

# Exchange of views European Union Aviation Safety Agency

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**Your safety is our mission.**

# Scope of competences

New Basic Regulation in force since September 2019 reinforces the total system approach and environmental role

## Aviation-wide activity

Airworthiness

Environment

3rd Country  
Operations

Operations  
& Licencing

Air Traffic  
Management

Aerodromes

Security

Drones

# Mission and tasks

- **SAFETY:** Ensure the highest common level of safety-security protection for EU citizens
  - EU common rules
  - Single certification system among Member States
  - Establish internal aviation market & level playing field for industry
  - Oversight and support to Member States (e.g. Air Operations , Air Traffic Management)
  - Cooperate with international actors in order to achieve the highest safety level for EU citizens globally & facilitate export of EU standards and products worldwide
  
- **ENVIRONMENT:** Protect climate, environment and human health
  - Set standards on Noise + Emissions and certify aircraft and engines against these standards
  - Facilitate Sustainable Aviation Fuels to combat climate change
  - Facilitate climate-friendly technologies (e.g. electric and hybrid propulsion, fuel cells)
  - Provide impartial and independent technical expertise and data: European Aviation Environmental Report/recommendations

# Strategic Priorities in the next 5 years (1/2)

## Delivering the New Basic Regulation

### → Innovation:

- New technologies
- Urban mobility (drones, air taxi)
- Digitalisation

### → Security: (cyber)security of air transport

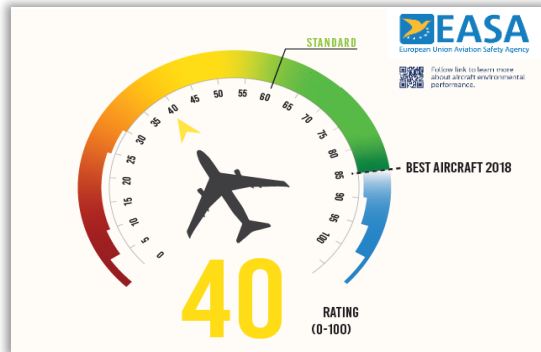
### → Reinforced presence on the International scene to support EU external policy and EU citizens needs

### → New relationship with National Authorities and Industry

# Strategic Priorities in the next 5 years (2/2)

## → Greener Aviation

- Supporting green technologies
- Environmental impact/framework for new vehicles, especially in urban environments
- Fuel efficiency and sustainable aviation fuels
- Air transport electrification and de-carbonisation
- EcoLabel



# B737 MAX

# Lion Air accident

- ❑ B737-8 MAX, PK-LQP, crashed on 28 Oct 2018 during initial climb leaving Jakarta. 189 fatalities (1 from EASA States)
- ❑ Shortly after take-off, the Angle of Attack values start deviating (left 20 deg higher than right side) and left stick shaker activated remaining active most of the flight.
- ❑ The crew experienced flight control problems and lost control of the aircraft which crashed into the sea a few minutes after take-off, 33 NM from Jakarta
- ❑ Investigation led by Indonesia as State of Occurrence
  - US (NTSB) appointed an Accredited Representative as State of Manufacture & Design
  - No EU representation



# Ethiopian accident

- ❑ B737-8 MAX, ET-AVJ, crashed on 10 March 2019 during initial climb leaving Addis Ababa. 157 fatalities (12 from EASA States)
- ❑ Shortly after take-off, the left Angle of Attack value became erroneous and the left stick shaker activated and remained active until near the end of the flight.
- ❑ The crew experienced flight control problems and lost control of the aircraft which crashed a few minutes after take-off, 28 NM SE of Addis Ababa
- ❑ Investigation led by Ethiopia as State of Occurrence
  - US (NTSB) appointed an Accredited Representative as State of Manufacture & Design
  - French BEA carried out the recorders read out at the request of Ethiopia
  - EASA appointed a Technical Advisor at the request of Ethiopia (few days after the crash)





# Decision to ground / ban

- ❑ **When:** Tuesday 12 March (published @ 18:23), 2 days after the 2<sup>nd</sup> crash.
- ❑ **How:** Airworthiness Directive and Safety Directive (Third Country Operators)
- ❑ **Why:** Technical decision, data driven, precautionary measure.
  - Similarities with the Lion Air accident data
  - Application of EASA guidance material for taking corrective actions in case of potential unsafe conditions
  - Additional considerations: no direct access to the investigation, unusual scenario of a “young” aircraft experiencing 2 fatal accidents in <6 months.
- ❑ **Who:**
  - before us: **China**, Indonesia, Ethiopia, Singapore, Australia.
  - after us: **Canada, USA, Brazil**, India, Japan,...

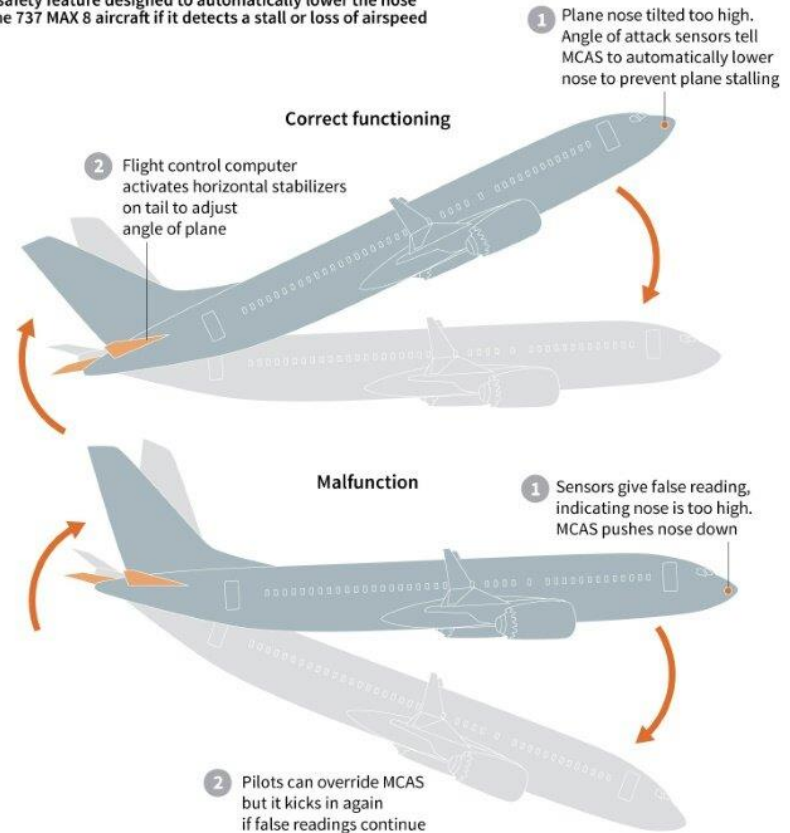
# Preliminary information

## On the Contributing factors

- ❑ One Angle of Attack sensor failed, leading to
  - Provide erroneous information to the systems
  - Wrongly activate the MCAS, and therefore
  - Trigger uncommanded repeated nose-down
- ❑ Crew was not able to
  - recognise the failure fully/timely
  - Properly counteract the nose down
  - Recover sustainable control of the aircraft

### Boeing's MCAS anti-stall system

The Maneuvering Characteristics Augmentation System (MCAS) is a safety feature designed to automatically lower the nose of the 737 MAX 8 aircraft if it detects a stall or loss of airspeed



Sources: Aviationweek.com, The Air Current

# Return to Service - EASA conditions

*Letter sent to the FAA on April 01, 2019.*

## 4 conditions:

1. Design changes proposed by Boeing are EASA approved (no delegation to FAA)
2. Additional and broader independent design review has been satisfactorily completed by EASA
3. Accidents of JT610 and ET302 are deemed sufficiently understood
4. B737 MAX flight crews have been adequately trained

# EASA design review

Objective: to ensure that no similar weaknesses in the design are present in the other (safety critical) areas of the 737 MAX design.

Activities are being carried out on the Flight Control System and all associated functions/systems including but not limited to the following: displays, alerting system, autopilot and air data system.

- Review of Functional Hazard Assessments and Safety Analysis
- Review of Development Assurance process
- Review of Flight Controls and Autopilot architecture and logics
- Review of Human Factors aspects
- Review of the methodology applied for the assessment of the Crew Training needs

# EASA activities

- *Unprecedented level of effort*, involving around 20 multi-disciplinary experts, including test pilots and engineers, 2-3 weekly web-based meetings with Boeing, review of 500+ documents and actions
- EASA requirements for flight/Simulator evaluation communicated on May 22. **70 test points** requested to be evaluated, covering:
  - Normal operations (identification of MCAS operation)
  - Abnormal operations (AoA failures, stabiliser runaway, MCAS inoperative,...)
- Simulators evaluation performed in June and July.

# EASA findings

## Significant technical issues:

- Lack of exhaustive monitoring of the system failures resulting in a stabiliser runaway
- Too high forces needed to move the manual trim wheel in case of a stabiliser runaway
- Too late disconnection of autopilot near stall speed (in specific conditions)
- Too high crew workload and risk of crew confusion in some failure cases, especially Angle of Attack single failure at take-off

**Findings communicated to Boeing and FAA in July 2019**

# Latest status

## Solutions proposed by Boeing

- Extensive change to the Flight Control Computer architecture and logics (incl. Autopilot)
- Improved crew procedures (and associated training)
- Improved architecture and/or logics for the Angle of Attack system



## Assessment by EASA

Independence of monitoring and execution roles, increased robustness

Simplification of procedures, work in progress

Still no appropriate response to Angle of Attack integrity issues

# Next major milestones

- Safety assessment of the new design changes proposed by Boeing, including operational procedures
- Human factor evaluation and functional tests of the new software
- **Flight tests** on a modified B737 max [one full week - at Boeing Flight Test Center]
  - ✓ MCAS operations (nominal behavior)
  - ✓ Flight without MCAS (including high speed turns and stall)
  - ✓ Scenario of stabiliser runaway (uncommanded MCAS activation, manual trim wheel forces)
  - ✓ Approach to stall with autopilot engaged
- **Crew Training requirements**, in particular using Computer Based Training or Simulator
- **Coordination with EASA Member States on Return to Service actions**



# Thank you for your attention!

[easa.europa.eu/connect](https://easa.europa.eu/connect)



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