

Historical Background of the Delegation System for Aircraft Certification in the U.S. and its Status after Boeing 737 MAX Accidents

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1 The Incidents of Boeing 737 MAX in 2018 and 2019
Boeing 737 MAX series aircraft have been delivered to airlines since May 2017, as a successor of the 737 Next Generation (737 NG) series aircraft of that company. However, there have been fatal accidents since their delivery, such as Indonesia's Lion Air Flight 610 in October 29th, 2018 and Ethiopian Airlines's Flight 302 in March 10th, 2019. Both flights crashed soon after their takeoff, and all of the passengers and crew died. After these two accidents occurred, the U.S. Federal Aviation Administration (FAA), which is the U.S. aviation safety authority, declared an Emergency Order on March 13th, 2019 based on US Code (U.S.C.) Title 49, 46105(c). This order banned the operations of all 737 MAX series aircraft by U.S. airlines and those operating within U.S. airspace by any other airline. Prior to the U.S., China and European countries had also banned operations of 737 MAX series aircraft by their own countries' airlines and in their airspace. However, the operations of the series was banned all over the world due to the fact that the aviation authority of the U.S., which is the State of Design and Manufacture of the aircraft, declared the emergency order. As of May 2020, the operations have not yet been resumed.

Regarding the Lion Air Flight 610 accident, the final accident investigation report was published on October 25th, 2019 by Indonesia's National Transportation Safety Committee. Ethiopia's private aviation authority also published a preliminary accident investigation report on April 4th, 2019, and they have been continuing their investigation on the Ethiopian Airlines Flight 302 accident. In addition, the US National Transportation Safety Board, who has supported the investigations of these two aviation accidents, issued safety recommendations to the FAA on

September 26th, 2019.

Through the investigation of these two cases, a malfunction in the flight control system of the aircraft was detected, which is considered to be the direct root cause of the accident.

In this report, I will not talk about this root cause. Instead, I will discuss the FAA's delegation system process for their certification of aircraft, which is given to aircraft manufacturers, and will also include historical background information and the status after the two aviation accidents.

2 The Role of the FAA in Aircraft Certification in the U.S. and its Delegation System for the Private Sector

2.1 The Role of the FAA

"Annex 8 to the Convention on International Civil Aviation," seeks for the State of Design to issue a certificate for each aircraft type upon evaluation of compliance with airworthiness standards, and to also provide mandatory information for the safe operation of said aircraft to other countries.

Due to this provision, the FAA evaluates whether aircraft made in the U.S. complies with airworthiness standards. They also utilize the private sector's abilities by delegating parts of the evaluations to individuals and organizations, as explained in the following sections.

2.2 Designated Engineering Representative (DER)

Based on Section 183.11 of Federal Aviation Regulations (FAR), the FAA authorizes appropriate individuals (including those belonging to aircraft manufacturers) as DER, and delegates parts of evaluating technical documents and witnessing tests to them. Additionally, DER authorization is specified based on technical field, such as

structures, engines, and avionics. Authorized DERs are responsible for reporting the status of their business affairs to the FAA.

Details about DER are listed in the FAA Order 8110.37. This FAA Order has been revised multiple times since it was first published in October 1979. Rev. F, which was published in August 2017, is the latest version as of now.

This FAA Order, in addition to defining DER of each technological field, specifies the authorization of Administrative DER and Management DER who manage certification. However, Rev. F states that they will stop new authorization of Administrative DER permanently, and will also abolish existing authorizations. Administrative DER will be migrated to the Organization Designation Authorization, which will be explained in the next section.

2.3 Organization Designation Authorization (ODA)

With the revision of FAR Part 183 in November 2005, the FAA, based on Section 183.45 of the amendment, authorizes appropriate organizations (including aircraft manufacturers) as ODA. Delegation Option Authorization (DOA) was the system to give authorization previously. However, due to the revision of FAR Part 183, DOA's authorized organizations were mandated to migrate to ODA by November 2009.

Tasks delegated to ODA are given based on the abilities of the organizations. Details are listed in FAA Order 8100.15. This FAA Order has been revised multiple times since the first version was published in August 2006. Rev. B Change 3, which was published in June 2018, is currently the latest version. Based on this FAA Order, organizations seeking ODA authorization create a "Procedures Manual" for approval from FAA. Then they can perform tasks on behalf of FAA in the scope of these manuals.

The DER system mentioned previously is structured where the FAA delegates parts of the evaluations of technical documents and test witnessing to DER. On the other hand, the ODA system is very different, as they perform most parts of the evaluation of technical documents and the witnessing of tests after the FAA authorizes their implementation procedures.

In addition, regarding members of the ODA, which are internal organizations of aircraft manufacturers performing ODA tasks, although the FAA performs preliminary reviews whenever a new member is assigned, organizations authorized as ODA, rather than individual members, report the status of their business to the FAA.

2.4 Delegation to Boeing

Although Boeing had been delegated under the DER system based on Section 2.2, since 2009, they have been delegated under the ODA system based on Section 2.3.

The development projects of aircraft in chronological order are 787-8 (an initial type of 787 series aircraft) during 2004 to 2011, 747-8 during 2005 to 2011, and 737 MAX 8 (an initial type of 737 MAX series aircraft) during 2011 to 2017. Therefore, 737 MAX series aircraft were the first aircraft type that Boeing applied a delegation for based on the ODA system during their entire developmental period for new and derivative types of aircraft with major design changes.

3 The FAA's Actions Taken for the Boeing 737 MAX Accidents

3.1 Actions Taken for the Lion Air 610 Accident

The FAA participated in investigations done by Indonesia's National Transportation Safety Committee right after the accident happened, and issued the Emergency Airworthiness Directive : AD for 737 MAX series on November 7th, 2018, one week later. In this AD, the FAA instructs that specific operation procedures for runaway of horizontal stabilizer control be included to flight manuals.

3.2 Actions Taken for the Ethiopian Airlines 302 Accident

The same as when the Lion Air 610 accident occurred, the FAA again participated in investigations directly after the accident, this time with an Ethiopian civil aviation authority charged with making inquiries. The FAA issued an emergency order to ban operations of all the 737 MAX series aircraft on March 13th, 2019, three days after the Ethiopian Airlines 302 crash.

The FAA also held a Joint Authorities Technical Review (JATR) on April 2nd, 2019 with participants consisting of experts of the FAA, NASA and foreign aviation safety

authorities (including Japan). The FAA made an announcement that they would have comprehensive investigations on the certification of the flight control system of 737 MAX series aircraft.

JATR performed investigations for up to 90 days after their first meeting on April 29th, 2019. As of this time, FAA mentioned that these investigations by JATR were not required for resuming operations of the 737 MAX series.

In tandem with the investigations by JATR, the FAA asked that the Technical Advisory Board (TAB), which consists of FAA experts who were not involved in evaluations from the beginning of development and professionals from the U.S. Air Force, NASA, and the Volpe National Transportation Systems Center, to conduct additional evaluations as unbiased third parties on the design changes of the aircraft's flight control system. Furthermore, the FAA emphasized that this process should be thoroughly implemented without setting a date of resuming 737 MAX series aircraft operations.

JATR published a report on their investigation activities on October 11th, 2019. In this report, they concluded that Boeing's certification had not been evaluated properly due to a lack of human resources at the FAA's internal organization (Boeing Aviation Safety Oversight Office : BASOO) charged with supervising Boeing's ODA unit and assessing technical documents, which was not a task delegated to ODA. This dearth of manpower resulted in a high ratio of task delegations from the FAA to ODA, and also improper supervising.

Additionally, it was reported that there were signs of ODA unit members given inappropriate pressure within Boeing. Therefore, they recommended that BASOO's human resources, in terms of both quantity and quality, be reviewed and restructured to make an environment where ODA unit members are able to contact the FAA without fear of getting punished within the company.

Moreover, in the final accident investigation report on Lion Air 610 by Indonesia's National Transportation Safety Committee published on October 25th, 2019, they advised reviewing the process of determining the scope of task delegations from the FAA to ODA.

On January 16th 2020, a report was published by a special committee for investigating the certification process established by the U.S. Secretary of Transportation.

In this report, the ODA system itself was considered appropriate. However, it advised against putting inappropriate pressure on ODA unit members from aircraft manufacturers, and encouraged establishing a system in which ODA unit members can communicate with the FAA directly.

4 The Impact on Current and Future Development Projects

According to a speech made by the Administrator of the FAA at the Transportation and Infrastructure Committee of the House of Representatives on December 11th, 2019, the FAA was evaluating all the documents related to the design changes of the flight control system, and TAB is also going to have an additional evaluation. These activities seem to be a major reason for why it is taking a long time for the operations to resume.

The additional evaluation by TAB is only being conducted for the design changes affecting the two accidents. However, it is expected that the FAA will not delegate tasks to ODA as much as before, following the recommendation given in reports by JATR and Indonesia's National Transportation Safety Committee, as mentioned in paragraph 3.2 above. Finally, although it is expected that human resources in the FAA's internal organizations will be reviewed, it will be difficult to resolve any issues found within a short period of time. For the time being, it is likely that it will take longer for the FAA to evaluate and supervise the certification process.

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