Boeing 737 MAX – How Is It Really Going?

It is going great according to the airlines and Boeing's CEO Dave Calhoun:

> *"Our airline customers have returned more than 200 previously grounded airplanes to revenue service. 31 airlines have returned their fleets to service. And those airlines have safely flown over 206,000 commercial flights totaling more than 500,000 flight hours. Importantly, the fleet has an impressive schedule reliability rate of more than 99%*."[1]

Admittedly these are some pretty impressive statistics. Certainly, these numbers are reassuring to passengers, airline customers, regulators, and investors. These large numbers also add to the aviation industry's much heralded commercial airplane safety statistics:

- Fatality and Accident Rates per 100,000 departures
- Fatality and Accident Rates per 100,000 flight hours
- Fatality and Accident Rates per 100 million miles flown

It would be wonderful if we knew our loved ones were boarding an airplane during the "millions of miles safely flown" period. These kinds of "big data" metrics make effective public relations talking points, but they are useless to passengers. Besides when was the last time you saw an airline's fatality and accident rates when you purchased a ticket?

We should not forget that before the two MAX tragedies occurred, the 737 MAX had even better operating statistics than it does now. If these statistics are so important, how come they did not provide any useful early warnings to anyone?

The reality is aviation safety is dependent on the manufacturing quality of the specific airplane and the leadership, experience and skills of the people that are supporting that airplane. Obviously the most visible leaders are the pilots and flight attendants, but behind the scenes are other critically important people in situational leadership roles. For example, the mechanics, technicians, electricians, engineers, quality inspectors, supply chain workers and all the other support personnel that perform a myriad of vital duties that can affect the safety of an airplane including air traffic controllers, flight dispatchers, weather forecasters, ground handling, fueling and deicing personnel, and less we forget, security professionals.

There are no statistics that measure whether or not the mechanic that completed a task card on second shift was well rested, trained, and equipped to do their job. Likewise there are no metrics for the courage it takes for a new quality representative to stand up against schedule pressure and refuse to sign off a job as being complete because he/she knows something is not right.

Every aviation accident has an element of human error, and every crashed airplane has its own unique history. Big numbers spread across an entire industry can hide the truth about the safety of airplanes. Oftentimes we realize too late that basic quantitative and qualitative warning bells unique to the doomed airplane, were simply ignored. The same can be said for production quality warning bells.

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[1] Boeing's 3rd quarter 2021 earnings call transcript

We know these types of warning bells exist because aircraft accident investigations frequently uncover them as they dig deep into the history of an airplane. Airplane safety needs to go all the way down to the airplane level. In the U.S. we assume (trust) the airlines and our aviation regulator, the Federal Aviation Administration (FAA), are fulfilling this public safety responsibility by monitoring model trends and paying close attention to individual airplanes.

U.S. airlines started flying the 737 MAX again on Dec 29, 2020. FAA Administrator Steve Dickson who led the "most comprehensive recertification process in history" agrees with Boeing's CEO Calhoun and believes 737 MAX airplanes are safe.

Nonetheless, inflight incident reports, legally required reporting, and basic math paint a starkly different picture. But first, a disclaimer from FAA Administrator Steve Dickson when he ungrounded the MAX:

> "Now while I am confident that the MAX is safe, inflight mechanical problems occasionally occur with every make and model of commercial aircraft. And for that reason, it is inevitable that at some time in the future, a Boeing 737 MAX will turn back to its originating airport, divert, or land at its destination with an actual or suspected inflight problem. While these events can be inconvenient and unsettling to passengers they occur virtually every day in our national aerospace system and are well handled by professional flight crews and the airline. The FAA evaluates every such event involving a U.S. airline and it is very important to differentiate between these routine events, that happen with any aircraft, and the acute safety issues that led to the loss of lives and grounding of the MAX. Now as I said in September when I flew the MAX, not a day goes by, that I and my colleagues don't think about the Lion Air and Ethiopian Airlines victims and their families and our solemn responsibility to identify and address the issues that played a role in the accidents."[2]

Warning Bells are Ringing – Is Anyone Paying Attention

Since the 737 MAX was ungrounded a year ago, according to official information buried deep in two obscure U.S. government databases, there have been at least 42 reports of equipment malfunctions occurring inflight on U.S. airlines.[3]

- On at least 22 of these flights the affected system involved was the flight control system, which was the primary focus of the FAA recertification,
- on 6 of these flights the engines malfunctioned,
- on 6 of these flights American pilots declared emergencies,
- on 14 of these flights U.S. pilots decided to submit anonymous reports.

There were (167) 737 MAX airplanes in service in the U.S. as of January 1, 2022.[4] Forty-two reports involving such a small number of airplanes equates to 25% (42/167). Put another way, 1 in 4 MAX airplanes in the U.S., has already experienced an inflight malfunction within its first year of returning to service. After two fatal crashes and 20 months of intense scrutiny, this rate does not seem like an "occasional" occurrence as described by FAA Administrator Dickson.

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[2] FAA Ungrounds 737 MAX

[3] Attachment #1 - FAA SDRs, NASA ASRS Reports from 11/18/20 to 12/30/21
Note: The spreadsheet includes some additional incidents recorded by other sources like Aviation Herald

[4] https://simpleflying.com/boeing-737-max-airlines/

To put the current malfunction rate in context, we need to consider there were approximately 118 MAX airplanes operating in the U.S. at the time of the initial grounding in March 2019.[5] During a 22-month period from the time the MAX first entered service in May 2017 until the Ethiopian crash in March 2019, U.S. airline personnel submitted 15 reports of inflight malfunctions via the FAA & NASA websites (8 FAA SDRs and 7 ASRS reports) or 13% (15/118).

In other words, inflight malfunctions on the 737 MAX are occurring at a higher rate now, after the FAA's 20-month recertification, then they were before the start of the recertification.

The 737 MAX airplane has a long history of production quality defects even before this past year's data is factored into the situation. Here is a partial list of publicly known defects—the majority of these came to light after the crashes:

- Significant amounts of Foreign Object Debris (FOD) found inside wing fuel tanks
- Installing defective slat tracks on the wings
- Installing unapproved Heads-Up Guidance System (HUD) Displays
- Grinding down of wiring protection around engines making airplanes vulnerable to lightning
- Failing to properly install Fuel Sealant
- Installing a refueling panel that does not indicate an automatic shutoff system failure
- Installing defective stab trim motors that move the horizontal stabilizer
- Faulty electronic flow control of air conditioning packs that vent air into the cargo hold (which could impact fire suppression capabilities)
- Electrical bonding and grounding defect affecting the P6 panel assembly, the mounting tray for the standby power control unit (SPCU), and the main instrument panel (MIP) assembly

Outside the U.S.

There are approximately 480 MAX airplanes operating worldwide as of January 1, 2022, with 313 of these airplanes operating outside the U.S.[6] Unfortunately, there is no single source, publicly available worldwide database containing information on aircraft malfunctions. However, if we simply extrapolate the U.S. data, and assume foreign airlines are facing a similar 25% inflight malfunction rate, it results in at least 78 additional inflight events (.25 x 313) = 78

Adding this estimate of 78 foreign events to the 42 U.S. events, equals at least 120 events worldwide or an average of 1 inflight malfunction on a MAX airplane every 3 days! This is a conservative estimate because the NASA data lags three months behind. It is also conservative because foreign airlines are further away from Boeing technical support, there are language barriers to overcome, and time zone differences. Attached are some examples of the malfunction reports including a few from Canada.[7]

Qualitative Comparison

If the horrible loss of life from the preventable MAX disasters is not compelling enough, a qualitative comparison between the 737 MAX and its main competitor the Airbus A320neo, provides numerous reasons why we should take each of these inflight malfunctions seriously. Unlike the A320neo airplane, the 737 MAX was involved in two fatal crashes mere months apart. It has been linked to a massive corporate scandal involving criminal conduct, misleading statements, omissions, deception, and lies. The MAX has been the subject of ongoing congressional investigations, "blue ribbon" committee

[5] The Boeing Company's Orders & Deliveries website

[6] https://simpleflying.com/boeing-737-max-airlines/

[7] Attachment #2 - Examples of 737 MAX Malfunction Reports

reports, regulatory reviews, thousands of news stories, documentaries, and lawsuits. Importantly, the MAX recently completed the most comprehensive 20-month recertification process in aviation history. And yet, here we are, just one year back in-service, and data is rolling in that demonstrates the 737 MAX is still unsafe. Why?

Conclusion

If these MAX airplanes had been flying for many years we might assume the airlines had been doing a poor job of maintaining them. But these are not old airplanes--they are new airplanes. As such, these inflight events should not be immediately downplayed as "routine incidents." Boeing and the FAA cannot blame MCAS software and the lack of pilot training for all of these malfunctions. These reports on individual airplanes are laser beams that point directly back to one common characteristic: the 737 Factory and its history of chaotic production operations and undue schedule pressure.[8] This is the same hectic production environment that led to unexplained (and unaddressed) electrical problems involving the flight control system and the failures of Angle of Attack Sensors on JT610 and ET302. Yes, MCAS has been redesigned and pilots are finally receiving long overdue training, but software fixes and pilot training do not solve electrical wiring interconnect system (EWIS) problems or chronic production process breakdowns.[9]

If we accept these malfunction events as routine now, when the airplanes are new, what are we going to accept when they are 5, 10, 15+ years old? At what point do these kinds of inflight safety events stop being routine? At what point does the FAA step in and provide effective oversight of the factory? Who at the FAA is analyzing and investigating these malfunction reports? Why is this information not made more accessible to the public? How do we know the root causes of these problems are being identified and addressed? Where is the transparency?

It seems we really do not know how individual 737 MAX airplanes are doing, maybe the FAA knows, but then again, is anyone paying attention?

~ Ed Pierson
Jan 13, 2022

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[8] Congressional Testimony
[9] Boeing 737 MAX – Still Not Fixed

Attachment #2

Examples of 737 MAX malfunction reports:

> *Climbing through 7,000 feet on the ZZZZZ SID, the aural warnings for airspeed, fire and pressurization came on. The First Officer and I scanned the flight deck for unreliable airspeed, fire warnings and any possible pressurization problems. We were in agreement that none were present and could not locate the source of the warnings, I elected to disengage the autopilot and auto throttles, to verify control of the aircraft. The First Officer and I searched again for any indication of fire or airspeed issues. We found none. With the fire bell still sounding we elected to return to ZZZ and request priority.* *NASA ASRS ACN* 1823130

> *Upon intercepting the Glide Slope, the First Officer called for 'Flaps 15, Landing Gear down.' The aircraft captured the glideslope uneventfully. Shortly after passing ZZZZZ, the First Officer called for 'Flaps 30.' I selected Flaps 30 and as the flaps were moving to Flaps 30 the aircraft abruptly pushed the nose over approximately 8 to 10 degrees down.* *NASA ASRS ACN* 1802427

> *STAB OUT OF TRIM LIGHT CAME ON DURING CRUISE FLT. RAN QRH; DETERMINED MAIN ELEC TRIM INOP. / R/R STAB TRIM MOTOR PER M/M 27-41-71 AND M/M 22-11-81 OP CKS GOOD. ISSUE# 3402820OFF PART# 6355D0001-01 S/N OFF 20297ON PART# 6355D0001-01 S/N ON 20472* *FAA SDR SWAA2021071693787*

> *AIRCRAFT WAS GROUNDED: STABILIZER OUT OF TRIM PANEL LIGHT ILLUMINATED NEAR TOP OF CLIMB AND AIRCRAFT WAS NOT TRIMMING NORMAL. FLIGHT DIVERTED TO MIA AND declared emergency FOR PRECAUTIONS. FLIGHT WAS NOT OVERWEIGHT FOR LANDING. REMOVED AND REPLACED STABILIZER TRIM MOTOR PER AMM 27-41-71 AS A PRECAUTION. PREFORMED INTEGRITY CHECK OF WIRING FOUND CONNECTOR D381 OF M1659 STABILIZER TRIM MOTOR NOT SECURE. RESECURED CONNECTOR* *FAA SDR AALA202106079024*

> *ON CLIMB OUT FA CALLED AND SAID ALL GALLEY POWER WAS OUT AT ALL FOUR GALLEY STATIONS. COMPLIED WITH QRH (NOTHING IN THERE); CHECKED CIRCUIT BREAKERS; NONE POPPED. SPOKE TO MX; CONT IN FAULT DESCR; ON CLIMB OUT FA CALLED AND SAID ALL GALLEY POWER WAS OUT AT ALL FOUR GALLEY STATIONS. COMPLIED WITH QRH (NOTHING IN THERE); CHECKED CIRCUIT BREAKERS; NONE POPPED. SPOKE TO MX; DISPACTCH & CPOC. MADE A DECISION TO TURN AROUND IN CASE TRANSFER BUS WERE LOAD SHEDDING. / [01] R&R BPCU IAW AMM 24-41-21. OPS CHECK GOOD PER AMM 24-41-21.* *FAA SDR SWAA2021111041941*

Examples of Canadian 737 MAX malfunction reports:

> DURING SCHEDULED TASK ZONAL GVI OF UPPER STABILIZER TORSION BOX COMPARTMENT, IT WAS NOTED THAT WIRE BUNDLE W3399 ON THE FORWARD SPAR OF THE TORSION BOX IS CONTACTING THE STRUCTURE AND CHAFING WHEN THE AIRCRAFT WAS IN THE FULL NOSE UP TRIM POSITION.

> R/H FWD MAIN FUEL PUMP LOW PRESSURE DURING CLIMB FAULT UNDER MEL. THE MEL 28-22-01-C WAS OPENED ON FEB.27. WHILE FOLLOWING FIM TASK 28-22-00-810-830, AME NOTICED R/H #2 FWD FUEL PUMP HARNESS CONNECTOR AT THE PUMP HAD SMOKE COMING WHEN PUMP RUNNING DURING T/S. AFTER TAKING CONNECTOR OFF, BURNT MARK THROUGH YELLOW HEAT SHRINK WAS NOTICED. WIRING AT PUMP CONNECTOR FOUND CHAFING AND WAS REPAIRED IAW WPM 20-61-00. FUEL PUMP TEST OK.