

FMECA Exercise: Analysis of the Boeing 737 MAX MCAS

Background

The Boeing 737 MAX's Maneuvering Characteristics Augmentation System (MCAS) is a flight control system designed to enhance the aircraft's safety in certain flight conditions.

1. Purpose of MCAS:

- The MCAS was developed for the Boeing 737 MAX to address the aircraft's tendency to pitch up under certain conditions, primarily due to the placement and size of its new, more efficient engines. This pitching up could potentially lead to a stall.

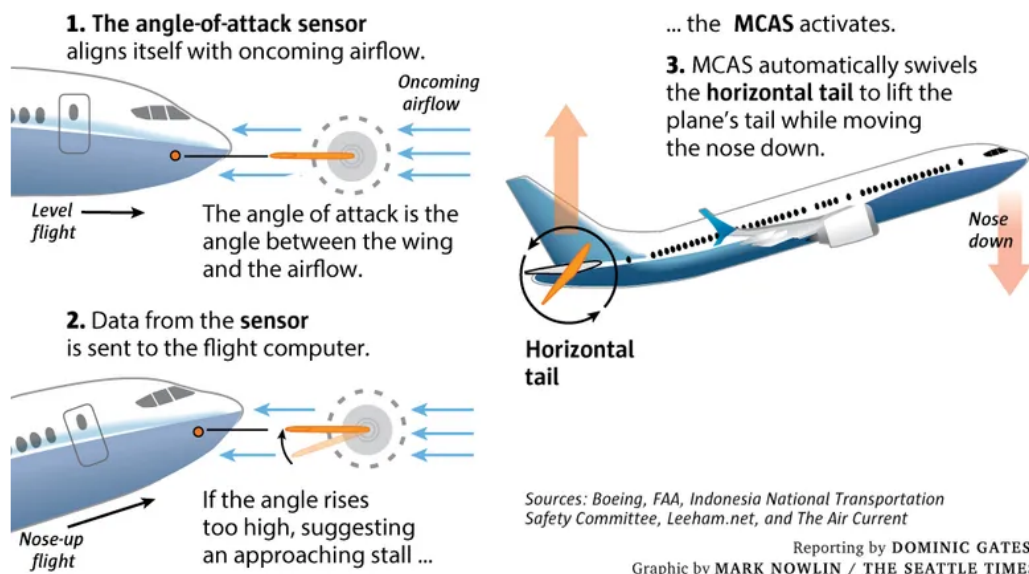
2. Functioning of MCAS:

- The system activates automatically only in manual flight, with the aircraft's flaps up at a high angle of attack (AoA).
- When the AoA sensor detects a high angle that could lead to a stall, the MCAS is designed to automatically adjust the horizontal stabilizer to pitch the nose down, helping the pilots maintain control.

3. Possible issues that can be faced:

- The MCAS in the 737 MAX relies on data from only one AoA sensor, making it vulnerable to incorrect data from a faulty sensor.
- The system has the authority to make significant and repeated nose-down inputs, which could be unexpected and overwhelming for the pilots.

How the MCAS (Maneuvering Characteristics Augmentation System) works on the 737 MAX



Objective:

Conduct a Failure Modes, Effects, and Criticality Analysis on the Boeing 737 MAX MCAS. The goal is to understand potential failure modes, their effects on aircraft operation and safety, and the criticality of these failures.

Task:

- 1. Identify Potential Failure Modes:** Focus on the MCAS components, such as the AoA sensors, MCAS software logic, pilot notification/alert systems, and override mechanisms. Potential failures might include sensor malfunctions, software errors, inadequate pilot training, or communication failures.
- 2. Analyze Failure Effects:** Assess how each identified failure mode would affect the MCAS function and, consequently, the aircraft's safety and operability. Consider both direct effects (e.g., uncommanded nose-down movement) and indirect effects (e.g., pilot confusion or incorrect responses).

3. **Assess Failure Criticality:** Evaluate the criticality of each failure mode, considering factors like the likelihood of the failure and the potential impact on flight safety. Rate the criticality on a predefined scale.
4. **Mitigation Strategies:** Based on the analysis, suggest improvements or changes to the MCAS design, sensor redundancy, pilot training, or alert systems to mitigate the most critical failures.
5. **Report:** Compile a comprehensive FMECA report for the Boeing 737 MAX MCAS.

Deliverables:

- A detailed FMECA report on the MCAS of Boeing 737 MAX.

This exercise will help you understand the importance of considering multiple failure modes and their effects and the critical role of FMECA in ensuring safety.