FAA

FAA Has Opportunities To Better Inform International Pilot Training for Boeing Aircraft Through Enhanced Transparency and Oversight

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Requested by the Chairmen and Ranking Members of the House Committee on Transportation and Infrastructure and its Subcommittee on Aviation

Federal Aviation Administration| AV2022034 | July 27, 2022

What We Looked At

Two fatal crashes involving Boeing 737 MAX 8 aircraft in 2018 and 2019 drew widespread attention to the Federal Aviation Administration's (FAA) oversight and certification practices, including the Agency's process for establishing pilot training requirements for the aircraft. The Chairmen and Ranking Members of the House Committee on Transportation and Infrastructure and its Subcommittee on Aviation requested that we review domestic and international pilot training standards related to commercial passenger aircraft. Our audit objectives were to (1) evaluate FAA's process for establishing pilot training requirements for U.S. and foreign air carriers operating U.S.-certificated large passenger aircraft and (2) review international civil aviation authorities' requirements for air carrier pilot training regarding the use of flight deck automation. We focused on FAA's role in setting training requirements as the certificating authority for Boeing aircraft and its efforts to enhance upset prevention and recovery training.

What We Found

While each country is responsible for setting its own pilot training requirements, FAA has the opportunity to inform other countries' requirements through increased transparency and oversight. For example, FAA provides aircraft-specific guidance to air carriers and other organizations when developing training programs. However, the guidance does not clearly state the level of experience FAA assumed pilots would have—which is significant given that the skills and average experience of pilots can vary between countries. In addition, FAA has worked with international civil aviation authorities to provide guidance on air carrier pilots' use of flight deck automation. This includes conducting outreach and training internationally on specific flight scenarios and leading an ongoing international working group to develop new international standards and guidance on pilots' use of automation. Nevertheless, our survey of international civil aviation authorities found that countries' requirements regarding the use of flight deck automation varied.

Our Recommendations

FAA concurred with our four recommendations to enhance the Agency's transparency and oversight to better inform international pilot training requirements and proposed appropriate planned actions and completion dates.

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

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U. S. Department of Transportation
Office of Inspector General

Memorandum

Date: July 27, 2022

Subject: ACTION: FAA Has Opportunities To Better Inform International Pilot Training for
             Boeing Aircraft Through Enhanced Transparency and Oversight
             Report No. AV2022034

From: Nelda Z. Smith
             Assistant Inspector General for Aviation Audits

To: Federal Aviation Administrator

On October 29, 2018, Lion Air Flight 610 crashed shortly after departing Jakarta, Indonesia, resulting in 189 fatalities. Five months later, on March 10, 2019, Ethiopian Air Flight 302 crashed shortly after departing Addis Ababa, Ethiopia, resulting in 157 fatalities, including 8 Americans. Although operated by foreign air carriers, both flights involved the Boeing 737 MAX 8 aircraft, which was certified by the Federal Aviation Administration (FAA) in March 2017.

These fatal accidents have drawn widespread attention to FAA's oversight and certification practices, including the Agency's process for establishing pilot training requirements for the aircraft. For example, at the time of the October 2018 fatal accident, pilots were reportedly unaware of the new automation system—known as the Maneuvering Characteristics Augmentation System (MCAS)—that Boeing included on the MAX aircraft to improve aircraft performance. According to the Lion Air accident report, the pilots were unable to recover from repetitive MCAS activations, raising international concerns about the adequacy of pilot training.

In light of these concerns, the Chairmen and Ranking Members of the House Committee on Transportation and Infrastructure and its Subcommittee on Aviation requested that we review domestic and international pilot training standards related to commercial passenger aircraft, including the use of automation. Accordingly, our audit objectives were to (1) evaluate FAA's process for establishing pilot training requirements for U.S. and foreign air carriers operating U.S.-certificated large passenger aircraft and (2) review international civil aviation authorities' requirements for air carrier pilot training regarding the use of flight deck automation. In reporting on our objectives, we focused on FAA's role in setting international pilot training requirements as the certificating

authority for Boeing aircraft and its efforts to enhance upset prevention and recovery training.[1] We plan to address FAA's process for establishing pilot training requirements for U.S. air carriers as part of a future audit.

We conducted this audit in accordance with generally accepted Government auditing standards. As part of our review, we surveyed 50 randomly selected civil aviation authorities in countries operating Boeing aircraft to obtain information about how they develop pilot training requirements and the level of consistency regarding enhanced requirements for air carrier pilots globally. We received 29 responses and analyzed the results in this report. Exhibit A details our scope and methodology, exhibit B lists the organizations we visited or contacted, and exhibit C lists the acronyms used in this report.

We appreciate the courtesies and cooperation of Department of Transportation (DOT) representatives during this audit. If you have any questions concerning this report, please contact me or Tina Nysted, Program Director.

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

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[1] Upset prevention and recovery training was developed to reduce loss of control events or, if they occur, enable recovery to normal flight.

Results in Brief

Enhanced transparency and oversight could help FAA better inform foreign aviation authorities' pilot training requirements for Boeing passenger aircraft.

FAA does not establish pilot training requirements for foreign air carriers operating U.S.-certificated Boeing aircraft. Instead, per the Chicago Convention,[2] each country is responsible for establishing its own aviation requirements for pilot training that meet or exceed International Civil Aviation Organization (ICAO) standards.[3] Nevertheless, the Agency's role as the regulator and certifying entity for the aircraft gives it the opportunity to better inform those requirements through enhanced transparency and oversight. For example, when certifying a new aircraft, FAA publishes a Flight Standardization Board (FSB) report that provides aircraft-specific guidance to air carriers and other organizations, including civil aviation authorities, when developing training programs. However, FAA's FSB reports do not clearly state the level of experience FAA assumed pilots would have—which is significant given that the skills and average experience of pilots can vary between countries. While FAA recently revised its processes to include pilots of varied experience, the Agency does not disclose the experience levels of those pilots in publicly available documents. As a result, other countries may not have sufficient information to interpret FAA's standards and develop training requirements accordingly. FAA also has opportunities to influence pilot training requirements through its review and approval of aircraft manufacturers' training documentation, such as Airplane Flight Manuals (AFMs), which many air carriers and civil aviation authorities use when developing training. Our review, and other stakeholder reviews, identified weaknesses in FAA's oversight of AFMs. In the case of the 737 MAX, FAA approved Boeing's AFM even though it did not include all required operating procedures.[4] While FAA plans to revise its guidance and processes for reviewing AFMs for future certificated aircraft, the Agency does not have a plan to determine whether existing AFMs comply with Federal requirements. As a result, air carriers and civil aviation authorities may not have all the information available when they set pilot training requirements.

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[2] Convention on International Civil Aviation ("Chicago Convention"), December 7, 1944, 15 U.N.T.S. 295 (entered into force on April 4, 1947). The Convention established the core principles permitting international transport by air, and led to the creation of the International Civil Aviation Organization.
[3] ICAO establishes the minimum standards applicable to aircraft operation by air carriers authorized to conduct international commercial operations.
[4] Title 14, Code of Federal Regulations (CFR) § 25.1581.

FAA has worked with international civil aviation authorities to provide guidance on air carrier pilots' use of flight deck automation, but countries' requirements vary.

Although it does not set international requirements, FAA has played a significant role in enhancing international pilot training related to the use of flight deck automation. This includes working with ICAO to develop guidance for upset prevention and recovery training. In addition, as part of its rollout of new domestic pilot training requirements[5]—which went into effect in 2019—FAA also conducted outreach and training internationally on specific flight scenarios. Nevertheless, our survey of international civil aviation authorities[6] found that countries' requirements regarding the use of flight deck automation varied. For example, while most of the 29 countries responding to our survey required training on FAA's suggested scenarios, 15 of them indicated they train on additional scenarios as well, such as aircraft failures. Further, 22 of the 29 countries reported they require air carriers to have automation management policies. In contrast, FAA stated it does not require automation policies but is developing guidance that aims to help ensure automation is viewed as a tool and not the most important factor in operating an aircraft. FAA is also taking part in international efforts to enhance pilots' flight path management. In particular, FAA is leading an ICAO working group that is studying concerns about pilots' overreliance of automation in order to develop new international standards and guidance. Given that FAA does not anticipate the research phase of the ICAO work to be completed until March 2023, it is not clear when these new international standards will be published.

We are making recommendations to enhance FAA's transparency and oversight to better inform international pilot training requirements.

Background

The Convention on International Civil Aviation, known as the Chicago Convention, was drafted in 1944 by 52 nations. The Convention established the core principles permitting international air transportation. It also led to the creation of ICAO as a collaborative group for the signatory countries to establish a common set of aviation standards. The intent was, in part, to ensure countries did not limit international carriers through overly restrictive requirements. Under the Convention, each country is responsible for establishing aviation requirements, including rules for training pilots that meet or exceed ICAO standards. As such,

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[5] 14 CFR § 121.423.

[6] For a list of the countries surveyed and a summary of our survey results, see exhibit D.

FAA establishes training requirements for U.S. air carriers and their pilots, but cannot extend any requirements that exceed ICAO standards to foreign carriers flying to and from the United States.

As an independent committee of aviation experts noted in a recent review of FAA's aircraft certification process,[7] the majority of U.S.-designed aircraft are registered outside of the United States and operate under the jurisdiction of an aviation authority other than FAA, each with its own standards and regulations. According to Boeing, airlines in 149 countries operate its aircraft (see figure 1).

Figure 1. Global Airline Use of Boeing Aircraft
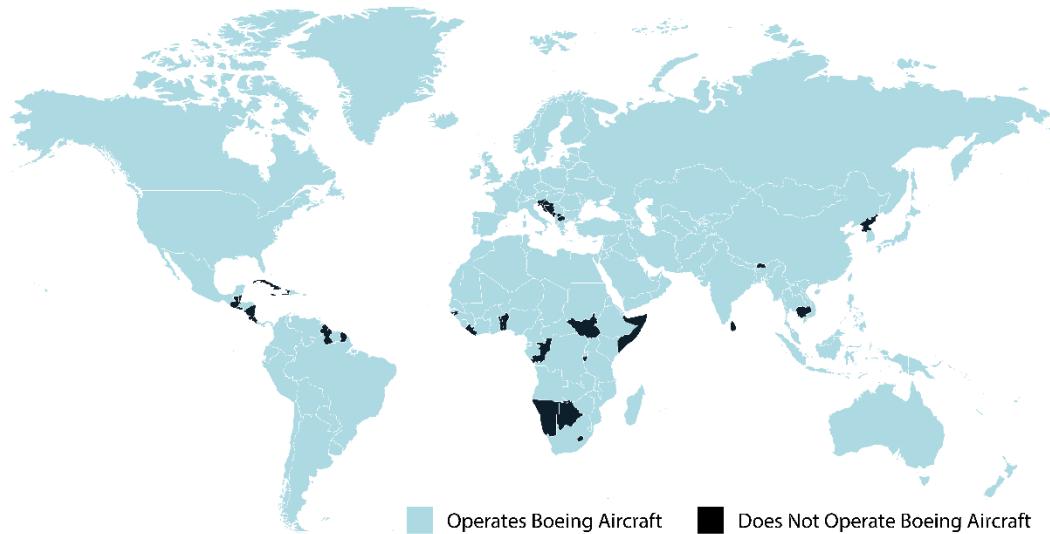
Source: OIG analysis of Boeing data

In order to determine the overall compliance with international standards, ICAO performs Universal Safety Oversight Audit Program audits. Similarly, FAA performs audits of specific countries with air carriers seeking to operate to and from the United States. Both of these programs focus on countries' civil aviation authorities' compliance with ICAO standards and recommended practices. They do not evaluate individual air carriers or compare other nations' practices to U.S. regulations. In contrast, the International Air Transport Association (IATA) is a trade association that audits air carriers to determine whether they meet international standards and best practices. FAA and U.S. air carriers use IATA's audit reports when evaluating international air carriers that could fly domestic passengers.

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[7] *Official Report of the Special Committee to Review the Federal Aviation Administration's Aircraft Certification Process* (January 16, 2020).

Enhanced Transparency and Oversight Could Help FAA Better Inform Foreign Aviation Authorities' Pilot Training Requirements for Boeing Passenger Aircraft

FAA does not establish pilot training requirements for foreign air carriers operating Boeing aircraft. However, the Agency has opportunities to better inform foreign aviation authorities that establish those requirements. This includes increasing transparency regarding pilot training assumptions and enhancing oversight to ensure manufacturer documentation meets FAA regulations.

FAA's Aircraft-Specific Training Recommendations Lack Transparency Regarding Pilot Training Assumptions

Per the Chicago Convention, each country is responsible for setting its own pilot training requirements. Nevertheless, FAA has the opportunity to inform other countries' requirements given its role as the regulator of U.S.-certificated aircraft. FAA acknowledged this role in a joint presentation to ICAO in 2019,[8] noting that nations responsible for designing and certifying an aircraft, especially aircraft with new or novel systems, "are uniquely suited to promote training programs and operational policies that highlight automation capabilities and accompanying manual flight operations skillsets."

For example, FAA's Aircraft Evaluation Group publishes flightcrew member training, checking, and other requirements and recommendations in FSB reports that are aircraft-specific. These reports provide guidance to U.S. organizations developing training programs on aircraft-specific systems, including requirements unique to the aircraft that require additional emphasis. Additionally, international air carriers and aviation authorities can use these publicly available reports when developing training requirements and programs. For example, 10 of the 29 countries we surveyed used FAA reports when establishing aircraft-specific training requirements.

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[8] ICAO A40-WP/296, Pilot Training Improvements to Address Automation Dependency (February 8, 2019).

However, FAA's FSB reports are not fully transparent in certain areas related to pilot training. Specifically, FAA does not define the pilot qualification assumptions used to establish these requirements and recommendations. For example, we asked the Agency about the qualifications of the pilots used to establish training requirements for the Boeing 787 aircraft. FAA representatives responded that pilots with varying skill levels participated, including pilots who had no previous Boeing flight experience. However, they were unable to provide specific information or verify their belief because they did not maintain relevant documentation. FAA does not have procedures to document or report those assumptions as part of its FSB report.

FAA's lack of transparency likely limits the value of FSB reports because they do not establish a common point of comparison or understanding for aviation authorities and operators to evaluate training programs. The cultures and average experience level for pilots of other countries may be significantly different than U.S. pilots. For example, the United States requires pilots to have an airline transport pilot (ATP) certificate or a restricted ATP certificate with at least 750 hours of time as a pilot to serve as a first officer. In contrast, 18 of the 29 countries we reviewed allow pilots to serve as first officers with a multi-crew pilot license (MPL), which requires a minimum of 240 hours of time as a pilot.[9]

In December 2020, Congress required FAA to revise existing policies to ensure manufacturers perform evaluations using pilots from air carriers expected to use such aircraft.[10] As a result, FAA now requires its FSB chairperson[11] to ensure air carrier pilots of varying levels of experience are included when establishing pilot training requirements. In addition, the FSB chairperson must document that the aircraft manufacturer—to the Administrator's satisfaction—meets these requirements.[12] However, FAA does not include the pilots' levels of experience in its FSB reports or other publicly available documents. As a result, civil aviation authorities and foreign air carriers may still not be aware of FAA's pilot training assumptions and may not have sufficient information to interpret those standards and develop their training requirements accordingly.

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[9] In 2006, ICAO established standards for the MPL. It is a license that allows a pilot to serve as a copilot (first officer) of an airline operation. The United States has not added the regulatory framework for an MPL. By law, all pilots in 14 CFR part 121 operations are required to hold an ATP certificate. Airline Safety and Federal Aviation Administration Extension Act of 2010, § 216(c), Pub. L. 111-216 (2010) (codified at 49 U.S.C. § 44701 note).

[10] Consolidated Appropriations Act of 2021, Division V, Section 128, Pub. L. 116-260 (Dec. 27, 2020) (codified at 49 U.S.C. § 44704 note).

[11] FAA Aircraft Evaluation Group employee who performs or directs the tasks of the FSB.

[12] FAA Notice N 8900.606, Use of Air Carrier Pilots During Flight Standardization Board Evaluations for Transport Airplanes (December 27, 2021).

FAA Does Not Effectively Oversee Manufacturers' Training Documentation During the Aircraft Certification Process

FAA also has opportunities to better inform international pilot training through enhanced oversight during the certification process. In particular, FAA can influence foreign aviation authorities' training requirements through its review of AFMs[13] created by aircraft manufacturers. Many countries use Boeing documentation when they develop aircraft-specific training. Twenty of the 29 countries in our survey used Boeing documentation to develop training requirements—twice the number of countries that used FAA's training report (see figure 2).

Figure 2. Number of Countries Using FAA and Boeing Documentation To Develop Pilot Training Requirements

Only FAA FSB Report

2   8   12

Both   Only Boeing Documentation
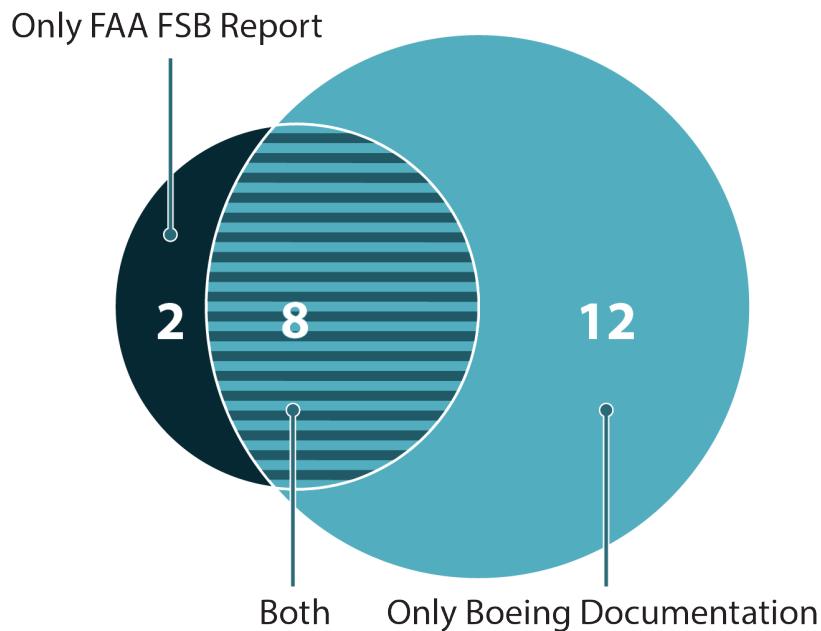
Source: OIG analysis of survey response data

FAA reviews and approves manufacturers' AFMs during its certification process to ensure manufacturers include step-by-step methods necessary to safely operate

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[13] An AFM is an FAA-approved document that contains information (operating limitations, operating procedures, performance information, etc.) necessary to operate the airplane at the level of safety established by the airplane's certification basis. Other manuals produced by manufacturers, such as the Flightcrew Operating Manual (FCOM), are not subject to FAA approval.

the aircraft during normal, non-normal, and emergency conditions. However, FAA's guidance encourages manufacturers to limit AFM content to "the smallest practicable amount" of material appropriate for the intended operation of the airplane. Moreover, the guidance does not contain sufficient instruction for determining which procedures are "necessary" for safe operation. According to FAA, the practice of using less content is intended to limit the complexity of the AFM. However, as a result, manufacturers may inappropriately deem certain procedures unnecessary for safe operation and fail to include those procedures in the AFM. This, in turn, prevents FAA from reviewing and approving all the procedures necessary for the aircraft's safe operation and leaves foreign countries unaware of essential training requirements.

For example, following the 2018 and 2019 fatal accidents involving the Boeing 737 MAX, FAA chartered the Flight Control Systems Joint Authorities Technical Review (Joint Review) to review the type certification of the aircraft's flight control systems. The Joint Review found that Boeing's AFM did not include all the operating procedures required by regulations.[14] Instead, Boeing included most of the operating procedures in the Flightcrew Operating Manual (FCOM), which FAA does not review. According to the Joint Review, this allowed Boeing to make changes to operating procedures without FAA approval, leaving the Agency possibly unaware of those changes. The Joint Review recommended that FAA require a documented process to determine what information is included in the AFM and other manuals.

In response to the Joint Review findings and recommendations, FAA determined the Boeing 737 MAX flight manual did not comply with regulatory requirements and initiated a review of its guidance. FAA requested that Boeing develop flight manuals for the ongoing 737-10 and 777-9 projects that are similar to existing FCOMs in scope and format. However, these actions are forward-looking and do not address potential regulatory deficiencies in existing AFMs. FAA did not establish a process for identifying and remediating potential deficiencies with existing FAA-approved AFMs. Further, the Agency has yet to issue updated guidance on how to determine what information must be included in AFMs based on the Joint Review's recommendation. As a result, FAA may be missing opportunities to ensure manufacturers' guidance provides air carriers and aviation authorities with critical information for developing training programs.

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[14] 14 CFR § 25.1581.

FAA Works With International Civil Aviation Authorities To Enhance Guidance on Air Carrier Pilots' Use of Flight Deck Automation, but Countries' Requirements Vary

Although the international aviation community (including FAA) continues to work on developing guidance and standards on pilots' use of automation, actual pilot and air carrier requirements vary amongst civil aviation authorities worldwide. Following two fatal accidents in 2009,[15] a number of aviation authorities, including FAA, began examining the qualification and training requirements for air carrier pilots, particularly the use of manual flying skills. In 2012, ICAO, the European Union Aviation Safety Agency (EASA), and FAA combined efforts to identify and establish an acceptable approach. These efforts resulted in the creation of the ICAO Upset Prevention and Recovery Training (UPRT) manual to increase safety standards and move toward situational training by standardizing the type of upset prevention and recovery training provided to pilots. The ICAO UPRT manual emphasizes that "pilots need to know the conditions under which it is best to allow automated systems to control the aeroplane and those under which manual intervention by the pilot is best." Further, the manual includes specific guidance for automation management to ensure pilots know how to use automated systems during prevention and recovery from upset events.

Domestically, FAA established enhanced pilot training requirements in 2013[16] for U.S. airlines to emphasize the development of manual flying skills. Air carriers had to implement the requirements in 2019. Specifically, FAA took action to require flight simulator enhancements[17] to facilitate training on six specific conditions, as shown in table 1.

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[15] Colgan Air Flight 3407, February 12, 2009, and Air France Flight 447, June 1, 2009.
[16] 14 CFR § 121.423.
[17] 14 CFR Part 60.

Table 1. Manual Flying Simulator Requirements

Training Maneuvers	Overview
Upset Prevention and Recovery	Aircraft upset is an unsafe condition that may result in loss of control. Training should focus on the pilot's manual handling skills to prevent upset, as well as the ability to recover from this condition.
Manually Controlled Departure and Arrival	Pilots will be trained to fly an instrument departure and arrival while manually controlling the aircraft.
Slow Flight	Pilots will be trained to understand the performance of the aircraft and the way it handles at airspeeds just above the stall warning.
Loss of Reliable Airspeed	Training will focus on the recognition and appropriate response to a system malfunction that results in a loss of reliable airspeed that increases risk of aircraft stall and/or upset.
Recovery from Stall/Stick Pusher Activation	Training will provide pilots with the knowledge and skills to avoid undesired aircraft conditions that increase the risk of encountering a stall or, if not avoided, to respond correctly and promptly.
Recovery from Bounced Landing	A poorly executed approach and touchdown can generate a shallow bounce (skip) or a high, hard bounce that can quickly develop into a hard landing accident.

Source: OIG analysis

In conjunction with the new domestic requirements, FAA developed training for its inspectors who would be responsible for approving air carrier training programs with the incorporated techniques. The training included classroom sessions on what air carrier programs should entail, such as examples of what FAA inspectors should look for when approving those programs. FAA also provided training in simulators to allow participants to practice the revised flight procedures.

FAA has also conducted significant international outreach regarding these trainings and flying skills. Notably, FAA has coordinated with ICAO and other organizations to provide training to representatives from at least 73 foreign countries since 2016. These sessions included 14 in-person events with simulator sessions and 2 virtual events that were held during the ongoing pandemic. See figure 3 for an overview of countries with participants in FAA's training.

Figure 3. Countries That Participated in FAA's Training Workshops
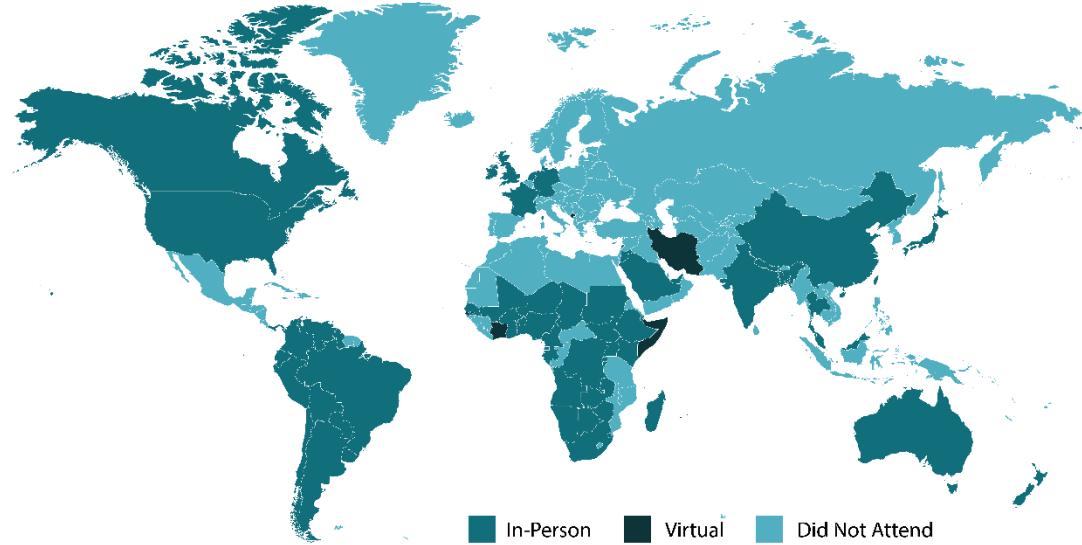
Source: OIG analysis of FAA data

Given FAA's significant outreach efforts, we asked civil aviation authorities whether they require airlines to train any of the specific scenarios identified by FAA to bolster pilots' manual flying skills. (See exhibit D for a list of countries we surveyed and a summary of the survey results.) Only 3 of the 29 countries that responded expressed that they did *not* require any specific scenarios for manual flying. The remaining 26 did require training on various specific scenarios to ensure pilots' manual flying skills. Approximately half of the countries (15 of 29) also indicated they train additional scenarios such as manually flown engine-out maneuvers, steep turns, aircraft failures, and return to service scenarios of the Boeing 737 MAX (see figure 4).

Figure 4. Number of Countries Requiring Manually Flown Training Scenarios
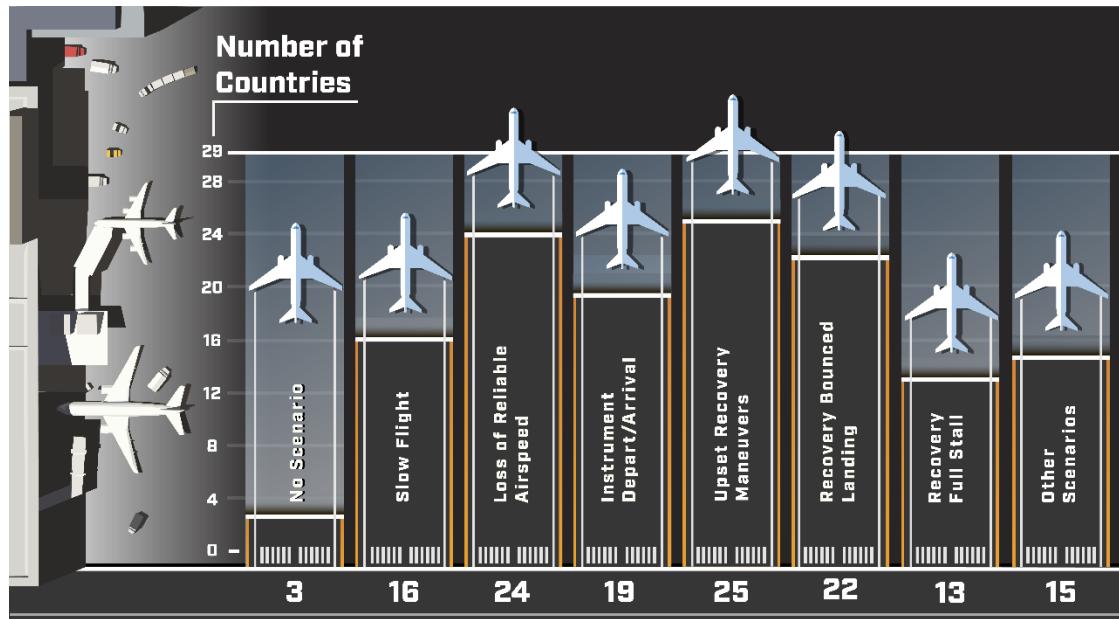
Source: OIG analysis of survey data

In addition to inquiring about training for specific scenarios, we asked whether the civil aviation authorities had performed analysis to determine if pilots needed additional training to enhance manual flying skills. As Congress noted in the Consolidated Appropriations Act of 2021, "increased reliance on automation in commercial aviation risks a degradation of pilot skills" and "manual flying skills are essential for pilot confidence and competence." Seventeen of the 29 countries reported they performed analysis to determine if additional training was needed.

Most of the countries (22 of 29) also reported they required carriers to have automation management policies (see figure 5). While FAA indicated it required U.S. carriers to have automation management policies, we found the Agency has not established these requirements. Instead, Agency officials indicated FAA is developing new guidance to focus on flight path management with automation policies as a subcomponent. FAA officials stated this guidance will aim to help ensure automation is viewed as a tool and not the most important factor in operating an aircraft.

Figure 5. Number of Countries Taking Specific Actions Regarding Pilots' Manual Flying Skills and Use of Automation
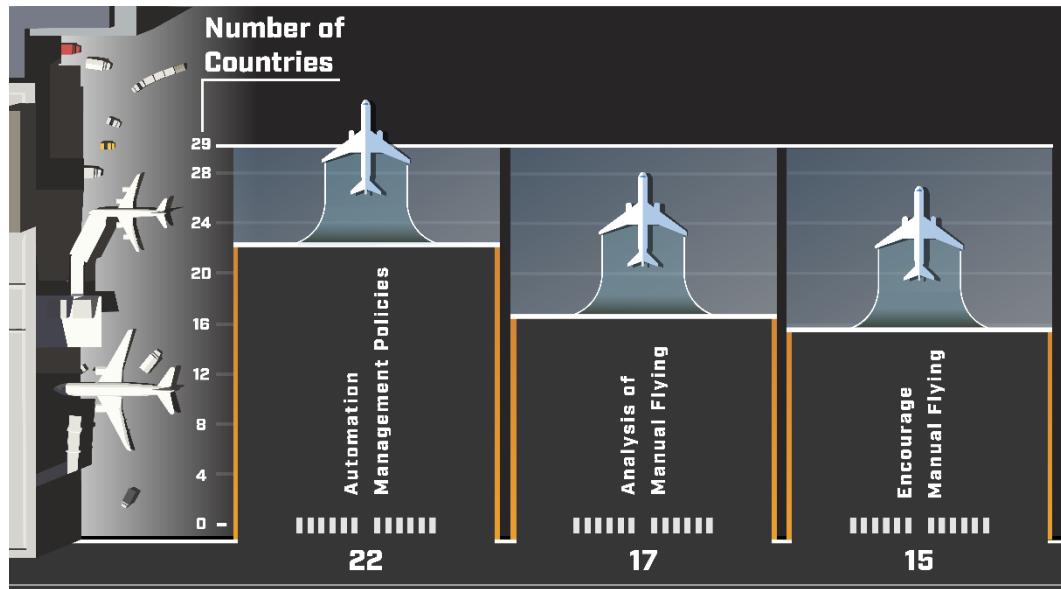
Source: OIG analysis of survey data

FAA is also taking part in international efforts to enhance pilots' flight path management, including the use of automation. In 2019, FAA co-presented (with Canada, Peru, and Trinidad and Tobago) a series of recommendations to mitigate the consequences of automation dependency and how it may be addressed at global, regional, and national levels. The presentation indicated that, "Further study of issues surrounding automation in the flight deck could enhance the safety of flight operations worldwide." The presenters recommended the study assess over-reliance on automation and the methodologies currently employed to ensure pilots maintain the necessary skills. In response, ICAO established a working panel, with a subgroup focused on these areas to provide recommendations for changes to ICAO standards and guidance documents. FAA is representing the United States by chairing this subgroup and anticipates completing the research phase in March 2023.

Conclusion

The tragic crashes of two international flights of the FAA-certificated Boeing 737 MAX 8 aircraft brought new attention to the importance of effectively training pilots to operate new aircraft worldwide. While FAA is not responsible for setting international pilot training requirements, FAA has opportunities to inform those requirements through increasing transparency in its reporting of minimum

training recommendations for specific aircraft. FAA can also better ensure that manufacturers' aircraft documentation fully adheres to Federal regulations, given that many air carriers and international civil aviation authorities rely on this documentation to develop training standards and plans. To its credit, FAA is working with international partners to strengthen worldwide standards regarding pilots' manual flying skills and reliance on automation systems. Continued attention during the certification process and beyond will help ensure FAA is taking all steps possible to promote the safe operation of U.S.-designed and certificated large passenger aircraft.

Recommendations

To enhance FAA's transparency and oversight to better inform international pilot training requirements, we recommend that the Federal Aviation Administrator:

1. Develop and implement procedures to document within Flight Standardization Board reports the experience level of pilots used to establish pilot training recommendations.

2. Develop and implement a process to evaluate existing Boeing airplane flight manuals to determine whether they contain required normal, non-normal, and emergency procedures that are necessary for the safe operation of the aircraft. Within this process, include methods to determine what corrective actions are needed if deficiencies are identified.

3. Develop and implement a documented process to identify what information manufacturers must include in airplane flight manuals.

4. Develop guidance for air carriers to support the development and implementation of automation management policies. Following publication of the guidance, validate that air carriers' policies, procedures, and training are consistent with the new guidance.

Agency Comments and OIG Response

We provided FAA with our draft report on June 14, 2022, and received its response on July 15, 2022, which is included as an appendix to this report. FAA concurred with all four of our recommendations and proposed appropriate actions and completion dates. Accordingly, we consider all recommendations as resolved but open pending completion of the planned actions.

Actions Required

We consider recommendations 1 through 4 resolved but open pending completion of the planned actions.

Exhibit A. Scope and Methodology

This performance audit was conducted between February 2020 and June 2022. We conducted this audit in accordance with generally accepted Government auditing standards. 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 objectives were to (1) evaluate FAA's process for establishing pilot training requirements for U.S. and foreign air carriers operating U.S.-certificated large passenger aircraft, and (2) review international civil aviation authorities' requirements for air carrier pilot training regarding the use of flight deck automation. This report is in response to a request from the Chairmen and Ranking Members of the House Committee on Transportation and Infrastructure and its Subcommittee on Aviation.

Our audit focused on FAA's role in setting international pilot training requirements as the certificating authority for Boeing aircraft and its efforts to enhance upset prevention and recovery training. To evaluate FAA's process for establishing pilot training requirements, we met with FAA representatives from the Flight Standards Aircraft Evaluation Division, including representatives from FSBs responsible for establishing pilot training requirements and recommendations for the Boeing 787. We reviewed the Chicago Convention to determine FAA's authority regarding international requirements and met with representatives from ICAO to gain a better understanding of the interactions between FAA, ICAO, and other CAAs. We reviewed pilot training requirements and recommendations from FAA, ICAO, and EASA. We also analyzed aircraft specific training recommendations from FAA in conjunction with EASA training requirements for the same aircraft. We analyzed Federal regulations and documents, including FAA FSB reports that establish aircraft specific pilot training recommendations for FAA-certificated air carriers. We obtained EASA-required pilot training documentation and analyzed them in conjunction with FAA's training reports. We also reviewed FAA orders and guidance for aircraft certification regarding pilot training requirements.

To determine how pilot training programs at foreign carriers partnering with domestic airlines are evaluated, we requested and obtained codeshare information from the Office of the Secretary of Transportation. We analyzed the documentation and identified seven U.S. carriers with foreign codeshare partners. We interviewed representatives from each of the seven airlines to determine how codeshare partners' pilot training programs are reviewed and how information is communicated to FAA. Each of the carriers identified its use of IATA safety audit

reports as a significant component of the review process. We reviewed IATA documentation and interviewed representatives to gain an understanding of their audit processes and how they review pilot training programs. We also interviewed FAA's codeshare manager to identify Agency requirements for air carriers requesting approval for foreign codeshare partners.

Further, we met representatives from FAA's International Affairs and International Field Office divisions. Given the ongoing pandemic, we developed a survey to obtain pilot training information from international civil aviation authorities. We pretested the survey with FAA representatives from the Air Transportation Division, the Aircraft Evaluation Division, and Foreign Affairs to facilitate phrasing that would be understood consistently by foreign authorities. We requested and obtained from Boeing a list of the countries with airlines operating its aircraft, including the various types operated by each country's carriers. Based on this information, we selected a random sample of countries representing each ICAO region. We then coordinated with FAA and the U.S. Department of State to identify any countries that should not be contacted due to ongoing sanctions or other government restrictions. FAA provided contact information for the sampled countries' aviation authorities and we emailed the survey to 50 civil aviation authorities, including FAA, on April 14 and April 15, 2021. We sent followup requests to authorities that had not responded by the requested response date of May 14, 2021. We closed the survey period on June 25, 2021, and analyzed the results to identify potential similarities across aviation authorities and by region.

We interviewed FAA representatives participating in ICAO pilot training initiatives to determine the Agency's actions to promote enhanced training standards and develop automation management policy recommendations. We analyzed pilot training documentation to determine the extent of FAA's outreach. We also reviewed documentation regarding FAA's involvement in the ICAO panel on automation dependency.

Exhibit B. Organizations Contacted

DOT

Office of the Secretary of Transportation

FAA

Air Transportation Division, Training and Simulation Group

Aircraft Evaluation Division (AED)

International Program Division

Office of Audit and Evaluation

Office of International Affairs

Office of the Chief Counsel

International Aviation Authorities

International Civil Aviation Organization (ICAO)

European Union Aviation Safety Agency (EASA)

Civil Aeronautical Authority of Panama

Civil Aviation Authorities (CAAs)*

Other Organizations – Industry

Air Line Pilots Association (ALPA)

Boeing

International Air Transport Association (IATA)

Other Organizations – Airlines

Alaska Airlines

American Airlines

Delta Air Lines

Frontier Airlines

Hawaiian Airlines

JetBlue Airways

United Airlines

For a list of the countries included in our survey, see exhibit D.

Exhibit C. List of Acronyms

AFM	Airplane Flight Manual
CAA	Civil Aviation Authority
CFR	Code of Federal Regulations
DOT	Department of Transportation
EASA	European Union Aviation Safety Agency
FAA	Federal Aviation Administration
FCOM	Flightcrew Operating Manual
FSB	Flight Standardization Board
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
MCAS	Maneuvering Characteristics Augmentation System
MPL	Multi-Crew Pilot License
OIG	Office of Inspector General
UPRT	Upset Prevention and Recovery Training

Exhibit C. List of Acronyms 21

Exhibit D. Survey Data and Responses

Table D-1. List of Countries Surveyed

Country	Survey Response Provided	Country	Survey Response Provided
Afghanistan	No	Madagascar	No
Algeria	No	Malawi	Yes
Aruba	Yes	Mali	No
Austria	Yes	Malta	Yes
Bahrain	Yes	Mexico	No
Belgium	Yes	Mongolia	No
Bermuda	Yes	Morocco	Yes
Brazil	Yes	New Zealand	Yes
Brunei Darussalam	Yes	Niger	No
Canada	Yes	Norway	Yes
Chad	No*	Paraguay	No
Chile	Yes	Rwanda	No
China	Yes	Senegal	Yes
Colombia	Yes	Serbia	Yes
Egypt	No	Sudan	No
Gambia	Yes	Suriname	Yes
Germany	Yes	Switzerland	Yes
Hungary	Yes	Tajikistan	No
Iceland	Yes	Tanzania, United Republic Of	No
India	Yes	Tunisia	No
Iraq	Yes	Uganda	No
Kazakhstan	No	Ukraine	No
Kyrgyzstan	No	United Arab Emirates	Yes
Laos	No	United States	Yes
Latvia	Yes	Vietnam	No

* Chad provided regulations, but did not respond to the survey questions.

Table D-2. Survey Responses by ICAO Region

	Asia and Pacific	Eastern and Southern African	European and North Atlantic	Middle East	North American, Central American and Caribbean Office	South American	Western and Central African
Total Countries	24	14	51	13	10	11	13
Number Surveyed	8	5	17	5	5	5	5
Survey Respondents	4	1	11	3	4	4	2

Table D-3. Number of Airlines and Aircraft Operated by Surveyed Countries, by ICAO Region

	Asia and Pacific	Eastern and Southern African	European and North Atlantic	Middle East	North American, Central American and Caribbean Office	South American	Western and Central African
Survey Respondents	4	1	11	3	4	4	2
Number of Airlines	34	1	20	8	36	8	0
Number of Boeing Aircraft	1787	1	451	294	3006	208	0

Table D-4. Survey Responses, by ICAO Region

Survey Question and Answer	Asia and Pacific	Eastern and Southern African	European and North Atlantic	Middle East	North American Central American and Caribbean Office	South American	Western and Central African
Total Respondents	4	1	11	3	4	4	2
Do those airlines operate any of the aircraft variants listed below for passenger service? Please select all that apply.							
737-NG	2	1	7	3	3	3	0
737-MAX	2	0	3	1	2	1	0
747-8	2	0	1	0	0	0	0
767-400ER	0	0	1	0	1	1	0
777	3	0	2	2	3	1	0
787	3	0	3	2	2	2	0
Are pilot qualification regulations available to the public?							
Yes	4	1	11	3	4	4	2
Are airline pilot training regulations available to the public?							
Yes	4	1	11	3	4	4	2
Are your CAA's regulations available in the English language?							
Yes	3	1	10	3	4	1	1

Survey Question and Answer	Asia and Pacific	Eastern and Southern African	European and North Atlantic	Middle East	North American Central American and Caribbean Office	South American	Western and Central African
Which of these licenses would permit a pilot to perform the duties of co-pilot for an airline? Please select all that apply.							
Commercial Pilot License with Instrument Rating	4	1	11	3	3	4	2
Multi-Crew Pilot License (MPL)	2	1	10	2	1	1	1
Airline Transport Pilot License (ATP)	4	1	11	3	4	3	2
Other	0	0	2	0	0	0	0
Does your CAA have additional requirements for pilots to serve as co-pilot at an airline? Please select all that apply.							
No additional requirements	1	0	0	0	0	0	0
Type Rating (co-pilot)	3	1	11	3	4	4	2
Upset Prevention and Recovery Training	2	1	11	3	3	2	1
Other	1	0	10	2	3	1	0
What are your CAA's requirements for pilots to serve as pilot-in-command at an airline? Please select all that apply.							
ATP	4	1	11	3	4	4	2
Type Rating (pilot-in-command)	3	1	11	3	4	4	2
Minimum number of hours as co-pilot	1	0	2	2	0	2	1
Upset Prevention and Recovery Training	1	1	11	3	3	2	1
Other	0	0	10	2	3	3	0

Survey Question and Answer	Asia and Pacific	Eastern and Southern African	European and North Atlantic	Middle East	North American Central American and Caribbean Office	South American	Western and Central African
What documents does your CAA use to establish minimum pilot training requirements for Boeing aircraft? Please select all that apply.							
FAA Flight Standardization Board (FSB) Report	1	1	1	2	3	2	0
EASA-approved Operational Suitability Data (OSD)	2	1	10	3	2	1	0
Boeing Documentation	2	1	8	2	3	4	0
Other	2	0	8	1	1	2	2
Does your CAA require airlines to implement automation management policies?							
Yes	2	1	11	2	2	4	0
Has your CAA performed an analysis to determine if airline pilots need additional training to enhance manual flying skills?							
Yes	2	1	11	2	1	0	0
Does your CAA require airlines to train specific scenarios to ensure pilots' manual flying skills? Please select all that apply.							
No Scenario	0	0	0	0	1	1	1
Slow flight	0	1	11	1	2	1	0
Loss of Reliable Airspeed	3	1	11	3	2	3	1
Instrument Depart/Arrival	1	1	11	1	2	3	0
Upset Recovery Maneuvers	4	1	11	3	2	3	1
Recovery Bounced Landing	3	1	11	3	2	2	0
Recovery Full Stall	3	1	2	3	2	1	1
Other	1	0	10	1	1	2	0

Survey Question and Answer	Asia and Pacific	Eastern and Southern African	European and North Atlantic	Middle East	North American Central American and Caribbean Office	South American	Western and Central African
Does your CAA encourage airline pilots to practice manual flying skills during line operations under appropriate operational conditions?							
Yes	3	1	4	3	3	1	0
Has your CAA made any changes to airline pilot training requirements as a result of the two Boeing MAX accidents?							
Yes	2	1	7	2	2	1	0
Has your CAA participated in any of the following international external audits as they relate to pilot training programs? Please select all that apply.							
ICAO Universal Safety Oversight Audit Programme (USOAP)	4	1	10	3	2	4	2
FAA International Aviation Safety Assessment (IASA)	1	0	4	1	1	2	0
Other	0	0	9	2	0	0	0

Exhibit E. Major Contributors to This Report

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Federal Aviation Administration

Memorandum

Date: July 15, 2022

To: Nelda Z. Smith, 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 Has Opportunities to Better Inform International Pilot
             Training for Boeing Aircraft Through Enhanced Transparency and Oversight

The FAA has a long history as the leader in global aviation safety. Accordingly, the Agency recognizes its role to enhance global aviation safety standards by working closely with the International Civil Aviation Organization (ICAO) and supporting foreign civil aviation authorities requesting FAA technical expertise. This commitment remains strong.

The FAA offers the following observations on the draft report:

- The draft OIG report correctly asserts that the FAA does not establish pilot training requirements for foreign air carriers, while also correctly asserting that the FAA has the opportunity to better inform training requirements. In addition, the report states that the FAA does not define pilot qualification assumptions used to establish training requirements and recommendations, and the FAA does not disclose that information in the Flight Standardization Board (FSB) Report to inform other authorities. The Agency understands the diversity and varying complexities of the other civil aviation authorities in which U.S.-produced aircraft operate. The FAA also believes it is important to provide the context and underlying information leading to FSB Report recommendations, in order to better inform other aviation authorities in their training requirements and determinations.

- The draft report correctly describes previous engagements with ICAO and other foreign civil aviation authorities regarding upset prevention and recovery training and managing automation. The draft report also correctly references a 2013 final rule, and subsequent actions, for implementing the enhanced pilot training requirements in 2019, which included enhanced simulator qualification requirements and inspector training. The Agency also coordinated with ICAO in providing international outreach in these areas, as noted in the report. As the FAA's work in this area continues to evolve, the Agency has shifted its focus to flightpath management with automation policies as a subcomponent and is developing new guidance as a result. Internationally, the FAA is leading a working group under the ICAO Personnel Training and Licensing Panel that is assessing pilot overreliance on automation globally.

- The draft report correctly identifies gaps between the FAA's current guidance for means of compliance with Airplane Flight Manuals (AFM), specifically Advisory Circular (AC) 25.1581-1, *Airplane Flight Manual*, dated October 16, 2012, and the regulatory requirements for AFM content. These gaps between the regulatory requirements and the AC means of compliance have been identified as the primary reason for an incomplete AFM.

Upon preliminary review of the recommendations, the FAA concurs with recommendations 1, 2, 3, and 4 as written.

For recommendation 1, as noted in the OIG's draft report, the FAA issued Notice 8900.606, *Use of Air Carrier Pilots During Flight Standardization Board Evaluations for Transport Airplanes*, in December 2021 to be responsive to Section 128 of the Aircraft Certification, Safety, and Accountability Act, Pub. L. 116-260. The Notice is directed at FAA inspectors charged with the execution of the FSB activities leading to the FSB Report and includes a requirement that the responsible inspector must issue the O-6 Operational Evaluation Issue Paper, which will document how the manufacturer ensures to the Administrator's satisfaction that air carrier pilots used in the operational evaluation include pilots of varying levels of experience. The inclusion of this information in the Issue Paper will support the FAA's ultimate publication in the FSB Report of the licensing level, experience, and countries of origin that participated in the FSB Operational Evaluation. The FAA has revised the template used by FAA personnel who develop the FSB Report to include a section documenting pilot experience. The FAA provided a copy of the O-6 Issue Paper to the OIG on June 30, 2022. The FAA requests the OIG close this recommendation within 30 days of issuing its final report.

Recommendation 2 is a follow-on activity to recommendation 3. The FAA will begin assessing existing Boeing AFMs this year, and with the implementation of recommendation 3, the FAA will have a process to evaluate existing Boeing AFMs developed by December 31, 2024

The FAA intends to implement recommendation 3 by updating AC 25.1581-1 with new guidance on the information that Title 14 of the Code of Federal Regulations §§ 25.1581 through 25.1587 require manufacturers to include in the AFM. The FAA expects to publish this updated AC for public comment by December 31, 2024.

The FAA intends to implement recommendation 4 by first publishing the recommended guidance as part of the new Flightpath Management AC. The FAA anticipates publication of the AC by December 31, 2022. This AC supports the existing regulatory framework that requires pilots to be trained on aircraft systems, including automated systems on the flight deck, and trained on operational policies and procedures. To implement the second part of the recommendation, the FAA must allow time for operators to evaluate their existing policies, procedures, and training against the objectives set forth in the guidance and make adjustments as operators deem appropriate. The FAA will follow up by December 31, 2024, to determine the degree to which operators have met these objectives.

Thank you for this opportunity to offer additional perspective on 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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