HASALMUN'25

FAA

STUDY GUIDE

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"Youth will shape the world"

1. Letter From the Secretary-General

Dear Delegates of the FAA committee,

It is my utmost pleasure and honour to welcome each and every one of you to the 12th annual session of HASALMUN and specifically to the FAA committee. I am proud to say, on behalf of our whole academic and organisation team, that every detail of this conference was devised with careful dedication and sincere enthusiasm so as to provide all of you with pleasant and unforgettable memories.

MUN is not just about building connections, the value of it goes much deeper; MUN is about bonding over world issues. It is about realising how all human beings are bound by different problems and understanding that the world is waiting for courageous, intellectual, kind-hearted leaders and individuals to heal the broken hearts, and rebuild the shadowed dreams.

HASALMUN has, since its day of foundation, been a stage where everyone is provided with the opportunity to express, debate, and negotiate. Every delegate is received with the greatest amount of excitement, happiness and pride; because, as young individuals ourselves, we know the importance of being recognized as worthy individuals. I assure you that HASALMUN'25 will be a place for growth, in every possible context.

This year, the FAA committee will be tackling an issue that requires great technical knowledge, a versatile approach, deep thought processes and heated debates. Luckily, our irreplaceable Under-Secretaries General **Mr. Emir Elhatip** and **Mr. Berk Doğan** have prepared this amazing study guide and the handbook with invaluable efforts in order to ensure that all delegates receive every piece of information needed. I thank them for being the greatest in their job and their marvelous commitments to the conference. Moreover, I also want to thank our Academic Assistant **Mr. Mehmet Efe Çetinkaya** for his contributions to the study guide, committee, and conference.

Last, but definitely not the least, I want to thank you delegates for making this conference truly meaningful. Without your words and actions, HASALMUN would not be what it is today. Thank you to all the youthful minds for adding value into this conference and the world we live in. Youth will shape the world!

Best wishes & Yours sincerely,

Öykü Tekman

Secretary-General of HASALMUN'25

2. Letter From the Under-Secretaries General

Dear delegates,

First and foremost, we'd like to welcome you to HASALMUN'25! Being in this conference is both an honor and a privilege for the two of us.

We have prepared an exciting committee for you as your Under-Secretaries General, Berk Doğan and Emir Elhatip. As Emir, an aviation-aficionado, and Berk, an actual pilot, aviation holds a special place in our hearts and we wanted to start a formidable discussion on this topic. Safety regulations are important in every industry, however, in aviation, they are exceedingly crucial, as any oversight can prove to be fatal.

In these three days, we will discuss the (in)famous Boeing 737 MAX incident, and what it means for the future of aviation and safety regulations. We can only hope that you'll enjoy the topic as much as we do.

All the best,
Berk Doğan & Emir Elhatip
Under-Secretaries General of the Federal Aviation Agency Committee

3. The Boeing Incident

3.1. Technical Overview

The Boeing 737 MAX was developed as a response to Airbus's A320neo, aiming to offer airlines a more fuel-efficient aircraft without requiring significant retraining of flight crews. To achieve this, Boeing equipped the MAX with larger, more efficient CFM LEAP-1B engines. However, these engines were too large to fit under the classic 737's low-mounted wings. To accommodate them, engineers mounted the engines farther forward and higher on the wing, which unintentionally altered the aircraft's aerodynamics. Specifically, this design change gave the plane a greater tendency to pitch upward under certain conditions, particularly at high angles of attack (AoA).

To compensate for this altered pitch behavior, Boeing introduced a new software system called the Maneuvering Characteristics Augmentation System (MCAS). MCAS was designed to automatically push the aircraft's nose down if it detected that the plane was climbing at too steep an angle, thus helping prevent aerodynamic stalls. However, the system had several critical design flaws. Most notably, MCAS relied on input from only a single AoA sensor. If that sensor malfunctioned — as it did in both of the fatal crashes — the system could misinterpret the plane's attitude and engage unnecessarily.

Once activated, MCAS could command the horizontal stabilizer to aggressively pitch the nose downward, and it was designed to repeat this action even if pilots tried to pull the nose back up. Worse still, Boeing did not disclose the existence of MCAS in pilot training materials or manuals, aiming to simplify the certification process and avoid additional simulator training costs for airlines. As a result, most pilots were unaware of MCAS and how to disable it. The procedure to override the system — turning off electric trim and manually adjusting the aircraft with a trim wheel — was not intuitive, especially under stress and at low altitude.

These flaws led to two catastrophic crashes. On October 29, 2018, Lion Air Flight 610 crashed into the Java Sea shortly after takeoff, killing all 189 people on board. A few months later, on March 10, 2019, Ethiopian Airlines Flight 302 experienced a nearly identical failure and crashed just minutes after takeoff, killing 157 people. In both cases, a faulty AoA sensor triggered MCAS, which repeatedly pushed the aircraft's nose down. The pilots were unable to regain control.

In the aftermath, the Boeing 737 MAX was grounded worldwide in March 2019. Investigations revealed not just technical shortcomings in the aircraft's design, but also deep organizational and regulatory failures. Boeing was heavily criticized for prioritizing speed to market and cost savings over safety, while the FAA came under fire for relying too heavily on Boeing's own assessments during certification. The scandal cost Boeing tens of billions of dollars, severely damaged its reputation, and prompted sweeping changes to aircraft certification procedures globally.

3.2. Legal Proceedings

Following the two fatal crashes of the Boeing 737 MAX, intense legal scrutiny fell on Boeing from both U.S. and international authorities. In early 2021, Boeing entered into a Deferred Prosecution Agreement (DPA) with the U.S. Department of Justice (DOJ), acknowledging that it had misled the Federal Aviation Administration (FAA) about the nature and functioning of the MCAS system. As part of the agreement, Boeing agreed to pay $2.5 billion, which included a $243.6 million criminal monetary penalty, $1.77 billion in compensation to airlines, and $500 million for a victim compensation fund. In exchange, the DOJ agreed not to prosecute Boeing on one count of conspiracy to defraud the United States, provided the company complied with certain conditions over a three-year period.

Critics, including family members of the crash victims, argued that the DPA allowed Boeing to avoid full accountability and shielded its executives from criminal charges. These families sought to overturn the agreement in court, asserting that they were not properly consulted as crime victims under federal law. In 2023, a U.S. federal judge ruled that the victims' families should have been notified before the agreement was finalized, but declined to scrap the deal. Still, the ruling acknowledged Boeing's conduct had caused direct harm and allowed families to continue pressing for greater transparency and accountability.

Separately, multiple civil lawsuits were filed against Boeing by families of the victims. Many of these suits were settled confidentially, although some proceeded through U.S. courts. In one high-profile case, internal Boeing documents revealed that employees had referred to the 737 MAX certification process in alarming terms, with one employee stating, "This airplane is designed by clowns who are supervised by monkeys." These disclosures intensified public outcry and bolstered claims that Boeing had cultivated a culture prioritizing cost-cutting over safety.

In addition to civil and federal proceedings, Boeing's former Chief Technical Pilot, Mark Forkner, became the only individual criminally charged in relation to the MAX disasters. He was accused of deceiving the FAA about MCAS during the certification process. However, in March 2022, Forkner was acquitted of all charges by a jury, with jurors concluding that he had been made a scapegoat for broader corporate failures.

As legal battles continued, Boeing faced heightened oversight from the FAA and Congress. In 2020, the U.S. Congress passed the Aircraft Certification, Safety, and Accountability Act, which restructured how aircraft are certified and increased transparency between manufacturers and regulators. While Boeing was able to resume MAX deliveries after software and training fixes were approved, its legal and reputational challenges are ongoing, especially as further safety concerns have emerged in subsequent years, including recent whistleblower complaints and manufacturing quality control issues.

3.3. Safety Regulations That Were Called Into Question

In the aftermath of the Boeing 737 MAX crashes, several key aviation safety regulations and oversight mechanisms were called into serious question, both in the United States and internationally. At the center of the controversy was the FAA's Organization Designation Authorization (ODA) program, which allows aircraft manufacturers like Boeing to certify their own aircraft systems under FAA supervision. Investigators found that during the MAX certification process, Boeing engineers with delegated authority failed to fully disclose the scope and risks of the MCAS system. In some cases, FAA officials were unaware that MCAS could activate repeatedly or rely on a single sensor, and the agency approved the aircraft without requiring additional pilot training or simulators.

This raised fundamental concerns about regulatory capture—the idea that Boeing had too much influence over the FAA's oversight decisions. Congressional hearings and internal FAA audits revealed that safety-critical functions were effectively under the control of Boeing employees whose interests may have conflicted with those of public safety. Additionally, whistleblowers and internal emails showed that engineers faced pressure to meet delivery deadlines and cost targets, potentially compromising safety standards. The lack of transparency about MCAS and its exclusion from flight manuals further exposed regulatory weaknesses in how safety-critical software systems were reviewed.

Another regulation that came under scrutiny involved the FAA's approach to pilot training requirements. Boeing had marketed the MAX as a "plug-and-play" upgrade to previous 737 generations, arguing that minimal training would be needed. This was financially attractive to airlines but ultimately dangerous, as pilots were not adequately prepared to deal with MCAS malfunctions. The FAA's initial agreement to certify the MAX without requiring simulator training was criticized as a failure to consider human factors in emergency scenarios. Following the crashes, the FAA and global regulators reversed this approach, requiring mandatory simulator training before pilots could fly the MAX again.

Internationally, the crashes also prompted a broader reevaluation of global certification standards. Aviation authorities in Canada, the EU, China, and elsewhere began to question the practice of automatically accepting FAA certifications. In response, some regulators conducted independent reviews of the 737 MAX before allowing it back into service, breaking with longstanding mutual recognition agreements. This shift exposed a need for greater international collaboration and consistency in evaluating aircraft safety, especially in the context of increasingly complex automation systems.

Ultimately, the regulatory failures surrounding the 737 MAX led to major structural reforms. In 2020, the U.S. Congress passed the Aircraft Certification, Safety, and Accountability Act, which tightened oversight of delegated authorities, enhanced whistleblower protections, and required more transparent communication between manufacturers and regulators. While these reforms marked progress, the Boeing case remains a cautionary tale about the risks of complacency in safety regulation and the dangers of putting commercial pressures above the rigorous testing and independent review that modern aviation demands.

3.4. Public Opinion

Public opinion in the wake of the Boeing 737 MAX disasters was deeply critical and marked a sharp shift in how the public perceived Boeing, the FAA, and even the safety of modern commercial aviation as a whole. Immediately after the crashes, there was widespread confusion and alarm, particularly given that two virtually identical accidents had occurred within a span of five months. When the 737 MAX was not grounded immediately following the first crash, and only after considerable international pressure after the second, many viewed the delay as a sign that economic and political interests were being placed above human lives.

As more information came to light—especially about the MCAS system, the lack of pilot training, and Boeing's internal communications—public outrage grew. Passengers and families of victims expressed disbelief that such a major design flaw had not only been certified but hidden from pilots. Boeing was accused of misleading regulators and putting profit before safety. The internal messages, including Boeing employees mocking regulators and expressing concerns about the aircraft's safety, went viral and became symbols of corporate negligence. These revelations deeply damaged Boeing's once-sterling reputation as a leader in aviation engineering.

The FAA also faced severe criticism from the public, especially within the United States. Many questioned why the agency had allowed Boeing so much autonomy in certifying its own aircraft, and whether it had become too deferential to the industry it was supposed to regulate. This distrust extended beyond Boeing and the FAA to the aviation system more broadly. For the first time in decades, a significant number of passengers reported avoiding specific aircraft models, especially the 737 MAX, and travel forums were flooded with questions about how to identify which aircraft would be used on a given flight.

Among the families of the crash victims, public opinion took on a more urgent and emotional tone. Many were highly vocal in the media and in front of congressional hearings, accusing Boeing and U.S. regulators of treating their loved ones as collateral damage. They criticized the Deferred Prosecution Agreement Boeing reached with the Department of Justice as a slap on the wrist and lobbied for criminal accountability, arguing that lives were lost due to a corporate culture that valued deadlines and cost-cutting over transparency and caution.

In the broader public discourse, the case became emblematic of a wider concern about corporate accountability in the modern era. Commentators and industry analysts compared Boeing's fall from grace to that of other once-revered institutions brought low by scandals. For some, it also raised broader concerns about the growing reliance on automation in aviation and the extent to which pilots remain equipped to intervene when systems fail. Although Boeing has worked to restore its image through apologies, compensation, and safety reforms, public confidence has been slow to return. Even years later, polls showed that a sizable segment of travelers remained wary of flying on the 737 MAX, and many view the case as a cautionary example of what happens when oversight fails in high-stakes industries.

3.5. Financial Impact and Market Fallout

The financial impact and market fallout from the Boeing 737 MAX crisis were both immediate and long-lasting, fundamentally reshaping the company's position in the global aerospace industry. After the two fatal crashes and the subsequent global grounding of the aircraft in March 2019, Boeing's share price fell sharply, erasing tens of billions of dollars in market value. Investors reacted not only to the grounding itself, but to the growing realization that the issue was systemic and would not be resolved quickly. Boeing halted MAX deliveries, causing a massive disruption in its cash flow, and the company was forced to suspend production of its best-selling aircraft entirely by early 2020.

Financially, Boeing faced staggering direct costs. The company reported over $20 billion in losses related to the 737 MAX by 2021, including customer compensation, legal settlements, increased manufacturing and regulatory compliance costs, and lost revenue. Airlines that had purchased the MAX sought compensation for grounded fleets and delayed deliveries, and Boeing entered into numerous settlement agreements with carriers around the world. In parallel, the company had to spend heavily on redesigning the MCAS system, overhauling pilot training protocols, and managing an exhaustive recertification process with multiple global regulators.

The crisis also triggered a significant loss of customer trust. Some airlines canceled orders or shifted business to rival Airbus, whose A320neo family saw a boost in demand during Boeing's troubles. The timing was particularly damaging, as Boeing had been relying on MAX sales to drive future growth and compete with Airbus in the narrow-body market, which accounts for the majority of global commercial aircraft sales. By the time the MAX was cleared to fly again, Boeing had lost its momentum in that race, and Airbus solidified its lead as the world's top aircraft manufacturer.

The broader supply chain also felt the effects. Hundreds of suppliers that depended on the 737 MAX program—from engine manufacturers to avionics companies—saw significant revenue declines. Boeing's prolonged production halt reverberated across the aerospace ecosystem, causing layoffs, factory slowdowns, and financial distress among parts vendors and logistics firms. In particular, Spirit AeroSystems, which builds fuselages for the MAX, was heavily impacted and faced its own operational challenges as a result.

Credit rating agencies downgraded Boeing's debt, and the company was forced to take on tens of billions in additional borrowing to stay afloat. This raised concerns about long-term financial health and prompted several changes in executive leadership, including the replacement of the CEO. The crisis also led to a broader re-evaluation of the company's corporate governance, transparency practices, and risk management processes.

Even years later, Boeing continues to grapple with the fallout. Although the MAX returned to service with updated systems and training protocols, ongoing quality control issues—such as the 2024 Alaska Airlines door plug incident—have reignited scrutiny. The company faces continuing expenses related to legal claims, regulatory compliance, and brand rehabilitation. In the eyes of investors, Boeing transitioned from a stable industrial blue chip to a more volatile and risk-laden stock. The 737 MAX crisis stands as one of the most expensive and damaging corporate disasters in aviation history, with financial repercussions that extend far beyond Boeing's own balance sheet.

4. Aircraft Maintenance

4.1. Short History and General Overview

When the Wright Brothers made their first flight in 1903 there was no such thing as an Aviation Maintenance Technician. Charles Taylor, a man who worked in their bicycle shop, was the closest thing they had. When he built the first aircraft engine, he had no instructions or manual to follow. If anything went wrong, it was his job to figure out the problem and try to fix it to the best of his abilities. He was completely self-taught, the first of his kind, but definitely not the last. He helped create an entirely new field of work: aviation maintenance technicians. At first there were no requirements or regulations, but by 1909, technicians began to be licensed. The first standards were implemented later, in 1919.

What did the field look like as planes started to "take off"?

- Aviation maintenance technician training was left up to the aircraft owner or in later years supplied by the airlines who hired them.
- Aviation technicians were not required to catalog the maintenance they were performing.

- Prior to the 1920s there were no regulations for aviation maintenance, meaning everyone was doing something completely different.
- Manuals finally started to be developed after the Air Commerce Act of 1925, with technicians keeping notes and documenting their repairs.
- By 1948, the International Civil Aviation Organization (ICAO) had implemented their own licensing standards, but did not enforce them.

As Boeing launched the first 747 aircraft in 1969, they were also innovating new ways to troubleshoot. Instead of trial and error, they started using the “bottom up” process. This gave technicians a pragmatic way to evaluate their systems and determine which components were malfunctioning. However, prior to the 1980s, technicians dealt with mechanical and analog systems, unlike the complex digital systems we see today.

Started in the 1960s and reinstated in the 1980s, Power-by-the-Hour allowed for more cost predictability with scheduled maintenance over an extended period of time. Planes were starting to have built-in test equipment (BITE) starting in the 1960s. Unfortunately, BITE was limited to indicators that were provided by the system, which did not take into account everything that could possibly malfunction. Because of this, there was still the possibility of technicians replacing the wrong equipment while the faulty parts remained. With the implementation of Power-by-the-Hour and scheduled maintenance, airlines were able to save money: only replacing necessary parts while leaving operational components alone. Scheduled maintenance also helped to increase safety standards.

Today with all the advances in technology there has also been an advancement in safety: not only for passengers and crew but also those on the ground. Everything in the aviation industry is highly regulated, with standards and policies set by the government. The biggest change however, is now technicians are taking preventative measures. They are no longer trying to fix problems as they arise, they are trying to prevent them from happening in the first place. Although this scheduled maintenance began almost 60 years ago, it has been fine tuned since with government regulations leading the way.

Today, maintenance checks occur after:

- A certain amount of hours flown
- Days since last check
- A certain amount of trips flown
- Or a combination of all three of these factors

After these maintenance checks are carried out, a licensed technician must record and sign off on all repairs made.

4.2. Regulatory Frameworks in Place

FAA regulations are codified under Title 14 of the Code of Federal Regulations (CFR), also known as the Federal Aviation Regulations (FARs). These regulations govern all aspects of aviation, including aircraft design and certification, pilot licensing, air traffic management, airport operations, and airline safety. In this section aircraft maintenance will be the main focus which is part 43 of FAA Regulations. Part 43 of CFR covers maintenance, preventive maintenance, rebuilding, and alterations. The full document of part 43 is included in the bibliography of this study guide if you wish to get deeper insight on aircraft maintenance. I suggest you take a look since understanding these basic concepts will benefit you during the sessions.

CFR Files are extremely organized and detailed about maintenance categorization. Different actions are categorized as different types of maintenance and rebuilding to achieve a more clear and comprehensive approach. Some examples are listed below:

(3) Propeller major repairs. Repairs of the following types to a propeller are propeller major repairs: (i) Any repairs to, or straightening of steel blades. (ii) Repairing or machining of steel hubs. (iii) Shortening of blades. (iv) Retipping of wood propellers. (v) Replacement of outer laminations on fixed pitch wood propellers. (vi) Repairing elongated bolt holes in the hub of fixed pitch wood propellers. (vii) Inlay work on wood blades. (viii) Repairs to composition blades. (ix) Replacement of tip fabric. (x) Replacement of plastic covering. (xi) Repair of propeller governors. (xii) Overhaul of controllable pitch propellers. (xiii) Repairs to deep dents, cuts, scars, nicks, etc., and straightening of aluminum blades. (xiv)

So the archives of the FAA are extremely detailed to grant safety with clear rules.

4.3. Future Improvements

Looking ahead, the future of aviation maintenance promises even more innovation. The development of electric and hybrid aircraft will bring new challenges and opportunities for maintenance professionals. Autonomous maintenance systems, leveraging robotics and AI, may become more common, further enhancing efficiency and safety.

The historical evolution of aviation maintenance is a fascinating journey that reflects the broader advancements in aviation technology and the increasing complexity of aircraft. From the early days of simple repairs to the sophisticated, technology-driven practices of today, maintenance has always been at the forefront of ensuring the safety and reliability of air travel. As the industry continues to innovate, maintenance practices will undoubtedly evolve, continuing to play a crucial role in the future of aviation.

By understanding the history of aviation maintenance, we can appreciate the progress made and anticipate the exciting developments that lie ahead. In this committee you delegates should use these base ideas to come up with new innovative ideas and solve possible crises. Learning from past crashes and advancing in technology is key in aviation.

As former fighter plane pilot Eddie Rickenbacker suggests: “Aviation is proof that given the will, we have the capacity to achieve the impossible.”

5. Safety Inspections

5.1. Current Standards

Currently safety standards are regulated and inspected by an office of the FAA named The Office of Safety Standards. The Office of Safety Standards focuses on establishing standards within the Service’s purview for operations, repair and alteration of aircraft and operations, the use of designees or delegation, flight technologies, safety promotion, and international operations. This office represents the safety policy component and shares in the representation of the Safety Risk Management (SRM) and safety promotion components of the Service’s SMS. These responsibilities are balanced across eight divisions.

The eight divisions of the Office of Safety Standards focus on the following:

- Air carrier and air taxi operations, and the maintenance and alteration of aircraft
- International agreements and certification and oversight for foreign entities, and determining operational suitability of aircraft
- Operating airmen, general flight operations,Unmanned Aircraft System (UAS), and flight technologies associated with air traffic management, airspace requirements, and Instrument Flight Procedures (IFP).

The Office of Safety Standards is responsible for the following:

- Develops, implements, and tracks regulations, guidance, and directives
- Works collaboratively and interdependently with other Service offices, divisions, and internal and external stakeholders to identify and create awareness of trends impacting aviation safety.

5.2. Possible Liabilities & Loopholes

Perhaps the most contentious loophole in aviation regulations is the delegation by the FAA of safety certification responsibilities to manufacturers through the Organization Designation Authorization (ODA) program. While optimizing procedures and improving technical excellence, this program has also raised serious questions, particularly following the Boeing 737 MAX disasters. Investigations found that MCAS and other essential systems were never fully inspected by third-party regulators. This left room for a risk where producers may have conflicting interests and balancing safety against commercial incentive. Although changes have been implemented, critics argue that regulatory oversight remains too reliant on industry self-regulation.

A second gap in regulation is caused by differences in training standards between large carriers and regional carriers. While federal regulation now requires all commercial pilots to have an Airline Transport Pilot (ATP) certificate (also known as the 1500 hours rule), there is still great variation in the quality and frequency of recurrent simulator training, especially at regional airlines with limited budgets. Further, while U.S. standards are higher than many foreign requirements, the global nature of aviation guarantees that safety can be undermined by less rigorous training systems overseas. The FAA needs to consider domestic standards harmonization with the encouragement of more international uniformity withICAO.

Despite advancements in aircraft technology, portions of the U.S. aviation infrastructure continue to be legacy-based. The FAA initiated the modernization of air traffic control through NextGen, but it has trailed in implementation and underfunding. Airports vary widely, as well, in embracing safety systems like Runway Status Lights or Surface Movement Radar. That inequality introduces exposure, especially among smaller or poorly funded airports. Rules often allow delays or discretion in following them, so national safety is not always consistent.

5.3. Past Alterations

Other than Chicago Convention Standards and Recommended Practices (SARP) are a big part of alliterations to regulations as well. However, SARPs are effective only if they are embraced in the domestic law and governmental institutions and procedures. As we have seen, member States have an obligation to follow SARPs to the maximum practicable extent. Soon after the United States and ICAO began to audit State compliance, it was discovered that some States either had not established a civil aviation code or regulatory agency, or had promulgated legal and regulatory requirements that fell short of the SARPs. ICAO noted that States should develop comprehensive legislation and regulations implementing the SARPs or "select a comprehensive and detailed code established by another Contracting State." The U.S. Department of Transportation has the authority to assist foreign nations in improving aviation safety. In order to assist States in achieving compliance, the FAA drafted a model Civil Aviation Safety Act (CASA) and model aviation regulations, based in part on U.S. aviation statutes and regulations. The model CASA and model regulations are both posted on the FAA website.

Also safety regulations got alliterated after massive events regarding aviation. After the 9/11 terrorist attack on twin towers Cockpit Door Reinforcement regulation required all U.S. airlines to have bulletproof and locked cockpit doors. Also flight deck crew received new safety protocols as well. Another example is the changed regulations after the Colgan Air Flight 3407 Crash in 2009. The crash was caused due to pilot error and fatigue resulting in 50 people's death. Now an increased minimum flight hour system is present due to this crash which is 1500 hours which all officers must obtain. Pilot monitoring and training have also improved amongst airlines after the Colgan Air Flight 3407 Crash as well. A final notable alliteration to aircraft safety regulations is the new Portable Electronic Device (PED) rule. Before, portable electronic devices had to be turned off before landing and takeoff. However, in 2013 FAA updated the guidance that devices can be used on airplane mode gate to gate and airlines need to prove their aircraft is not vulnerable to any interference caused by PEDs.

6. Past Aviation Case Studies for Reference

The Boeing 737-MAX was not the first of its kind, neither in reputational damage, widespread legal action, financial reimbursements, nor public outreach. There have been many aviation disasters that previously led to similar discourses, which is a testament to just how far aviation safety regulations have come.

6.1. McDonnell Douglas' DC-10: Regulatory Oversights Lead to Catastrophe

One of the most popular aircrafts of the 1970s, DC-10 initially had a very successful run. McDonnell Douglas intended to design a wide-body aircraft that is smaller than Boeing 747, which was heavily sought after by popular commercial service providers like American Airlines at the time. The company started design efforts for the aircraft in 1967, and the DC-10 was ready for its maiden flight in 1970. The initial testing raised no red flags, so after a year, in 1971, the FAA and McDonnell Douglas did not hesitate to give the green light to American Airlines to start operating the aircraft in its fleet. The aircraft successfully operated for a year, but in 1972, American Airlines Flight 96 raised quite the concern about its design. On a 40-minute commercial flight from Detroit to Windsor, which are only separated by a river that marks the United States-Canada border, the DC-10's rear cargo door blew wide open, which led to a partial decompression in the aircraft. Luckily, the flight was quite short and the pilots managed to safely land in Windsor airport, so there were no fatalities, nor any injuries. However, the incident (dubbed "Windsor Incident") highlighted crucial design flaws, and both the FAA and McDonnell Douglas were quick to react, and re-evaluated the cargo hatch design. However, only incidental solutions were suggested, and widespread implementation unfortunately did not happen. This is a great demonstration of how lax the regulations were at the time.

The deadliest disaster in aviation history stemmed from the same problem in DC-10s, which is a critical flaw that was repeatedly overlooked in cargo door design. Turkish Airlines' Flight 981 (known as the Ermenonville Disaster in Aviation) was a regular flight that was scheduled from Istanbul's Atatürk Airport (formerly known as Istanbul Yeşilköy Airport) [IST, code now used for Istanbul Airport, which was opened in 2021] to make a stopover in Paris Orly [ORY] Airport and then continue its journey to London Heathrow [LHR] Airport. The aircraft successfully completed the first half of its journey, and landed at Orly. After its initial assessment at Orly, the aircraft was cleared for takeoff again, and standby passengers from a British-European Airways flight that was delayed were also allowed to board. The plane was fully loaded with no empty seats, boasting a total of 332 passengers, and 14 crew members on board. Just a mere ten minutes after its takeoff from Orly, the same cargo door latch design problem mentioned priorly led to an unforeseen catastrophe. The rear-cargo door blew wide open again, but this time, the sudden change in air pressure resulted in an explosive decompression of the cabin, which put too much stress on the outer lining of the plane, and eventually tore the passenger cabin floor off. The hydraulic lines and control cables that travelled through the cabin floor were severed, which ultimately led to system failures across the board. The pilots completely lost control of the aircraft, and that led to a catastrophic crash into the Ermenonville forest just outside of Paris. The aircraft disintegrated on impact, immediately killing all 346 on board, and its wreckage was scattered over a 25-mile radius in the forest. Recovery efforts were extremely challenging due to the high-speed vertical impact.

After the crash, inspectors took off to Paris to find out what went wrong. They already knew that a similar event exposed a critical flaw in DC-10's cargo hatch design, so they were quick to search for the remains of the cargo door. Their suspicions were confirmed once they found remains of the passenger cabin floor considerably further away from the initial 25-mile radius. They quickly figured out that a decompression in the cargo cabin led to the catastrophe. So, they now had another question in their hands: The plane's manufacturer McDonnell Douglas, the FAA, major airlines that operated the aircraft like Turkish Airlines, and runway inspectors in hotspot airports such as Orly airport knew about the possibility of such a problem, so who exactly was to blame? Long story short, the inspectors learned that the ground crew in Orly Airport was severely lacking in sufficient training, and were not equipped with the information regarding DC-10's cargo hatch problems. They should not have cleared the aircraft after its landing at Orly Airport. The ground crew at Istanbul's Yeşilköy Airport were cleared of any wrongdoing after inspections of their reports. It became evident to inspectors that locking mechanisms used to hold the aircraft's cargo door in place were not strong enough. The DC-10's cargo door design equipped outward-opening doors to maximize space, which required immensely powerful locking mechanisms, and DC-10s at the time just did not have that. So, inspectors announced that the same problem could happen any time, on any flight, and the entire fleet of DC-10s was grounded worldwide. Multiple lawsuits were filed against McDonnell Douglas, Turkish Airlines, Air France, who was the training provider for the ground crew at Orly Airport, and even the British-European Airlines, however, Turkish Airlines and British-European Airways were cleared of any wrongdoing. McDonnell Douglas and Air France, on the other hand, received penalties, with McDonnell Douglas paying a record high fine for aviation at the time.

Overall, Flight 981 was a milestone in aviation safety. A mixture of technical design flaws, human error, and regulatory shortcomings were the liabilities that led to the disaster. So, inspectory regulations were evaluated, ground crew trainings became more technically-inclusive, and mandatory ICAO safety requirements for aircrafts were severely altered.

6.2. Comet: Market Competition and Rushed Design Process

de Havilland's Comet was the world's first jetliner, by mere months. After the Second World War, most aircraft manufacturers prioritized luxury, and the British government was no-stranger to that. They collaborated with de Havilland, a British aircraft manufacturer to design a jetliner that did not utilize piston-engines, which would come in handy for luxurious air travel as jet engines were faster, less noisy, thus ultimately, more luxurious. However, there was a great opening in the market for that as most air service providers were building up their fleets for post-war air service, and they all wanted the same thing, so de Havilland was on a timer. Boeing, an up-and-coming American aviation services company was rumored to have designed the "ultimate" jetliner, so de Havilland needed to one-up Boeing to dominate the market. This ambition ultimately led to Comet's downfall, as its roll-out was quite reckless with the timeline. The design for the aircraft was finished in under a year, and the first prototype Comet-1 flew from Hatfield, UK. The aircraft was powered by four de Havilland Ghost turbojets embedded in the wings, and the pressured, sleekly designed cabin featured square windows with hardened glass.

Comet-1 had a longer test run with authorities, and eventually entered into commercial service in 1952, where the British Overseas Airways Corporation (also the operator of American Airlines at the time) launched the world's first ever jet-powered passenger service from London to Johannesburg. Passengers were enthralled by the quietness and smoothness of the ride, and definitely seemed to enjoy the reduced travel times. However, after a successful debut, Comet crashes began due to previously undetected structural weaknesses.

To briefly explain, the first crash was eventually blamed on turbulence, however, repeat incidents showed a tendency for Comets to disintegrate mid-air. Aviation inspectors figured out that repeated pressurization cycles caused a great deal of metal fatigue, and due to both the figure of the windows, which were unusually square, and the poor riveting technique used, metal fatigue caused cracks to form around the window corners, which eventually led to complete disintegration. This resulted in a complete grounding of Comet 1s, permanently. de Havilland and the British Overseas Airways Corporation mutually agreed to retire Comet from passenger service, and restricted further Comet models Comet 2 and Comet 3 to only be used for military missions.

The Comet crashes led to the invention of a whole new pre-prototype aviation safety inspection technique, water tank pressure test, which utilizes hydraulic pumps to simulate outer and inner cabin pressures to a fuselage prototype. This technique allows inspectors to witness the effects of real time pressure changes due to higher altitudes, which are mainly how well the structure withstands high cabin pressure, how long can the aircraft travel before metal fatigue settles in, and how strong the fuselage is.

de Havilland eventually returned Comet to passenger service with an updated design that included oval windows, stronger fuselage, and better metallurgy, however, by then, the thing that they had initially feared the most had happened. Both Boeing and McDonnell Douglas had already successfully launched their jetliners, Boeing 707 and DC-8, respectively, and they were already faster, bigger, and had longer range. So, Comet ultimately did not complete its original mission and was slowly phased out through the 60s, however, it contributed a great deal to today's aviation safety standards.

6.3. Airbus A320: Human-Machine Interactions and Fly-By-Wire Systems

Airbus A320's story is perhaps the closest to Boeing's, the initial launch of the A320 ended in a disaster due to software control over human input. Airbus had recently developed a new fly-by-wire software that would allow commercial airplanes to be automated fully by flight software, which was a groundbreaking first at the time. However, there was a massive oversight that neither Airbus nor any regulatory agency could see at the time. The aircraft was set to debut in 1989 (which, perhaps, is also the greatest album of all time, by Taylor Swift), however, to make headway into marketing and promotion efforts, Airbus decided to organize a demonstration flight, in collaboration with Air France. - wonder why Air France and American Airlines account for 95% of the crashes in this guide, nevermind - The first edition of the aircraft, the Airbus A320-111, took off from Habsheim Airfield near Mulhouse, at an annual airshow organized by Air France. Since the demonstration was during an airshow with a large audience, the demonstration flight had to be a low-altitude flyby, so that bystanders could fully witness the aircraft's agility and sleek design. However, there was a slight oversight there. The aircraft prototype was only 2 months old, yet was also fully functional with Airbus' brand-new fly-by-wire technology, which meant that even the most experienced pilot did not have enough time to be fully trained in it, let alone inaugurally test out the technology in-flight. Even though Air France was concerned with the possibility of problems arising due to how unfamiliar the controls would be for pilots, Airbus reassured the airline to go ahead with the demonstration.

Directly after its takeoff, the aircraft was gaining altitude quite slowly, which was expected, however, the pilot, Michel Asseline, did not take the fact that 100 feet AGL (above-ground-level) was below the treetop line into account. This, combined with the slow thrust speed of the engines and a high angle of attack, caused the aircraft to strike the trees at the end of the runway. Seconds before impact, the pilots tried to apply full throttle, however, they claimed that the automated system was too slow to react and the engines did not gain enough thrust to uplift the aircraft above treetop level. Nevertheless, the impact from the trees, combined with the low altitude and slow speed of the aircraft, was enough to halt its inaugural flight, and thus the aircraft crashed into the woods and burst into flames. Most passengers escaped, however, 3 passengers that were in the rear-end of the aircraft were trapped and died in the fire subsequent to the crash.

Since the entire incident was recorded, it was highly politicized in France, in true French fashion. The pilots were blamed, and they were actually convicted of involuntary manslaughter, though the captain pilot, Michel Asseline, insisted that Airbus' system was at least just as to blame. Both the manufacturer, Airbus, and the operator, Air France, were highly criticized for inadequate oversight.

The crash allowed aviation safety regulators to draw very key conclusions for future references, which mostly revolved around human-software interactions and flight mode awareness. Moreover, it highlighted the fact that pilots did need to be trained in a new way to be able to handle automated flight software-assisted aircrafts. And despite the crash, A320's fly-by-wire safety systems have proved themselves very reliable and have since become the industry standard, even as of today.

6.4. Concorde: Aviation Economics

The Concorde occupies a very unique position in passenger aviation industry history. Developed by Aérospatiale, a French company, in the 1960s, Concorde was, and still is, the world's only international, commercial supersonic transportation vehicle. The aircraft flew higher, faster, and more luxurious than any other air transportation mode and became a status symbol. It was used by royalty, CEOs, and celebrities. A flight from London to New York only took 3 hours if you flew in a Concorde, which was less than half of what it would take the fastest subsonic jet, the Boeing 737, to fly, at the time. However, Concorde also came with its fair share of downsides. Firstly, the plane had a very unique design, with a narrow fuselage, sharp nose, and triangular wings (dubbed "delta wings") which made it quite challenging for maintenance workers to upkeep Concordes. Moreover, due to the narrow fuselage, Concordes could only fly a hundred passengers, and due to high fuel consumption during takeoff, Concordes could only be used for high-range flights. This made Concordes quite expensive to operate, with minimal revenue for airlines.

As they have become a symbol of aviation luxury, Concordes were regulated heavily, and their inspections were thorough. Therefore, there has only been one recorded Concorde crash, but it was quite the catastrophe.

The Concorde crash of July 25, 2000, marked the tragic end of an era for supersonic commercial aviation and revealed a convergence of rare but fatal technical vulnerabilities. Air France Flight 4590 was scheduled to fly from Paris Charles de Gaulle Airport to New York JFK, carrying 100 passengers and 9 crew members. Just moments after takeoff, the aircraft ran over a metal strip that had fallen onto the runway from a Continental Airlines DC-10 that had departed minutes earlier. This titanium debris ruptured one of the Concorde's tires, sending high-speed rubber fragments into the underside of the left wing, where they punctured a fuel tank.

The rupture led to a massive fuel leak, which was likely ignited by electrical arcing or heat from damaged wiring or equipment. The aircraft caught fire rapidly, and within seconds, engine No. 2 began to lose thrust. The pilots attempted to gain altitude and veer toward nearby Le Bourget Airport for an emergency landing, but the aircraft remained unstable, struggled to gain lift, and ultimately stalled. It crashed into a hotel in Gonesse, just outside Paris, killing all 109 people on board and 4 people on the ground.

The crash investigation, led by France's Bureau of Enquiry and Analysis for Civil Aviation Safety (BEA), concluded that the Concorde was brought down by a chain reaction initiated by foreign object debris (FOD)—a piece of titanium that should not have been on the runway. However, the tragedy also highlighted known design vulnerabilities of the Concorde, such as the lack of tire blowout protection and the wing's susceptibility to fuel tank puncture from tire debris. Although modifications had been recommended in the past, they were not considered urgent, and the aircraft had continued flying without major changes.

As a result of the crash, the entire Concorde fleet—operated only by Air France and British Airways—was grounded. Engineers implemented safety modifications including Kevlar lining in fuel tanks and improved tires, and the aircraft resumed limited commercial service in 2001. However, by then, public confidence had been significantly shaken. Coupled with high operating costs, low profitability, and the post-9/11 decline in air travel demand, Concorde was unfortunately pushed into obsolescence.

The crash had a profound cultural and symbolic impact. The Concorde had long been a symbol of speed, innovation, and elite travel, but the disaster exposed the risks of aging technology and the consequences of overlooking cumulative design flaws. While the root cause lay in a highly specific and rare event, the implications led to a reassessment of safety assumptions even in seemingly well-tested systems. It also effectively closed the chapter on supersonic passenger flight—a realm no commercial jet has entered since.

7. Bibliography

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