



August 8, 2021

### **Comment of FlyersRights.org**

Another day and another piece of evidence indicating that the Boeing 737 MAX is not as safe as it should be and that the FAA did not take safety seriously enough when working to unground the plane.

When ungrounding the 737 MAX in November 2020, FAA Administrator Steve Dickson proclaimed that the 737 MAX was completely safe, announcing that the FAA can “assure the global community that the 737 MAX is safe to operate.”<sup>1</sup> Administrator Dickson repeated his promise from earlier in 2020 that “[w]e have not left anything to chance here. I would put my own family on it, and we will fly on it.”<sup>2</sup> Administrator Dickson also promised full transparency to Congress and the public, that it would know everything he knew before the plane was ungrounded. But Congress disagrees and the FAA has kept all substantive documents secret rejecting FlyerRights.org FOIA request and scores of others.

Accordingly from information that is publicly available, passengers should not trust the Boeing 737 MAX. And the FAA should not have ungrounded the plane without independent experts gain access to technical data and documents that convinced the FAA, once again, that the 737 MAX is safe.

We renew our challenge to the FAA to release the technical details of the fix to allow independent experts to evaluate the aircraft. By keeping these documents secret, the FAA is relying on a body of private law.

From a safety perspective, it is baffling how the FAA would address a known problem in undelivered aircraft before delivered aircraft flying thousands of passengers per day.

The need for these CMRs, like many other recent revelations, underscore how the FAA and Boeing need to deliver on their transparency pledges and release important technical

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<sup>1</sup> [https://www.washingtonpost.com/local/trafficandcommuting/boeing-737-max-ungrounded/2020/11/18/c4d6c1a8-2902-11eb-8fa2-06e7cbb145c0\\_story.html](https://www.washingtonpost.com/local/trafficandcommuting/boeing-737-max-ungrounded/2020/11/18/c4d6c1a8-2902-11eb-8fa2-06e7cbb145c0_story.html)

<sup>2</sup> <https://www.cnbc.com/2020/11/18/cnbc-excerpts-cnbc-exclusive-faa-administrator-steve-dickson-speaks-with-cnbc-squawk-box-today.html>; <https://www.npr.org/2020/09/30/918924566/i-like-what-i-see-faa-chief-flies-737-max-but-not-ready-to-recertify-plane>

documents to the public and independent experts. See Attachments 1 & 2 for current analysis of this AD by two highly qualified experts.

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## Attachment 1

### 1. Use of failure probabilities in Safety Analyses

The analyst starts by naming a top-level failure mode. As a simple example, for the MCAS this might be “MCAS does not activate when needed, even though no indications or warnings have occurred to let anyone know that it is not available”. That’s quite a lot of words, but we want to be sure we know exactly what we are analyzing.

The analyst will then look at all the parts and functions of the system to identify what failures could lead to this top-level failure mode. Typically there will be a sequence of failures that need to occur, let us assume that a warning mechanism fails first, in a way that will not result in the desired warning when needed, and then the second failure is the fault that the warning was there to warn about and thus protect from. The combined probability of these two faults must be shown to be less than (or equal to) the maximum probability that is acceptable according to the safety regulations<sup>3</sup>.

We know that for the original MCAS this two-fault type of scenario was not the case for the failure mode “MCAS activates, repeatedly, in a flight regime that it was not designed for”. All it took was for one AoA sensor to fail and there was no warning in the system designed to raise a flag that it would manifest as runaway of the horizontal stabilizer trim function<sup>4</sup>. But we have been told that problem has been designed out in the current MCAS so we continue with the postulated example.

The warning function is known to be operable at entry into service because production tests are performed to ensure that. The probability of failure of the warning function increases with time in service, and at some point it may become great enough that the probability of the top-level event exceeds the maximum probability that is acceptable. If so, this situation can be dealt with by an in-service test that once again verifies that the warning function has not failed and resets

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<sup>3</sup> The safety regulations require the probability of the top-level failure mode to be smaller if the fault is more severe.

<sup>4</sup> And of course we also know that the flight crews were denied foreknowledge that this could happen.

the probability number back to zero<sup>5</sup>. This test will be required to be performed at (or before) a defined number of operating hours, and the Boeing/FAA terminology is Certification Maintenance Requirement (CMR). These are what are introduced in the latest AD and are shown in the table (“Figure 1 to paragraph (g)”).

**The issues with the new AD and the original return to service AD are (a) that the original one only mentions two CMRs (and then only in some text responding to comments submitted) whereas this AD makes three CMRs requirements. If CMRs need to be added for MCAS safety then (b) the original AD seems to be lacking rigor. And (c) if there are three CMRs required then the original AD appears to have omitted one.**

I think we know enough about the aisle stand switches to use them as an example. Their purpose is to disable the horizontal stabilizer trim system – in order to stop a trim runaway. They do this by being closed (completing circuits) in normal operation and being open (breaking the circuits) when operated in response to an emergency checklist. But switches may fail (break internally) so that they can’t open the circuits when operated, and/or wiring may fail such that short circuits bypass the switches. In the table, the aisle stand switch CMR, 27-CMR-09 tests to see that these faults have not occurred in the previous 12000 Flight Hours and provides confidence that they will operate when needed with sufficiently high probability to satisfy the safety probability number allocated to the top-level failure mode “Aisle stand switch does not arrest runaway of horizontal stabilizer trim system when operated”.

## 2. The MCAS is an Anti-Trim system

I have repeatedly criticized this in comments submitted to the first AD. In discussion of comments to the first AD FAA dismisses my criticism with the rationale that the MCAS as modified is safe enough – therefore FAA does not need to consider alternative (I would say better and preferable) implementations that would provide the stick force gradient modification that are needed to satisfy handling qualities regulations. My position is that if stick force gradient needs to be modified then engineering common sense requires modifying the stick force gradient directly. Using out of trim forces as a proxy is a fundamentally more dangerous implementation.

I think that the public needs to know that FAA did in fact consider this issue, but it appears that the best I got from my comments was that they said I had assumed that reviews had taken place to consider whether MCAS should be persisted with or whether alternative solutions should be developed. Clearly, if reviews did in fact take place (and they certainly should have) the outcome was the decision to persevere with MCAS. Since they will not reveal why, one is tempted, almost forced, to hypothesize that reasons such as loss of face, cost, timescale and so on, rather than sound engineering principles, ruled the day.

## 3. Piecemeal solutions

I also made a note that I should include thoughts on the appearance given by these two ADs in that they seem to be dealing piecemeal with return to service requirements, rather than

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<sup>5</sup> This is an assumption that would need to be based on knowledge of the types of failures that would nullify the warning function.

holistically and as a rigorous set of actions traceable to the conclusions of a completed safety process. I hold that a return to service action should be comprehensive and rigorous. But of course the way that FAA works is reactively rather than proactively, so I doubt that my concern will receive much sympathy. However, one would think that with this high profile case they would have made sure to have got it right in one.

#### 4. Aerodynamic (Passive) handling enhancement vs. Electronic (Active)

I agree that an aerodynamic solution to the stick force gradient problem would be preferable. But active electronic handling enhancements, such as yaw damper (including turn coordinator), have been on Transport category airplanes since before I started in the industry. Done properly they have proved to be safe. Therefore I have chosen to accept that Boeing has gone the route of adding an active system to address the stick force gradient requirement. Of course I have no insight into what they tried aerodynamically and why they came to the decision, but once an electronic add-on becomes status quo the issue becomes whether it has been done properly. It wasn't. My focus is "Is it now?"

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August 8, 2021

#### Attachment 2

The main concern I have arises from the following contradiction: MCAS was originally deemed necessary for the Max to meet all the FAA certification requirements. But now, with the proposed "fix", MCAS turns off whenever there is disagreement between the two AOA sensors. So, for the remainder of that flight, the airplane is operating without MCAS. So, is MCAS required or not? If it is not, then why was it put into the design in the first place? If it is required, how can this be acceptable to turn it off and continue the flight? How often do we expect the AOA sensors to be out of agreement? I should note that this type of sensor is notoriously unreliable. Without a comprehensive review of the data by outside experts, there is no way of really understanding how risky the current Max is.

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August 7, 2021

#### Attachment