

Enhancing Aviation Safety: Uncovering Human Error Patterns and Mitigating Risk

Madyson Jean-Louis, Mogomotsi Mahloele, Sun Ho Jeon, Pol Borbonet, Zachary Phillips

Faculty Advisor: Dr. Sohel M. Imroz (BA 520)



Abstract

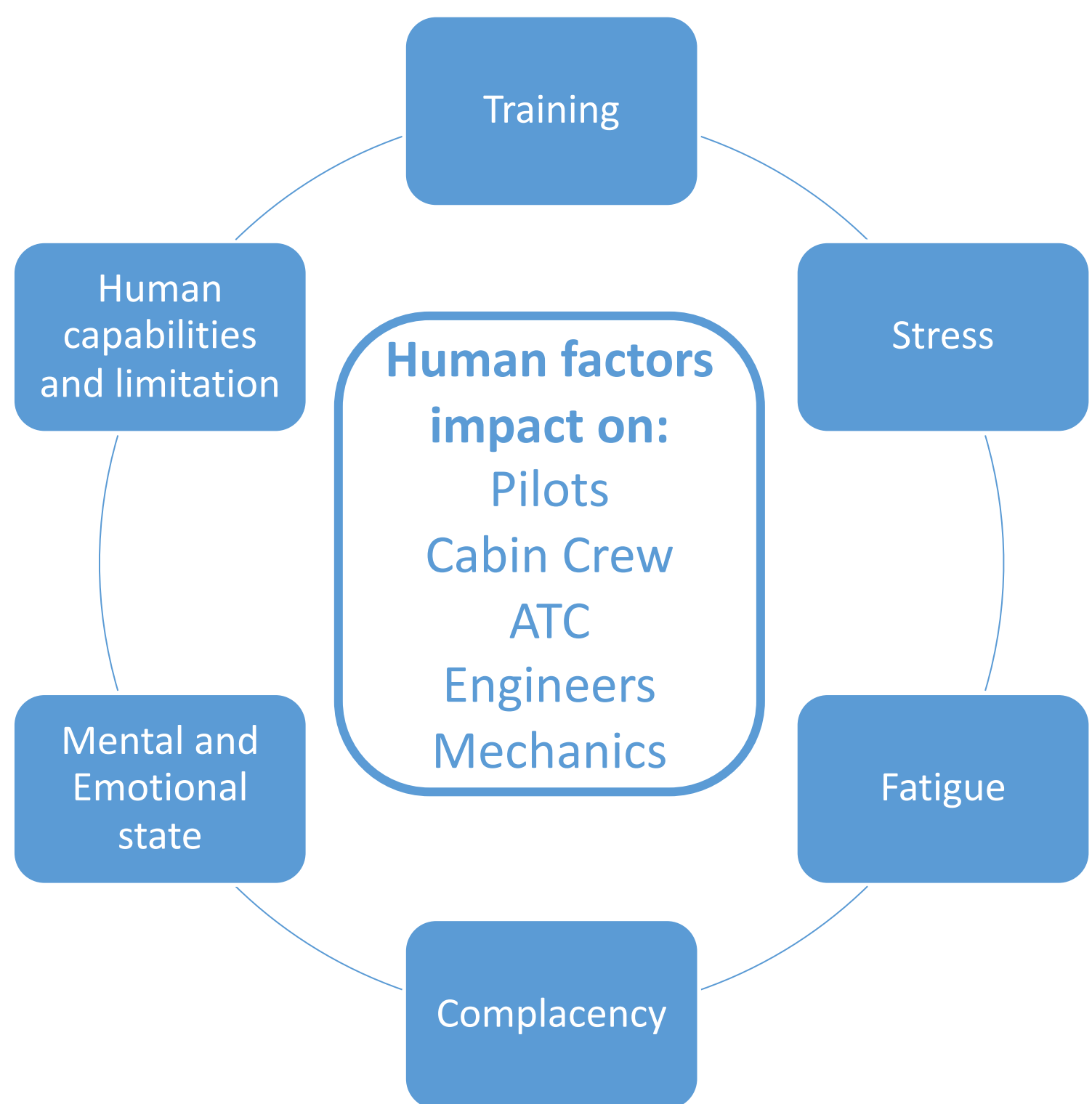
Human factors are the application of scientific insights concerning people and systems to optimize system performance. Given that human beings are integral to every aspect of systems, the potential for human errors stemming from stress, fatigue, or complacency is significant. In aviation, where errors can lead to catastrophic consequences, it is imperative to take comprehensive preventive measures. Our objective is to analyze major human factors issues contributing to aviation accidents, identifying patterns, and generating recommendations to enhance safety regulations and prevent future accidents. Additionally, we aim to assess the financial impact of accidents on the aviation industry. Through a thorough investigation of various accidents and their primary causes, the poster seeks to understand how to mitigate and reduce future incidents. Improved aviation safety benefits airlines, passengers, airports, governments, and regulatory agencies. They can utilize the findings of this poster to enhance aviation regulations and ensure a safer mode of transportation.

What is Human Factors?

Human factors is the application of scientific knowledge about the limitations and capabilities of people to the analysis and design of systems so that total system performance is optimized. Human factors is important from the beginning because it can save time and money, improve safety, reduce operator errors to save lives. Without human factors, it is difficult to make change after the product or system is designed. In addition, the ultimate goal of human factors is to reduce potential information processing errors and enhance user performance.

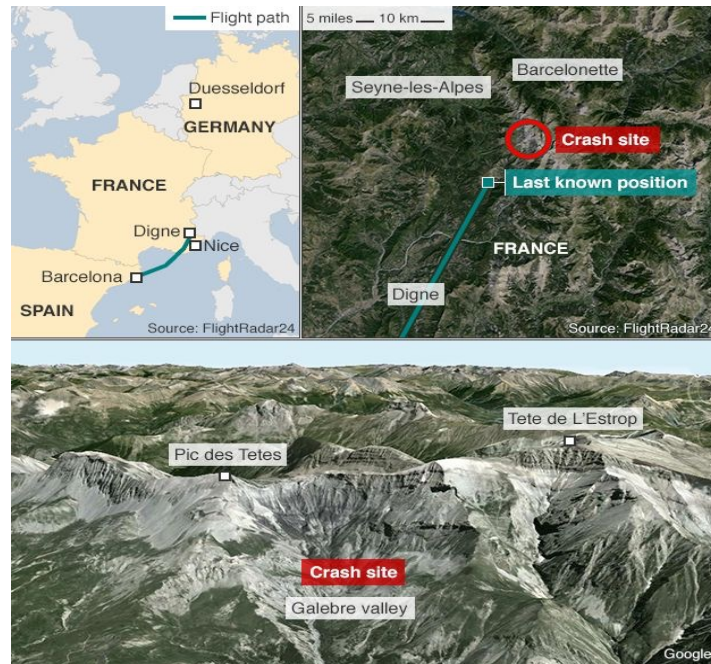


In relation to aviation, tangible human factors aspects include the training of pilots and flight attendants and how they interact with the avionics, flight controls, and other various systems that they encounter with on a daily. Examples of intangible human factors aspects include workload and stress and how it affects the communication and decision making by pilots on board.

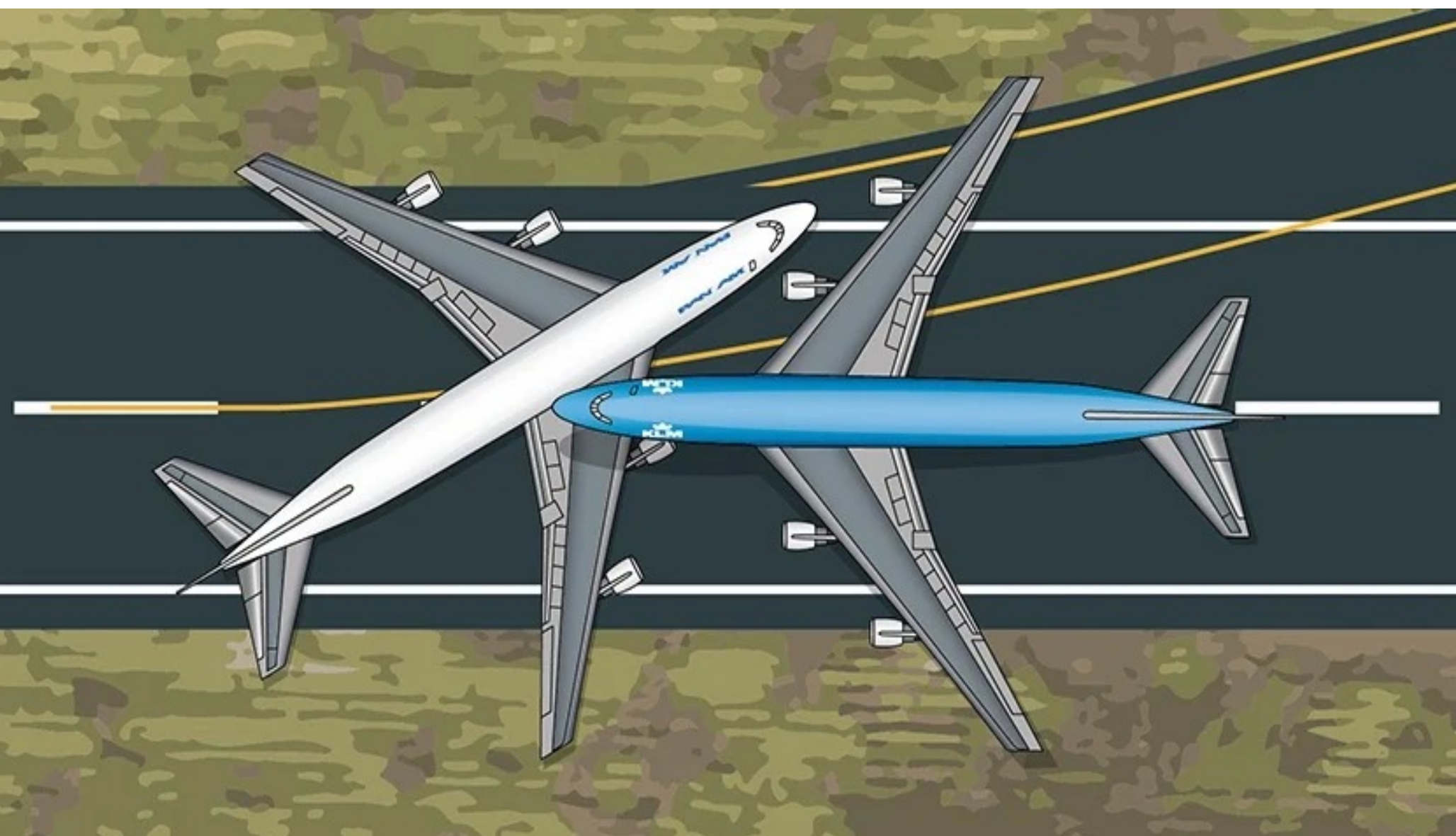


Human Factors Involved in Aviation Accidents

Germanwings 4U9525



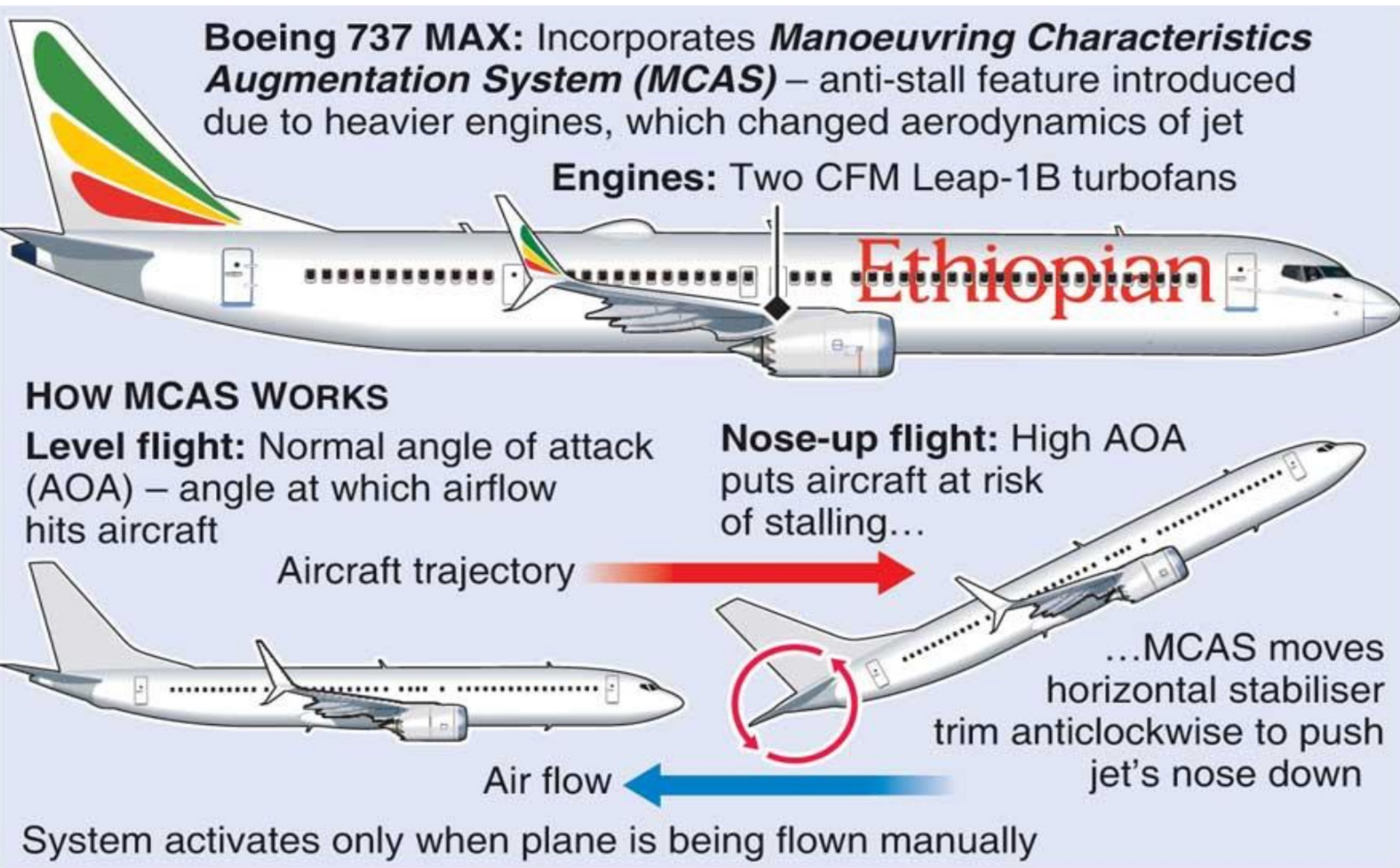
Tenerife Airport Disaster



Korean Air 801 & Asiana Airlines 214



Ethiopian Boeing 737-MAX 8



Lion Air Boeing 737-MAX 8



Human Error Patterns

1. Since 1980, at least 20 accidents were caused by medical issues, including schizophrenia, substance use, suicide, among others. These incidents highlight that mental incapacitation poses a greater flight safety risk than physical.

Physical Illness vs. Mental Illness



2. Communication has been a key element in many aviation crashes in the past and will likely impact several accidents in the future. It is imperative that more emphasis is placed on good communication techniques in order to minimize chances of future crashes.
3. Accidents caused by human factors can happen during any flight phase, but the takeoff and landing are the most critical parts of a flight. Fatigue can deteriorate a pilot's mental ability without them even realizing.
4. Some companies have chosen to deliver low-quality products in order to improve their financial reports and achieve quicker results, rushing through the product development phase.

Communication

Fatigue

Mental incapacities

Group-think

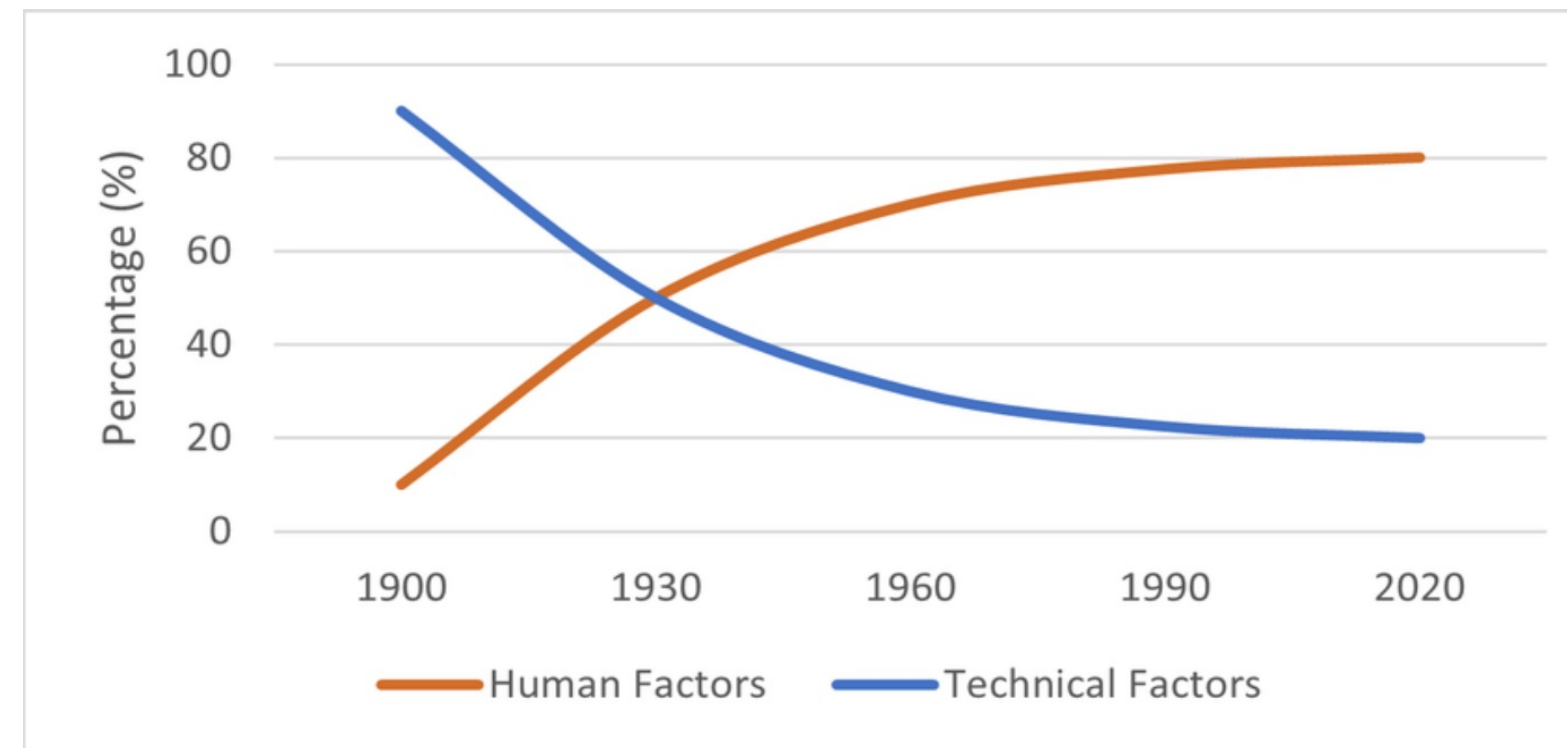
Human Error Mitigation

Patterns mitigation

1. Balance between medical confidentiality and public safety.
 - Pilots with a history of psychological/psychiatric issues may need periodic psychiatric evaluations for revalidations or renewals of their medical certificate.
2. Periodic pilot training to improve crew resource management and communication between pilots.
 - Diminish authority gradient in the flightdeck environment to empower first officers to challenge captains when they feel appropriate.
3. Require pilots to complete additional class instruction and simulator training, rather than 30-minute self-study courses.
 - FAA and Boeing should properly inform their pilots about any new software systems.
 - FAA should properly regulate software rather allowing plane manufacturers to self-regulate for safety.
4. Require pilots to complete additional instrument and simulator training even when similar iterations of an aircraft type are launched by manufacturers.
 - FAA and Boeing should properly inform their pilots about any new software systems.
 - FAA should properly regulate software rather allowing plane manufacturers to self-regulate themselves for safety.

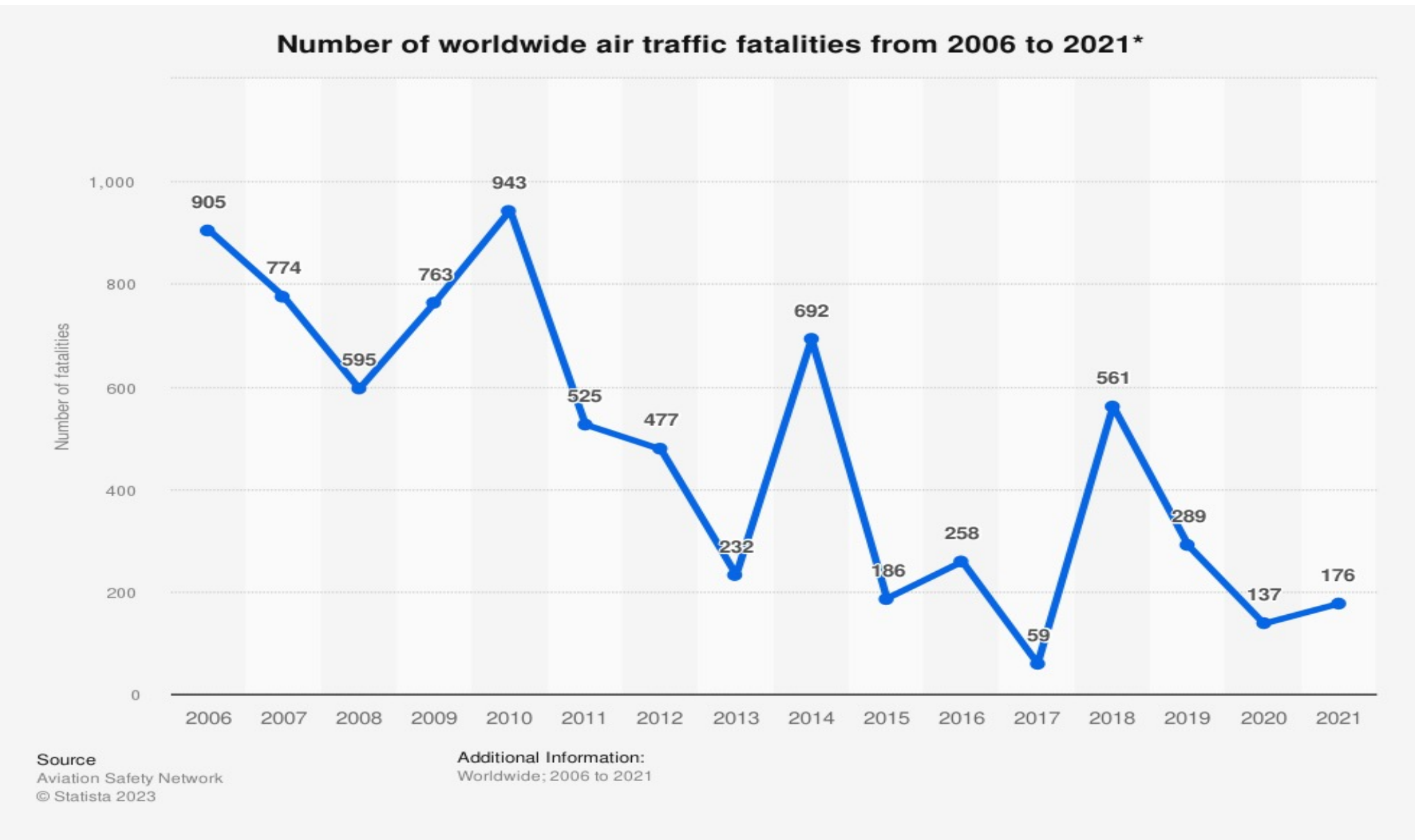
Recommendation and Future Research Study

1. Increase the number of accidents that are analyzed in order to get a better idea of the occurrences of which human factor occur most often.
2. Compare the results obtained with other similar studies to determine if they align with our findings, thus strengthening our conclusions.
3. The human factor that has the most occurrences requires an in-depth analysis and find further mitigation methods and present the results to the FAA.
4. Human-Automation Interaction: Research the evolving role of automation in aviation and its impact on human performance. Study how pilots adapt to advanced automated systems, with a focus on the potential for complacency and the need for ongoing training.
5. Human Factors in General Aviation: Extend human factors research beyond commercial aviation to encompass general aviation. Investigate the unique challenges faced by private pilots and smaller aircraft operations.



Conclusions

In the last century, aviation accidents have decreased over time, but the percentage of accidents caused by human factors has been increasing at the expense of technical factors, primarily due to advances in technology. It is important that humans can effectively interact with these new technological advancements to ensure efficiency and increase safety. It is clear that aviation accidents in the last decade and a half have decreased however with all the technological advancement we have accomplished, we have not solved many human factors affecting today's accidents. The accidents displayed in this poster are examples that human factors can be overarching issues in aviation accidents. Therefore, a large degree of accidents can be prevented or mitigated with effective human error mitigation strategies.



References

1. Evolution of aviation accident causes (adapted from [6]). - researchgate. ResearchGate. (n.d.). https://www.researchgate.net/figure/Evolution-of-aviation-accident-causes-adapted-from-6_fig2_349212918
2. Masrani, P. (n.d.). Aviation medicine (avmed) section . Aviation Medicine (AVMED) Section. <https://www.icao.int/safety/aviation-medicine/Pages/default.aspx>
3. Published by Statista Research Department. (2023, February 3). Worldwide air traffic - fatalities 2021. Number of worldwide air traffic fatalities from 2006 to 2021. <https://www.statista.com/statistics/263443/worldwide-air-traffic-fatalities/>

Additional references are available upon request