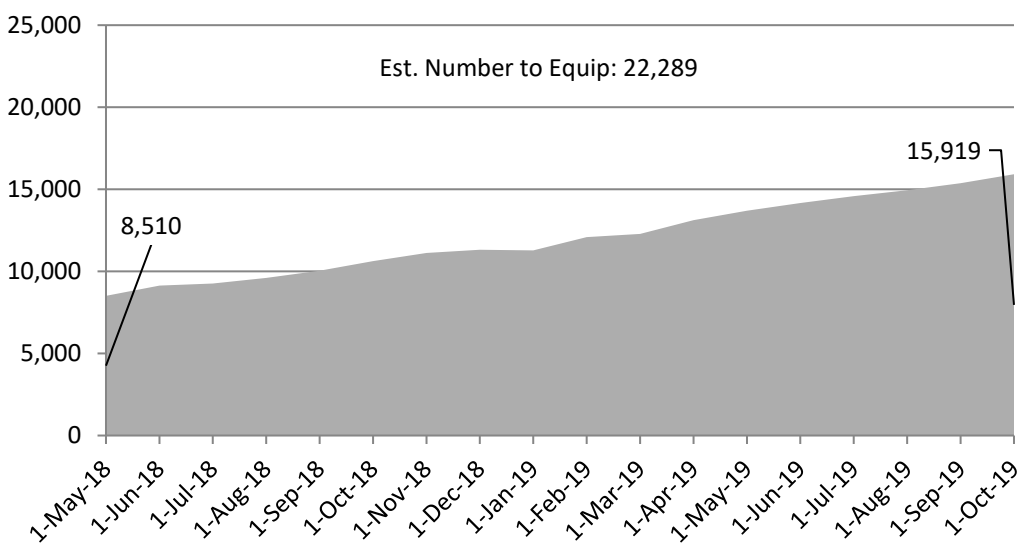
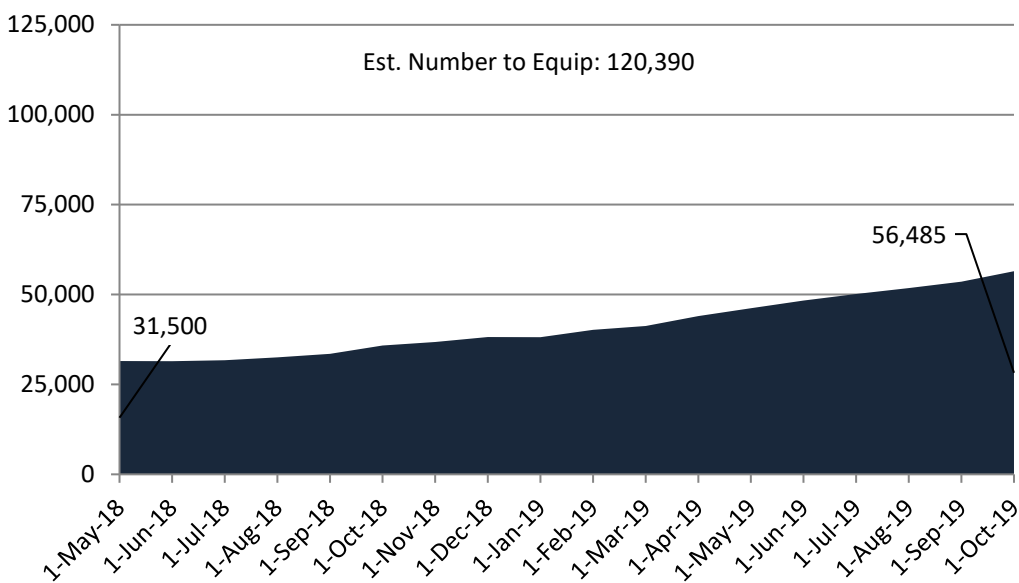


Figure F-6. ADS-B Out Equipage: Single & Multi-Piston Engine General Aviation Aircraft



Source: FAA/MITRE

Exhibit G. Major Contributors to This Report

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Appendix. Agency Comments




Federal Aviation Administration

Memorandum

Date: December 6, 2019

To: Matthew E. Hampton, Assistant Inspector General for Aviation Audits

From: H. Clayton Foushee, Director, Office of Audit and Evaluation, AAE-1 

Subject: Federal Aviation Administration's (FAA) Response to Office of Inspector General (OIG) Draft Report: Next Generation (NextGen) Equipage – Automatic Dependent Surveillance-Broadcast (ADS-B) Out Equipage Rates Are Increasing, but FAA Must Address Airspace Access Issues

The FAA is committed to collaboration with all aviation stakeholders in the modernization of the National Airspace System (NAS) infrastructure. This collaboration, and the resulting implementation of new infrastructure, has resulted in the successful deployment of ADS-B, Data Communications (Data Comm) and Performance Based Navigation (PBN). Enhancements include 5 NM of separation through the NAS, reduced delays, and a reduction in communication errors. Future enhancements will further increase user benefits. These include:

- Tower Data Comm now operational at 62 air traffic control towers across the country, saving time and reducing delays and fuel consumption for equipped aircraft. In the next year, Data Comm will come online for communication between en route controllers and pilots, providing additional benefits. These are the primary airports, which account for a significant portion of NAS Operations.
- PBN procedures have been deployed across the NAS, leveraging satellite-enabled technology to create precise, repeatable, predictable, and efficient 3-D flight paths. More than 9,600 PBN routes, departure, arrival, and approach procedures across the NAS have been published by the FAA. Eight Metroplex projects have been completed resulting more effective airspace optimization
- The ground infrastructure for ADS-B is complete, with 634 ground stations throughout the NAS, providing more accurate, higher update rates for surveillance of aircraft.

The FAA offers the following additional context for some of the statements in the report:

- OIG states that general aviation (GA) operators have been slow to equip with ADS-B avionics, but the overall number of expected installations includes operators who have the flexibility to alter their operations in such a way that they can effectively avoid the

immediate need for ADS-B equipage. This fact more clearly explains GA equipage rates.

- The report states that FAA should “have the necessary systems and procedures in place so operators can access ADS-B Out required airspace regardless of their equipage status.” As the OIG acknowledges, we are developing the ADS-B Deviation Authorization Pre-Flight Tool (ADAPT). The use of ADAPT is mandatory to aircraft operators seeking to operate aircraft that are not equipped with ADS-B out equipment in ADS-B Airspace after January 1, 2020.

FAA has reviewed the draft report and concurs with recommendations 1 and 3 and plans to complete actions for both recommendations by December 31, 2019.

We do not concur with Recommendation 2 to analyze the feasibility of developing automated systems to provide operators with more timely information regarding Global Positioning System issues, such as outages and degradations. As the OIG acknowledges, we have the Notice to Airmen (NOTAM) and Service Availability Prediction Tool (SAPT) in place as mechanisms that will notify the aviation community when service outages and degradations occur. The NOTAM system acts as the focal point for disseminating relevant NAS operational limitations, outages, and/or deficiencies. An investment in an additional system would be redundant and an inefficient use of resources.

We appreciate this opportunity to respond to the OIG Draft Report. Please contact H. Clayton Foushee at (202) 267-9000 if you have any questions or require additional information about these comments.

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