# BALPA Flight Safety Comments on FAA Proposed Airworthiness Directive (AD) for B737 MAX Return to Service (ref: FAA-2020-0686)

## Overview

Whilst it is acknowledged that the proposed AD focuses specifically on airworthiness related solutions to mitigate the unsafe MCAS condition on the B737 MAX, there are numerous other outstanding issues arising from the accident investigations and subsequent technical reviews (e.g. Joint Authorities Technical Review) still to be resolved. Given that many of these issues are systemic in nature and are relevant to the certification of all aircraft, we call on the FAA to again engage in a public consultation on how it proposes to address them.

It is strongly felt that all future substantial aircraft design changes should result in certification as a new type with a commensurate level of training required for pilots. This training should suitably equip pilots with the operational knowledge and skills to transition from one aircraft type/variant to another, and to handle all emergency scenarios comprehensively and with confidence. It is also felt that fundamental aircraft flying or handling quality deficiencies should not be masked by flight control augmentation systems but instead should require aerodynamic re-design from the outset, wherever possible. Above all, the piloting community needs to be able to trust regulatory authorities to act independently, thoroughly and to robustly enforce their regulations so that commercially driven decisions cannot be allowed to adversely impact safety again.

## Specific Comments on Proposed AD

### Page 3, Proposed Design Changes

- *"These revised flight control laws would use inputs from both AOA sensors to activate MCAS"* – This is clearly an improvement on the original design, but it would be preferable for the system to utilise three AoA sensors (as per the Airbus A320 family of aircraft) in which case 'voting' can be implemented to discard an erroneous AoA value. There are other systems onboard the aircraft requiring AoA input, so how will they deal with two sensors that disagree?

- *"If the difference between the AOA sensor inputs is above a calculated threshold, the FCC would disable the speed trim system (STS), including its MCAS function"* – What if there are two "valid erroneous" AoA values that do not differ by more than 5.5. degrees but are sufficiently large to trigger MCAS? Is this viewed as an extremely improbable event?

- *"…the revised flight control laws would permit only one activation of MCAS per sensed high AOA event"* – Will there be a PFD annunciation alerting the flight crew that an MCAS activation is taking place (to aid their situational awareness)? The importance of an 'attention-getting' facility was highlighted in the AAIB investigation of the Kegworth accident (ref the engine vibration indicators on the B737-400 Engine Instrument System).

- *"The updated MDS software would implement an AOA DISAGREE alert on all 737 MAX airplanes… the FAA is proposing to mandate this software update"* – BALPA strongly supports such a mandate to ensure that all MAX aircraft are so equipped. It

is also arguable that the AoA gauge (currently an option) should be a standard fit to help enhance pilot situational awareness (or at least be a no-cost option).

**Page 4, Proposed Design Changes**

- *"Finally, the checklist would be revised to add a reference item to manually trim the horizontal stabilizer for pitch control, and note that a two-pilot effort may be used to correct an out-of-trim condition"* – Requiring both crew members to turn the trim wheel simultaneously in a non-normal scenario is extremely undesirable and goes against all philosophies of having one pilot fly and one run the QRH. No flight control system should require both pilots to operate it at any stage, let alone in an emergency. The FCOM/FCTM has not included a procedure such as the 'yo-yo/roller coaster' manoeuvre as a mitigation to move the stabilizer trim wheel at high speed for quite some time. It is felt that this should be reconsidered (particularly in light of the smaller diameter trim wheel as fitted to the MAX to enable the new larger screens to fit, and as per the scenario observed in the Ethiopian Airlines accident). There needs to be assurance that the stabilizer trim wheel can be operated at speeds of up to, say, Vmo +40 kts by a single pilot.

- General comments on revised checklists:
    - Will applicable changes also be applied to the B737 NG AFM? If not, there is a risk of pilots that regularly interchange between NG and MAX becoming confused if they need to use a non-normal checklist item during an emergency.

    - In an emergency, it can be difficult for flight crew to quickly diagnose faults and prioritise checklists, and this is exacerbated with the need to complete two or more memory items at the same time (e.g. airspeed unreliable and stabilizer runaway). Has thought been given to merge the two memory items/checklists into one to create an 'MCAS memory item/checklist'?

**Page 8, Figure 2 to paragraph (h)(3) – AFM revision: Airspeed Unreliable**

- *"Stick shaker, overspeed warning and airspeed low alerts may sound erroneously or simultaneously"* – Simultaneous activation of stick shaker and overspeed warning will be extremely confusing for pilots. There needs to be a procedure for cancelling a known spurious stick shaker activation.

**General Comments**

- A fundamental issue at the heart of the MAX tragedies would seem to be the practice of modifying aircraft in such a way that deemed sufficient commonality (e.g. with existing systems) precludes the need for a level of certification rigor that arguably the modification deserves. The Kegworth accident can again be cited in which the design of the B737 Engine Instrument System (EIS) represented a minimum change from the previous hybrid display such that pilots did not need to be separately rated for EIS-equipped models. Had this been required and had the system been evaluated (with the involvement of line pilots) for its efficiency in imparting information to pilots, then perhaps a different outcome may have occurred.

- There are numerous other airworthiness related safety issues affecting the MAX (e.g. LEAP engine secondary gearbox drive directives, flawed slat-track assemblies, inadequate electrical bonding on LEAP engine nacelle/strut, etc.). Can the FAA provide assurance that these issues have also been satisfactorily addressed?

**BALPA Wish List for Future Aircraft Design & Certification, Flight Crew Training and Regulatory Oversight**

Aviation regulatory authorities to:

- Require that fundamental aircraft flying or handling quality deficiencies are aerodynamically designed out and not masked by flight control system augmentation.
- Require that substantial aircraft design changes result in certification as a new type with a commensurate level (breadth and depth) of training required for pilots (e.g. through a review of the Changed Product Rule and associated guidance material).
- Require that no aircraft system be reliant on just a single input of a critical data source (such as a single AoA sensor).
- Require at least three AoA sensors to be fitted to transport category aircraft (with at least two being physical sensors and if a synthetic sensor is used, then for it to perform to an equivalent level to the physical sensors).
- Review the logic for triggering and cascade of cockpit warnings/alerts in the event of a single faulty sensor to avoid overloading flight crew with multiple actions.
- Review the assumptions made about the efficacy of pilot interventions as a mitigation for system failures, particularly in terms of timeliness and consistency of response.
- Review training requirements to improve pilots' ability to diagnose and manage complex technical failures.
- Review the efficacy of type rating training to suitably equip pilots with the operational knowledge and skills to transition from one aircraft type/variant to another, and to handle all emergency scenarios comprehensively and with confidence.
- Require that descriptions of aircraft technical systems such as MCAS are included in appropriate aircraft operational documentation such as the FCOM (and not hidden from flight crew).
- Review the level of validation work required to accept the certification decision of another regulatory authority (based on the significance of the certification task).
- Review the effectiveness of oversight arrangements for Design Organisation approvals (particularly where Organisation Designation Authorisation (ODA) arrangements are in place) and ensure resilience against regulatory capture.
- Review the in-service operational data requirements necessary to validate aircraft design and pilot performance assumptions.
- Ensure that OEMs cannot charge extra for aircraft equipment that demonstrably increases flight safety and arguably should be standard fit.