中国民用航空局 CIVILAVIATION ADMINISTRATIONOFCHINA

C A A C

适航指令征求意见通知

NOTICE OF PROPOSED AIRWORTHINESS DIRECTIVE

编号：NPAD-2021-0012

一. 标题

机动特性增强系统（MCAS）不安全状态的改正

二. 适用范围

本指令适用于所有序列号的波音 737-8 飞机。

三. 征求意见期限

征求意见的截止日期为 2021 年 11 月 26 日。

四. 参考文件

1.CAD2018-B737-21（2018 年 12 月 21 日发布）

2.波音紧急要求通告 737-22A1342 RB（2020 年 11 月 17 日发布）

3.波音特别关注服务通告 737-00-1028（2020 年 7 月 20 日发布）

4.波音特别关注服务通告 737-27-1318（2020 年 6 月 10 日发布）

5.波音特别关注服务通告 737-27-1318 Revision 1（2020 年 6 月 24 日发布）

6.波音特别关注服务通告 737-27-1318 Revision 2（2020 年 11 月 20 日发布）

7.波音 AMOC 通知 737-27-1318 AMOC 01（2020 年 11 月 25 日发布）

8.波音 AMOC 通知 737-27-1318 AMOC 02（2020 年 12 月 23 日发布）

9.波音 AMOC 通知 737-27-1318 AMOC 03（2020 年 12 月 23 日发布）

10.波音特别关注服务通告 737-31-1860（2020 年 6 月 12 日发布）

11.波音特别关注服务通告 737-31-1860 Revision 1（2020 年 7 月 2 日发布）

12.波音服务通告 737-27-1320（2020 年 10 月 14 日发布）

13.Boeing 737 MAX B-737-8/-8200/-9 MMEL, Revision 3（2021 年 04 月 12 日发布）

五. 原因

波音 737-8 飞机先后发生印尼狮航和埃塞俄比亚航空两起空难，调查结果表明两起事故的发生皆因当波音 737-8 飞机处于人工飞行且襟翼收上的状态，错误的高迎角输入反复激活机动特性增强系统（MCAS，Maneuvering Characteristics Augmentation System），导致水平安定面重复低头配平，飞行机组在多重告警的干扰下，无法有效识别定位故障并采取措施，最终造成飞机失去控制。

为了解决上述不安全状态，波音启动了飞行控制系统软件和显示系统软件的设计更改工作，中国民用航空局在对波音提交的飞行控制系统软件设计更改、显示系统设计更改、飞机飞行手册修订、水平安定面配平线束敷设改装等相关改正措施开展了全面的评估后，确认相关改正措施能消除上述不安全状态。

基于以上情况，为了消除上述不安全状态，中国民用航空局颁发本适航指令，替代 CAD2018-B737-21，要求贯彻实施飞行控制计算机操作程序软件（FCC OPS）的安装与验证、MAX 显示系统软件（MDS）的安装与验证、水平安定面配平线束敷设的改装、迎角（AOA）传感器系统的测试、安装失速警告系统抖杆跳开关按键（带有颜色的键帽）、飞机飞行手册的修订、MEL 的修订等改正措施。

六. 拟采取的措施和规定

本指令替代 CAD2018-B737-21　　39-9644

除非之前已完成，应在本指令规定的时间内完成相应工作。

1.飞行控制计算机操作程序软件（FCC OPS）的安装与验证

下次飞行前，按照波音紧急要求通告 737-22A1342 RB（2020 年 11 月 17 日发布）的施工指南，在飞控计算机（FCC）A 和 B 上安装

P12.1.2 版本的飞行控制计算机操作程序软件（FCC OPS）（件号 2274-COL-AC2-26 或后续经批准的件号），并进行安装验证。在安装测试中，若发现飞控计算机 A 和 B 未显示件号 2274-COL-AC2-26 或后续经批准的件号，则应采取纠正措施，直到在飞控计算机 A 和 B 上安装有经批准的飞控软件版本。自本适航指令生效后，后续批准的、并且仅是波音的软件版本，可被确认为是由局方批准的型号设计中对应软件的替代版本。

注 1：波音 737-7/8/8200/9/10 飞机维修手册（AMM）Section 22-11-33 包含安装 FCC OPS 并开展安装测试的指南。

注 2：可在波音紧急要求通告 737-22A1342RB（2020 年 11 月 17 日发布）索引的波音紧急服务通告 737-22A1342（2020 年 11 月 17 日发布）找到本段要求的施工指南。

2.MAX 显示系统（MDS）软件的安装与验证

下次飞行前，按照波音特别关注服务通告 737-31-1860 Revision 1（2020 年 7 月 2 日发布）的施工指南，完成所有标识为“RC”的适用措施。

3.水平安定面配平线束敷设更改

下次飞行前，按照波音特别关注服务通告 737-27-1318 Revision 2（2020 年 11 月 10 日发布）及 737-27-1318 AMOC 01（2020 年 11 月 25 日发布）或 737-27-1318 AMOC 02（2020 年 12 月 23 日发布）的施工指南，完成所有标识为“RC”的适用措施。

4.安装失速警告系统抖杆跳开关按键（带有颜色的键帽）

下次飞行前，按照波音服务通告 737-27-1320（2020 年 10 月 14 日）的施工指南，完成失速警告系统抖杆跳开关按键（带有颜色的键帽）的安装。

5.修订飞机飞行手册

下次飞行前，从 AFM 审定限制和操作程序中删除 CAD2018-B737-21 要求的信息，并按（2）至（12）的要求修订 AFM，也可将图 1 至图 11 直接插入 AFM。

（1）在审定限制和操作程序章节，删除 CAD2018-B737-21 要求

的信息。

（2）在操作程序章节，修订综述段落以包含图 1 的信息。

图 1 **AFM Revision: General Paragraph**

Definitions: **Required by CAD2021-B737-XX**
Recall items are minimum immediate action items. Reference items are accomplished after Recall items have been accomplished.

（3）在操作程序章节，以图 2 的信息替代已有的空速不可靠(Airspeed Unreliable)段落。

图 2 **AFM Revision: Airspeed Unreliable**

Airspeed Unreliable (E) **Required by CAD2021-B737-XX**
Airspeed or Mach indications are suspected to be unreliable: Recall: If autopilot is engaged, disengage. If autothrottle is engaged, disengage. Set both F/D swiches to off. Set the following gear up pitch attitude and thrust: Flaps extended: 10 °and 80% N1 Flaps up: 4 °and 75% N1 Reference: PROBE HEAT swiches check on. The following indications are reliable: attitude, N1, ground speed, and radio altitude. **Notes:** 1. Stick shaker, overspeed warning and airspeed low alerts may sound erroneously or simultaneously. 2. The flight path vector and pitch limit indicator may be unreliable on the PFD and HUD (as installed). 3. If the AOA indicator option is installed, the stick shaker indicator may be unreliable. AOA digital readout, analog needle, and approach reference band may be unreliable if the airspeed unreliable condition is caused by erroneous AOA. Attempt to determine a reliable airspeed indication. If a reliable airspeed indication can be determined: Use the reliable airspeed indication for the remainder of the flight. If only the standby airspeed indication is reliable do not use autopilot, autothrottle, or flight directors. If the captain’s or first

officer's airspeed indication is reliable, turn on the flight director switch on the reliable side. If needed, engage autopilot on the reliable side. Do not use autothrottle.

Note: Autopilot may not engage or may disengage automatically.

If a reliable airspeed indication cannot initially be determined:

Using performance tables from an approved source, set the pitch attitude and thrust setting for the current airplane configuration and phase of flight. When in trim and stabilized, compare the captain, first officer, and standby airspeed indicators with the airspeed shown in the table. An airspeed indication that differs by more than 20 knots or 0.03 Mach from the airspeed shown in the table should be considered unreliable. If only the standby airspeed indication is reliable, do not use autopilot, autothrottle, or flight directors. If the captain's or first officer's airspeed indication is reliable, turn on the flight director switch on the reliable side, and autopilot if needed. Do not use autothrottle.

Note: Autopilot may not engage or may disengage automatically.

If a reliable airspeed indication cannot be determined:

Using performance tables from an approved source, set pitch attitude and thrust setting for the airplane configuration and phase of flight as needed. Reference an approved source for landing distances.

Note: 1. Maintain visual conditions if possible.

2. Establish landing configuration early.

3. Radio altitude reference is available below 2500 feet.

4. Use electronic and visual glideslope indicators, where available, for approach and landing.

Attempt to determine a reliable altitude indication.

If the captain's or first officer's altitude indication is reliable:

Use the most reliable altitude indication for the remainder of the flight. The airplane may not meet RVSM requirements. Set transponder to reliable side and select traffic alerts only mode.

If captain's and first officer's altitude indications are both unreliable:

Turn off transponder altitude reporting.

Note: Airplane does not meet RVSM requirements.

A nuisance stick shaker may be deactivated at pilot's discretion. This improves recognition of a stall warning on the opposite side.

Note: Elevator Feel Shift may be active, resulting in increased control column forces.

If deactivating stick shaker is needed: Only the active stick shaker should be deactivated. Deactivate erroneous stick shaker.

Note: 1. When the circuit breaker is pulled, increased control column forces due to Elevator Feel Shift activation are removed.

2. The stick shaker on the opposite side is not deactivated.

If deactivating stick shaker is not needed; end of procedure except deferred items.

In addition to the normal descent, approach and landing checklists, complete the following deferred items:

For approach, only set the BARO minimums on the reliable PFD. Remove the BARO minimums from the unreliable PFD.

Note: If BARO minimums are set only on the first officer's PFD, DA/MDA aural callouts are not provided. In the event of a go-around, do the normal go-around procedure except refer to the Flight with Unreliable Airspeed go-around table to determine the go-around pitch setting.

In the event of a go-around if either the captain's or first officer's airspeed indication is reliable, when TO/GA is pushed, the flight director pitch bar may be removed. Selection of an AFDS pitch mode change, such as LVL CHG, restores the flight director pitch bar.

Note: Only use flight director guidance on the reliable PFD.

In the event of a go-around and the standby airspeed indication is the only reliable airspeed, do not use TO/GA.

（4）在操作程序章节，以图 3 的信息替代已有的安定面失控（Runaway Stabilizer）段落。

图 3 **AFM Revision: Runaway Stabilizer**

Runaway Stabilizer (E) **Required by CAD2021-B737-XX**

If uncommanded stabilizer movement occurs continuously or in a manner not appropriate for flight conditions:

Recall:

Firmly hold control column. Disengage autopilot if engaged. Disengage autothrottle if engaged. Use the control column and thrust levers to control airplane pitch attitude and airspeed. Use main electric

stabilizer trim to reduce control column forces.

If the runaway stops after autopilot is disengaged, do not re-engage autopilot or autothrottle; end of procedure.

If the runaway continues after autopilot is disengaged, place both STAB TRIM cutout switches to CUTOUT.

If the runaway continues, grasp and hold stabilizer trim wheel.

Reference:

Trim the stabilizer manually.

Notes:

1. A two-pilot effort may be used to correct an out of trim condition.
2. Reducing airspeed reduces air loads on the stabilizer which can reduce the effort needed to manually trim. Anticipate trim requirements. Do not re-engage autopilot or autothrottle.

In addition to the normal descent, approach and landing checklists, complete the following deferred item:

Establish landing configuration and in-trim condition early on final approach.

（5）在操作程序章节，以图 4 的信息替代已有的安定面配平不工作（Stabilizer Trim Inoperative）段落。

图 4 **AFM Revision: Stabilizer Trim Inoperative**

Stabilizer Trim Inoperative **Required by CAD2021-B737-XX**

Loss of electric trim through the main electric stabilizer trim switches, or when directed by the Stabilizer Out of Trim procedure.

Place both STAB TRIM cutout switches to CUTOUT. The autopilot is not available. Trim stabilizer manually. A two-pilot effort may be used and will not cause system damage.

Notes:

1. Reducing airspeed reduces air loads on the stabilizer which can reduce the effort needed to manually trim.
2. If the failure could be due to ice accumulation, descend to a warmer temperature and attempt again to trim manually.

If the stabilizer can be trimmed manually, anticipate trim requirements.

If the stabilizer cannot be trimmed manually, expect higher than normal elevator forces during approach and landing. The thrust reduction at flare will cause a nose down pitch.

Plan a flaps 15 landing. Set Vref 15+10 knots.

Note: The maximum wind additive should not exceed 5 knots. Check the non-normal landing distance tables in an approved source.

In addition to the normal descent, approach and landing checklists, complete the following deferred items:

Review the normal go-around procedure. During a go-around, advance thrust to go-around smoothly and slowly to avoid excessive pitch-up.

Establish landing configuration early on final approach.

（6）在操作程序章节，以图 5 的信息替代已有的速度配平失效（Speed Trim Fail）段落。

图 5 **AFM Revision: Speed Trim Fail**

Speed Trim Fail **Required by CAD2021-B737-XX**

The Speed Trim function and MCAS function are inoperative.

Continue normal operation.

Note: The Speed Trim System will not provide stabilizer trim inputs when deviating from a trimmed airspeed.

（7）在操作程序章节，以图 6 的信息替代已有的安定面失去配平（Stabilizer Out of Trim）段落。

图 6 **AFM Revision: Stabilizer Out of Trim**

Stabilizer Out of Trim **Required by CAD2021-B737-XX**

The STAB OUT OF TRIM light illuminates for the following conditions:

On the ground: A partial failure of a Flight Control Computer.

In-flight: the autopilot does not set the stabilizer trim correctly.

If on ground, do not take off. End of procedure.

In flight, during large changes in trim requirements, the STAB OUT OF TRIM light may illuminate momentarily. If the stabilizer is trimming, continue normal operation; end of procedure.

In flight, if the stabilizer is not trimming, hold control column firmly. Disengage autopilot. Disengage autothrottle if engaged. Use main electric stabilizer trim as needed.

If the stabilizer responds to electric trim inputs, do not re-engage the autopilot or autothrottle; end of procedure.

If the stabilizer does not respond to electric trim inputs, accomplish the Stabilizer Trim Inoperative procedure.

（8）在操作程序章节，增加图 7 中的信息。

图 7 **AFM Revision: AOA Disagree**

AOA Disagree **Required by CAD2021-B737-XX**

When AOA DISAGREE appears on the PFD, this indicates the left and right angle of attack vanes disagree. Accomplish the Airspeed Unreliable procedure.

（9）在操作程序章节，增加图 8 中的信息。

图 8 **AFM Revision: ALT Disagree**

ALT Disagree **Required by CAD2021-B737-XX**

The ALT DISAGREE alert is displayed on the captain's and first officer's altitude tape on the PFD when the indications disagree.

If the IAS DISAGREE alert is also shown on the speed tape of the PFD, accomplish the Airspeed Unreliable procedure.

If the IAS DISAGREE is not shown, check all altimeters are set to correct barometric setting.

If the ALT DISAGREE alert extinguishes, continue normal operation.

If the ALT DISAGREE alert remains, standby altimeter is available, do not use the flight path vector, maintain visual conditions if possible and if a reliable altitude is determined, use the transponder for the reliable side.

Note: Airplane does not meet RVSM requirements.

If a reliable altitude is not determined, set the transponder to not transmit altitude.

In addition to the normal descent, approach and landing checklists, complete the following deferred items:

For approach, only set the BARO minimums on the reliable PFD. Remove the BARO minimums from the unreliable PFD.

Note: If BARO minimums are set only on the First Officer's PFD, DA/MDA aural callouts are not provided.

Establish landing configuration early.

Radio altitude reference is available below 2,500 ft.

Use electronic and visual glideslope indicators where available for approach and landing.

（10）在操作程序章节，增加图 9 中的信息。

图 9 **AFM Revision: IAS Disagree**

IAS Disagree **Required by CAD2021-B737-XX**

When IAS DISAGREE appears on the PFD, this indicates the captain's and first officer's airspeed indicators disagree. Accomplish the Airspeed

Unreliable procedure.

（11）在运行数据章节，增加图 10 中的信息。

图 10 **AFM Revision: Practical Operational Flight Envelope (POFE)**

Practical Operational Flight Envelope (POFE)

Required by CAD2021-B737-XX

The Practical Operational Flight Envelope describes the boundaries where compliance to the controllability and maneuverability requirements of 14 CFR Part 25 are met with a single failure of any Stability Augmentation, Automatic, or Power-Operated System.

For Speed Trim System Inoperative, the controllability and maneuverability requirements of 14 CFR Part 25.672(c)(2) are met Flaps Up at load factors up to +1.8g or prior to initial buffet, at speeds up to Vmo/Mmo. Beyond this envelope, column forces may be slightly lower than normal.

（12）在运行数据章节，增加图 11 中的信息。

图 11 **AFM Revision: AOA DISAGREE Alert Latching Logic**

AOA DISAGREE Alert Latching Logic

Required by CAD2021-B737-XX

1. AOA DISAGREE Alert Latching Passing 400AGL:

The AOA DISAGREE alert logic is active when the airplane is above 400 feet RA.

If the AOA DISAGREE alert is shown when descending through 400 feet RA, the alert remains until landing.

2. AOA DISAGREE Alert Latching with Radio Altitude Loss:

At all altitudes (above and below 400 feet), if the Radio Altitude data is lost, the AOA DISAGREE is displayed based on its previous state. If the AOA DISAGREE alert was displayed prior to loss of Radio Altitude, the AOA DISAGREE alert is latched as displayed. If the AOA DISAGREE alert was not displayed prior to loss of Radio Altitude, the AOA DISAGREE alert is not displayed. The latching remains until landing or until Radio Altitude data is received by the MDS.

The only unique flight deck effect in this condition is that the AOA DISAGREE alert may only be displayed on one PFD.

3. AOA Indicator Option:

The AOA DISAGREE alert is based on vane angle and the AOA

indicator is based on body angle.

6.修订 MEL

下次飞行前，按 CAAC 认可的 MMEL（Boeing 737 MAX B-737-8/-8200/-9 MMEL, Revision 3（2021 年 04 月 12 日发布）以及后续修订的版本）修订 MEL 以包含图 12 的要求。当按照本适航指令改装后的飞行控制系统的飞机功能不工作时，允许按照经局方批准的 MEL 放行飞机。

图 12 ***MEL Provisions***

(1) Dispatch is not permitted with both autopilot systems inoperative. (2) The autopilot disengage aural warning system must be operative for dispatch. (3) The STAB OUT OF TRIM light must be operative for dispatch. (4) The speed trim function must be operative for dispatch. (5) The SPEED TRIM FAIL light must be operative for dispatch. (6) Dispatch is not permitted with both A/P ENGAGE Command(CMD) Switches (A and B) inoperative. (7) Dispatch is not permitted with both A/P ENGAGE Command(CMD) Switch lights inoperative. (8) Dispatch is not permitted with both autopilot (A/P) disengage lights inoperative. Dispatch may be made with one A/P disengage light inoperative provided the autopilot disengage aural warning system operate normally. (9) Dispatch is not permitted with both Control Wheel Autopilot Disengage Switches inoperative. Dispatch may be made with one control wheel autopilot disengage switch inoperative provided the following conditions are met. a) Mode Control Panel autopilot DISENGAGE bar operates normally. b) Autopilot is not used below 1,500 feet AGL, and c) Approach minimums do not require use of autopilot. (10) Both control wheel trim switch systems must be operative for dispatch.

7.迎角传感器系统的测试

下次飞行前，按照波音特别关注服务通告 737-00-1028（2020 年 7 月 20 日发布）的施工指南，完成其中“迎角（AOA）传感器系统

测试”所有标识为“RC”的适用措施。

8.运行准备飞行

（1）下次飞行前，在完成本适航指令 1-7 要求的措施后，按照波音特别关注服务通告 737-00-1028（2020 年 7 月 20 日发布）的施工指南，完成其中“运行准备飞行（Operational Readiness Flight）”所有标识为“RC”的适用措施。“运行准备飞行（Operational Readiness Flight）”需在其它飞行前完成。“运行准备飞行（Operational Readiness Flight）”无需申请特许飞行证。

（2）完成“运行准备飞行（Operational Readiness Flight）”之后，在下次飞行前，所有“运行准备飞行（Operational Readiness Flight）”期间发生的任何机械故障（mechanical irregularities）都必须按照经局方批准的航空公司维修大纲加以解决（如适用）。

9.特许飞行

可按照 CCAR21 部相关规定申请特许飞行证将飞机调至可完成本适航指令相关措施的地点。

10.认可已完成的措施

（1）认可在本适航指令生效之前已按波音特别关注服务通告 737-31-1860（2020 年 6 月 12 日发布）完成的相关措施满足本适航指令六.2 段的要求。

（2）若 737-27-1318 Revision 2（2020 年 11 月 20 日发布）中“Description”1.D 段中所列的 14 项 IDR（Installation Deviation Records）及 737-27-1318 AMOC 01（2020 年 11 月 25 日发布）或 737-27-1318 AMOC 02（2020 年 12 月 23 日发布）已在飞机上贯彻，在本适航指令生效之前已按波音特别关注服务通告 737-27-1318（2020 年 6 月 10 日发布）或 737-27-1318 Revision 1（2020 年 6 月 24 日发布）及 737-27-1318 AMOC 03（2020 年 12 月 23 日发布）完成相关措施可认为满足本适航指令六.3 段的要求。完成 737-27-1318 Revision 2（2020 年 11 月 20 日发布）“Description”1.D 段中未包含但已获局方批准的 IDRs，若这些 IDRs 引至 737-27-1318 Revision 1（2020 年 6 月 24 日发布），可认为符合 737-27-1318 Revision 1（2020 年 6 月 24 日发布）标识为“RC”的相关要求。

11.等效替代

（1）完成本适航指令可采取能保证安全的等效替代方法或调整完成的时间,但必须得到适航审定部门的批准。

（2）在使用任何经批准的等效替代方法之前，通知有关飞行标准部门的主管监察员。

七. 意见反馈要求

要求所有意见反馈应通过《适航指令征求意见通知回执》填写，并通过联系邮件反馈。

八. 联系人：

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