



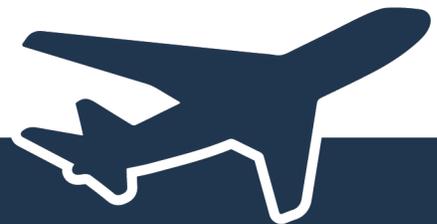
U.S. DEPARTMENT OF TRANSPORTATION
OFFICE OF INSPECTOR GENERAL

**FAA's Process for Updating Its Aircraft
Evacuation Standards Lacks Data
Collection and Analysis on Current
Evacuation Risks**

FAA

Report No. AV2020045

September 16, 2020





FAA's Process for Updating Its Aircraft Evacuation Standards Lacks Data Collection and Analysis on Current Evacuation Risks

Requested by the Ranking Member of the House of Representatives Committee on Transportation and Infrastructure and the Ranking Member of the Subcommittee on Aviation

Federal Aviation Administration | AV2020045 | September 16, 2020

What We Looked At

Effective evacuations of aircraft during emergencies can help save lives. Two aircraft accidents involving evacuations—one in September 2015 involving a British Airways aircraft and another in October 2016 involving an American Airlines aircraft—resulted in no fatalities, and highlighted the importance of effective aircraft evacuation standards. Federal Aviation Administration (FAA) regulations require that aircraft manufacturers demonstrate that all passengers and crew can evacuate an aircraft within 90 seconds by conducting live demonstrations of simulated evacuations or through a combination of analyses and testing. Our audit objective was to assess FAA's process for developing and updating aircraft emergency evacuation standards, including how changes in passenger behavior, passenger demographics, and seating capacity affect the standards.

What We Found

FAA's process for updating its evacuation standards lacks data collection and analysis on current risks. FAA largely updates evacuation standards only after accidents and it conducted its last update based on an accident in 1991. FAA also has not conducted sufficient research on passenger behaviors—such as evacuations with carry-on bags and the presence of emotional support animals—and seat dimensions to show how they affect evacuation standards. Furthermore, FAA does not collect comprehensive evacuation data to identify needs for regulation updates, and allows manufacturers to use decade-old data in evacuation analyses. FAA's Safety Management System requires FAA programs to collect and analyze comprehensive data using systematic procedures and policies for the management of safety risk. However, FAA has not established a systematic process to obtain and evaluate data from accidents and demonstrations. As a result, FAA is inhibiting its ability to identify current evacuation risks and updates to its aircraft emergency evacuation standards.

Our Recommendations

We made two recommendations to help FAA improve its data collection and analysis for developing and updating aircraft emergency evacuation standards. FAA concurred with both recommendations.

All OIG audit reports are available on our website at www.oig.dot.gov.

For inquiries about this report, please contact our Office of Government and Public Affairs at (202) 366-8751.

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Memorandum

Date: September 16, 2020

Subject: INFORMATION: FAA's Process for Updating Its Aircraft Evacuation Standards Lacks Data Collection and Analysis on Current Evacuation Risks | Report No. AV2020045

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

To: Federal Aviation Administrator

Effective evacuations of aircraft during emergencies can help save lives. Two high-profile accidents—one in September 2015 involving a British Airways aircraft and another in October 2016 involving an American Airlines¹ aircraft—resulted in no fatalities, and of those injured, most were minor. These accidents drew attention to the importance of evacuation standards. The Federal Aviation Administration's (FAA) regulations² for certifying aircraft require that each manufacturer demonstrate that all passengers and crew can evacuate an aircraft within 90 seconds by conducting live demonstrations of simulated evacuations or through a combination of analyses and testing.

Stakeholders have raised concerns about the validity of the assumptions that drive FAA's evacuation standards and industry tests and simulations for certifying new aircraft. Significant changes in the industry and consumer behavior—such as passengers' reliance on carry-on baggage—have occurred since FAA last updated the regulations in 2004. Citing the 2016 American Airlines accident, the Ranking Member of the House of Representatives Committee on Transportation and Infrastructure and the Ranking Member of the Subcommittee on Aviation asked us to examine FAA's evacuation standards and whether passengers can safely evacuate

¹ According to the National Transportation Safety Board, the evacuation of 157 passengers and 13 crew from the British Airways aircraft at McCarran International Airport near Las Vegas in 2015, resulted in 19 minor injuries and 1 serious injury. The evacuation of the American Airlines aircraft at Chicago O'Hare International Airport in October 2016, resulted in 19 minor injuries and 1 serious injury.

² 14 CFR § 25.803; 14 CFR Appendix J to Part 25.

aircraft in emergencies in light of changes in the airline industry and consumer behaviors.

Accordingly, our audit objective was to assess FAA's process for developing and updating aircraft emergency evacuation standards,³ including how changes in passenger behavior, passenger demographics, and seating capacity affect the standards.

We conducted this audit in accordance with generally accepted Government auditing standards. Exhibit A details our scope and methodology. Exhibit B lists the entities we visited or contacted.

We appreciate the courtesies and cooperation of Department of Transportation (DOT) representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-1987, or Nelda Smith, Program Director, at (202) 366-2140.

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

³ In this report, we refer to the regulations that cover the evacuation of passengers and crew from an aircraft in an emergency as "evacuation standards."

Results in Brief

FAA's process for updating its evacuation standards lacks data collection and analysis on current risks.

FAA's process generally results in updates only after accidents with the last update based on an accident that occurred in 1991. According to FAA officials, the Agency has not updated its evacuation standards recently because of high rates of accident survivability due to reduced flammability of cabin components and safer seat designs. However, FAA also conducts insufficient research on passenger behaviors—such as evacuations with carry-on baggage and use of emotional support animals—and seat dimensions to determine how they affect evacuation standards. This lack of passenger behavior research and data limits FAA's ability to assess risk to ensure passenger safety to the extent possible in emergency evacuations. FAA also does not collect comprehensive data from evacuations, and does not maintain certification data to identify emerging risks and needs for regulation updates. For example, FAA does not collect data on factors that influence actual evacuation times.⁴ The Agency also does not maintain data from manufacturers' demonstrations or analyses to identify risks. FAA instead relies on manufacturers to retain data on the results of evacuation demonstrations and analyses. Furthermore, FAA allows manufacturers to use decade-old data in analyses for certifications, and manufacturers are more frequently using analyses for model certifications than evacuation demonstrations. FAA's Safety Management System (SMS) requires FAA programs to collect and analyze comprehensive data using systematic procedures, and policies for the management of safety risk. However, FAA has not established a systematic process to obtain and evaluate data from accidents and demonstrations to identify evacuation risks. This lack of a process for continuous data collection, maintenance, and analysis limits FAA's ability to identify current evacuation risks and make risk-based decisions on updates to its aircraft emergency standards. It also inhibits the Agency's ability to meet Congress' 2018 mandates related to aircraft evacuations.

We have made two recommendations to help FAA improve its data collection and analysis for developing and updating aircraft emergency standards.

⁴ Of the 40 National Transportation Safety Board (NTSB) reports we reviewed, 7 contained data on evacuation times or information to calculate estimated evacuation times. Evacuation times ranged from 57 seconds to about 5 minutes.

Background

FAA has established evacuation standards for passenger aircraft.⁵ In 1967, the Agency implemented a requirement for aircraft manufacturers to demonstrate that each aircraft model with more than 44 passenger seats can be fully evacuated in 90 seconds or less under specific test conditions. In 1965, an accident⁶ had occurred in Salt Lake City that resulted in 43 fatalities. The next year, FAA established an Agency Task Force to study factors identified in accident investigations that affected crashworthiness and passenger evacuations. The task force also reviewed the adequacy of existing regulations, and made a recommendation for regulatory changes. After this review in 1967, FAA implemented the 90-second evacuation demonstration test requirement for aircraft manufacturers.

To obtain FAA certification for an aircraft model, a manufacturer must either conduct a successful full-scale demonstration of an emergency evacuation or use a combination of tests and analyses. In a successful full-scale evacuation demonstration, volunteers exit an aircraft within 90 seconds. The regulation specifies the conditions under which manufacturers must conduct full-scale simulations, including lighting, demographics of the volunteer passengers, locations of minor obstructions in the aisles—such as baggage, pillows, and blankets—and blocking of doors. See figure 1.

⁵ 14 CFR § 25.803.

⁶ FAA defines the word accident as an occurrence involving an aircraft that results in death, serious injury, or significant damage to the aircraft. The Agency defines the word incident as an occurrence that affects or could affect the safety of operations.

Figure 1. Requirements for Manufacturers' Emergency Evacuation Demonstrations

Maximum passenger load and time

"It must be shown that the maximum seating capacity . . . can be evacuated from the airplane . . . under simulated emergency conditions within 90 seconds" (14 CFR 25.803).

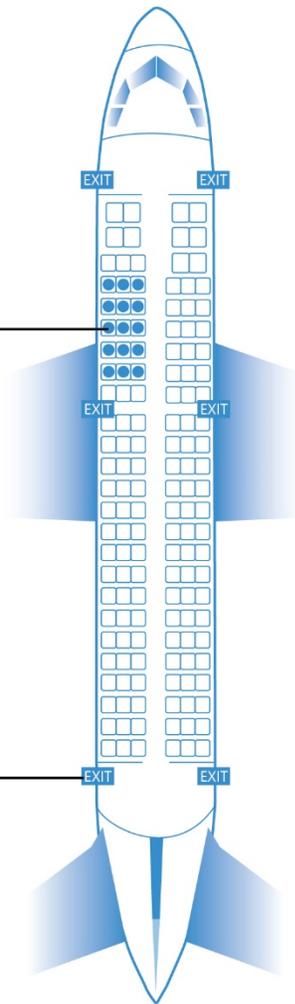
Passengers

Passengers must be a mix of male and female.

- ≥40% female
- ≥35% over 50 years of age
- ≥15% female and over 50 years of age
- 3 lifesize dolls must be carried by passengers to simulate live infants 2 years old or younger (14 CFR 25 Appendix J).

Exits

50% of exits must be blocked.



Lighting

Low level ambient lighting is used during the demonstration.



Source: Docket FAA-2015-4011

Baggage

"Approximately one-half of the total average amount of carry-on baggage, blankets, pillows, and other similar articles must be distributed at several locations in aisles and emergency exit access ways to create minor obstructions" (14 CFR 25 Appendix J).

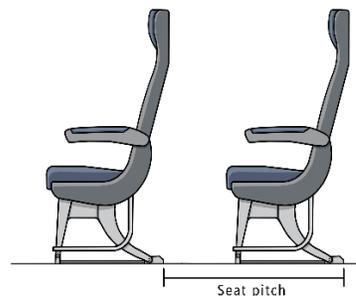
Source: OIG presentation of 14 CFR § 25.803 and 14 CFR Appendix J to Part 25.

Instead of performing a demonstration, a manufacturer may test parts of an aircraft model's exit components, such as exit doors and slides, to gather evacuation data, then use these test data in the analysis method for determining the number of persons that can exit the aircraft timely. Component test data, demonstration data, or a combination can be used in the analysis method. FAA's guidance⁷ states that an analysis should present a prediction of success using the most conservative data collected. The regulation also states that an analysis must yield results equivalent to a full-scale demonstration of the model.

⁷ FAA Advisory Circular 25.803-1A, *Emergency Evacuation Demonstrations*, 2012.

FAA conducts general research⁸ to collect and report on safety data that respond to the Agency's regulatory and oversight needs. In 2015, a passengers' rights group expressed concerns to FAA about increases in passenger size and decreases in seat pitch—the distance between one point on a seat to the same point on the seat in front of it (see figure 2)—and seat size. The group was concerned that these changes could endanger passenger safety by slowing the pace of evacuations.

Figure 2. Seat Pitch



Source: OIG representation of seat pitch

Pilot, flight attendant, and passenger organizations have also expressed concerns over passenger size, the presence of emotional support animals on aircraft, and passengers carrying baggage with them during evacuations. In the FAA Reauthorization Act of 2018⁹ (see exhibit D), Congress mandated that by October 2019, FAA establish minimum dimensions for aircraft seats, and conduct a review of its evacuation certification standards and recent accidents and incidents.

FAA has implemented SMS,¹⁰ an agency-wide approach to managing safety risk and making safety risk controls as effective as possible. According to FAA, SMS will promote continuous improvement of safety by predicting hazards from concerns reported by employees and collected data. It includes systematic procedures, practices, and policies for safety risk management. SMS's risk management policy outlines standardized principles that enhance FAA's ability to coordinate risk-based decision-making throughout the Agency. These principles include steps Agency programs should take to identify risks of fatalities related to

⁸ FAA's Civil Aerospace Medical Institute conducts research on evacuation-related issues such as seating density, and exit size and location. FAA's William J. Hughes Technical Center conducts research and testing on how to improve the fire resistance of aircraft material to allow passengers more time to evacuate. FAA uses the results of this research to substantiate its standards.

⁹ Pub. L. No. 115-254.

¹⁰ FAA Order 8000.369B, *Safety Management System*, March 18, 2016.

aircraft accidents, collect and analyze data, and work to eliminate or mitigate risks to passengers and flight crews on aircraft.

FAA's Process for Updating Its Aircraft Evacuation Standards Lacks Data Collection and Analysis on Current Evacuation Risks

FAA largely updates its evacuation standards only after accidents, and its last update that was based on an accident occurred in 1991. FAA also has not conducted sufficient research on passenger behaviors and seat dimensions to determine how they affect evacuation standards. Furthermore, FAA does not collect comprehensive data from evacuations or data from aircraft model certifications to identify emerging risks and needs for regulation updates.

FAA Generally Updates Standards Only After Accidents Have Occurred

The Agency has updated its standards after five accidents. The first update was based on data from the 1965 accident in Salt Lake City and the last on data from a 1991 accident in Los Angeles. For example, FAA updated the standards to improve access to exits and developed standards for emergency markings on exit doors in response to an accident in Manchester, England in 1985, that resulted in 55 fatalities. In its accident report, the British Aircraft Accident Investigations Branch identified safety issues with passengers' evacuations through the exit located over the aircraft wing. See table 1 for details on accidents.

Table 1. Accidents Since 1965 Resulting in Updates to FAA’s Certification Standards

Location	Year	Accident Details	Changes to the Certification Standards
Salt Lake City, UT	1965	Aircraft crashed while attempting to land; a ruptured fuel line caused a fire; 43 fatalities.	New requirements for simulated evacuations in 90 seconds; exit door sizes; design criteria for evacuation slides; aisle lighting
Los Angeles, CA	1978	Aircraft overran a runway after a rejected takeoff, causing landing gear to collapse and a fire; slides deployed from emergency exits exposed to fire and radiant heat failed before evacuation was complete; 2 fatalities.	New requirements for slide and raft fire resistance, strength, inflation time, and testing
Cincinnati, KY	1983	A fire caused an emergency landing. After landing, a flash fire enveloped the cabin; 23 fatalities.	New requirements for seat cushion flammability; emergency escape path markings on aisle floors; lavatory smoke detection and trash fire extinguishers; increased numbers of cabin fire extinguishers
Manchester, UK	1985	During takeoff, aircraft exhibited engine failure; fuel ignited; evacuation delays caused by door malfunction and restricted access to exits; 55 fatalities.	New requirements for design and construction of emergency exits and access to exits; exit door lighting and markings; emergency equipment
Los Angeles, CA	1991	During landing, aircraft collided with another awaiting takeoff; passengers succumbed to smoke inhalation while waiting to exit; 22 fatalities.	New requirements for improved access to emergency exit doors

Source: OIG analysis of information at the website www.lessonslearned.faa.gov. According to FAA, this website presents synthesized and summarized information on “safety-shaping” large commercial aircraft accidents.

In 2004, in response to a serious injury that occurred during a demonstration in 1991, FAA updated the standards¹¹ to reduce the possibility of injuries to demonstration participants. According to FAA officials, the Agency has not updated its evacuation standards recently because of high rates of accident survivability. This high rate of survivability results from several factors, including reduced flammability of

¹¹ Federal Register, vol. 69, no. 221, pp. 67491-67499, November 17, 2004. FAA made changes to improve the protection of demonstration participants, including exterior light levels during demonstrations; exits with inflatable slides that are deployed and are available for use prior to the start of a demonstration; and passenger briefings on safety procedures to stop a demonstration.

cabin components, improved floor escape path lighting, and safer seat designs that resulted from FAA research and development.

Furthermore, in a 2011 DOT review of departmental rules and regulations,¹² the Agency reported that it had amended its evacuation standards after every accident from which it identified new risks. It also reported that the current level of safety provided by the regulations was acceptable based on DOT's 2011 review. However, according to the Department's report, the Department conducts its reviews every 10 years. Every 10 years is not frequent enough to meet FAA's SMS requirements for continuous risk monitoring to capture new risks such as increases in carry-on baggage during evacuations, changes in passenger demographics, and decreases in seat spacing.

FAA Has Conducted Insufficient Research on Passenger Behaviors and Demographics, and Seat Dimensions To Determine How They Affect Standards

FAA has not conducted sufficient research on passenger behaviors, passenger demographics, and seat dimensions to determine how these factors affect its evacuation standards. The Agency has a process—the Aviation Safety Research and Development Prioritization Process—to annually develop a prioritized list of research topics, and gives top priority to topics resulting from accidents. The Agency then funds the top priorities for research.¹³ However, FAA has not identified as priority topics passenger behaviors such as retrieval of carry-on bags during evacuations, changes in passenger demographics, and seating space. Consequently, the Agency has done little to no research on these topics.

FAA Has Not Studied the Effects of Passengers' Retrieval of Carry-On Baggage During Evacuations

FAA has not conducted research on how passengers' retrieval of carry-on baggage affects evacuations. In a 2000 study of emergency evacuations, NTSB found that passengers' efforts to evacuate with carry-on baggage created issues for flight attendants. Based on an NTSB recommendation,

¹² DOT, *Plan For Implementation of Executive Order 13563: Retrospective Review and Analysis of Existing Rules*, August 2011.

¹³ The number of priorities that are funded varies each year depending on FAA's budget and the cost of each priority.

FAA provided guidance to its principal operations inspectors—officials responsible for overseeing airline operations such as certification activities—on how to minimize problems with carry-on baggage during evacuations.

Furthermore, following its investigation of an American Airlines accident in 2016, NTSB recommended¹⁴ that FAA conduct research to measure the effects of carry-on baggage on deplaning during emergency evacuations and to identify effective measures to reduce risk. FAA agreed with NTSB's recommendation but has yet to develop a research program.

In our review of all 40 reports¹⁵ on evacuations that NTSB investigated between 2008 and 2018, we found that in 12 reports, crew members stated that passengers evacuated or attempted to evacuate with their carry-on baggage. Media coverage of the 2016 American Airlines accident and a Delta Airlines accident in 2018 shows passengers carrying baggage during the evacuations.

Despite this media coverage and NTSB's findings, FAA officials state that measuring the effect of carry-on baggage would not be meaningful since the problem is known and conducting research could result in a risk of injury to volunteers. FAA officials state further that research regarding passenger education, including the prevention of baggage retrieval, would be more beneficial.

FAA Has Not Studied Passenger Demographics Since 2004

FAA has not studied passenger demographics since 2004 to determine whether it needs to update the standards based on demographic changes, including the standard on the mix of volunteer passengers for manufacturers' evacuation demonstrations.

In 1985, FAA established the Emergency Evacuation Task Force to review the standards. The task force recommended that FAA change the standard on the volunteer mix to require an age mix less prone to injury in evacuation demonstrations.¹⁶ In 1993, FAA's new standard included a proportion of female passengers of 40 percent¹⁷ with 15 percent over 50 years of age and no children under 12. FAA has not updated the mix of age and gender since 1993.

¹⁴ NTSB, *Uncontained Engine Failure and Subsequent Fire American Airlines Flight 383*, October 28, 2016.

¹⁵ See exhibit A for details on these 40 reports.

¹⁶ FAA Emergency Evacuation Task Force. *Task Force Report on Emergency Evacuation of Transport Airplanes, Volume 1 – Summary Report*, July 1986, DOT/FAA/VS-86/1-1.

¹⁷ Increased from 30 percent.

Furthermore, industry associations and passenger advocacy groups have expressed concerns that FAA has not updated passenger demographic standards to account for increases in passenger size. In 2004, FAA gathered data on age and girth while testing passengers' abilities to move towards exits located over aircraft wings, which are normally smaller in size than those in the front and back of cabins. According to FAA, the Agency found some evidence that girth can affect passengers' abilities to evacuate aircraft, but not that girth meaningfully affects the speed at which passengers can exit their seats and enter aisles. However, FAA did not examine the impact of passenger size and smaller seat pitches in this 2004 study. For large passengers, small seat pitches provide less room to exit from seats, and consequently, may affect egress.

Data from the Centers for Disease Control and Prevention (CDC) show that the demographics of the general public change over time. For example, between 1960 and 2016, the mean weight of Americans grew by over 30 pounds. Over the same time period, height for both men and women increased by just over half an inch. Furthermore, the body mass index (BMI)¹⁸ for men and women increased from around 25 to over 29 over the same period. CDC considers a BMI between 25 to 29.9 an indication that a person is overweight.

Due to FAA's lack of an up-to-date study on passenger demographics, it is unclear whether the mix of passengers involved in demonstrations reflects the current flying public, and whether updates to the mix are necessary.

FAA Prioritized Research on Seat Dimensions After the 2018 Reauthorization Act

In fiscal year 2015, FAA identified seat pitch as a research topic but did not rank it high enough on its priority list to fund the research. The Agency also did not identify seat width as a research topic.

The FAA Reauthorization Act of 2018 calls for FAA to issue regulations on minimum seat dimensions—including seat pitch, width, and length. In response to this mandate, the Agency has conducted research¹⁹ on the effects of seat pitch and seat width on evacuations. The act also requires FAA to review relevant changes to passenger seating configurations, including changes to seat width, padding, reclining, size, pitch, leg room,

¹⁸ According to CDC, BMI is a person's weight in kilograms divided by the squared height in meters.

¹⁹ FAA conducted seat testing at its Civil Aerospace Medical Institute in Oklahoma City from November 2019 through January 2020.

and aisle width. However, FAA's research did not include a review of seat padding, reclining, or aisle width.

While some manufacturers include data on seat dimensions, including pitches, in the reports on their evacuation demonstrations, FAA does not require this information. FAA also does not collect this information to assess risks. Furthermore, the standards contain no seat dimension requirements for evacuation demonstrations, and manufacturers decide what pitches to use to demonstrate for certifications.

In 2015, a passenger advocacy group petitioned FAA to set a minimum standard for seat dimensions due to members' concerns over seat spacing and safety. In its 2018 response to the petition, FAA stated that full-scale evacuation demonstrations have been performed on models with all seat pitches at 28 inches—including the Boeing 737-300 and the Airbus 320. We reviewed 43 manufacturers' evacuation demonstration reports provided by FAA, and found that 30 reports²⁰ referred to seat pitches. One report discussed a demonstration the manufacturer conducted using seats that all had pitches of 28 inches. The 29 other reports discussed demonstrations that almost all used seats with pitches larger than 28 inches, some up to 38 inches. Among the aircraft in these 29 reports were the Boeing 737-300 and the Airbus 320, which both had pitches above 28 inches during their evacuation demonstrations.

According to FAA, seat pitch is unlikely to go below 27 inches because of FAA's regulation²¹ that requires seats to not deform on impact to a point that they could impede rapid evacuation.²² FAA also stated that compliance with this standard requires a minimum of 9 inches between the front of one seat to the nearest point on the back of the next seat; since seat bottoms have typically been about 18 inches from front to back for at least 30 years, seat pitch is unlikely to go below 27 inches (18 inches plus 9 inches).

Lack of comprehensive information on the pitches of seats used in evacuation demonstrations hinders FAA's ability to respond to public concerns about seat pitch. It also affected the accuracy of the Agency's response to the 2015 passenger petition. Furthermore, the lack of data on the effects of seat pitch and width on evacuations inhibits FAA's ability to

²⁰ Some aircraft models were tested in more than one report.

²¹ 14 CFR § 25.562(c)(8).

²² We found that the average seat pitch among three of the top six airlines is about 30 inches. To make this determination, we used DOT Bureau of Transportation Statistics data on the four aircraft with the highest number of planes in the 2017 fleet (the most recent data available) for three of the top six airlines (according to FAA fiscal year 2019 aerospace forecast data).

adequately assess risk due to seat dimensions and ensure passenger and crew safety to the extent possible in emergency evacuations.

FAA Also Has Not Researched the Effects of Emotional Support Animals on Evacuations

The FAA Reauthorization Act of 2018 requires the Secretary to develop by April 2020, minimum standards for service and emotional support animals, and to consider measures to ensure the safety of all passengers. However, the Agency has not studied the effect that the presence of emotional support animals in aircraft cabins may have on evacuations. Additionally, FAA has not researched the number of evacuations that have involved emotional support animals, any known effects from them, and ways to mitigate the effects.

Aviation stakeholders have expressed concerns about increases in the numbers of emotional support animals in aircraft cabins. In 2018, United Airlines stated that year over year, it had seen a 75 percent increase in passengers that brought emotional support animals on board, and had experienced a significant increase in incidents involving the animals. In 2019, the Association of Professional Flight Attendants testified²³ before Congress that a variety of animals—including chickens, pigs, and one miniature pony—have been brought onto aircraft as emotional support animals.

According to FAA officials, the Agency lacks the approval under laws governing Federal research to study the effects of animals in aircraft cabins. However, the complexity created by multiple carry-on items and emotional support animals in aircraft cabins could introduce new safety risks for emergency evacuations. FAA's lack of research on seat dimensions, passenger demographics, and the presence of carry-on items and emotional support animals inhibits the Agency's ability to ensure that its evacuation standards mitigate as much safety risk as possible.

FAA Does Not Collect Comprehensive Data on Actual Evacuations

FAA does not collect comprehensive data on actual evacuations to identify emerging risks and needs for updating regulations. SMS requires FAA programs to collect and analyze comprehensive data. Furthermore,

²³ Testimony before the U.S. House of Representatives Committee on Transportation and Infrastructure, Subcommittee on Aviation, *State of Aviation Safety*, July 17, 2019.

the Government Accountability Office's (GAO) *Standards for Internal Control in the Federal Government* (Federal Control Standards) states that effective internal controls²⁴ at Federal agencies call for management to obtain quality information from external parties. However, FAA has not established a systematic process to collect evacuation data from accidents and incidents.

SMS also calls for systematic collection of data that can be used in risk identification. In a 2000 study,²⁵ NTSB determined that during its study period, an emergency aircraft evacuation occurred on average every 11 days. However, because FAA does not collect and analyze evacuation data, the Agency cannot determine the total number of evacuations that occur or identify factors from actual accidents and incidents that impede evacuations. This lack of data also prevents FAA from analyzing non-accident related emergency evacuations.

Furthermore, FAA does not collect data on factors that influence the time it takes for actual evacuations to occur. NTSB's investigation reports sometimes include evacuation data, such as why and how an evacuation occurred and who initiated it; how long it took exit doors to be opened and slides to inflate; what exit doors were usable and unusable and why; how many passengers exited each door; whether smoke and fire were present during the evacuation; and whether passengers were familiar with emergency procedures. Of the 40 NTSB reports we reviewed, 7 contained data on evacuation times ranging from 57 seconds to about 5 minutes. Five of these seven reports covered accidents.²⁶ See table 2 for factors impacting the time it took passengers to evacuate during these five accidents.

²⁴ According to GAO, internal control is a process used by management to help an entity achieve its objectives. See GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G, September 2014.

²⁵ NTSB, *Emergency Evacuation of Commercial Airplanes*, June 2000. During the 16-month study period, 42 evacuations occurred.

²⁶ Five of the seven reports that discussed evacuation times or contained information that we could use to estimate evacuation times were on accident investigations, and two of the seven were on incident investigations. The incident evacuation times are not included in table 2.

Table 2. Passenger Evacuation Times in Recent Accidents

Accident Year	Airline	Evacuation Times in Minutes and Seconds ^a	Total Numbers of Passengers and Crew on Flight	Factors Impacting Evacuation
2016	American Airlines Flight 383	2:11	170	Flight attendants were unable to contact cockpit; engine was not shut off before passengers exited plane. Passengers took bags off plane.
2015	British Airways Flight 2276	2:32	170	Cabin crew and pilots did not communicate; engine was not shut off before passengers exited plane.
2015	Delta Airlines Flight 1086	5:00	132	Communication, coordination, and decision making regarding evacuations between cabin crew and cockpit were inadequate; passengers took bags off plane; passengers used cell phones during evacuation.
2015	Dynamic International Airways Flight 405 ^b	1:48	101	Flight attendants did not hear signal to evacuate or any commands from the flight deck; passengers were inattentive during safety briefing; passengers attempted to take bags off plane; passengers attempted to open emergency exit before assessing outside conditions.
2009	US Airways Flight 1549	3:00	155	Passengers were inattentive during safety briefing; passengers attempted to take bags off plane.

^a NTSB investigation reports do not always contain actual evacuation times but may contain detailed timelines of evacuation events. We estimated evacuation times using this information for each accident except British Airways Flight 2276.

^b As of March 2020, the final report had not been released.

Source: OIG analysis of NTSB accident investigation reports and dockets

As seen in table 2, passengers evacuating with bags and poor communication between pilots and crew can create challenges during evacuations. However, FAA does not track these factors and others that may affect evacuations. FAA's lack of a mechanism for tracking these evacuation data inhibits the Agency's ability to identify other factors that

may impede evacuations and collect information that could help assess risk and needs for regulation updates.

FAA Does Not Maintain Manufacturers' Evacuation Certification Data, Allows Use of Old Data, and More Often Relies on Analyses for Certifications

While FAA officials attend demonstration evacuations, the Agency does not maintain critical data from demonstration evacuations or analyses to identify risks. FAA instead relies on the manufacturers to retain data on the results of evacuation demonstrations and the data they generate from component testing and analyses. When we requested certification reports from FAA, the Agency had to request most of the reports from the manufacturers. FAA also certifies some aircraft by analysis even though the manufacturers' data differ from the actual demonstration results. Furthermore, FAA does not account for the presence of emotional support animals or passengers' exits with carry-on baggage in demonstrations or analyses.

The FAA Reauthorization Act of 2018 requires FAA to review relevant data for evacuation certifications, and to provide recommendations to Congress for revisions to the assumptions and methods used for assessing evacuation certifications. FAA's lack of a process to maintain and analyze evacuation certification data inhibits the Agency's ability to identify factors and make risk-based decisions that may call for updates to the standards.

FAA Certifies Some Aircraft Based on Analyses Using Data That Are More than a Decade Old

According to FAA guidance,²⁷ the use of analysis can eliminate the need to conduct full-scale demonstration evacuations when adequate information is available from previous demonstrations or other tests such as component testing. However, FAA does not limit the age of data that manufacturers can use in their analyses, and certifies aircraft models based on manufacturers' analyses using data that are decades old. For example, in 2018, FAA certified a model based, in part, on data used from

²⁷ FAA Advisory Circular 25.803-1A, *Emergency Evacuation Demonstrations*, March 2012.

an evacuation demonstration in 1974—44 years before the 2018 certification.

We reviewed data on the top 10 aircraft models in the 2017 national fleet,²⁸ and found that FAA certified 6 of these 10 models based on analyses, and certified 4 of the 6 models based on data that were 10 years old or older. See table 3 for details on these certifications.

Table 3. Age of Data Used for Analyses and Testing Certifications of Top 10 Aircraft in the 2017 Fleet

No.	a. Aircraft model	b. Month/Year of FAA Certification	c. Aircraft Model That Is Basis for Analysis	d. Month/Year Manufacturer Conducted Demonstration, Analysis, or Partial Test	e. Years Between Certification and Demonstration, Analysis, or Partial Test ^a (e)=(b)-(d)
1	Boeing 737-800	March 1998	737-300 Demo	Nov 1984	13 years
			737-400 Demo	June 1988	10 years
2	Boeing 737-700	Nov 1997	737-300 Demo	Nov 1984	13 years
			737-400 Demo	June 1988	9 years
3	Airbus 320 Max Pax	May 2015	A320 Demo	Oct 1987	28 years
			A319 Analysis	June 2012	3 years
			A320*	Feb 2014	1 year
4	Airbus 321	Dec 1995	A320 Demo	Oct 1987	8 years
			A321*	July 1993	2 years
5	Airbus 319 ^b	August 1996	A320 Demo	Oct 1987	9 years
6	Boeing 737-900	April 2001	737-300 Demo	Nov 1984	16 years
			737-400 Demo	June 1988	13 years

^a The numbers of years in this column are rounded.

^b The Airbus 319 analysis was conducted in 1994 and updated in 2012.

*Partial evacuation tests

Source: OIG analysis

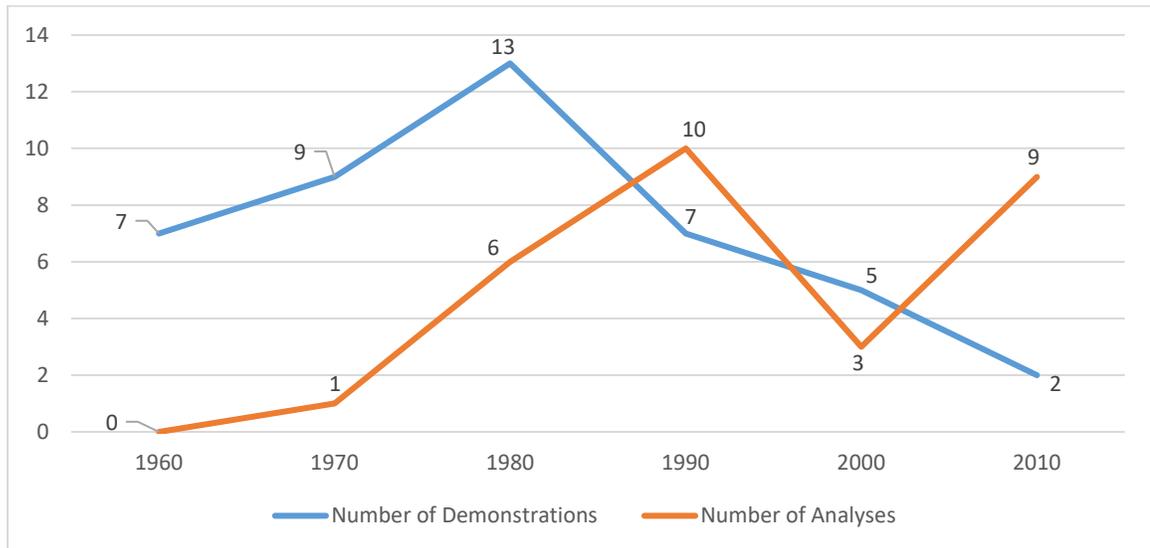
²⁸ Using the most current BTS data available—from 2017—we determined the 10 aircraft models with the highest number of planes in the domestic fleet.

Based on our analysis, use of recent data can yield results that differ from the results based on old data. For example, a manufacturer used data that were about 12 years old to calculate the evacuation time for an aircraft model, despite the fact that data approximately 3 years old were available. The test with the 12-year-old data indicated that participants evacuated through an exit door in under 90 seconds. However, we found that use of the 3-year-old data indicated participants could not evacuate through the same door in 90 seconds.

Manufacturers Use the Analysis Method More Frequently Than Evacuation Demonstrations for Certifications

In our review of the reports of all 43 demonstrations and all 29 analyses provided by FAA that manufacturers completed between 1966 and 2017, we found that the number of demonstrations that manufacturers conducted decreased while their use of analyses increased. Since the 1980s, the number of demonstrations has declined, with only two occurring between 2010 and 2017, while manufacturers used the analyses method nine times (see figure 3). Aircraft models among these nine include the Boeing 737-900 and the Airbus 380-800.²⁹ FAA’s acceptance of manufacturers’ greater reliance on analyses rather than on demonstrations poses risks as demonstration data grows older.

Figure 3. Evacuation Demonstrations and Analyses Conducted By Decade



Source: OIG analysis

²⁹ The manufacturer used analysis to increase the Airbus 380-800’s upper deck capacity.

Additionally, in 19 of the 29 analyses, we found that manufacturers used the analysis method to increase aircraft models' seating capacities. For example, the Boeing 777 increased in capacity from 440 passengers to 550 passengers after the manufacturer submitted analyses using data from a previous demonstration and installed an additional pair of exits.

Passenger and flight attendant organizations have expressed concerns over constraints on personal space and passengers' safe evacuations from aircraft with increased seating capacities. Bureau of Transportation Statistics (BTS) data indicate that domestic passenger load factors—the average percentage of seats filled in commercial passenger aircraft—have increased from 77.16 percent in 2005 to 84.57 percent in 2017. At the same time, while average seating capacities for some models with high numbers of aircraft in service have increased, seat numbers have not exceeded the numbers certified by FAA (see table 4). However, airlines can increase seat numbers up to the certified maximum without additional FAA approval via the certification process.³⁰

Table 4. Average Seating Capacities^a in 2005 and 2017, and Maximum Passenger Capacities for Selected Certified Aircraft Models

Aircraft Model	Average Seating Capacity in 2005	Average Seating Capacity in 2017	Maximum Number of Passengers Certified by FAA
Boeing 737-700	136	142	149
Boeing 737-800	153	166	189
McDonnell Douglas 80	138	149	172
Airbus 320-200	151	159	190
Airbus 319	122	134	160

^a Average seating capacity is the average number of seats on an aircraft model. Each airline can configure each model with the number of seats up to FAA's maximum allowed per model. Source: OIG analysis

³⁰ If an airline's change to the number of seats on a plane results in a change to the flight attendants' number, location, or emergency evacuation duties or procedures, then under 49 CFR § 121.291, an airline is required to demonstrate that flight attendants can open 50 percent of emergency exits and slides within 15 seconds. However, according to FAA guidance, a change in seating capacity that does not result in the addition of a required flight attendant usually does not require this demonstration.

FAA Certifies Aircraft Even When Manufacturers' Data from Analyses Differ From Demonstration Results

In our review of manufacturers' analyses, we found instances in which data from the analyses did not match data from the demonstrations the analyses were based on. When conducting an analysis, a manufacturer uses data collected from demonstrations, such as averages of passenger flow rates through exits, to calculate the numbers of passengers that it can reasonably expect to evacuate the aircraft model within the 90-second time limit. Based on our analysis, we found that FAA certified 10 aircraft models based on inaccurate data or allowed manufacturers to exclude the evacuation times of some passenger and crew participants when determining exit times.

For example, one report stated that the manufacturer based its analysis for certification on data from a demonstration, but the data the manufacturer used in its analysis differed from the demonstration data. Specifically, in the analysis report, the number of passengers that evacuated from three of four exit doors differed from the numbers in the demonstration report. However, FAA certified the aircraft model. It is unclear whether at the time of certification, FAA recognized the differences in the numbers.

In another example, in 1998 and 2011, a manufacturer conducted analyses for two aircraft models using data from a 1996 evacuation demonstration. During the 1996 demonstration, flight attendants performed a simulated sweep of the cabin then exited the plane within 90 seconds. However, for the analyses in 1998 and 2011, the manufacturer excluded the flight attendants' exit times from evacuation time calculations because the sweep extended the evacuation time for the aircraft.³¹ As a result, the manufacturer calculated faster evacuation times for the exits the flight attendants used. FAA certified the two models based on the analyses.

In addition to exit times, manufacturers' reports often contain information on factors such as passenger tendencies in exit door selection and adherence to crew instructions.³² FAA officials informed us that the Agency does not retain these data because the manufacturers state the information is proprietary, even though FAA can obtain them upon request. FAA's lack of an historical record of these data inhibits the

³¹ The manufacturer's report on the 1996 test stated that the flight attendants conducted a "non emergency cabin sweep (which is not to be performed in an unplanned emergency evacuation.)"

³² These details are sometimes captured in the written report from video footage of the demonstration.

Agency's ability to identify data inaccuracies and risks that could slow exit times.

FAA Does Not Account for Real-World Risks in the Aircraft Cabin During Demonstrations

Neither evacuation demonstrations nor analyses take into account real-world factors, including smoke created during cabin emergencies and passengers' behaviors such as use of personal devices. While the standards on evacuation demonstrations state actual flight attendants may brief volunteer participants, simulate dark of night conditions, as well as only using emergency lighting in the cabin, the standards do not require the use of smoke or simulations of actual passenger behaviors such as cell phone use.

According to FAA officials, use of smoke during evacuation demonstrations is not required because it may result in injuries to volunteers, and the purpose of demonstrations is to develop a repeatable standard test to measure evacuation effectiveness. FAA further stated that an evacuation demonstration cannot safely and reliably replicate a real-life evacuation because of the number of possible real-life variables. However, the results of demonstrations and analyses may not accurately represent how effectively passengers exit during an actual emergency in today's cabin environments.

Computer modeling could be used to examine risks by including more realistic passenger behaviors and aircraft configurations that more accurately represent current aircraft cabin environments without risk of injury to volunteer passengers. FAA guidance allows manufacturers' use of computer modeling for certification with Agency approval. FAA is examining the development of a computer model, but the model requires validated accident and evacuation demonstration data, which the Agency does not have. The Agency's lack of validated data also inhibits use of computer modeling for evacuation testing for certification. As a result, to date, FAA has not certified any aircraft models using computer modeling.

FAA's Lack of Data Inhibits the Agency's Ability To Meet Congress's 2018 Mandates

FAA's lack of data inhibits the Agency's ability to address its 2018 mandates in the timeframe required by Congress (see exhibit D). FAA completed testing for the seat pitch study in January 2020, and plans to issue its report at a later time. At this time, however, FAA has no plans to conduct research on carry-on baggage or emotional support animals. Furthermore, the Agency has not outlined plans to update passenger

demographics, although researchers plan to collect data on height, weight, and girth from participants in the seat pitch study.

To address the other mandates, FAA has convened an Emergency Evacuation Standards Aviation Rulemaking Committee (ARC) of industry experts to review evacuation requirements, actual evacuations, and the results of the seat pitch testing. ARC submitted its report to FAA in May 2020, but to date, FAA has not submitted its report to Congress.

Conclusion

The Nation's aviation system is among the safest in the world. Although evacuations of passenger aircraft are rare, FAA lacks comprehensive data on aircraft evacuations in emergencies and a data-driven, systematic process for updating its evacuation standards. This lack of data inhibits FAA's ability to determine how to improve evacuation regulations and protect passenger safety in emergencies. In addition, FAA cannot rely on accidents to evaluate the adequacy of and make changes to its evacuation standards. By continuously collecting data on emergency evacuations and the state of aviation travel today, FAA would be better positioned to make data driven risk-based decisions to ensure the safety of our Nation's air carrier passengers.

Recommendations

To improve FAA's process for updating its standards for emergency aircraft evacuations, we recommend that the Federal Aviation Administrator:

1. Develop and implement a systematic process to regularly collect and analyze data on emergency evacuations to determine whether evacuation standards need to be revised or updated based upon current risks.
2. Develop a policy or procedures to maintain and analyze a record of critical data from aircraft manufacturers' evacuation demonstrations and analyses to identify risks and ensure data used in analyses and computer modeling are accurate and up to date.

Agency Comments and OIG Response

We provided FAA with our draft report on July 13, 2020, and received its formal response on August 10, 2020. We have included the response in its entirety in the appendix to this report. FAA also provided us with technical comments that we have addressed where appropriate. FAA concurred with both of our recommendations and proposed completion dates.

In its response, however, FAA states that in our report, we overstate the importance of the 90-second evacuation demonstration, and do not take into account standards that have produced significantly safer aircraft cabins. According to FAA, these standards included enhanced egress paths, emergency lighting, escape systems, reduced flammability of materials, and dynamic testing of seats. FAA also states that in our report, we are largely silent on these requirements and focus only on what is addressed in the full scale evacuation demonstration.

We disagree. While cabin design standards may aid in the safe exit of passengers, the 90-second standard is the only standard that is purportedly meant to demonstrate the maximum number of passengers that can safely evacuate an aircraft model. Furthermore, in our report, we acknowledge that FAA has made changes to certification requirements to improve cabin safety, including reduced seat cushion flammability and emergency escape path markings on aisle floors.

FAA also states in its response that it uses a systems approach for regulatory action that includes requirements to maximize the time available for evacuation and enable as rapid an evacuation as possible. Additionally, FAA states that in our report, we create the impression that the full-scale demonstration is the most important component and that that conclusion is inconsistent with a systems approach to the evaluation of evacuation requirements.

We agree that a systems approach is warranted but note that FAA has acknowledged that passenger behaviors—such as carry-on baggage retrieval and use of personal electronic devices—can slow evacuations. Therefore, FAA's inaction on collecting and analyzing data on passenger behaviors is inconsistent with the Agency's use of a systems approach to maximize the time available for evacuations and enable as rapid an evacuation as possible.

FAA also presents in its response "points of disagreement" with our report. First, FAA states that the Agency's evacuation requirements address real world conditions. However, we identify real world risks in an

aircraft cabin—such as smoke created during cabin emergencies and passengers’ use of personal electronic devices—that FAA does not take into account in its evacuation requirements for demonstrations.

Second, FAA states that the Agency retains selected evacuation data from the certification process. However, we did not find evidence that FAA uses these data to identify risks or that selected data are sufficient to determine the accuracy of manufacturers’ analyses.

Third, FAA states that operators are required to identify hazards under SMS, but also acknowledges that SMS does not cover the evacuation certification process. As a result, it is unclear how FAA intends to collect these data. We maintain that because FAA has not included the evacuation certification process in SMS, the Agency has diminished its ability to identify current risks.

Finally, FAA states that accident evacuation times in our report bear no relation to certification requirements and are not relatable to an actual accident. However, we have included actual accident evacuation times and factors that influenced passengers’ exit times—indicating that that data on current risks are available for FAA to collect and evaluate in data-driven decision-making on how to update its evacuation standards.

Actions Required

We consider our recommendations resolved but open pending FAA’s completion of its planned actions to implement recommendation 1 by December 31, 2021, and recommendation 2 by March 31, 2021.

Exhibit A. Scope and Methodology

We conducted this performance audit between July 2018, and July 2020, 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 audit objective was to assess FAA's process for developing and updating aircraft emergency evacuation standards, including how changes in passenger behavior, passenger demographics, and seating capacity, affect the standards. Specifically, we evaluated FAA's process to develop and update aircraft emergency standards by

- reviewing Federal regulations, policies, and rulemakings related to aircraft evacuations, including 14 CFR § 25.803, 14 CFR Appendix J to Part 25, and the FAA Reauthorization Act of 2018;
- analyzing FAA and manufacturers' role in conducting aircraft evacuation demonstrations and analyses as discussed in FAA Advisory Circular 25.803-1A, *Emergency Evacuation Demonstrations*;
- analyzing FAA documentation of regulatory actions taken after major accidents;
- interviewing FAA officials in FAA's Aircraft Certification Service and Flight Standards Service;
- interviewing officials and analyzing research studies from the FAA Civil Aerospace Medical Institute and William J. Hughes Technical Center;
- analyzing airline manufacturers' reports of all 72 aircraft evacuation demonstrations and analyses provided by FAA that manufacturers performed from 1966 to 2017 to determine the number of successful demonstrations and analyses, seat dimensions of aircraft used during demonstrations, age of demonstration and testing data used in analyses, and the number of certifications based on analyses used to increase seating capacity;

- observing a partial evacuation of a Boeing 737-8200 that tested passenger interaction during an emergency evacuation at the Boeing Field in Seattle, WA; and
- reviewing videos of the seat dimension testing and the procedures used to screen and intake participants for the seat space study at FAA’s Civil Aerospace Medical Institute to address the congressional mandates.

To validate evacuation times for 29 aircraft models that FAA certified by analysis, we obtained evacuation data that manufacturers used from previous demonstrations and calculated the exit times based on the information in the analyses. We compared our results to the manufacturers’ results to determine whether the exits times were accurate.

We also interviewed NTSB officials and analyzed NTSB data and reports containing information on evacuations investigated between 2008 and 2018. Specifically, NTSB provided us with a list of 38 14 CFR Part 121 evacuation related accidents and incidents. In addition, we selected two high profile 14 CFR Part 129 evacuation-related accidents involving foreign carriers in the United States. We reviewed the accident reports and dockets for all 40 to determine evacuation times and factors that impacted passengers’ exiting aircraft, such as the presence of carry-on baggage.

To determine the 10 aircraft with the largest number of planes in the domestic fleet in 2017, we reviewed BTS’s 2017 Schedule B43 inventory report on annual inventory of airframe and aircraft engines.

To determine the average seat pitch for the four aircraft models with the highest number of planes in the 2017 fleet (most recent data available), we used BTS data for the top three airlines based on FAA fiscal year 2019 aerospace forecast data. According to BTS T-100³³ data from July 2018 to June 2019, the 3 airlines performed 2.5 million departures between July 2018, and June 2019. Of the 2.5 million departures, 1.2 million were performed on 4 aircraft models—the Airbus 320, Airbus 321, Boeing 737-700 or Boeing 737-800. Additionally, 196 million seats were available on these 4 aircraft models that transported 166 million passengers.

To determine the average seating capacity of commonly flown aircraft, we analyzed BTS T-100 data to determine the aircraft that most frequently

³³ According to BTS, the Air Carrier Statistics database, also known as the T-100 data bank, contains domestic and international airline market and segment data. Certificated U.S. air carriers report monthly air carrier traffic information using Form T-100.

had scheduled passenger service with at least 200,000 departures for both 2005 and 2018. We calculated the average seating capacity of an aircraft for a given year by dividing the number of seats flown on each aircraft in a given year by the number of departures in a given year. To then determine the maximum seating capacity of the aircraft, we reviewed each aircraft's Type Certificate Data Sheet in FAA's online Regulatory and Guidance Library that prescribes conditions and limitations under which the aircraft meets FAA's airworthiness requirements.

BTS is a Federal statistical Agency required to abide by standards and guidelines governing Federal statistical agencies. These standards are intended to ensure that statistical agencies' data are as reliable as possible and that the agencies document their methods. We reviewed that documentation and independently compared summaries of several fields, such as the numbers of flights, departures and aircraft types obtained from different data sets for consistency. We found no instances of data discrepancies that we believed would lead us to an incorrect finding, and determined that the data were sufficiently reliable for the purposes of this audit.

Exhibit B. Organizations Visited or Contacted

Federal Aviation Administration Facilities

Headquarters

Aircraft Certification Service

Flight Standards Service

Field Offices

Aircraft Certification Service, Policy and Innovation Division, Aircraft Cabin Security and Survivability, Des Moines, WA

Civil Aerospace Medical Institute, Oklahoma City, OK

William J. Hughes Technical Center, Atlantic City International Airport, NJ

Other Organizations

Air Line Pilots Association

Airbus

Airlines 4 America

Association of Flight Attendants

Boeing

Bombardier

Flyers' Rights

National Transportation Safety Board

Exhibit C. List of Acronyms

BTS	Bureau of Transportation Statistics
CDC	Centers for Disease Control and Prevention
DOT	Department of Transportation
FAA	Federal Aviation Administration
GAO	Government Accountability Office
NPRM	Notice of Proposed Rulemaking
NTSB	National Transportation Safety Board
OIG	Office of Inspector General
SMS	Safety Management System

Exhibit D. Selected Sections of the FAA Reauthorization Act of 2018 Related to Aircraft Evacuations

Section	Text	Due Date
§ 323 Exit Rows	FAA shall conduct a review of current safety procedures regarding unoccupied exit rows on a covered aircraft in passenger air transportation during all stages of flight. In carrying out the review, FAA shall consult with air carriers, aviation manufacturers, and labor stakeholders.	Not later than 1 year after the date of enactment of this act, ^a [FAA] shall submit to the appropriate committees of Congress a report on the results of the review.
§ 337 Aircraft Cabin Evacuation Procedures	FAA shall evaluate: (1) evacuation certification of transport-category aircraft used in air transportation, with regard to (A) emergency conditions, including impacts into water; (B) crew procedures used for evacuations under actual emergency conditions; (C) any relevant changes to passenger demographics and legal requirements, including the Americans with Disabilities Act of 1990 (42 U.S.C. § 12101 <i>et seq.</i>), that affect emergency evacuations; (D) any relevant changes to passenger seating configurations, including changes to seat width, padding, reclining, size, pitch, leg room, and aisle width; (2) recent accidents and incidents in which passengers evacuated such aircraft.	Not later than 1 year after the date of enactment of this act, [FAA] shall submit to the appropriate committees of Congress a report on the results of the review . . . and related recommendations, if any, including recommendations for revisions to the assumptions and methods used for assessing evacuation certification of transport-category aircraft.
§ 437 Harmonization of Service Animal Standards	DOT shall conduct a rulemaking proceeding—(1) to define the term “service animal” for purposes of air transportation; and (2) to develop minimum standards for what is required for service and emotional support animals carried in aircraft cabins.	Not later than 18 months after the date of enactment of this act, [DOT] shall issue a final rule pursuant to the rulemaking conducted under this section
§ 577. Minimum Dimensions For Passenger Seats	FAA shall issue regulations that establish minimum dimensions for passenger seats on aircraft operated by air carriers in interstate air transportation or intrastate air transportation, including minimums for seat pitch, width, and length, and that are necessary for the safety of passengers.	Not later than 1 year after the date of enactment of this act, and after providing notice and an opportunity for comment.

^a The act became law on October 5, 2018.
Source: Pub. L. No. 115-254.

Exhibit E. Major Contributors to This Report

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ASSOCIATE COUNSEL

VISUAL COMMUNICATIONS SPECIALIST

VISUAL COMMUNICATIONS SPECIALIST

Appendix. Agency Comments

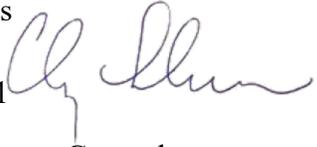


Federal Aviation Administration

Memorandum

Date: August 10, 2020

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: FAA's Process for Updating Its Aircraft Evacuation Standards

The FAA employs a “systems approach” to aircraft evacuation requirements and has promulgated increasingly rigorous cabin safety requirements over the years. These requirements include enhanced standards for egress paths, emergency lighting, escape systems, flammability of materials, and dynamic testing of seats. These system requirements have increased survivability and the amount of time available for successful evacuations, as demonstrated in many accidents.

The FAA believes that the draft report overstates the importance of the 90-second evacuation demonstration and does not take into account the many other standards and requirements that have produced significantly safer aircraft cabins. The 90-second evacuation standard does not represent all accidents, because many variables are present in real world evacuations, and accident scenarios vary widely.

During its meetings with the OIG, FAA specialists emphasized the systems approach utilized for regulatory actions pertaining to occupant safety in an evacuation. The FAA's systems approach includes the requirements below, which are intended to enable successful evacuations:

1. Provide survivability in the event of an accident,
2. Maximize the time available for evacuation, and
3. Enable as rapid an evacuation as possible.

The FAA has identified the following key points of disagreement with the draft report:

- Numerous requirements apply to evacuation, including addressing occupant protection, prolonging the time for egress, and enabling faster egress. The report is largely silent on these requirements and focuses only on what is addressed in the full-scale evacuation demonstration. Thus, the draft report creates the impression that the full scale demonstration is the most important component; however, that conclusion is not consistent with a systems approach to the evaluation of evacuation requirements.
- FAA requirements address real world conditions by considering fires, landing gear collapse, and exit failure, among others.
- FAA retains selected evacuation data, including both test plans and reports, as well as the analyses. The FAA also has access to all certification data.
- Although the evacuation certification process is not covered by 14 CFR Part 5 Safety Management System (SMS) requirements, operators are required to identify hazards under SMS and mitigate them.
- Evacuation times in the accidents cited in the report bear no relation to the certification requirement for a given airplane. The certification standard is a benchmark, under a specific set of conditions, and is not relatable to an actual accident, unless *all* of the same conditions exist. In an actual event, the key parameter is whether the time required to evacuate is less than the time available to evacuate. The time required is particularly difficult to establish for evacuations in non-emergency conditions.

The FAA concurs with the recommendations as written and will implement recommendation 1 by December 31, 2021 and recommendation 2 by March 31, 2021.

We appreciate this opportunity to respond to the OIG draft report. Please contact H. Clayton Foushee at clay.foushee@faa.gov if you have any questions or require additional information about these comments.

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