Congressional Research Service
Informing the legislative debate since 1914

INSIGHT

Boeing 737 Max to Fly Again, Clouded by Certification Concerns

December 7, 2020

On November 18, 2020, the Federal Aviation Administration (FAA) issued an order rescinding its March 2019 order that had grounded the Boeing 737 Max passenger jet for nearly 20 months. Congress continues to debate legislation (H.R. 8408, S. 3969, and S. 3866) seeking to reform aircraft certification in an effort to avoid future safety stand-downs of this magnitude involving the design of highly complex transport aircraft.

Two high-profile fatal accidents, the crash of Lion Air flight 610 in October 2018 and the crash of Ethiopian Airlines flight 302 in March 2019, prompted the unprecedented worldwide grounding of the 737 Max as investigators and engineers sought to identify and remedy a common set of causes. Both accidents were linked to an automated flight control system feature called the Maneuvering Characteristics Augmentation System (MCAS). The design of the 737 Max included larger engines than earlier versions of the 737. Under certain circumstances, these engines could cause an unintended pitch up of the airplane's nose. MCAS was installed to automatically compensate for this undesirable tendency. In both accidents, MCAS activated repeatedly, resulting in extreme nose-down pitching. Analysis after the accidents revealed that MCAS relied on a single sensor that was reportedly prone to damage, and that the aircraft lacked safeguards to prevent its activation if that single sensor failed. The two crashed airplanes had no cockpit indicators to notify pilots of a possible sensor failure, and Boeing had not advised airlines to train pilots about the existence and functioning of MCAS or proper procedures to override or disable it if necessary.

Design Certification Probed

The crashes triggered a number of investigations and reviews of FAA's procedures for certifying the safety of the 737 Max in particular and of passenger aircraft more broadly. FAA joined with aviation authorities from other countries and the European Union to complete a comprehensive technical review of the Boeing 737 Max flight control system design and certification. The Department of Transportation independently convened a special committee to review the certification of the Boeing 737 Max, which urged FAA to require aircraft manufacturers to implement Safety Management Systems (SMS) like those already required of airlines. While FAA initiated rulemaking back in 2014 to comply with international

standards requiring SMS at aircraft design and manufacturing organizations, FAA and industry had settled on voluntary implementation of an SMS standard rather than a mandatory requirement.

A House Transportation and Infrastructure Committee investigative report found, in addition to faulty design and performance assumptions specific to the Boeing 737 Max, a "culture of concealment" at Boeing that contributed to withholding critical details from FAA, airlines, and pilots. It concluded that FAA had insufficient oversight over the aircraft's development after delegating significant aspects of certification to Boeing itself under the Organization Designation Authorization (ODA) program. The report also concluded that schedule, cost, and production pressures at Boeing further compromised safety.

Grounding Order Lifted

FAA's November 18 order requires Boeing 737 Max operators in the United States to take certain corrective actions detailed in Airworthiness Directives to address identified MCAS flaws before the airplanes can return to service. It also requires airlines to develop FAA-approved pilot training regarding the MCAS system and its functionality, including flight simulator training to help pilots respond to MCAS failures. American Airlines reportedly plans to resume some 737 Max flights by late December 2020, while United Airlines and Southwest Airlines reportedly plan to reintroduce the jet in early 2021.

Air safety agencies in some other countries and the European Union grounded the 737 Max prior to FAA's action in 2019, leading to speculation that they might impose stricter conditions than FAA before allowing the aircraft to reenter service. However, the European Union Aviation Safety Agency (EASA), along with its counterparts in Canada and Brazil, has reportedly mostly harmonized with FAA in setting conditions for returning the 737 Max to service, allaying concerns over potentially lengthy disagreements among international regulators. It remains to be seen whether foreign regulators will scrutinize aircraft certification more closely in the future and rely less on FAA's determinations.

Legislation Seeks Certification Reforms

On November 17, 2020, the House passed the Aircraft Certification Reform and Accountability Act (H.R. 8408). The bill would require each aircraft manufacturer to develop and implement an FAA-approved SMS that includes a confidential, nonpunitive safety reporting program for employees to voice safety concerns and to follow a code of ethics setting safety as the company's top priority. It would also order an expert review of all ODA holders that manufacture transport category airplanes. The review would assess the extent to which those manufacturers have implemented a safety culture, the effectiveness of measures implemented to prioritize safety, and each company's capability to make reasonable and appropriate decisions regarding certification functions delegated by FAA under ODA.

Similarly, the Aircraft Safety and Certification Reform Act of 2020 (S. 3969) would mandate changes to the aircraft certification process, the ODA program, and FAA oversight of that program. The bill would mandate implementation of FAA-approved SMS for aircraft manufacturers. It would additionally require that FAA review and approve all personnel assigned to an aircraft manufacturer's ODA unit, and would increase FAA involvement with and oversight of ODA activities. The bill would direct FAA to convene an expert panel to review ODA best practices and to address the panel's findings and recommendations. It would also require FAA to review and update existing requirements and guidance regarding human factors and human systems integration, particularly those related to aircraft-pilot interfaces. A separate bill under consideration in the Senate, the Aircraft Safety Improvement Act of 2020 (S. 3866), would similarly require aircraft manufacturers to implement SMS, and would require FAA to identify and implement ODA best practices and address human factors considerations in the design of aircraft automation.

Author Information

Bart Elias
Specialist in Aviation Policy

Disclaimer