Description of the MCAS’s role in the Air Lion 610 incident

On 29 October 2018., a Boeing 737 MAX 8 ( Lion Air Flight 610) crashed near Jakarta Indonesia and killed all 189 passengers and the flight crew 12 minutes after takeoff. During the incident analysis, MCAS is suspected.

MCAS, Maneuvering Characteristics Augmentation System, was added into the computer system of Boeing 737 MAX 8. The larger engines in Boeing 737 MAX 8 were placed farther forward on the plane wings and therefore the airframe’s aerodynamic lift was changed, which could lead to a stall. To avoid the stall, MCAS was needed because it was designed to spin the horizontal tail in the plane to push the nose of 737 MAX 8 down so as to avoid the stall (Gates, The Seattle Times, 2019). Boeing designed the MCAS to act automatically in the background without the pilot awareness and input, relying on the information from one of the two angle-of-attack(AOA) sensor on 737 MAX 8 (Ostrower, 2018).

During the Lion Air Flight 610 crash of 737 MAX, the black box data showed that the two angle-of-attack(AOA) sensors, which measure the angle between the airflow and the wing, recorded erroneous data with disagreement before the takeoff and the pilots did not know it (Gates, The Seattle Times, 2019). The MCAS system was designed to take a reading from one single AOA sensor and the sensor it chose was faulty and collected erroneous data which was sent to the MCAS (Gates, Flawed analysis, failed oversight: How Boeing, FAA certified the suspect 737 MAX flight control system, 2019). Nevertheless, the MCAS system did not react because it was not designed to operate until the flaps are retracted. When the plane was taking off, the warnings about the risk of a stall, which is caused by the AOA sensor, were showed to the pilots. The pilots managed the plane to ascend successfully and retract the flaps used on takeoff. However, once the pilots on Lion Air Flight retracted the flaps when the plane was at the altitude of 5000 feet, the MCAS is activated by interpreting the wrong information from the AOA sensor. Then MCAS swiveled the horizontal tail of the 737 MAX 8 and therefore push the nose of the plane down in the background sharply and automatically. The black box data indicated that the captain used the thumb switches on the control column to pull the plane back up. Unfortunately, under the false AOA reading, MCAS kicked in to swivel the tail and push the nose down again. After this cycle repeated 21 times, the pilots lost control and Lion Air Flight 610 ended up diving into the sea, which killed 189 people (Gates, Flawed analysis, failed oversight: How Boeing, FAA certified the suspect 737 MAX flight control system, 2019).

There were a few details that are noticeable: 1. Boeing installed the MCAS on planes without informing the pilots how it works (Rivero, 2019). 2. The MCAS was capable of swiveling the tail with a limit of 2.5 degrees, which was four times farther than that(0.6 degrees) was stated in the original Boeing safety analysis document provided to the FAA. This higher limit meant the MCAS could cause a much greater movement of the tail. 3. The cockpit warning light for the AOA-disagree alert was an optional add-on and the Lion Air 737 MAX 8 did not have it. Therefore, without the warning light, the crew and pilots on that plane could not know that AOA readings were erroneous and that it was likely to trigger the MCAS unnecessarily.

# Reference

Gates, D. (2019, March). *How boeing, faa cer- tified the suspect 737 max flight control system*. Retrieved from The Seattle Times: https://www.seattletimes.com/business/boeing-aerospace/ failed-certification-faa-missed-safety-issues-in-the-737-max-system-implicated-in-the-lion

Gates, D. (2019, March). *The Seattle Times*. Retrieved from Lack of redundancies on boeing 737 max system baffles some involved in developing the jet: https://www.seattletimes.com/business/boeing-aerospace/ a-lack-of-redundancies-on-737-max-system-has-baffled-even-those-who-worked-on-the-jet/

Ostrower, J. (2018, November). *What is the boeing 737 max maneuvering characteristics angmentation system?* Retrieved from The Air Current: https://theaircurrent.com/aviation-safety/ what-is-the-boeing-737-max-maneuvering-characteristics-augmentation-system-mcas-jt610/

Rivero, N. (2019, March). *Everything we know about the boeing 737 max 8 crisis.* Retrieved from Quartz: https://qz.com/1578227/ everything-we-know-about-the-boeing-737-max-8-crashes/.

Wikipedia. (n.d.). Retrieved from Boeing 737 max: Accidents and incidents: https://en.wikipedia.org/wiki/ Boeing\_737\_MAX#Accidents\_and\_incidents