HAS BOEING'S SAFETY MANAGEMENT SYSTEM FAILED?

By: Alan Armstrong*

I.

INTRODUCTION AND OVERVIEW

Two events shocked the confidence of Americans in Boeing Aircraft Company. The first was the crash on October 29, 2018, of a Boeing 737 MAX-8 aircraft operated as Indonesian Lion Air Flight 610 which crashed in the Java Sea. The second was the March 10, 2019, crash of Ethiopian Flight 302 that departed Addis, Ababa. The erratic flight profiles of the aircraft were very similar and resulted in President Donald Trump taking the unprecedented action of grounding the Boeing 737 MAX-8 aircraft on March 13, 2019.

As a result of the air disasters involving the Boeing 737 MAX-8 aircraft, the author wrote a paper entitled *An Analysis of the Engineering Decisions Made by Boeing in Designing the B-737 MAX Aircraft*.[1] It was astonishing to the author that Boeing could have designed and placed in service an aircraft with a stall barrier system called MCAS (Maneuvering Characteristics Augmentation System) and not have disclosed this information to pilots who operated the aircraft. It was equally remarkable that the aircraft was designed in a manner that a single point of failure (a malfunction in a single angle of attack indicator) could bring down a transport category aircraft.

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[1] https://alanarmstronglaw.com/engineering-decisions-made-by-boeing-in-designing-the-b-737-max-aircraft/.

In this article, we will examine events that have transpired with Boeing Aircraft Company and ask ourselves, has Boeing's Safety Management System (SMS) failed?

II.

WHAT IS A SAFETY MANAGEMENT SYSTEM AND HOW DOES IT WORK?

A. How The FAA Defines a Safety Management System

FAA Order No. 8000.369C, *Safety Management System* (06/24/20) recites: "This Order establishes the Safety Management System (SMS) policy and requirements for the Federal Aviation Administration (FAA)." In the Order, the FAA describes a Safety Management System as "... more process-oriented system safety approach with an emphasis on Safety Risk Management (SRM) and Safety Assurance processes."[2] In the Order, the FAA, "[r] requires adopting a common approach to implementing and maturing an integrated SMS, including fostering a positive safety culture and other attributes as applicable." [3] While the focus of FAA Order 8000.369C is on the operations of the FAA, the FAA in its oversight functions is required to ensure that product and service providers also employ Safety Risk Management (SRM). In the Order, the FAA has declared:

> "The FAA is never responsible for performing SRM or primary Safety Assurance on behalf of an individual aviation product/service provider that it oversees. Aviation product/service providers are responsible for managing safety for their operations, including conducting SRM and Safety Assurance for their operations. Aviation product/service providers can directly control risk related to the hazards in their operations because they control resources and activities of people directly exposed to hazards."[4]

[2] FAA Order 8000.369C, *Safety Management System* (06/24/20).
[3] *Id.*
[4] *Id.*, Ch. 2, ¶3(g).

In the Order, the FAA describes a Safety Management System as Follows:

> "SMS is the formal, top-down, organization-wide approach to managing safety risk and assuring the effectiveness of safety risk controls. It includes systematic procedures, practices, and policies for the management of safety risk. The four main components of an SMS are: (1) Safety Policy, (2) Safety Risk Management, (3) Safety Assurance, and (4) Safety Promotion. They provide a means of defining SMS within the FAA and a systematic approach to describing and achieving the desired safety performance. The applicable FAA organizations must meet the requirements in this chapter..."[5]

B. A Review of the Boeing Safety Management System and Quality Management System

In furtherance of the goals set out by the FAA in its Order concerning Safety Management Systems, Boeing has promulgated a Safety Management System declaring, inter alia:

> Safety is, and always will be, a foundational value. We are committed to strengthening our culture of safety through continuous improvement, learning and innovation. This requires a daily commitment, and we pledge to remain focused, vigilant and humble in our work.
>
> Our team members have a deep and personal commitment to the safety of Boeing products and services. Every employee is empowered and encouraged to speak up if they have any safety or quality concern. [6]

In its Safety Management System, Boeing goes on to declare:

> Recognized worldwide as an industry best practice, SMS is an integrated framework for managing safety risks. Boeing's SMS collects and monitors date to identify and reduce product safety risks. It relies on all those involved in the design, build, support and operation of Boeing products and services to speak up when they see safety risks.[7]

[5] *Id.,* Ch. 3, P1.
[6] https://www.boeing.com/safety#sms.
[7] *Id.*

Boeing, extolling the virtue of people speaking up, further declares in its Safety Management System:

> Product safety depends on a culture that is rooted in transparency, accountability and every person feeling safe and empowered to speak up when they have a concern or make a mistake affecting product safety. This reporting culture is at the heart of Boeing's Safety Management System. In 2019, Boeing established a confidential reporting channel called Speak Up for employees to voice their concerns about product quality and safety and offer ideas on how to improve.
>
> In everything we do and in all aspects of our business, safety is our foundation. We strive for first-time quality and hold ourselves to the highest ethical standards as set forth in our code of conduct and company policies. That commitment begins at the highest levels of the company. [8]

One page of the Boeing Safety Management System is replete with signatures of persons in positions of authority including the former Chief Executive Officer, David L. Calhoun. Inscribed in this page of the Safety Management System are, among others, the following tenants:

- We commit to a Safety Management System to advance our goals for safety, quality and compliance.
- We foster a positive safety culture that enables proactive identification and mitigation of risks in order to prevent accidents, injuries, or loss of life.
- We ensure that all employees understand the requirement to report any safety hazard, incident, or concern, and *can do so without fear of retaliation* (italics supplied) ...[9]

Boeing, in addition to having a Safety Management System in place has a Quality Management System (QMS) that is "based on AS9100 which is the internationally recognized and premier aerospace QMS standard. Boeing, as well as other major aerospace manufacturers, flow

[8] *Id.*
[9] *Id.*

down AS9100 certification and compliance to its suppliers in order to enable effective and efficient processes to meet multiple customer, statutory and business requirements."[10] The Boeing Quality Management System is integrated with its Safety Management System, since Boeing declares: "QMS and the company's Safety Management System (SMS) work together and are built into the company's organizational structure policies, processes, procedures and resources..."[11]

The contents of the Boeing Safety Management System and Quality Management System portrays Boeing as a company where employees are encouraged to bring to the attention to their superiors practices and procedures which are dangerous or which may compromise air safety.

III.

EVENTS AND CONTROVERSY SURROUNDING BOEING IN RECENT YEARS

A. The Move from Seattle to Chicago

Historically, Boeing Aircraft Company had been dominated by engineers and visionaries. Boeing took considerable risks in designing and funding both the Boeing B-17 Bomber and the Boeing 707 aircraft. The Boeing 707 aircraft was the first transport category aircraft in the United States that was turbojet powered. The design and certification of the Boeing 747 aircraft was also a tremendous technological achievement, since it can accommodate up to 416 passengers. A mainstay of the company from 1945 to 1972 was William Allen, Esq. A Harvard-educated lawyer, Allen took over as President on September 1, 1945, just at the end of the Second World War. Under the tenure of Allen, Boeing built and designed the B-47 Bomber, the B-52 Bomber, the Boeing 707, the Boeing 720, the Boeing 727, the Boeing 737 and the Boeing 747. Although trained as a lawyer, Allen gave considerable authority and deference to engineers and their vision about the type of aircraft that could be designed and constructed at Boeing.

[10] https://www.boeing.com/sustainability/quality
[11] *Id.*

While Boeing enjoyed great success, one of its competitors had for some time been Douglas Aircraft Company which later merged and became McDonnell Douglas. In 1997, McDonnell Douglas merged with Boeing and four years later, Boeing moved its headquarters from Seatle, Washington to Chicago, Illinois. It has been reported that this move isolated management from its engineering and manufacturing staff and diminished the former engineering influence at Boeing in favor of a management style dominated by corporate executives as opposed to engineers.[12]

B. The Growth of Airbus as a Competitor and the Design of the 737 MAX-8

While Boeing, Douglas, McDonnell Aircraft and Lockheed were producing prodigious amounts of aircraft in the United States, European aircraft manufacturing languished. This led to the birth of Airbus which is a consortium of aircraft manufacturers in Europe. In time, Airbus became competitive and prosperous and was threatening Boeing in relation to sales of aircraft to American Airlines. Airbus had recently developed the A320neo at a time when Boeing was offering the Boeing 737NG (or Next Generation). While Boeing was contemplating the design and construction of a new aircraft to replace the Boeing 737NG, pressures to effect sales to American Airlines called for adapting the Boeing 737 design to accept larger engines and other modifications to the airframe resulting in the birth of the Boeing 737 MAX-8. The Boeing 737 MAX-8 was based on earlier Boeing 737 designs. A narrow-bodied airliner sitting low to the ground, in order to accommodate the CFM International LEAP-1B engine, aerodynamic changes were necessary to the aircraft including moving the engines slightly forward and thereby producing a nose up moment which engineers sought to minimize with the installation of the Maneuvering

[12] https://en.wikipedia.org/wiki/BoeingBuilding

Characteristics Augmentation System (MCAS). Unfortunately, the MCAS system activated on two separate occasions leading to fatal consequences for two jet airliners and their passengers.

C. The Fatal Accidents of Two Boeing 737 MAX-8 Aircraft and The Grounding of the Fleet

The crashes of two Boeing 737 MAX-8 aircraft within five months of each other under circumstances suggesting the aircraft exhibited loss of control resulted in President Trump grounding the fleet on March 13, 2019. This led to a loss of confidence in the aircraft as expressed by aircraft regulatory agencies around the world which had previously concluded the American airworthiness certificate issued by the FAA to Boeing ensured the aircraft was safe. As investigations into the crashes continued, it became clear that Boeing's economic decisions in designing the aircraft played a role in the accidents. Pilots were not required to get a new type rating for the aircraft nor were they required to undergo differences training thereby saving the airlines revenue in pilot training expenses. The stall barrier system was designed in such a manner that a single failure in the aircraft's systems could result in a loss of control and a catastrophe. This did not appear to be the Boeing Aircraft Company of old. How could Boeing have offered an aircraft for sale with a Maneuvering Characteristics Augmentation System that was never disclosed to the pilots? How could Boeing have manufactured an aircraft in such a fashion that a single point of failure could spell its doom and destruction?

As if the grounding of the Boeing 737 MAX-8 fleet was not enough, together with civil litigation arising from massive loss of life in those crashes, in January of 2021, Boeing agreed to pay $2.5 billion to settle conspiracy charges brought by the United States Department of Justice.[13]

[13] https://www.cnbc.com/2024/05/14/justice-department-says-boeing-breached-2021-agreement-that-shielded-it-from-criminal-charges-over-737-max-crashes.html

At the time this article is written, the United States Department of Justice has initiated court proceedings arguing that Boeing breached the 2021 settlement by "failing to design, implement, and enforce a compliance and ethics program to prevent and detect violations of the U.S. fraud laws throughout its operations." [14] Boeing denies the claims made by the Department of Justice.[15] Responses are due to the filings of the Department of Justice by June 13, 2024.[16] On May 5, 2022, Boeing announced it was moving its global headquarters to Arlington, Virginia, Boeing Chief Executive Officer, David Calhoun, declaring, in part: "We are excited to build on our foundation here in Northern Virginia..."[17] Boeing's move from Chicago to Arlington occurred subsequent to the controversy that had arisen about the Boeing 737 MAX-8 aircraft crashes.

D. The Recent Rash of Incidents and Accidents Involving Boeing Aircraft

A recent spate of aircraft accidents and incidents has ensured that Boeing has been continuously in the news. Consider the following:

- January 5, 2024, Alaska Airlines Flight 1282 suffered a rapid decompression when a piece of the fuselage departed the aircraft, a Boeing 737 MAX-9. The aircraft was equipped with a plug to secure an area in the fuselage where a door could have been installed. Fortunately, the seats adjacent to the opening were unoccupied, and the aircraft was at an altitude of 16,000 feet. The results could have been devastating had the aircraft a much higher altitude where the effects of the rapid decompression would have been much more violent and explosive.

[14] *Id.*
[15] *Id.*
[16] *Id.*
[17] https://boeing.mediaroom.com/2022-05-05-Boeing-Names-Northern-Virginia-Office-Its-Global-Headquarters-Establishes-Research-Technology-Hub

- January 6, 2024, the FAA grounded all Boeing 737 MAX-9 aircraft and sought assistance of the National Transportation Safety Board in its investigation.
- January 9, 2024, United Airlines and Alaska Airlines reported that they found loose parts in other Boeing 737 MAX-9 aircraft.
- January 11, 2024, Six Alaska Airlines passengers filed a class-action lawsuit against Boeing demanding compensation for their injuries which included a concussion and a seizure as well as injuries sustained by 165 other passengers.
- February 6, 2024, NTSB investigators reported that four bolts that held the fuselage component in place were missing at the time of the blow out. A preliminary report including a photograph taken in September of 2023, by Boeing employees showed that bolts were missing even earlier. This finding suggests that the aircraft had been flown in this dangerous and unairworthy condition months before the incident of January 5, 2024.
- March 7, 2024, a wheel fell off a Boeing 777-200 aircraft while departing from San Francisco bound for Osaka, Japan. The aircraft diverted to Los Angeles and landed without incident.
- March 7, 2024, flames erupted from the engine of a Boeing 737-900 during a United Airlines flight from Houston to Fort Worth, Texas.
- March 12, 2024, a Boeing 787-9 Dreamliner departed controlled flight en route from Sydney, Australia to Aukland, New Zealand.
- March 15, 2024, United Flight 433 from San Francisco to Rogue Valley, Oregon revealed a missing fuselage panel upon landing in a Boeing 737-800 aircraft.

- March 29, 2024, a Boeing 777-200 operated by United Airlines departed San Francisco, suffered an engine issue, and diverted to Denver, Colorado.

E. The Death of One Boeing Whistleblower and the Senate Testimony of Another

On March 9, 2024, John "Swampy" Barnett was found dead in his truck with what appeared to be a self-inflicted gunshot wound on the final day of his deposition testimony in Charleston, South Carolina. [18] Barnett had spoken with reporters at the New York Times and the BBC claiming that he discovered poor quality parts inside aircraft, but his claims were dismissed by management.[19] A family friend named "Jennifer" told ABC-4 News in Charleston that Barnett had told her: "If anything happens to me, it's not suicide." [20]

On April 17, 2024, Sam Salehpour testified before members of the United States Senate claiming that he received physical threats after witnessing and raising concerns with Boeing personnel about manufacturing shortcuts and the failure to properly close gaps in the fuselage assemblies of Boeing 787 aircraft. [21] Mr. Salehpour testified during the hearing that pieces of the aircraft assembly were being pushed together with excessive force and further asserted that Boeing was "putting out defective airplanes." [22] Salehpour testified that people were jumping up and down on pieces of the aircraft in an effort to align components, a practice he called the "Tarzan effect."[23] According to Salehpour his boss told him: "I would have killed someone who said what you said in a meeting."[24] Salehpour further maintained that he received a phone call on his personal

[18] *Id.*
[19] *Id.*
[20] *Id.*
[21] https://www.thestreet.com/personalities/boeing-whistleblower-says-he-received-physical-threats-over-safety-concerns.
[22] *Id.*
[23] *Id.*
[24] *Id.*

telephone and that he was berated and chewed out for 40 minutes about raising safety concerns regarding production procedures.[25] According to Salehpour, "I am at peace because I feel like by coming forward I will be saving a lot of lives, and I am at peace. Whatever happens, happens."[26]

IV.

THE DEVELOPMENT AND THEN GROUNDING OF THE DREAMLINER

A. Is Production of the Dreamliner Inconsistent with SMS and QMS?

The Boeing 787 Dreamliner was announced on January 29, 2003.[27] It is a wide-body airliner constructed largely of composite materials and is powered by two General Electric GEnx or Rolls-Royce Trent 1000 high-bypass turbofans.[28] It was targeted to consume 20% less fuel burn than the Boeing 767.[29]

Boeing decided to outsource 70% of the design, engineering, and manufacturing of entire modules to over fifty strategic partners.[30] If, as the FAA maintains, a Safety Management System is a "top-down, organization-wide approach to managing safety risks and assuring the effectiveness of safety risk controls,"[31] how do we reconcile that definition with Boeing's outsourcing 70% of the design, engineering and manufacturing to over fifty strategic partners? Further, in light of this production strategy, how is Boeing's Quality Management System governing the conduct of over fifty structures and component suppliers? The answer is obvious. Boeing's Safety management System and Quality Management System do not provide for a vertically integrated "top-down, organization-wide approach to managing safety risk..."[32]

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[25] *Id.*
[26] *Id.*
[27] https://en.wikipedia.org/wiki/boeing_787_dreamliner
[28] *Id.*
[29] *Id.*
[30] https://www.industryweek.com/supply-chain/supplier-relationships/article/21282352/boeings-organizational-problems-date-back-two-decades
[31] FAA Order No. 8000.369C, *Safety Management System*, (06/24/20)
[32] *Id.*

Recognizing what appears to be a problem with SMS and QMS at Boeing, one is left to wonder: To what extent will FAA oversight force Boeing to correct these safety issues?

B. The Troubled History of the Dreamliner

The Boeing 787 Dreamliner has experienced a checkered service history as shown by the following:

- January 7, 2013, a battery overheated in a Boeing 787 Dreamliner operated by Japan Airlines (JAL) and a fire ensued.[33]
- January 9, 2013, United Airlines reported a problem with a Dreamliner with wiring located in the same area as that involved in JAL aircraft.[34]
- January 11, 2013, the FAA announced a comprehensive review of the Dreamliner's critical systems.[35]
- January 16, 2013, an All Nippon Airways (ANA) Dreamliner made an emergency landing at Takamatsu Airport after the crew received a computer warning of smoke in an electrical compartment.[36]
- January 16, 2013, the FAA issued an emergency airworthiness directive ordering all United States' airlines to ground their Dreamliners until modifications could be made to their electrical systems to reduce the risk of battery overheating or catching fire.[37]
- July 12, 2013, an Ethiopian Airlines Dreamliner battery caught fire while on the ground at London Heathrow Airport.[38]

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[33] https://en.wikipedia.org/wiki/2013_Boeing_787_Dreamliner_grounding#
[34] *Id.*
[35] *Id.*
[36] *Id.*
[37] *Id.*
[38] *Id.*

- January 24, 2014, JAL maintenance crew discovered smoke coming from the main battery of a Dreamliner.[39]
- December 1, 2014, the National Transportation Safety Board released its report assigning blame to: (1) GS Yuasa of Japan for battery manufacturing methods that could introduce defects not caught by inspection, (2) Boeing's engineers, who failed to consider and test for worst-case battery failures, and (3) the FAA for failing to require proper testing as part of the aircraft certification process.[40]

V.

HAS THE BOEING SAFETY MANAGEMENT SYSTEM FAILED, AND IF SO, WHY?

The events and circumstances outlined in this article suggest that the Boeing Safety Measure System has failed. The catastrophic loss of life following two air disasters is a testament to deficiencies in the Boeing Safety Management System. Certainly, someone must have realized that installing a software program in the aircraft without disclosing its existence to the pilots was a bad idea. Further, someone must have appreciated that designing an aircraft in a manner such that a single point of failure could doom the aircraft was a terrible idea. On those two grounds alone, we can condemn Boeing's Safety Management System as inadequate. However, our criticism is not limited to the design of the Boeing 737 MAX-8 aircraft. The departure of a fuselage plug from an Alaska Airlines flight where components to stabilize and strengthen the plug were missing and overlooked demonstrates that Boeing has a severe quality control problem. The Quality Management System failed again in the production of the Boeing 737 MAX-9 aircraft.

If we are to believe Sam Salehpour, when dangerous practices are brought to the attention of Boeing personnel, employees are threatened with violence. It is one thing to voice platitudes

[39] *Id.*
[40] *Id.*

announcing you have a Safety Management System and a Quality Management System. It is something altogether different if you actually have safety systems in place that actually work. Moreover, severing the head from the body is not a way to rationally operate a business. Immunizing executives in glass towers from the realities of aircraft design and construction is no way to operate an aircraft company. According to the FAA, "SMS is the formal, top-down, organization wide approach to managing safety risks and assuring the effectiveness of safety risk controls..."[41] However, if the "top" is in Arlington, Virginia while the engineers are in Everett, Washington or Charleston, South Carolina, ensuring that a Safety Management System is operating on an "organization-wide approach" is clearly problematic. Telephone calls and Zoom meetings are fine. However, consequential decisions about aircraft design and fabrication are better left to direct personal communication.

When the decision was made to insulate top Boeing executives from the cares and concerns of design and construction, Boeing began to sow the seeds of its own destruction. It is not too late for Boeing to turn back to tried and true procedures that work. It is not too late to return to Seattle, Washington and make the design and construction of aircraft a collaborative effort and not one involving patricians and plebians where the executives are the patricians and the engineers and workmen are plebians. Unity and commonality of purpose will be of paramount importance if Boeing is to overcome the existential threats of continued failure that loom over the horizon if it fails to take corrective action.

Finally, Boeing's decision to outsource seventy percent of the design, engineering and manufacture of aircraft modules undercuts any argument it works to ensure robust Safety Management and Quality Management Systems. The grounding of American-manufactured and

[41] FAA Order 8000.369C, *Safety Management System* (06/24/20).

certificated commercial airliners is a very rare occurrence. Prior to the grounding of the Dreamliner in 2013, the last American airliner grounded was the McDonnell Douglas DC-10 in 1979. Only six years after the Dreamliner was grounded the Boeing 737 MAX-8 was grounded. Then Boeing suffered further humiliation when approximately 171 Boeing 737 MAX-9 aircraft were grounded following the Alaska Airlines episode.

The time for mouthing platitudes has passed. Boeing is a name that made Americans proud. It is time for Boeing to reconstitute itself into what we have believed it to be, an American icon. It is time for Boeing to rediscover its greatness. Making hard decisions and putting quality and safety over short-term profits would be a starting point. Vigorous Safety Management and Quality Management Systems are not optional in aviation. They are mandatory. Hopefully the leadership at Boeing has finally gotten the message.