United States Government Accountability Office

Report to Congressional Committees

June 2022

AIRCRAFT CERTIFICATION

Comparison of U.S. and European Processes for Approving New Designs of Commercial Transport Airplanes

GAO-22-104480

GAO Highlights

Highlights of GAO-22-104480, a report to congressional committees

June 2022

AIRCRAFT CERTIFICATION

Comparison of U.S. and European Processes for Approving New Designs of Commercial Transport Airplanes

Why GAO Did This Study

FAA and EASA certify the safety of new commercial airplane designs for use in the U.S. and Europe, respectively. Two deadly accidents involving the FAA-certified Boeing 737 MAX raised concerns about FAA's certification and oversight processes of airplane manufacturers.

The explanatory statement accompanying the Further Consolidated Appropriations Act, 2020, included a provision for GAO to compare FAA's and EASA's oversight regimes for airplane certification. This report examines, among other things, the similarities and differences between FAA's and EASA's (1) activities and standards for certifying new designs of commercial transport airplanes, (2) approaches for manufacturer involvement in the design certification process, and (3) audits of manufacturers' design certification process activities.

GAO reviewed applicable U.S. and EU laws, FAA and EASA documentation, and international agreements related to certification. GAO interviewed FAA officials and received written responses from EASA officials. GAO also interviewed representatives from Boeing, Airbus, two other aviation authorities, and an aviation association to better understand the two processes. The information about foreign law in this report is not the product of our analysis but is derived from interviews and information provided by EASA.

View GAO-22-104480. For more information, contact Heather Krause at (202) 512-2834 or krauseh@gao.gov

What GAO Found

GAO's comparative analysis found that activities and standards for certifying new designs of commercial transport airplanes are largely similar in the U.S. and Europe. The similarities stem from a U.S.-European Union (EU) 2008 bilateral agreement that helped harmonize their processes and allows the Federal Aviation Administration (FAA) and the European Union Aviation Safety Agency (EASA) to streamline verification of each other's safety certification approvals. While FAA and EASA continue to work toward greater harmonization, FAA is evaluating changes to its certification process to address investigative findings and legislative changes following the grounding of the Boeing 737 MAX. These efforts are expected to change how FAA carries out some certification activities, such as expanding use of technical advisory boards in assessing new designs.

Examples of Boeing and Airbus Commercial Transport Airplanes

Source: GAO collage, Boeing and Airbus. | GAO-22-104480

Both FAA and EASA rely on manufacturers to support the design certification process, but their approaches to involving manufacturers and reviewing their work differ. For example, both authorities involve manufacturers in determining whether aircraft systems and components comply with design standards. FAA and EASA said they require manufacturers' employees that work on compliance determinations and findings to carry out their duties independently and free from undue pressure. Prior to approving an aircraft design, both FAA and EASA review manufacturers' certification packages. FAA reviews the completeness of the overall certification packages and compliance determinations involving high risk areas, but this review does not customarily include an independent review of the technical basis for compliance determinations. In contrast, EASA officials said they use a risk-based approach for evaluating compliance findings as part of their review of the final certification package based on agreements made with the manufacturer earlier in the certification process. As part of this review, EASA engineers evaluate the technical basis of the compliance findings.

FAA and EASA oversee manufacturers' certification activities by reviewing internal audit results and conducting their own audits, but the scope of their oversight differs. FAA's oversight pertains to the manufacturer's certification compliance activities and does not include airplane design information. However, EASA officials said that they oversee the manufacturer's certification compliance activities and all aspects involved in designing the airplane.

Contents

Tables

Abbreviations

737 MAX	Boeing 737 MAX
Aircraft Certification	Aircraft Certification Service
EASA	European Union Aviation Safety Agency
EU	European Union
FAA	Federal Aviation Administration
ICAO	International Civil Aviation Organization
ODA	Organization Designation Authorization

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

June 30, 2022

The Honorable Brian Schatz
Chair
The Honorable Susan M. Collins
Ranking Member
Subcommittee on Transportation, Housing and Urban Development, and Related Agencies
Committee on Appropriations
United States Senate

The Honorable David Price
Chair
The Honorable Mario Diaz-Balart
Ranking Member
Subcommittee on Transportation, Housing and Urban Development, and Related Agencies
Committee on Appropriations
House of Representatives

The U.S. has historically been viewed as setting the global standard for the approval of aviation products such as new aircraft, aircraft components, and other aviation products.[1] The Federal Aviation Administration (FAA), the U.S. civil aviation authority, certifies the safety of aircraft made in the U.S. FAA also facilitates U.S. manufacturers' export of aircraft by cooperating with foreign civil aviation authorities on the rules and processes those authorities use to validate the safety of U.S. designed and manufactured aircraft for use in foreign countries.[2] One such foreign civil aviation authority is the European Union Aviation Safety Agency (EASA), which certifies the safety of aircraft manufactured in the European Union (EU).[3] FAA then validates the safety of aircraft designed and manufactured overseas and imported into the U.S. by

[1] While commercial passenger transport airplanes are but one type of aviation products, for purposes of this report, we focus our discussion on such airplanes.

[2] According to the Aerospace Industries Association, in 2019, the exports of U.S. aviation products contributed $126.5 billion in foreign sales to the U.S. economy. Aerospace Industries Association, 2020 Facts and Figures: U.S. Aerospace and Defense (Arlington, VA: Sep. 15, 2020).

[3] EASA also certifies the safety of aircraft for the non-EU countries of Iceland, Liechtenstein, Norway, and Switzerland.

commercial airlines and others.[4] Due to the worldwide nature of commercial transport airplane manufacturing, FAA's certification of aircraft and coordination with foreign aviation authorities are critical to the safety of global aviation.

In recent years, two accidents involving the 737 MAX 8 airplane, which killed 346 people, have raised questions about aircraft design certification processes and related oversight efforts by FAA as the primary certifying authority, as well as by EASA and other civil aviation authorities responsible for validating FAA's certification of the airplane. Subsequent to the crashes, and resulting concern about FAA's oversight, the explanatory statement accompanying the Further Consolidated Appropriations Act, 2020, included a provision for us to compare the oversight regimes of FAA and EASA for airplane certification.[5] This report examines similarities and differences between FAA's and EASA's (1) activities and standards for certifying the designs of commercial transport airplanes, and how they fund their aircraft certification processes and assess performance, (2) approaches for how airplane manufacturers are involved in the design certification process, and (3) audits of manufacturers' design certification process activities and potential penalties for certification violations.

For the purpose of this report, our focus is on new designs of commercial transport airplanes, including entirely new airplane designs and new airplane designs that modify an already certified airplane type.[6] For all three objectives, we reviewed applicable laws relevant to FAA's airplane certification process, including the FAA Reauthorization Act of 2018 and the Aircraft Certification, Safety, and Accountability Act.[7] Furthermore, we compared relevant FAA regulations, orders, and standards; EU regulations and EASA guidance materials and standards; and other

[4] Aviation authorities with a bilateral agreement use validation, a form of certification, to establish compliance with their own airworthiness standards for airplanes certified, or in the process of being certified, by another country's aviation authority.

[5] 165 Cong. Rec. H11454 (daily ed. Dec. 17, 2019) (incorporating by reference Senate Report 116-109); see also S. Rep. No. 116-109, at 27 (2019).

[6] Additional information regarding different certification types is included in the background section below.

[7] FAA Reauthorization Act of 2018, Pub. L. No. 115-254, 132 Stat. 3186; Aircraft Certification, Safety, and Accountability Act, Pub. L. No. 116-260, div. V, title I, 134 Stat. 1182, 2309 (2020).

relevant documents related to aircraft certification and oversight pertaining to both agencies. The information about foreign law in this report is not the product of our analysis but is derived from interviews and information provided by EASA. We also reviewed our previous reports, as well as those by the Department of Transportation's Office of Inspector General, a special committee report to the Secretary of Transportation, and a report by the House Committee on Transportation and Infrastructure related to aircraft certification and validation.[8]

We obtained FAA's and EASA's perspectives on their certification processes and on how the two compare, including information on how the processes are funded and assessed. We collected this information through interviews with FAA officials responsible for aircraft certification. We also submitted questions to EASA officials to obtain information and perspectives regarding EASA's certification process and received written responses. We also interviewed officials from Transport Canada and Brazil's National Civil Aviation Agency to obtain the perspectives of other civil aviation authorities that have experience working with both FAA and EASA on developing and implementing regulatory and policy solutions related to certification issues.[9] We also interviewed representatives from Boeing and Airbus—both of which manufacture commercial transport airplanes—and the General Aviation Manufacturers Association to obtain their perspectives on the similarities and differences of FAA's and EASA's certification processes and oversight programs. Having focused on policies, processes, and the legal context, we are not able to gauge if

[8] Our review included GAO, Aviation Certification: FAA Needs to Strengthen Its Design Review Process for Small Airplanes, GAO-21-85, (Washington, D.C., Nov. 16, 2020); GAO, Aviation Certification: FAA Has Made Continued Progress in Improving Its Processes for U.S. Aviation Products, GAO-17-508T (Washington, D.C. Mar. 23, 2017); Department of Transportation, Office of Inspector General, Weaknesses in FAA's Certification and Delegation Processes Hindered Its Oversight of the 737 MAX 8, Report No. AV2021020, Washington, D.C., Feb. 23, 2021; Department of Transportation, Office of Inspector General, Timeline of Activities Leading to the Certification of the Boeing 737 MAX 8 Aircraft and Actions Taken After the October 2018 Lion Air Accident, Report No. AV2020037, Washington, D.C., June 29, 2020; Special Committee report on the Federal Aviation Administration's Aircraft Certification Process, January 16, 2020, Washington, D.C.; House Transportation and Infrastructure Report on the Design, Development, and Certification of the Boeing 737 MAX, September 2020, Washington, D.C.

[9] Transport Canada and Brazil's Agência Nacional de Aviação Civil are responsible for aircraft airworthiness certification for their respective countries. These two civil aviation authorities also have experience in working with FAA and EASA to support greater harmonization of civil aviation authorities' airplane certification processes

there is an appreciable difference in safety outcomes between FAA's and EASA's certification processes.

We conducted this performance audit from August 2020 to June 2022 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.

Background

Large Airplane Manufacturers

The U.S. and EU are home to the two largest commercial transport airplane manufacturers in the world, Boeing and Airbus, respectively. Boeing is headquartered in Arlington, Virginia, and employs more than 140,000 people worldwide.[10] As of January 2022, there are more than 10,000 Boeing commercial airplanes in service. Airbus is headquarters in Leiden, Netherlands, employs over 131,000 people, and has approximately 12,000 commercial airplanes in service.[11] Both manufacturers currently have various large commercial airplanes in production.

Type Certification of New Airplane Designs

Generally, before a commercial transport airplane can be manufactured in the U.S. for sale and use, a domestic airplane manufacturer must seek certification for, and FAA must certify, the airplane design. FAA's Aircraft Certification Service (Aircraft Certification) issues "type certificates," signifying that the aircraft design meets FAA's airworthiness, noise, and emission standards for the type of aircraft it is.[12] Aircraft Certification has

[10] Boeing is organized into three business units: Commercial Airplanes; Defense, Space & Security; and Boeing Global Services. As the world's largest aerospace company, Boeing manufactures commercial jetliners; defense, space and security systems; and is a service provider of aftermarket support. On May 5, 2022, Boeing announced it would move its headquarters from Chicago, Illinois to Arlington, Virginia.

[11] Airbus is the largest aeronautics and space company in Europe. Spanning the commercial aircraft, helicopter, defense, space, and security segments, Airbus designs, manufacturers and delivers aerospace products and services worldwide.

[12] FAA and EASA each have a separate process for granting and overseeing production certificates. A production certificate is an approval to manufacture duplicate products such as transport aircraft under an approved type design.

two operational divisions responsible for overseeing type certification and design and production activities.

In Europe, EASA is an agency of the EU for civil aviation safety responsible for the airworthiness and environmental certification of aircraft designed by organizations under the jurisdiction of EU Member States and associated non-EU States.[13] Similar to in the U.S., manufacturers generally obtain a type certificate for a new commercial transport airplane before delivering the first manufactured aircraft that conforms to the approved design.[14]

Both FAA and EASA review the design of a wide variety of aviation products and issue three different type certificates if they approve the design.

- **New type certificates:** FAA and EASA issue new type certificates when approving the design of new airplanes, engines, or propellers.[15]
- **Amended type certificates**: Both FAA and EASA allow for the issuance of additional certificates to approve changes to existing, certified airplane designs made by the manufacturer. FAA issues an amended type certificate when it approves the proposed modification and how the modification affects the original design. For example, FAA issued an amended type certificate for the Boeing 737 MAX (737 MAX) airplane. This occurred after FAA accepted Boeing's assessment of the 737 MAX airplane as a derivative of the already certified 737 Next Generation design and approved the modifications to the original design. According to EASA officials, EASA can add additional models of an aircraft to an existing type certificate or amend the design by issuing an approval of a change to the existing type certificate.[16]

[13] EU and non-EU states participating in EASA's work are commonly referred to as EASA member states. At the time of this report, EASA member states totaled 31 European countries.

[14] According to EASA, aircraft can be produced before a type certification is granted by EASA, but they cannot be released to service prior to type certification approval.

[15] A proposal to change a product will require a new type certificate if "FAA finds that the proposed change in design, power, thrust, or weight is so extensive that a substantially complete investigation of compliance with the applicable regulations is required." 14 C.F.R. § 21.19.

[16] EASA uses this process instead of issuing "amended type-certificates."

- **Supplemental type certificates:** FAA and EASA can issue supplemental type certificates to approve design changes that allow modifications to existing airplanes.[17] Under FAA's process, while a type certificate holder may elect to obtain an amended type certificate or supplemental type certificate for modifications made to its aircraft design, a person or company who does not hold a type certificate but is seeking a modification to an existing airplane must apply for a supplemental type certificate. These changes can range from engine replacement parts to more minor modifications such as the installation of an in-flight air-ground telephone system or changes to the cabin seating configuration. Design changes contained in supplemental type certificates are typically implemented in the field after airplane delivery. As of January 2022, FAA has approved over 75,000 supplemental type certificates.[18]

Harmonizing Airplane Certification

The International Civil Aviation Organization (ICAO) collaborates with FAA, EASA, and other civil aviation authorities to maintain and advance the safety of international air transportation.[19] ICAO develops international standards and recommended practices and procedures for civil aviation systems, in cooperation with its member states and various intergovernmental and non-governmental organizations. The U.S. and EU countries are members of ICAO and are, therefore, obligated to establish regulations or take other appropriate steps to implement the ICAO standards—such as certification requirements for commercial aircraft—

[17] According to EASA officials, supplemental type certificates are generally issued to approved third party design organisations (non-type certificate holders) and only to type certificate holders in very rare occasions. We did not obtain data on the number of EASA-approved supplemental type certificates.

[18] FAA's public database for all approved supplemental type certificates can be found at https://rgl.faa.gov/Regulatory_and_Guidance_Library/rgSTC.nsf/6e2e3b6e3510840b86257bcf00638d4a/25884808c6888ec386258734005e99dc/$FILE/STC.zip.

[19] ICAO is a United Nations specialized agency, established by member states (countries) in 1944 to reach consensus on international civil aviation standards and recommended practices and policies in support of a safe, efficient, secure, economically sustainable, and environmentally responsible civil aviation sector. The U.S. is a founding member of ICAO. Currently, there are 193 members, or member states, in ICAO, which is governed by a Council of 36 member states. Headquartered in Montreal, Canada, ICAO's core function is to develop and support the implementation of global standards and recommended practices applicable to international aviation.

within their own civil aviation systems.[20] EASA supports member countries in implementing the ICAO standards.

According to FAA and EASA officials, an airplane design must adhere to the applicable airworthiness standards of the countries to which the resulting aircraft will be exported. To facilitate this, countries in which airplanes are produced can establish bilateral agreements with other countries that enable reciprocal acceptance of findings and cooperation on aviation safety.

In 2008, the U.S. and EU signed their current bilateral agreement. The agreement, along with related documents, streamlined the validation process used by the importing country's civil aviation authority to verify the airworthiness and environmental certification approvals of an aviation product certified by the other signatory's civil aviation authority. Specifically, according to the bilateral agreement, it:

- enables the reciprocal acceptance of findings of compliance and approvals issued by the two aviation authorities;
- is designed to promote a high degree of safety in air transport; and
- ensures the continuation of a high level of regulatory cooperation and harmonization between the U.S. and the EU.[21]

As we previously reported, FAA and EASA have agreed to coordinate their certification and validation efforts while recognizing each agency's authority to develop and enforce its own standards.[22] In order to promote efficiency, FAA and EASA established a validation process for issuing type certificates for airplanes designed in each other's jurisdiction. FAA is the primary certificating authority for airplanes designed and manufactured in the U.S., and EASA is a validating authority. EASA and FAA reverse roles for airplanes designed and manufactured in the EU. Under the defined procedure, the primary certificating authority takes the

[20] Member states' interpretations of the standards may vary, and member states may have additional standards that apply only in their countries.

[21] The bilateral agreement also requires that FAA and EASA develop and adopt procedures for regulatory cooperation in civil aviation safety and environmental testing and approvals. FAA and EASA determined that they should actively promote mutual rulemaking cooperation to maintain and further improve the harmonization of their rules. As part of this effort, FAA and EASA finalized a rulemaking agreement in 2013.

[22] GAO, Aviation Safety: Status of FAA's Actions to Oversee the Safety of Composite Airplanes, GAO-11-849, (Washington, D.C., Sep. 21, 2011).

lead role in working with the manufacturer while the validating authority remains involved as defined by bilateral agreements.

According to FAA and EASA officials, streamlining the certification and validation processes also helps:

- conserve their limited certification resources—and focus those resources on areas of high safety relevance—by avoiding the need to redo each other's work, particularly in areas with no safety benefit;
- shorten the certification and validation processes;
- improve the process for manufacturers to sell their products in other countries; and
- provide more regulatory certainty and cost savings for manufacturers.

Subsequent to signing the bilateral agreement, FAA and EASA have continued to work toward greater reliance on the activities of the certifying authority by continuing to streamline the validation process. For more information regarding FAA's and EASA's continued airplane certification harmonization efforts, see appendix I.

FAA's and EASA's Activities and Standards for Certifying New Airplane Designs Are Largely Similar

FAA and EASA Certification Activities Are Similar

Our comparative analysis of relevant documentation along with explanations and views from aviation stakeholders found that FAA's and EASA's activities are largely similar for certifying new transport airplane designs. The similarities stem from the harmonization of processes sought in the U.S.-European Union 2008 bilateral agreement. FAA's and EASA's certification processes have multiple phases with similar activities and typically take several years to complete. Both processes generally provide a 5-year time limit for manufacturers to complete the certification process for transport airplanes, though manufacturers may apply for an

extension.[23] Because their phases are not identical—there are five FAA phases and four EASA phases—we grouped the certification activities into three broader phases: (1) initiation, (2) requirements setting and compliance planning, and (3) compliance demonstration and certification.[24] Table 1 shows our analysis of the key similarities and differences between FAA's and EASA's commercial transport airplane type-certification process by each of the three phases and activities within these phases.[25]

[23] *See* 14 C.F.R. § 21.17(c) and Commission Delegated Regulation 2019/897, 2019 O.J. (L 144) 1 (EU) (amending Commission Regulation 748/2012, 21.A.15).

[24] We created three broader phases from an amalgamation of FAA's and EASA's phases. FAA's five phases are (1) conceptual design, (2) requirements definition, (3) compliance planning, (4) implementation, and (5) post-certification activities. EASA's four phases are (1) technical familiarization, (2) establishment of the certification program, (3) compliance demonstration, and (4) technical closure and issue of approval.

[25] For our analysis, phases generally flow in a sequence and certain activities may occur at different times during the process. We did not attempt to force an alignment for activities that only occur at a specific time.

Table 1: GAO Analysis of Key Similarities and Differences between the Federal Aviation Administration (FAA) and the European Union Aviation Safety Agency (EASA) Commercial Transport Airplane Type-Certification Process

GAO-Identified Certification Phase and Related Activities	FAA	EASA
Phase 1: The initiation phase		
This phase provides manufacturers with an opportunity to inform the aviation authority (i.e., FAA or EASA) about a proposed airplane design and the aviation authority with an opportunity to form certification teams.		
• Manufacturers in the European Union demonstrate (or are in the process of demonstrating) their capability to perform design and certification compliance activities by obtaining an approval for its Design Organisation from EASA.[a]	n/a	✓
• The aviation authority may hold preliminary meetings to help manufacturers understand the aviation authority's processes.	✓	✓
• Manufacturers continue to design the airplane.		
• Manufacturers submit an application for a type certificate and the aviation authority acknowledges the receipt of the manufacturers' application for a type certificate.	✓ ✓	✓ ✓
• Manufacturers familiarize the aviation authority with descriptive information about the proposed airplane design; describe its intended use and operations; and provide a project schedule with major milestones.	✓	✓

• Manufacturers submit initial certification plans containing such items as:
  • the regulatory operating environment,
  • the proposed certification basis with applicable standards (e.g., airworthiness, noise, and exhaust standards) and any special conditions by which applicants must show compliance for the project,[b]
  • the means of compliance—a detailed design standard that, if met, accomplishes the safety intent of the regulation, and
  • the method of compliance—a description of how compliance will be shown (i.e., data with calculations and analysis, laboratory demonstrations, ground test, and flight test).
	✓	✓

• The aviation authority establishes certification teams to conduct oversight.
  • The FAA team resolves issues arising throughout the process, helps applicants move from phase to phase, and is the focal point of communication with manufacturers. The team also conducts reviews, inspections, or analysis to determine compliance with requirements.
  • The EASA team also conducts reviews, audits and inspections to verify manufacturers have demonstrated compliance.
	✓	✓

GAO-Identified Certification Phase and Related Activities	FAA	EASA
Phase 2: The requirements setting and compliance planning phase		
In this phase, manufacturers and the aviation authority agree on the requirements (e.g., airworthiness, environmental) to be met for approval of the aircraft design (referred to as the certification basis) and the plan for demonstrating compliance with those requirements.		
• Manufacturers develop a prototype of the airplane.	✓	✓
• Manufacturers may notify the aviation authority if they plan to export the airplane.	✓	✓

• Manufacturers and the aviation authority reach agreement on the certification basis and the means of compliance. One nuance of this process is the following:
  • For FAA, the certification basis includes approval of aircraft design requirements, and FAA outlines steps for assessing operational requirements. These requirements can be met after the type certificate is issued.
  • For EASA, the certification basis includes approval of aircraft design requirements and certain operational data that EASA deems important to safe operations (referred to as operational suitability data).
	✓	✓

• The aviation authority and manufacturers reach an understanding on which entity is to be responsible for determining compliance—while the aviation authority retains some level of involvement in the project.
  • In the FAA process, FAA is responsible for performing aircraft certification compliance determinations but may delegate to manufacturers to perform many determinations on its behalf.
  In the EASA process, EASA officials said approved Design Organisations are responsible for performing all certification compliance demonstrations and findings.[c]		

GAO-Identified Certification Phase and Related Activities	FAA	EASA
Phase 3: The compliance demonstration and certification phase		
In this phase, manufacturers demonstrate that the design of the airplane prototype complies with all requirements before the aviation authority issues a type certificate.		
• Manufacturers implement the approved certification plan by conducting activities in accordance with the methods of compliance to demonstrate that aspects of the airplane's design comply with all applicable standards. Examples of these activities are: • conducting flight tests; • analyzing test results; • assessing the safety of airplane systems and subsystems; and • making a formal statement that the manufacturer has demonstrated the aircraft meets the certification basis and environmental protection requirements to ensure safe flight.	✓	✓
• The aviation authority documents key decisions (i.e., resolution of significant technical, regulatory, and administrative issues that may arise during the certification process) in similar ways, albeit with different names for the decision papers. • FAA documents key decisions in Issue Papers. • EASA documents key decisions in Certification Review Items or Certification Action Items. These documents note additional elements of the certification basis in the form of special conditions, equivalent safety findings, and deviations. Decisions can also be documented within the manufacturers' certification plan.	✓	✓
• The aviation authority may allow manufacturers to use alternative means to demonstrate compliance in certain cases, such as when requirements can have various interpretations, and for such elements as new technologies or materials.	✓	✓
• The aviation authority performs an examination of the manufacturers' compliance demonstrations, including detailed examinations of those aspects deemed to be most critical to safety.	✓	✓
• Manufacturers receive a product type-certificate after demonstrating their compliance. In addition, EASA officials said that manufacturers are legally obligated to ensure that there are no unsafe features.	✓	✓

Legend: ✓ = the agency's process includes activities listed

Source: GAO analysis of FAA and EASA documentation and officials. The information about foreign law in this table is not the product of our analysis, but is derived from interviews and information provided by EASA. | GAO-22-104480

Notes: Given that FAA and EASA group their certification activities into four and five phases, respectively—making direct comparisons between phases difficult—we grouped certification activities into three broader phases for purposes of our comparative analysis. Parts of these three phases may overlap with another phase and key activities may not occur in the sequence shown.

[a]The approval recognizes that the Design Organisation complies with Part 21, Subpart J of European Regulation No. 748/2012. A Design Organisation is a group within the manufacturer's company that designs aviation products and verifies their compliance through EASA's certification process.

[b]The FAA and EASA issue special conditions containing technical safety standards (or specifications) when existing airworthiness regulations for an aircraft, aircraft engine, or propeller design do not contain adequate or appropriate safety standards, such as for a novel or unusual design feature.

[c]For the purposes of this report, the term "compliance demonstration" means that an applicant's engineer who has designed portions of a transport airplane demonstrates or shows that the design complies with applicable individual airworthiness and environmental standards. These standards are identified during the requirements setting and compliance planning phase. Subsequently, FAA and EASA determine whether a compliance demonstration is valid by evaluating that it meets the applicable, identified, individual airworthiness and environmental standards, known as "compliance determinations" for FAA and "compliance findings" for EASA.

In addition to our analysis above, additional documentation and interviews with stakeholders confirmed the similarities between FAA's and EASA's activities for certifying new transport airplane designs. For example, documentation associated with the U.S. and EU bilateral agreement states that the two aviation authorities have determined that their standards, rules, practices, and procedures pertaining to their respective commercial transport airplane certification processes are sufficiently compatible in structure and performance. This allows both FAA and EASA to accept the other's certification results. Furthermore, nearly all of those we contacted, including officials from FAA, EASA, and multiple aviation stakeholders affirmed that the two certification processes are largely similar.

As shown in Table 1, the requirements for initiating the certification process with EASA and FAA differ, but in practice, their processes for initiating certification for commercial transport airplanes are similar. According to EASA officials, before applying for a type certificate, manufacturers in the EU must hold, or be in the process of obtaining, a design organisation approval issued by EASA, meaning that they have demonstrated to EASA the capability to perform design and certification compliance activities.[26] In contrast, FAA officials said they generally allow manufacturers to design and go through the certification process for a wide range of aviation products (engines, propellers, etc.). If FAA determines that a manufacturer lacks resources to carry out the process, they encourage the manufacturer to first address those gaps. However, in practice, FAA officials said that manufacturers applying for this type of certification for commercial transport airplanes have already been approved to participate in FAA's Organization Designation Authorization (ODA) program, through which FAA delegates certain of its certification responsibilities. This is due to the complexity and duration of the type certification process for such airplanes. A manufacturer's participation in the program allows it to perform certification compliance activities and according to FAA officials, the ODA also allows an applicant greater

[26] According to EASA officials, EU regulations allow a manufacturer to begin the design certification process while obtaining Design Organisation approval from EASA; however, for commercial transport airplanes, EASA requires the approval be in place before a manufacturer begins design.

flexibility and control over schedules than applicants whose projects are directly managed by FAA.[27]

Recent independent reviews have found deficiencies with FAA's certification process, which could lead to changes in how FAA carries out its certification-related activities such as expanding use of technical advisory boards in assessing new designs. See appendix II for more information regarding investigative findings and legislative changes following the grounding of the 737 MAX.

FAA and EASA Have Adopted Similar Standards and Have a Process to Resolve Differences

Under their bilateral agreement, FAA and EASA have agreed that they have sufficiently compatible standards (i.e., type design and airworthiness of aircraft, and environmental protection) that are applied when evaluating aspects of the new airplane design within their respective certification processes. These standards are also codified in regulation and intended to be consistent with international standards.[28] FAA and EASA codified their type design standards using a similar numbering scheme to help denote how they address each standard as it applies to commercial transport airplanes.[29]

According to FAA officials, because FAA and EASA treat most of their standards the same way or similarly, their certification standards are considered to be similar, although not identical. Both aviation authorities, for example, have regulatory standards that address the extent to which specified aircraft structures can withstand collisions with birds. FAA regulations require the structure of the aircraft's tail (the "empennage") to be designed to assure capability of continued safe flight and landing after

[27]Later in this report, we discuss the qualifications EASA uses to determine whether to approve design organizations and FAA uses to delegate certain certification responsibilities to manufacturers.

[28] FAA and EASA carry out the design function in accordance with ICAO airworthiness standards pursuant to section 3.2.1 and section 3.2.2 of Annex I of the Agreement between the United States of America and the European Community on Cooperation in the Regulation of Civil Aviation Safety, dated June 13, 2008.

[29] FAA's type design standards for transport category airplanes are codified in Title 14, Code of Federal Regulations, Part 25 Airworthiness Standards: Transport Category Airplanes, whereas EASA's type design standards are codified in Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes, CS-25. Because this category of airplane is used by commercial airlines, we also use the term "commercial transport airplanes."

impact with an 8-pound bird at specific velocities.[30] EASA's standards require that the aircraft be designed to assure capability of continued safe flight and landing after impact with a 4-pound bird at specific speeds.[31]

Both FAA and EASA periodically identify differences in their governing regulations of transport airplanes. As of July 2021, FAA's comparative analysis of 419 sections of federal regulations and 2 special sections of federal aviation regulations determined that EASA's requirements do not include 48 of FAA's requirements.[32] For instance, FAA requires icing protection systems for engines.[33] EASA officials stated that they have similar requirements for ice protection systems for engines, but requirements may differ at the engine or aircraft level. EASA's comparative analysis determined that FAA regulations do not include 63 of its requirements.[34] For instance, EASA requires aircraft to establish the susceptibility of airplane features to the effects of volcanic cloud hazards and to have means to prevent certain fuselage door latches from being moved to the latched position unless it can be shown that an open door would be clearly evident before flight.[35] FAA has no equivalent requirements. In practice, however, representatives from Boeing and Airbus said that they design airplanes to the more stringent requirements.[36]

If and when differing interpretations occur on the same standards by FAA and EASA, the bilateral agreement prescribes a process to resolve conflicts. That process generally aims for FAA and EASA to resolve

[30] 14 C.F.R. § 25.631.

[31] CS-25.631.

[32] FAA's analysis comparing 14 CFR Part 25 Amendments 25-146, effective 11/19/2018 against CS-25 Amendment 23, effective 7/15/2019.

[33] 14 C.F.R. § 25.903(a)(3).

[34] EASA's analysis comparing CS-25 Amendment 18 against 14 CFR Part 25 Amendment 144. We accessed EASA's website on September 24, 2021, at https://www.easa.europa.eu/easa-ssd-list-cs-25-amdt-18-vs-14cfr-25-amdt-144.

[35] *See* CS-25.1593 (exposure to volcanic cloud hazards) and CS-25.783(d)(8) (latching and locking fuselage doors).

[36] Lists of standard differences are generated at a certain point in time, and therefore, FAA and EASA may address those differences in different amendment comparisons. In some cases, resolving differences can be addressed through the issuance of special conditions.

issues at the lowest levels before elevating issues to the Bilateral Oversight Board—which was established in the US-EU bilateral agreement and consists of representatives from the U.S. and Europe. According to EASA officials, if differences of interpretation are not recorded as safety emphasis items—areas of design in which the validating authority has an interest—then the certifying authority's interpretation should prevail. According to FAA officials, if FAA and EASA officials cannot resolve an issue, it may be raised to the board to make the final decision or to task a team to resolve the issue through standardization or harmonization of policy to prevent the issue from arising in the future.

FAA and EASA Fund Their Certification Processes Differently

FAA's certification and validation processes are federally funded—approximately $261 million were obligated for Aircraft Certification Service in fiscal year 2020 to support certification activities.[37] The FAA Reauthorization Act of 2018 authorizes the FAA Administrator to establish and collect a certification services-related fee from a foreign government or entity under certain circumstances.[38] FAA officials said they do not currently charge these fees. Should FAA decide to exercise this authority, officials said that they would have to begin the rulemaking process to change applicable federal regulations. Apart from fees, FAA may enter into reimbursable agreements to cover reasonable travel and per diem expenses in order to support or expedite validation activities for U.S. or foreign type certificates.[39]

In comparison, EASA's certification and airworthiness oversight activities are financed through charges and fees that are paid by manufacturers within and outside the EU.[40] According to EASA, the charges and fees

[37] U.S. Department of Transportation, Budget Estimates, Fiscal Year 2022, Federal Aviation Administration, FY 2020 Actual.

[38] Pub. L. No. 115-254, § 244, 132 Stat. at 3260 (codified at 49 U.S.C. § 45305(b)). The act states that the fee may be collected regardless of where FAA provides the certification services. The act also states that the fee (1) must be established and collected in a manner consistent with aviation safety agreements and (2) cannot exceed the estimated costs of the services.

[39] FAA Order IR 1500.70, Validation Travel and Per Diem Reimbursement Guidance (2017).

[40] *See* Commission Regulation 2019/2153, chapter 1, art. 1, 2019 O.J. (L327) 36 (EU) ("This Regulation determines the matters for which fees and charges are due to the Agency, and establishes the amount of the fees and charges and the way in which they are to be paid."). EASA also obtains some funding for other activities from EU entities.

usually provide EASA full cost recovery for its certification work.[41] According to Airbus officials, its fees amounted to about €2 million European Euros (or $2.3 million) per year per aircraft certification project. We previously reported that for the certification of U.S. aircraft and components, EASA has charged U.S. companies up to 95 percent of the cost of conducting a domestic certification of a similar European-manufactured aviation product.[42] The report noted that several U.S. companies said that EASA fees were "significantly high" relative to those levied by other foreign authorities. According to FAA and EASA, the Bilateral Oversight Board is taking steps that may allow EASA to charge lower fees to U.S. manufacturers for certain types of activities.

FAA Is Developing Performance Metrics and EASA Uses Peer Reviews and Safety-Related Information to Assess Their Airplane Certification Processes

FAA has been working to develop metrics to measure its performance of its aircraft certification process but has not yet finalized the metrics. The FAA Reauthorization Act of 2018 required FAA to develop metrics to assess its progress in achieving 11 objectives.[43] Although the Aircraft Certification, Safety, and Accountability Act repealed this requirement, FAA officials told us that they are continuing to develop some performance objectives and metrics.[44]

Among other things, FAA's performance objectives and metrics aim to streamline the certification process and increase transparency and accountability for both FAA and the aviation industry. Below are examples of FAA's planned safety metrics:

[41] Pursuant to EU regulations, EASA's revenue includes "the fees paid by applicants for, and holders of, certificates issued by the agency, and by persons who have registered declarations with the Agency" and "charges for publications, training, and other services provided and for the processing of appeals by the Agency." Regulation 2018/1139, art. 120, 2018 O.J. (L 212) 1 (EU).

[42] GAO-15-327T, footnote 40.

[43] The 11 objectives identified in the act are as follows: (1) eliminate certification delays and improving cycle times; (2) increase accountability for both FAA and aviation industry; (3) achieve full utilization of FAA delegation and designation authority; (4) fully implement risk management principles and a systems safety approach; (5) reduce duplication of effort; (6) increase transparency; (7) develop and provide training in auditing and a systems safety approach to certification oversight; (8) improve the process for approving and accepting certification actions between FAA and bilateral partners; (9) maintain and improve safety; (10) streamline the hiring process for certain engineers; and (11) maintain leadership of the United States in international aviation and aerospace. The FAA Reauthorization Act of 2018 directed FAA to establish such performance objectives. Pub. L. No. 115-254, § 211, 132 Stat. at 3246.

[44] *See* Pub. L. No. 116-260, div. V, title I, § 129, 134 Stat. at 2349.

- **Maintain and improve safety.** For this objective, FAA is planning three metrics—tracking the fatal accident rate for U.S. manufactured aircraft types in commercial operation, tracking the time to issue a directive that requires the manufacturer to correct an unsafe condition, and tracking the number of voluntarily reported safety issues and recommendations identified by manufacturers, FAA employees, and others.
- **Implement risk-management principles and a systems safety approach.** For this objective, FAA is planning to track the percentage of directives issued by FAA that require the manufacturer and FAA to analyze system root cause(s) of engineering design challenges and approve corrective action to address the root cause(s). FAA also plans to monitor the percentage of manufacturers with an FAA-recognized safety management system.

Additionally, FAA officials said they continue to develop efforts to analyze safety events, determine common trends, and measure the safety performance of certification. They said these efforts provide feedback to manufacturers on how they can improve the quality of their certification documents.

EASA officials did not identify any performance objectives or metrics that they use for evaluating their certification process. Instead, EASA officials said that they use several peer reviews to determine whether the certification process had been consistently applied and whether manufacturers appropriately determined compliance. EASA officials told us that their system ensures that safety standards are maintained. For example, according to EASA, Design Organisations have the legal obligation to establish a system to collect, analyze and report in-service safety-related occurrences. EASA officials also told us that EU regulations mandate the collection and reporting of these occurrences from other aviation stakeholders such as maintenance organizations and air operators.

FAA and EASA Both Rely on Manufacturers in the Airplane Design Certification Process, but They Use Different Approaches

We found that FAA and EASA use different approaches to working with airplane manufacturers. FAA is responsible for making airplane certification compliance determinations but generally delegates the vast majority of these determinations for manufacturers to make on its behalf.[45] However, EASA officials told us manufacturers in Europe are themselves responsible for making all compliance findings and verification under oversight of EASA. In addition, FAA's and EASA's approaches to ensuring that manufacturers' certification compliance engineers conduct their work with independence and free from undue pressure differ. For example, unlike FAA, EASA prohibits compliance verification engineers from verifying compliance findings for systems or designs they have worked on as an employee of the manufacturer, according to EASA officials. The number of times compliance determinations and findings are reviewed and attested to, and by whom, is also different.

FAA and EASA Rely Heavily on Approved Manufacturers to Certify Commercial Transport Airplanes

Both FAA and EASA rely heavily on the expertise and activities of commercial transport airplane manufacturers to undertake and complete type certifications for commercial transport airplane designs. Leveraging private sector resources in the commercial transport airplane type certification process makes the process more efficient, lessening the time and government resources required to complete it, according to international agreements and interviewees at FAA and EASA;[46] manufacturers' representatives; and an aviation association. For example, FAA recognizes that it does not have the necessary resources for completing all certification activities, and federal law allows FAA to delegate certain functions to private individuals or organizations, such as determining compliance with aircraft certification regulations. EASA officials told us that the European system of working with manufacturers in its type certification process provides for a balanced and efficient approach to product safety oversight that combines direct oversight of the product and oversight of the design organization.

To facilitate manufacturers' activities in the type certification process for such airplanes, FAA and EASA have both established programs to assess whether a manufacturer is qualified to take part in the process. If either FAA or EASA finds a manufacturer to be qualified, the authorities can issue an approval, which allows the manufacturer itself to determine

[45] *See* 49 U.S.C. §§ 44702, 44704.

[46] Officials at Transport Canada Civil Aviation and Agência Nacional de Aviação Civil in Brazil also discussed that their agencies work with the aviation industry in similar ways.

whether it is complying with certification requirements. The process of ensuring whether designs comply with certification requirements is known under FAA's system as making "compliance determinations," and under EASA's system, as verifying "compliance findings".

- FAA is required by statute and regulation to ensure manufacturers meet its standards to gain approval to perform certification compliance activities if they wish to take part in the ODA delegation program. As previously noted, in practice, commercial transport airplane manufacturers have received approval to perform certification compliance determinations up front,
- EASA officials stated that an organization that designs transport aircraft needs to demonstrate that it has the right organizational structure, procedures, responsibilities and resources to do so. Officials stated that EASA requires transport airplane manufacturers to gain approval to perform design and certification compliance findings activities before initiating the design of a commercial transport airplane.[47]

In both the U.S. and Europe, once a manufacturer is approved to perform type certification compliance work, it forms an internal group of authorized employees within its company to carry out such work. The internal groups perform the certification compliance tasks that the authority has authorized the manufacturer to perform, in the agreed-upon manner and at the manufacturer's cost. Such tasks include applying airworthiness and other safety standards to system designs, understanding and mitigating engineering issues that arise, agreeing on testing protocols, testing system designs for adherence to standards, and reviewing data to ensure that the designs comply with the applicable standards.

FAA Typically Delegates Most Certification Compliance Determinations to Approved Manufacturers' Employees

Under FAA's statutory and regulatory authority, FAA is responsible for making compliance determinations for all parts of an airplane design in the type certification process. However, through its ODA program, FAA is allowed to delegate as much certification compliance work as it deems appropriate to an approved manufacturer's internal group, called the ODA unit.[48] In practice, for U.S. commercial transport airplane type certification

[47] *See* Commission Regulation 748/2012, 21.A.13, 21.A.14, 2012 O.J. (L224) 1 (EU).

[48] *See* 49 U.S.C. § 44702(d); *see* also 14 C.F.R. Part 183, Subpart D. An entity that receives an Organization Designation Authorization is known as an "ODA holder." It supervises its internal ODA unit.

projects, FAA has typically delegated 90 percent or more of the certification compliance determinations for commercial transport airplane certification projects to approved manufacturers.[49]

To obtain such authorization, a manufacturer must:

- show FAA that it has a prospective, internal group of employees that will make up the ODA unit and will be able to perform certification compliance work;
- provide names of ODA unit members in key positions, such as the ODA Administrator and engineering and flight test staff; and,
- provide qualifications for all ODA unit members to show they meet FAA's standards for necessary knowledge, skills, and abilities to make certification compliance determinations;
- provide a description of the manufacturer's organizational structure and describe how the proposed ODA unit relates to it so that ODA unit members may conduct their certification compliance work free from interference from the rest of the company; and
- provide a comprehensive, written ODA-holder procedures manual to be followed, along with self-audit procedures to ensure the ODA holder follows the policies and procedures described in the manual and appropriately supervises its employees' certification compliance work.[50]

If FAA approves the ODA, the ODA holder's FAA-approved procedures manual will list the certification compliance work that the ODA unit is authorized to undertake.[51] Once established, an ODA may span many

[49] Department of Transportation, Office of Inspector General, Timeline of Activities Leading to the Certification of the Boeing 737 MAX 8 Aircraft and Actions Taken After the October 2018 Lion Air Accident, Report No. AV2020037, Washington, D.C., June 29, 2020. We discuss below how FAA determines which compliance determinations to delegate and which to retain.

[50] In order for the manufacturer to obtain authorization, FAA must approve the procedures manual, which establishes what activities the ODA holder is authorized to perform on behalf of FAA and how they will be performed, documented, and supervised.

[51] If a manufacturer has not been approved for an ODA, FAA officials and industry association representatives told us that the agency's process will shift to accommodate the manufacturer's capability to support the certification process with FAA staff performing more of the certification activities and directly overseeing certification compliance engineers they appoint to assist them.

years and many certification projects.[52] During the requirements setting and compliance planning phase of each individual airplane certification project, FAA then decides at its discretion which of the authorized certification compliance determinations will be delegated to the ODA unit members.

FAA considers several factors when deciding which compliance determinations to delegate. For example, according to FAA officials, the agency considers the airplane systems being assessed, such as for new systems that can affect the safe operation of the aircraft, and may opt to retain these compliance determinations. FAA also considers the risk level of the system. To determine the risk level, FAA officials told us that the manufacturer's design engineers conduct safety-risk analyses for all airplane systems. Through these analyses, manufacturers identify both high-risk systems, which could affect an airplane's airworthiness if they failed, and lower-risk systems, which would not affect airworthiness if they failed. FAA officials said that their staff review the manufacturer's list of brief descriptions of the airplane's low-risk systems and may ask for more information for specific systems to understand the assigned risk level. FAA may instruct the manufacturer to recategorize a system's risk level, for example, from lower to higher risk. Such a change may result in FAA staff performing the certification compliance determinations instead of ODA unit members, although FAA officials said they may delegate compliance determinations for high-risk systems when they deem it appropriate. FAA staff may also determine that the ODA unit does not have the appropriate expertise to make certification compliance determinations for a particular system, regardless of risk, and decide to retain that responsibility.

When determining delegation responsibilities, FAA also uses professional judgement to balance the ODA unit's resources, including staff experience and expertise, and FAA's resources, which depend on the availability of FAA staff to oversee the ODA unit's work in specific areas.[53] FAA officials explained that FAA staff gain direct knowledge of ODA unit members' capabilities through project involvement and direct

[52] The ODA continues until the date designated in the authorization or until terminated by FAA, either on its own initiative or at the request of the ODA holder.

[53] ODA unit members are identified by name in certification plans for specific certification compliance activities based on FAA's and the ODA holder's understanding of the unit member's capability. FAA's ODA policy allows for the substitution of any similarly qualified engineering unit member without updating the certification plan or coordinating with the FAA, if permitted by the ODA procedures manual.

communication with ODA unit members over the course of a project. Such knowledge also informs which responsibilities to delegate for new designs.

The Aircraft Certification, Safety, and Accountability Act ("the act"), enacted in December 2020, amended some requirements concerning FAA's certification process, including its ODA program. For example, FAA must now review and validate any underlying assumptions related to human factors before delegating transport category airplane type certification activities for critical system design features (e.g., those for which an operational failure could result in catastrophic or hazardous conditions).[54] The act also rescinded language enacted in the FAA Reauthorization Act of 2018 that involved several requirements for FAA. As a result, FAA is no longer directed to:

- at the request of the ODA holder, eliminate certain limitations specified in a procedures manual that are low and medium risk as determined by a risk analysis using criteria established by FAA and disclosed to the ODA holder;[55]
- delegate fully all certification activities addressed in an ODA unit's procedures manual unless FAA determined that the public interest and safety required those activities be limited; and
- work with ODA holders to develop their capability to safely and effectively execute functions that FAA had previously limited due to public interest and safety, and that FAA expeditiously approve an ODA unit's requested changes to its procedures manual.

In EASA's Certification Process, Manufacturers Are Responsible for All Certification Compliance Findings

According to EASA officials, under EASA's transport airplane type certification compliance process, manufacturers are responsible for making all compliance findings for all parts of a commercial transport airplane design. In EASA's certification process, the approved manufacturer's internal group making those findings is called a Design Organisation.[56]

[54] Pub. L. No. 116-260, div. V, title I, § 106, 134 Stat. at 2320 (codified at 49 U.S.C. § 44702(d)(4)(A)).

[55] This previous requirement included an exception for where an ODA holder's performance warranted the retention of a specific limitation due to documented concerns about inadequate current performance in carrying out the authorized function.

[56] Often such organizations are referred to with the acronym "DOA," however in this report, we use the term "Design Organisation."

According to multiple aviation stakeholders we interviewed, the aspects of a manufacturer's planned Design Organisation that EASA evaluates before approving such an organization are similar to those FAA evaluates when approving an ODA unit. For example, EASA confirmed that it evaluates whether:

- Design Organisation managers and key staff, such as compliance verification engineers, are in place with the proper qualifications and expertise to perform their duties;
- the Design Organisation is appropriately positioned within the larger company such that they can pursue their work independently, without interference from other parts of the company;
- the internal structure of the Design Organisation will allow the compliance verification engineers performing verification of compliance findings made by the manufacturer under the supervision of its internal certification compliance unit, called the Office of Airworthiness, to do so without interference from the rest of the Design Organisation; and
- a comprehensive, written handbook has been developed that includes (1) policies and procedures for type certification compliance demonstration and findings and (2) self-audit procedures to ensure that the handbook is being widely used and that the Design Organisation follows all requirements for its authorized activities and appropriately supervises its employees' certification compliance work.

However, Design Organisations are different from ODA units in the U.S. because they encompass all aspects of the manufacturer's company that contribute directly to a product's design and its eventual type certification compliance findings. In the U.S., the ODA unit only involves the certification compliance activities that have been delegated. According to multiple aviation stakeholders we interviewed, because a Design Organisation includes more parts of the manufacturer's company, this means EASA evaluates more aspects of the manufacturer's company when approving and overseeing the Design Organisation than FAA does for ODA holders.

According to EASA officials, EASA's process for delegating the verification of compliance demonstrations includes the following:

- The manufacturer must propose a break-down of the certification program into meaningful groups of compliance demonstration activities and data.

- For each identified group of compliance demonstration activities and data, the manufacturer must perform a risk assessment, which considers various factors such as the likelihood of non-compliance with the type-certification basis; environmental protection requirements; and the potential impact of that non-compliance on product safety or environmental protection.
- Based on its assessment, the manufacturer proposes the agency's level of involvement in the verification of compliance demonstration activities.
- EASA determines its level of involvement considering the proposals submitted by the manufacturer.

Furthermore, EASA officials stated that they require manufacturers seeking a Design Organisation approval to develop and describe a design assurance system in its handbook. EASA officials explained that such a design assurance system provides for the control and supervision of the airplane design and shall include an independent checking function of the Design Organisation's showing of compliance. FAA has no such requirement for manufacturers. This issue is discussed in more detail later in this report.[57]

Approved Manufacturers' Design Certification Compliance Work Is Performed and Supervised Differently in the U.S. and E.U.

Under both FAA's and EASA's programs facilitating manufacturers' participation in the type certification process, manufacturers' engineers demonstrate how a new airplane design complies with safety standards and the methods of compliance specified in the certification plan, but how compliance determinations and compliance findings are made and reviewed differs in a few ways. These differences include whether the engineers demonstrating compliance must meet aviation authority qualifications, as well as the number and nature of reviews conducted of completed compliance determinations and compliance findings.

Compliance demonstration and initial review: Under both programs, manufacturers' design engineers perform the initial compliance demonstrations to show that the system they have designed meets safety requirements. However, one difference between the two programs relates

[57] *See* Commission Regulation 748/2012, 21.A.239 (a)-(b) ("The design organisation shall demonstrate that it has established and is able to maintain a design assurance system for the control and supervision of the design, and of design changes, of products, parts and appliances covered by the application. . . . The design assurance system shall include an independent checking function of the showings of compliance on the basis of which the organisation submits compliance statements and associated documentation to the Agency.").

to the design engineers performing these demonstrations. While ODA unit compliance engineers must meet FAA qualifications, FAA does not establish the qualifications of, or have oversight over, manufacturers' design engineers. However, under EASA's program, the manufacturers' design engineer qualifications are defined in the Design Organisation's handbook, and design engineering and compliance demonstrations occur within the design assurance system that is overseen by EASA.

A second difference relates to who has the responsibility for signing the compliance determination or compliance finding. Design engineers' demonstrations for U.S. manufacturers must fulfill the agreed-upon methods of compliance. However, the design engineer demonstrating system compliance does not sign or attest to the validity of the compliance findings. FAA officials and Boeing representatives explained that ODA unit members review design engineers' initial compliance demonstrations against regulatory standards for the certification items FAA has delegated to the ODA unit, and make the compliance determinations. FAA also explained that once any identified issues regarding a compliance demonstration are addressed, and agreed-upon compliance demonstration tasks (e.g., tests and data analyses) have been reviewed by the ODA unit member, the ODA unit member attests to the validity of the compliance findings by signing the relevant documentation. The determination is not reviewed again by another ODA unit member or FAA staff. By contrast, Airbus representatives told us EASA requires the design engineer demonstrating compliance to attest to the validity of the compliance findings by signing the initial compliance finding documentation. Once the compliance verification engineer evaluates and accepts the demonstration, this engineer attests to the validity of the compliance finding paperwork by signing it as well.

Review of completed compliance determinations and compliance findings: A number of differences exist in how FAA and EASA review completed compliance determinations and compliance findings. For FAA, once all the required compliance determinations are completed, the ODA holder gathers all the required information into a final certification package for FAA's final review. Both FAA staff who participated in making compliance determinations and other FAA staff who were less or not involved in the compliance determinations process may have a role in approving the final certification package. Approving the package consists of reviewing the completeness of the overall certification package and compliance determinations involving high-risk areas. When reviewing the certification package, FAA staff said they ensure they understand the work performed and the results, typically asking ODA unit members

questions related to testing methodologies and data analyses, among other areas of interest. However, FAA officials explained that this review does not customarily include an independent review of the technical basis for compliance determinations within the package to ensure that an uninvolved engineer would agree with the determination. FAA officials said that for complex certification projects, such as for a commercial transport airplane, FAA convenes a type certification board of appropriate technical staff to ensure all compliance determinations required for the certification package have been made in accordance with the certification plan.[58] The board members do not review compliance determinations.

In February 2022, FAA announced that it will be expanding the use of Technical Advisory Boards, such as it developed during the recertification efforts for the Boeing 737 MAX, in the type certification process. These boards, which will conduct reviews by technical specialists who are independent of a certification project, are intended to help ensure FAA has a consistent and thorough approach for all aircraft certification projects. According to FAA, these reviews could include various activities, such as:

- identifying new technologies, designs, or design features that could be catastrophic if they failed,
- determining whether FAA project specialists have reviewed all major issues, and
- determining whether similar systems have caused problems on other aircraft.

This approach is intended to build on recent reforms FAA reports that it is undertaking, such as plans to delegate less to ODA units.

Under EASA's program for manufacturers, Airbus representatives explained that Design Organisation staff attest to the validity of the certification compliance findings twice. First, the design engineers within the Design Organisation attest to the validity of compliance demonstrations and findings for their designs. Next, compliance verification engineers under the supervision of the Office of Airworthiness

[58] A type certification board includes FAA staff and may include employees of the manufacturer. The purposes of a type certification board are to acquaint the applicant and the FAA with the certification project, resolve significant problems, establish milestones and schedules for the overall accomplishment of the type certification project, review the applicant's certification plan, review proposed certification basis, and assure all outstanding certification issues are resolved.

review and verify the technical basis of the first compliance finding, and either approve or reject the compliance finding. Upon approval, the compliance verification engineers attest to the validity of the compliance finding and sign it the second time. Then the finding is accepted into the certification package, which, like an ODA unit's certification package, contains all the verified compliance findings and other information. When the certification package is completed, the Office of Airworthiness submits it to EASA for type certificate approval or rejection.

At this point, EASA officials explained that EASA conducts an additional review of a sample of compliance findings involving high-risk areas. This review includes the technical basis of the findings to evaluate whether EASA's engineers are technically satisfied with the Design Organisation's compliance findings. EASA officials said this review is based on EASA's level of involvement established with the applicant in the requirements setting and compliance planning phase of the certification process and described in the certification plan. According to EASA officials, although EASA staff do not perform compliance findings, they can be involved in all aspects of the process as defined in the level of involvement criteria described in the certification plan. For example, they might review and approve test plans, witness tests, participate in flight tests, and review compliance reports and statements.

FAA and EASA Rely on Different Safeguards to Ensure Manufacturers' Certification Compliance Employees Act Independently

The way certification compliance work is conducted by ODA unit members in FAA's process and compliance verification engineers in EASA's process appears to have similarities but have different safeguards to ensure that engineers can conduct their work independently and free from the manufacturer's interference.

According to FAA and EASA, both ODA unit members and a Design Organisation's compliance verification engineers may spend part of their time performing design work and part of their time making compliance determinations or verifying compliance findings.

- FAA officials and Boeing representatives we interviewed said that, when ODA unit members are not acting on behalf of FAA, they function as design engineers. When doing so, they can perform design work for the airplane design being assessed for type certification. FAA allows ODA unit members to make compliance determinations for their own design work; however, in practice, Boeing representatives said that Boeing's ODA unit members do not make compliance determinations for systems they helped design. Boeing representatives emphasized the importance of having ODA unit

members working closely with other design engineers on a project. These representatives told us that this allows the ODA unit members to develop a thorough understanding of the systems for which they will later make compliance determinations.

- According to EASA officials, compliance verification engineers in a Design Organisation are also allowed to perform design work when not verifying certification compliance findings. The safeguard to help ensure independence in compliance findings for these designs is not allowing these engineers to verify compliance findings on systems they helped design, as described by Airbus representatives we interviewed. In practice, according to Airbus representatives, Airbus's compliance verification engineers do not perform any design work, even though EASA would allow them to do so as long as it is independent from the design process they are checking. These engineers do, however, work closely with design engineers in a consultative role, advising on design decisions' potential effects on compliance with airworthiness and safety standards. Airbus' representatives said that acting in this role allows the compliance verification engineers to remain independent while developing the necessary expertise to verify compliance findings later in the process.

According to an FAA order and EASA officials, both authorities' programs facilitating manufacturers' participation in the type certification process require these engineers to conduct their certification compliance activities without interference from other parts of the company; however, the safeguards employed to ensure this are different.

- FAA's ODA unit rules are a safeguard to help ensure independence in compliance determinations. These rules require that ODA unit members have no responsibilities that conflict with their certification compliance activities and are independent and free from corporate pressures or influence when performing certification compliance work on behalf of FAA.[59] Boeing representatives acknowledged, however, that ODA unit members have dual roles that subject them to different work environments. When engineers who work in the ODA unit act in their capacity as design engineers outside the ODA unit, they are subject to the same project schedules and report to the same managers as their design engineering colleagues who do not work in the ODA unit. Boeing representatives we interviewed also said that to

[59] *See* FAA Order 8100.15B, Organization Designation Authorization Procedures, 3-4(b)(2)–(3) (2018). Such pressures may include those from design schedules or business goals from other parts of the company.

mitigate project schedule pressures and ensure independence by protecting ODA unit members from interference, ODA unit members report only to managers within the ODA unit when performing work on FAA's behalf.

FAA released a draft notice in February 2022 aimed to mitigate potential interference with ODA unit members employed by manufacturers of transport airplanes and to implement changes in the act.[60] The notice defines interference as including not only outright acts, such as harassment, beratement, threats, and reprisal, but also the presence of other conflicting activities that may be discovered by reviewing the totality of the circumstances. This may include whether any other action, assigned duties, activities, or time constraints inhibit ODA unit members from properly performing their authorized functions. The notice proposes requiring the ODA holder to incorporate procedures into its procedures manual related to protecting ODA unit members from interference. These additions are intended to provide an understanding of actions that constitute interference so that it can be avoided, and the notice aims to ensure free communication between ODA unit members and FAA.[61] Public comments closed in April 2022. [62]

- According to EASA officials and representatives from an aviation manufacturing association, the Design Organisation's independent checking function, as performed by compliance verification engineers under the supervision of the Office of Airworthiness, prohibits compliance verification engineers from verifying compliance findings for design work they contributed to. In addition, according to EASA officials, when compliance verification engineers perform design work, it is conducted under the design assurance system that is overseen by EASA, not in a part of the company that EASA does not oversee.

[60] *See* 49 U.S.C. § 44742.

[61] This action responds to the recommendation regarding implementing internal controls to prevent undue pressure on manufacturers' employees who determine compliance on FAA's behalf, made in the previously mentioned report by the Department of Transportation's Office of Inspector General, No. AV2021020.

[62] FAA, Notice N8100.ODA, Organization Designation Authorization (ODA) Holder Interference with ODA Unit Members (UMs) and Communication between UMs and the Federal Aviation Administration (FAA), February 2022.

FAA's and EASA's Audits of Manufacturers Differ in Scope, but Potential Penalties for Violations Are Similar

FAA and EASA Oversee Compliance with the Certification Process through Audits that Differ in Scope

In both FAA's and EASA's programs for facilitating approved manufacturers' compliance work during the type certification process, the authorities audit the manufacturers' ODA units or Design Organisations, respectively. The ODA holders and Design Organisations also conduct internal audits and provide these audits to the authorities for their review.

Key differences in the scopes of both the internal audits and the aviation authorities' audits are driven by the different structures of ODA units and Design Organisations. Under FAA's ODA program, because the manufacturer's product design and internal design assurance system are not part of the ODA holder's duties, they are not included in its internal audits or FAA audits. For example, FAA officials told us they expect the manufacturer's product design engineers and, in turn, ODA unit members, to reveal all relevant information about systems and system design changes throughout the product development and certification process. As such, the information they share, and how they decide what to share, is in large part at the manufacturer's discretion without verification by FAA. In February 2022, FAA mentioned plans to require more transparency for ODA holders in a press release, but specifics are not yet available.[63]

Under EASA's Design Organisation program, the manufacturer's internal design assurance processes are included under the umbrella of the Design Organisation. Both internal Design Organisation audits and EASA audits can review how design decisions were made. EASA officials said that Design Organisations must have an independent monitoring function that conducts its audit work separately from all other Design Organisation functions. In addition, according to EASA officials and Airbus representatives, the product design engineers' work is subject to EASA's

[63] FAA, "FAA Expands Use of Independent Review Groups When Certifying Aircraft," February 28, 2022, https://www.faa.gov/newsroom/faa-expands-use-independent-review-groups-when-certifying-aircraft

oversight because they are members of the Design Organisation. Airbus representatives explained that design organisations under EASA's certification program encompass all of the manufacturer's operations that contribute to type design and certification activities. We did not obtain information to validate how this oversight structure works.

Internal Audits

The focus of both ODA holders' and Design Organisations' internal audits is to determine if their staffs are following the approved procedures manuals and handbooks, respectively.

- **FAA requirements.** FAA's ODA order requires ODA holders to conduct annual internal audits of unit members to help ensure that they are complying with processes and procedures described in the ODA holder's procedures manual and applicable FAA regulations and policy. The ODA holder must also annually audit ODA unit members at the manufacturer's suppliers and perform onsite oversight every 18 months. Language in FAA's February 2022 draft notice shows FAA intends to require ODA holders to address potential undue pressure by, among other things, conducting self-audits of all reports of alleged or suspected interference and providing FAA a summary of the reports and their results.
- **EASA requirements.** According to EASA officials, a Design Organisation's internal audit program is defined in the design assurance system and should include every aspect of that system, covering all Design Organisation departments and staff, as well as suppliers and contractors in the roles they perform for the Design Organisation. These audits are conducted by an independent body within the Design Organisation. Airbus representatives told us that, in practice, at any given time, audits of various different parts of the design assurance system are being performed.

External Audits

According to FAA and EASA officials, aviation authorities' audits generally consist of evaluating ODA unit or Design Organisation policies, practices (e.g., documentation practices), and compliance verification activities against the requirements stated in the FAA-approved procedures manual or EASA-approved handbook. In addition, according to FAA and to Airbus officials, these audits also generally include reviewing the results of manufacturers' internal audits.

- FAA staff complete annual supervision and biennial audits of ODA holders. According to FAA officials, FAA staff should conduct annual supervisory reviews using a defined list of items pertaining to ODA holder responsibilities and unit activities. For example, this review

should check that the ODA unit is only performing activities included in its procedures manual, only authorized ODA unit members are conducting FAA-related functions, and ODA unit members are receiving proper training.[64] FAA officials also said that as part of this review, each staff member on the FAA management team overseeing an ODA holder is required to review each annual internal ODA audit report. Officials told us that these reports should be reviewed against the approved procedures manual and the ODA holder's technical performance to identify any gaps between policies and practices. Then biennially, FAA staff are to perform in-depth audits comparing the ODA unit's actual practices and activities against all the requirements in the procedures manual. This may include reviewing compliance testing procedures and documentation and other activities during the inspection. In addition, FAA may conduct an audit at any time without notice, although FAA officials told us this has not occurred.[65]

FAA officials told us that over the past several years, the agency has been applying a more systems-based approach in its ODA oversight, which helps FAA focus on the highest-risk areas, such as new, innovative aircraft designs.[66] FAA staff continue to select a sample of ODA unit members' work on individual projects to review in detail as part of the annual supervision and biennial ODA audits. However, FAA officials said that they are developing new organization assessments that will enable them to adjust oversight requirements based on ODA type and performance. Based on these criteria, FAA plans to use a risk-based approach to conduct full ODA audits over a

[64] *See* FAA Order 8100.15B, 5-3.

[65] According to FAA, as required under the FAA Reauthorization Act of 2018, FAA previously established the ODA Office to provide oversight and to ensure consistency of the FAA's audit functions under the ODA program. In April 2021, the FAA realigned the ODA Office to report directly to the Associate Administrator for Aviation Safety. This reporting structure reflects the FAA's priority to oversee, standardize, and ensure consistency in the ODA system, as well as to facilitate many of the ODA reform requirements contained in the Aircraft Certification, Safety, and Accountability Act. FAA previously stated that the ODA Office anticipates adding more employees in Fiscal Year 2022, and hiring has already begun. According to FAA, the additional staff will allow the office to perform more outreach, identify best practices, and implement measures to maintain consistent oversight.

[66] According to the Department of Transportation Office of Inspector General, systems-based oversight shifts from focusing on individual project engineering work to holistically assessing whether ODA companies have the people, processes, procedures, and facilities in place to produce safe products.

period of 1 to 4 years at FAA's discretion, instead of reviewing all ODA holders on a 2-year schedule as it currently does.[67]

- EASA officials stated that they use a risk-based approach that evaluates a Design Organisation's scope and level of activity, as well as performance, to determine when and which type of audit to conduct. EASA officials said that agency staff conduct on-site or remote, and desk audits of Design Organisations in a continuous monitoring cycle conducted by a team of EASA experts.

U.S. and European Manufacturers may be Subject to Similar Penalties for Certification-Related Violations

According to U.S. law and EASA officials, when FAA and EASA find issues in ODA holder or Design Organisation processes or activities, the authorities may take a variety of actions for violations committed during the certification process.

- **Changes to the status of an ODA holder or Design Organisation.** If FAA finds violations during the type certification process or for other reasons, it may revise or terminate an ODA. FAA officials we interviewed said that if a U.S. manufacturer were to lose its ODA, it could still conduct design work and continue in the type certification process. This is possible because FAA could use its own staff and Designated Engineering Representatives (i.e., individual designees who are appointed by and managed by the FAA), who would perform certification determinations on FAA's behalf.

  According to EASA officials, it can also limit, suspend, or revoke a Design Organisation's approval, but it would only consider doing so in the case of an inadequate resolution to identified issues, including violations. However, if an E.U. transport airplane manufacturer's Design Organisation were suspended or revoked, the manufacturer would not be able to continue design work or move ahead in the type certification process.

- **Penalties.** FAA can levy civil penalties, including financial penalties, on ODA holders whose internal groups do not follow policies and procedures. The Department of Justice can also seek civil penalties or file criminal charges for violations such as fraud (see sidebar). In addition, FAA can also direct the ODA holder to change its activities or policies. This can include dismissing members of the ODA unit who have acted without integrity.

[67] 49 U.S.C. § 44736(d) requires FAA to audit an ODA holder once every 7 years "or more frequently as determined appropriate by the Administrator."

Penalties for Manufacturer Violations in the 737 MAX Certification Process

In January 2021, the Department of Justice entered into a deferred prosecution agreement with Boeing, fining the company approximately $2.5 billion after investigating the cause of two 737 MAX crashes that together killed 346 people.

In addition, Boeing undertook remedial efforts to make internal changes, including to ensure that all Boeing engineers report through Boeing's chief engineer rather than to the business units.

Justice alleged that Boeing employees had lied to FAA regarding the function and features of a key flight control system, a malfunction of which led to the crashes. They allegedly miscategorized the system to avoid expensive pilot simulator training and removed mentions of the system from the airplane manual even though Boeing was aware of potential catastrophic outcomes. In addition, a Boeing employee faced criminal charges but was found not guilty in March 2022.

Source: DOJ, FAA, House Transportation and Infrastructure Committee, and U.S. v. Forkner, No. 4:21-CR-00268, (N.D. Tex. 2022). | GAO 22 104480

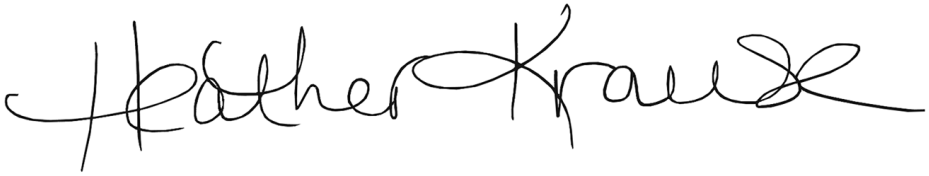
According to EASA officials, EASA does not have a mandate to impose penalties against Design Organisations but may propose them to the European Commission to take action on violations of EU regulations. Such penalties are not of criminal nature. However, EASA officials said that EU Member States may have the ability to pursue a criminal prosecution as part of their domestic legal frameworks.

Agency Comments

We provided a draft of this report to the Department of Transportation and European Union Aviation Safety Agency for comment. The Department of Transportation and European Union Aviation Safety Agency provided technical comments, which we incorporated as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Department of Transportation, and the European Union Aviation Safety Agency. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-2834 or krauseh@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.



Heather Krause
Director, Physical Infrastructure

Appendix I: Federal Aviation Administration (FAA) and European Union Aviation Safety Agency (EASA) Harmonization Efforts

In 2008, the U.S. and European Union signed their current bilateral agreement for aviation safety, including for airplane certification. The agreement, along with related documents, streamlined the validation process used by the importing country's civil aviation authority to verify the airworthiness and environmental certification approvals of an aviation product certified by the other signatory's civil aviation authority. Subsequent to signing the bilateral agreement, FAA and EASA have continued to work toward greater reliance on the activities of the certifying authority by continuing to streamline the validation process. While the ultimate stated objective of the bilateral agreement is for the validation authority to accept the work of the certification authority without requiring further review of decisions made during the certification process, FAA and EASA recognize that challenges remain to fully attain that objective. See table 2 for an overview of FAA's and EASA's continued airplane certification harmonization efforts.

Table 2: Federal Aviation Administration (FAA) and the European Union Aviation Safety Agency (EASA) Bilateral Airplane Certification Harmonization Efforts, as of April 2022

Harmonization effort	Date	Description
2008 U.S.-European Union Bilateral Agreement	2008	• The agreement streamlined the procedures used by the importing country's civil aviation authority to verify the airworthiness and environmental certification approvals of an aviation product certified by the other signatory's civil aviation authority.
Technical Implementation Procedures for Airworthiness and Environmental Certification	2011[a]	• FAA and EASA determined that the aircraft certification processes of each authority for the design approval, production approval, airworthiness approval, and continuing airworthiness of the civil aeronautical products and articles identified in this document, are sufficiently compatible in structure and performance to support these procedures. • According to the Technical Implementation Procedures, FAA and EASA mutually recognize each other's aircraft certification processes.
FAA and EASA Rulemaking Agreement	2013	• The agreement requires FAA and EASA to develop and adopt procedures for regulatory cooperation in civil aviation safety and environmental testing and approvals. • FAA and EASA determined that they should actively promote mutual rulemaking cooperation to maintain and further improve harmonization of their rules within the scope the agreement.
EASA/FAA Certification Oversight Board Validation Improvement Roadmap[b]	2016[c]	• According to the EASA/FAA roadmap, FAA and EASA have documented key focus areas and associated initiatives (concluded or underway) that will reduce validating authority involvement in the number and scope of validation activities conducted under the bilateral agreement.[d]

Source: GAO summary of FAA and EASA information. | GAO-22-104480

[a]Since issuing the Technical Implementation Procedures for Airworthiness and Environmental Certification document, FAA and EASA have made some revisions to the document. The latest revision (revision 6) was made on September 22, 2018 and was amended on June 22, 2018 and April 2, 2019.

[b]The Certification Oversight Board—which was established as part of the U.S.-EU bilateral agreement—was tasked with developing a validation improvement roadmap.

[c]The first Certification Board Validation Improvement Roadmap was signed on February 29, 2016. Updates were made to the EASA/FAA Certification Oversight Board Validation Improvement Roadmap in June 2018 August 2018.

[d]An importing country's civil aviation authority must verify the airworthiness and environmental certification approvals of an aviation product certified by the other signatory's civil aviation authority, a process called validation.

Efforts to harmonize the certification and validation processes for new commercial transport airplanes extend beyond those of FAA and EASA. For example, in 2015, FAA and EASA, along with aviation authorities in Canada and Brazil where large commercial transport airplanes are also produced, initiated the quadrilateral Certification Management Team to support greater harmonization of certification and validation processes among the four countries' civil aviation authorities. This management team oversees and manages collaboration efforts to permit the

development and implementation of harmonized regulatory and policy solutions.[1]

[1] In 2016, the Certification Management Team agreed to a collaboration strategy identifying its vision and objectives, four high-level strategic focus areas, and goals to realize the team's vision. The team is working collectively to address these focus areas but recognizes partners may also develop bilateral validation improvements.

Appendix II: Recent Reviews of and Legislative Changes to the Federal Aviation Administration's (FAA) Certification Process

FAA is evaluating changes to its commercial airplane certification process to address investigative findings and legislative changes following the grounding of the 737 MAX. Specifically, independent reviews of FAA's certification process—under which the 737 MAX was certified—identified areas of weakness in FAA's certification process requiring FAA actions to improve. Addressing these and other recommendations and mandates will take some time, according to FAA documentation.[1] Illustrative independent reviews and relevant legislative changes are summarized below:

- **Special Committee Recommendations to FAA.** In January 2020, a Special Committee—commissioned by the Secretary of Transportation to review the FAA aircraft certification process—made several recommendations to FAA covering 10 areas.[2] These areas included amended type certificates and delegation, among others. In particular, the committee found that FAA evaluates a product submitted for certification through an amended type certificate using the same structured process outlined in the regulations and orders as for a new type certificate. According to the committee, the underlying issue related to new and amended type certificates should not be whether an airplane (or other aeronautical product) is produced under a new type certificate or an amended type certificate. Rather, the issue is whether the airplane's level of safety, embodied in the airworthiness standards it complies with, is as high as practicable. Therefore, the committee recommended FAA update existing internal guidance to

1. evaluate how multiple changes impact equipment, users, or the environment when integrated into aircraft design;
2. highlight the vulnerabilities that can develop around multiple adaptations of existing systems, where the transfer of historical assumptions about those systems may not be appropriate or may require specific verification, and

[1] In addition to the recommendations and mandates mentioned below, FAA is responding to other reports, such as the Joint Authorities Technical Review Submittal, the National Transportation Safety Board Report, the Technical Advisory Board Final Report, and the Final Komite Nasional Keselamatan Transportasi Aircraft Accident Investigation Report (Republic of Indonesia)—all of which have recommendations to address.

[2] In 2019, the U.S. Secretary of Transportation created the Special Committee to review the FAA aircraft certification process in response to the crashes of two Boeing 737 MAX 8 airplanes. *See* Official Report of the Special Committee to review the Federal Aviation Administration's Aircraft Certification Process, January 16, 2020, Washington, D.C.

3. clarify the roles and responsibilities of FAA and the manufacturer in assessing assumptions in determining what constitutes a significant change.

The committee report stated that this situation can be relevant to new type certificate programs, but is more likely relevant to amended type certificate programs where system integration can have unique challenges. The committee's finding about updating guidance for amended type certificates is similar to a finding made by the Department of Transportation's Inspector General. FAA's anticipates addressing all the findings identified in the report by the end of 2025.

- **Inspector General Recommendations to FAA.** In February 2021, the Department of Transportation's Office of Inspector General reported on weaknesses in FAA's certification guidance and delegation processes under the Organization Designation Authorization program that allow manufacturers to approve some aspects of an aircraft's design.[3] The report contained 14 recommendations covering a range of areas to help restore confidence in FAA's certification process and ensure the highest level of safety in future certification efforts of commercial transport airplane. One recommendation, for example, calls for FAA to update its internal guidance to address the integration of technological advances into existing aircraft models and the number and types of exceptions granted to areas certified under older standards.[4] Another recommendation calls on FAA to ensure it has implemented internal controls to prevent undue pressure on those at manufacturers who determine compliance on FAA's behalf. In its written response to the Department of Transportation's Inspector General's draft report, FAA agreed with the recommendations and planned to implement all of

[3] Department of Transportation, Office of Inspector General, Weaknesses in FAA's Certification and Delegation Processes Hindered Its Oversight of the 737 MAX 8, Report No. AV2021020, Washington, D.C., Feb. 23, 2021.

[4] The report noted that FAA's guidance lacks clarity on assessing aircraft areas that have changed from previous designs. Under FAA's certification process, generally, if an aircraft model receives an amended type certificate (as was the 737 MAX), then systems that have been significantly changed from the previous type certificated model must meet the current standards. To view the status of recommendations made, see https://www.oig.dot.gov/library-item/38302.

them by December 31, 2025. As of April 2022, one of 14 recommendations had been closed.[5]

- **Aircraft Certification, Safety, and Accountability Act Mandates for FAA.** The Aircraft Certification, Safety, and Accountability Act, enacted in December 2020, requires FAA to make a number of changes to how it carries out and oversees its certification processes. Among other things, the act requires establishment of integrated project teams—made up of technical experts from FAA and other federal agencies such as the National Aeronautics and Space Administration and the Air Force—for certification of large commercial aircraft. FAA is to submit a report to congressional committees on this effort annually through fiscal year 2023. In February 2022, FAA expanded the use of Technical Advisory Boards, independent groups composed of experts from inside and outside the FAA that help guide its approach during aircraft certification projects. The boards are to become familiar with proposed designs or design changes, and how changes will meet FAA certification regulations, among other things.

  In addition, this act directs the FAA Administrator to establish a process through which FAA decisions, findings, or other actions regarding a manufacturer's compliance with applicable design requirements may be appealed. As of December 31, 2021, FAA had not yet issued an order doing so, as required by the legislation. The act also prohibits FAA leadership and manufacturers from communicating with each other about an appeal outside of the established review process unless those communications are publicly disclosed. Furthermore, the legislation directs FAA to (a) require that applicants for and holders of type certificates perform a system safety assessment for certain design and operational details and (b) undertake an analysis of topics, such as the cumulative effects of proposed design changes to the aircraft, human factors issues, and impacts on training for pilots.

[5] The one closed recommendation related to a signed settlement agreement between FAA and Boeing.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Heather Krause, (202) 512-2834 or krauseh@gao.gov

Staff Acknowledgments

In addition to the contact named above, Edward Laughlin (Assistant Director), Ray Griffith (Analyst-in-Charge), James Geibel, Delwen Jones, Elke Kolodinski, Steve Martinez, Camilo Flores, Madhav Panwar, Malika Rice, Kelly Rubin, and Michael Soressi made key contributions to this report.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through our website. Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. You can also subscribe to GAO's email updates to receive notification of newly posted products.

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, https://www.gao.gov/ordering.htm.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on Facebook, Flickr, Twitter, and YouTube.
Subscribe to our RSS Feeds or Email Updates. Listen to our Podcasts.
Visit GAO on the web at https://www.gao.gov.

To Report Fraud, Waste, and Abuse in Federal Programs

Contact FraudNet:

Website: https://www.gao.gov/about/what-gao-does/fraudnet

Automated answering system: (800) 424-5454 or (202) 512-7700

Congressional Relations

A. Nicole Clowers, Managing Director, ClowersA@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, DC 20548

Strategic Planning and External Liaison

Stephen J. Sanford, Managing Director, spel@gao.gov, (202) 512-4707
U.S. Government Accountability Office, 441 G Street NW, Room 7814,
Washington, DC 20548