Second Comment of FlyersRights.org

Boeing, and by all public accounts, the FAA, seem persistent to tailor their actions to ensure that pilots do not need extra training. From day one of the planning of the 737 MAX, Boeing has been motivated by the desire to minimize the (1) regulatory costs of certifying the MAX as a new family of planes and (2) training costs to ensure pilots are aware of new features and how to react to theoretically unlikely, but known problems.

The FAA and DOT have not made transparent the process of determining if and when to unground the 737 MAX. Although investigations such as the DOT Inspector General’s Audit of the FAA’s 737 Certification Process should remain independent and confidential until completed, the two investigations appointed by the DOT and FAA have remained secretive and closed to outside perspectives. What is most troubling is that the FAA has signaled that it will not wait for any of the investigations to be completed before ungrounding the 737 MAX. The investigations include the DOT IG investigation, the Joint Authorities Technical Review, the DOT’s “Blue Ribbon” Panel, the FBI criminal investigation, and Congressional investigations.

The one place where the public, including independent safety experts, can make their perspectives known is through comments here on the Flight Standardization Board’s proposed decision to continue to not require simulator training for 737 MAX pilots. It is here that FlyersRights.org, on behalf of airline passengers, can tell the FAA to slow down its process of re-approving the 737 MAX, to consider the opinions of independent experts, and to put an end to the “profits over safety” approach that incentivized Boeing to downplay the changes made to the 737 MAX in its attempt to sell the plane as a 737 to the FAA, to airlines, and to the public.

Having to install larger, more fuel efficient engines on the same fuselage dating back to the 1960’s, while also attempting to minimize outward and obvious changes that would attract the attention of the FAA and clearly require substantial pilot training, led Boeing to propose a software fix: MCAS.

The only problem with MCAS, however, was that it was a badly-written piece of software\(^1\) relying on only one error-prone angle of attack sensor input\(^2\), whose existence was not disclosed to airlines or pilots\(^3\), that operated differently than Boeing anticipated and told the

\(^{1}\) Gregory Travis Declaration


FAA\(^4\), and that could not be overridden, in certain flying conditions\(^5\), by following the checklists provided by Boeing.

And while Boeing appears to still be working on that software fix, ensuring the redundancy features first deemed optional by the FAA are installed, and ensuring that these redundancy features work as advertised, the FAA’s Flight Standardization Board still proposes no simulator training requirements. This proposal is not supported by the Allied Pilots Association, Capt. Sully Sullenberger, other aviation and software experts, and the public.

According to Capt. John Cox, formerly the top safety official for the Air Line Pilots Association, MCAS creates a condition similar to a runaway stabilizer. But corrective action for a runaway stabilizer problem, the “roller coaster” technique, was no longer included in training manuals sometime after 1982. Capt. Cox has said that runaway stabilizer ceased to be a problem after the 737-200\(^6\). Starting with the 737-300, “the product got so reliable you didn’t have that failure.”\(^7\)

This “roller coaster” technique is counterintuitive. If it were included in the pilot’s manual, pilots would be more likely to correct MCAS errors.

The Allied Pilots Association has argued that the proposed training requirements are insufficient. APA argues that more computer training “will not provide a level of confidence for pilots to feel not only comfortable flying the aircraft but also relaying that confidence to the traveling public.”\(^8\)

Capt. Sully Sullenberger states that “he agrees wholeheartedly with no reservations” with the comment submitted herein.

The first attachment is a declaration by Gregory Travis, a software engineer with over 40 years of experience and a pilot with over 30 years of experience. Gregory Travis argues that MCAS needs to be removed entirely and the 737 MAX airframe must be altered to eliminate its inherent longitudinal instability.

The second attachment is a statement from Travelers United President Charles Leocha.

The third and final attachment is the first comment of FlyersRights.org, submitted on April 30, 2019.


\(^5\)https://www.seattletimes.com/business/boeing-aerospace/boeings-emergency-procedure-for-737-max-may-have-failed-on-ethiopian-flight/

\(^6\)Id.

\(^7\)Id.

\(^8\)https://www.reuters.com/article/us-ethiopia-airplane-boeing-pilots/pilots-demand-better-training-if-boeing-wants-to-rebuild-trust-in-737-max-idUSKCN1S40IA
Conclusion

In light of the following chain of errors, an MCAS software fix expeditiously approved by FAA, without any pilot simulator training requirements, is unacceptable to flying public.

- Boeing’s decision to place the new engines on the existing 737 fuselage instead of starting with a frame that could support the engines
- Boeing’s failure to thoroughly review and understand MCAS and its failure modes
- Boeing’s failure to alert the FAA to MCAS’ capacity of 2.5 degrees, larger than the 0.6 degrees previously communicated
- Boeing’s failure to inform pilots of MCAS
- Boeing and FAA’s decision not to include MCAS in the United States and European pilot manuals
- Boeing and FAA’s decision to not require any redundancy for the angle of attack sensors
- FAA’s decision to classify an AOA failure rating as “hazardous” and not enforce the redundancy requirement, despite AOA sensor failure historically occurring more frequently than allowed under the “hazardous rating”
- Boeing and FAA’s decision to not require the angle of attack sensor heaters to be operable, according to the MMEL.
- Boeing’s software’s failure to identify that a reading was erroneous because its rapid change was structurally not possible
- FAA’s decision to not require, as safety features, the AOA disagree light and the AOA indicator display
- Boeing’s failure to ensure that one optional feature, when purchased separately, would operate when the other feature was not purchased by the airline.
- Boeing and FAA’s failure to conduct test flights simulating an erroneous AOA reading
- Boeing’s inadequate emergency procedures, which were followed by the Ethiopian Airlines pilots
- Boeing’s failure to allow pilots to cut off MCAS without cutting off the stabilizer trim.

Until the FAA commits to wait until the conclusion of the investigations before deciding if and when to unground the 737 MAX, the process will have been rushed. Any ungrounding at this time is premature. Any proposal that does not mandate simulator training for pilots makes light of the chain of events that caused these two crashes and will illustrate the FAA’s continued priority for commercial expediency over safety.
/s/ Paul Hudson
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May 15, 2019
Exhibit A: Gregory Travis Declaration

(3 pages enclosed)
Gregory Travis Declaration

I, Gregory Travis, declare as follows:

I. Qualifications

1. I currently work as General Manager of Supporwell, LLC a leading patient-centric relationship management system developer.
2. I have a B.A. in history and graduate work towards a Ph.D in the field.
3. My areas of expertise are software development and as a pilot.
4. I have over 40 years of experience as a software engineer. As a teenager, I wrote NOTE, one of the first social media platforms. In 1982, I created the ISRNIX UNIX distribution and co-wrote its TCP/IP networking stack. On behalf of NeXT computer, I evangelized the adoption of the NeXT workstation on university campuses. In 1992, along with my colleagues, I created the DecisionDB massively parallel decision support database platform. Following the events of 9/11, I was tapped to run an NSA-sponsored program securing the nation’s cyber infrastructure.
5. I have been a pilot for over 30 years. I have owned and operated a 1979 Cessna 172 for the same time. Early in my piloting career, I was apprehended at gunpoint and forced to fly my Cessna to Montana. The FAA used my experience to revamp and redesign its hijack response protocols.
6. I wrote an article for Spectrum IEEE on April 18, 2019 detailing my perspective on the 737 MAX situation as a software developer and pilot.

II. Analysis of the Boeing 737 MAX engines

7. My analysis is based solely off of my experience, public information, and reporting.
8. The 737 airplane first appeared in 1967 as a smaller aircraft with smaller engines and simpler systems. Engines became bigger and bigger on later 737 variants in order to achieve higher fuel efficiency. Boeing wanted to install the CFM International LEAP engine on the 737 MAX, but this engine would not have enough clearance with the ground.
9. Boeing’s solution was to extend the engine up and in front of the wing. The engine type and placement change altered the longitudinal pitch stability of the aircraft. In particular, it increased the risk that the airplane would enter an aerodynamic stall.
10. In my opinion, this is aerodynamic malpractice of the worst kind for a civil airliner.
11. While it is fairly common to augment airliner stability with a variety of methods, such as electromechanical yaw dampers and the software solutions employed by Airbus in its A320 series, the implementation of Boeing’s solution in the 737 MAX was dramatically inadequate for the reasons I outline below.

III. Analysis of Boeing’s Solution

12. Boeing could have altered the airframe hardware, but instead chose to rely on the “Maneuvering Characteristics Augmentation System” (MCAS).
13. MCAS is a much less expensive solution than modifying the airframe to accommodate the new, larger engines. Modifying the airframe could have been extensive enough to require the FAA to certify the MAX as an entirely new aircraft.

14. The angle of attack sensors, one on each side of the plane, are mechanical hands designed to rotate in response to changes in the angle of attack. This measures the aircraft’s direction relative to the air.

15. When MCAS activates and pushes the nose down (when the flight computer commands the horizontal stabilizer to move in a nose-down), a set of motors and jacks push the pilot’s control columns forward, via the Elevator Feel Computer. The Elevator Feel Computer can put so much force into that column that a human pilot can quickly become exhausted trying to pull the column back to signal to the computer that this should not be happening.

16. Not letting the pilot regain control by pulling back on the column was an explicit design choice and one contrary to pilot expectations. MCAS would be useless if a pilot could pull up the nose as soon as MCAS said the nose should go down. MCAS denies the sovereignty of the pilot to respond to what is before his or her own eyes. MCAS is active only when the autopilot is turned off, when the pilots believe they are flying the plane.

17. In the 737 MAX, only one of the flight management computers is active at a time, either the pilot’s or copilot’s computer. Although the flight computers are linked by a communication channel, the active computer only takes input from one of the two angle of attack (AOA) sensors. To not use multiple angle of attack inputs is astounding to me as a software developer.

18. Furthermore, the computer code in the flight management computer does not appear to do even rudimentary sanity checks on the data it is getting from the single sensor. For example, in the Lion Air crash, the faulty AOA sensor did not “droop” on the ground (in the absence of airflow) as would be expected and as the other sensor was doing. The computer did not check that the sensor was outputting a reasonable droop angle of attack on the ground. In the Ethiopian crash, the faulty sensor went from a nominal angle of attack reading of a few degrees to over sixty degrees in an instant. This is not physically possible and it remains a question why the software did not disregard such blatantly unreliable data.

19. The people who wrote the code for MCAS were either terribly far out of their league or were explicitly commanded to use only a single AOA, and to do no “sanity checks” on the data from the single AOA. I do not believe the same people who wrote the code can implement a software fix or give the public any comfort that the rest of the flight management software is reliable. I do not understand why the software did not cross-check multiple indicators to let the pilot know that he or she is receiving conflicting signals. It appears that the most basic engineering best practices, to say nothing of regulatory requirements or independent certification oversight, were completely disregarded during the development of the MCAS software. There has been no assurance so far that those practices, requirements, or independent oversight were applied to the “fix.”
III. Relevant Experiences as a Pilot


21. Between the Lion Air crash and the Ethiopian Airlines crash, I installed a new digital autopilot at a cost of approximately $20,000.

22. Installation of the autopilot required a Supplemental Type Certificate (“STC”). This means that the autopilot manufacturer and the FAA agreed that my plane was no longer the same aircraft that rolled off the assembly line. Installation of the autopilot also required a large amount of paperwork to be carried in the plane. This included revisions and addenda to the aircraft operating manual. Included in the documentation were explanations of the autopilot system, including its command of the trim control systems and its envelope protections.

23. The autopilot on my Cessna has a self-contained attitude platform that checks the attitude information coming from the G5 flight computers. If there is disagreement, the system goes off-line and alerts the pilot that the pilot is flying manually. It does not point the airplane’s nose to the ground.

24. In my Cessna, the pilot wins the battle of wills against the computer. I can easily overcome the computer. This used to be the design philosophy of every Boeing aircraft, and one that they could hold up with pride against their rival, Airbus, who had a different philosophy. With the 737 MAX, it seems that Boeing has changed this philosophy quietly.

IV. Final Opinion

25. MCAS needs to be removed altogether and the 737 MAX airframe must be altered to eliminate its inherent longitudinal instability.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 15th day of May 2019

/s/ Gregory Travis

Gregory Travis

Greg@littlebear.com
Exhibit B: Travelers United Statement

(1 page enclosed)
Travelers United Statement

Travelers United is not technically competent to comment on the current FAA/Boeing technical processes. However, we have learned enough to know that fixes need to be made by Boeing and approval of those fixes must be approved by the FAA. The joint FAA/aviation industry approach has worked well when many airlines and maintenance organizations cooperate. Everyone helps each other to keep flying safely. Woefully, the safety culture of the FAA and aviation industry appears to have failed in the instance of the certification of the Boeing 737 MAX.

Our concerns were outlined in a Travelers United blog post on April 9, 2019 (https://www.travelersunited.org/faa-safety-focus-failed/). Now, it appears that other national safety organizations will be involved in the worldwide recertification of this aircraft. Both software changes and training changes seem certain to be implemented by the FAA before the aircraft is certified to fly in the US airspace. Other national approvals may take longer.

Our organization supports all necessary changes to allow the Boeing 737 MAX to fly again and to guarantee the confidence of pilots and passengers of its safety.

Charles Leocha, Travelers United
America’s largest travel advocacy organization.

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Exhibit C: April 30, 2019 Comment of FlyersRights.org

(3 pages enclosed)
motion to extend time for comments

flyersrights.org requests extended time for the public comment period on revision 17 of the flight standardization board’s report. on behalf of the travelling public, we request an additional 7 days for safety experts, pilots, and others to submit their comments to the faa.

the recertification of the boeing 737 max is of great interest to the general public and deserves a full investigation. after two crashes within six months of each other, both occurring within the first two years of the max’s commercial service, the public needs assurances that these airplanes are safe and that the faa and boeing are doing everything they can to prioritize safety for the 737 max and all other aircraft. to achieve that end, more time is needed for independent safety experts to come forward to share their expertise and concerns.

the recertification process of the 737 max will require regaining the confidence of safety experts, pilots, and flight attendants. additionally, it requires regaining the confidence of passengers and the public. the process to date has been shrouded in secrecy, and we predict passengers will boycott the boeing 737 max if the process is perceived to be rushed, secretive, conflicted, and incomplete.

on behalf of airline passengers, we are petitioning for more time to gather and encourage safety experts to submit their comments to the faa. the comment period has only been open for 10 business days. in consideration of the faa’s pending decision to choose the least rigorous change available, “differences level b”, an extended comment period will not create prejudice for the faa or any stakeholder. while boeing may want the 737 max recertified as quickly as possible, we see no reason for the faa want to jeopardize safety, or appear to jeopardize safety, by recertifying the 737 max too quickly and endangering even more lives.

the lion air crash, the ethiopian airlines crash, other reported problems with the 737 max, prominent news reports of problems with boeing’s 787 south carolina factory, and the u.s. air force’s refusal to accept the kc-46 after finding foreign objects have resulted in a near complete loss of confidence in the integrity of the faa’s and boeing’s safety regime. safety experts, pilots, flight attendants, and passengers are only left to wonder what other safety vulnerabilities exist in the above-mentioned aircraft as well as in other aircraft.

if public confidence is not restored, many passengers will not only avoid travelling on the 737 max, they may avoid flying on the 787 and other boeing airplanes. this may already be happening internationally as airlines have considered cancelling orders of the 737 max.

normal comment periods under the administrative procedure act (apa) provide for at least a 30 day comment period. the apa requires a minimum comment period of 30 days except for interpretative rules and for good cause shown. unless there is a modest extension granted, after balancing the need for an expeditious remedy against the need for a comprehensive and open process to decide on that remedy, there will be a lack of due process here. unsafe aircraft may be prematurely ungrounded, risking passenger and public safety, and the faa will lose even more public trust.
Comments on FAA’s Proposal Not to Mandate Simulator Training

FlyersRights.org strongly recommends that the FAA require simulator training on the MCAS feature for all pilots of the 737 MAX before a single aircraft returns to the air.

The Allied Pilots Association has stated that the FAA’s proposed fix does not go far enough because it does not include simulator training. The Allied Pilots Association has said the requirement for only more computer time will not only fail to restore the confidence of its pilots to fly the plane, but it will fail to restore the confidence of the public to fly on the plane. American Airlines has said it is exploring additional training options, but an individual airline should not have to unilaterally put themselves at an economic disadvantage relative to other airlines in order to achieve a safety advantage that should be mandated across all airlines.

New information is continuously coming to light each day. Today, April 30, the deadline for public comments, the Wall Street Journal reported that the optional AOA disagree signal did not operate as expected. It was intended to be a standalone feature but was inoperable if the airline did not also purchase the AOA indicator optional upgrade.

A recent whistleblower reported that he or she has observed loose debris damaging the wiring of AOA sensors in the 737 MAX. While Boeing denies this specific claim, the New York Times has reported on a separate whistleblower from the Boeing 787 South Carolina factory who has claimed that he has seen planes approved with debris in them and has been told by superiors to ignore the violations. The U.S. Air Force stopped accepting deliveries of the Boeing KC-46 aircraft because debris was found inside the aircraft. This is a pattern of misbehavior that must be fully investigated by the FAA and independent investigators before the FAA continues its push to quickly re-certify the 737 MAX.

The FAA must slow down this frenzied, secretive rush to allow the 737 MAX back into the skies until it acquires the whole picture from independent safety experts, pilots, and others.

The short period has made a full comment impossible and has likely prevented others from fulling sharing their expertise, knowledge, and experiences.

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About FlyersRights.org

FlyersRights.org advocates for the interests of airline passengers and aviation safety. FlyersRights.org is a non-profit organization with over 60,000 airline passenger members. It publishes a Know Your Rights page, operates a hotline for passengers at 1-877-FLYERS-6, and publishes a weekly newsletter.

Date: April 30, 2019