Pilot Safety and Human Factors Affecting the Aviation Industry

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Abstract

This article aims to identify the most significant human factors affecting offshore aviation safety and the adverse effects on pilot behavior (Goode, J. H., 2003). Aviation accidents account for between 70 and 80 percent of all incidents. The most effective methods for decreasing the number of incidents incorporate human factors into their design and implementation. These human elements can help managers and aviation safety professionals better comprehend the context of the industry as a whole and their individual company's specificities. According to the research, helicopter pilots' views on the most critical parts of their own and their passengers' safety diverged dramatically. Offshore aviation companies don't care about the well-being of employees if it means losing money. To avoid an unacceptable number of accidents caused by human error, the companies in question must devote their full attention to aviation safety.

The aviation and aerospace sectors have changed dramatically over the previous century. The Wright brothers made the first powered flight with a pilot on December 17, 1903. Nonstop flight. It began in 1919. First flight of a jet plane. Chuck Yeager was the first to fly a plane faster than sound. Quicker than sound in 1947 Neil Armstrong and Ed Aldrin. The Lunar Module landed for the first time on July 20, 1969. After 12 years, the shuttle Columbia, the world's most complex plane, took flight. From KSC. We met on December 23, 1986. Dick Rutan flew the first nonstop round-the-world trip. The types of aircraft and operations have changed substantially in 95 years. But pilots are still individuals.

Human factors experts in the Aviation Safety (AVS) division of the FAA seek to decrease and improve human performance in aviation systems to increase safety in the national airspace. Design severe issues in aircraft systems, maintenance, operations, procedures, and pilot performance are competence for these professionals. They also know related FAA regulations and advice. Aircraft certification and certification of pilots and mechanics, amongst other safety-related professions, are supported by these legislation, instructions, and processes.

Introduction

You can achieve anything, they claim. Even without statutory or prescriptive Flight Time Limitations, airline pilots' high level of burnout is a human issue. Growth in the air transport industry requires a sophisticated psychological approach and attention to human behavior under stressful working situations. Flying has long been a career dream for many. Professional airline pilots confront unique challenges. Is flying a plane a worthwhile career or just for the glitz? This study looks at cumulative tiredness, pilot job demands, and resource development. Pilot burnout occurs when fatigue problems intensify and work needs exhaust all available resources. In a high-risk situation like aviation, fatigue and burnout can lower performance and longer reaction times. This may have negative consequences, such as increased risk to one's safety. Flight 9525, operated by German wings, showed industry vulnerabilities and psychological dangers to aviation safety. Preventing burnout is more important than identifying and coping with work-related stress. Burnout is challenging to identify at first but becomes evident once it has taken hold. Flight crews view anti-turnout coping strategies as excellent and motivating**.**

More than 70% of commercial aviation hull-loss incidents can be attributed to human error. In addition to flight operations, human error has freshly emerged as a severe issue in repairs practices, and air traffic exacting issue engineers, pilots, and mechanics from Boeing work together to apply the most up-to-date information about the human-aircraft interaction to improve safety and efficiency in the daily operations of commercial airlines. As the retail aeronautics sector has understood that human mistakes, rather than mechanical failure, because most aviation accidents and incidents, "human factors" have become increasingly prevalent. Team resource management (CRM) and maintenance resource management (MRM) are often used interchangeably when discussing human issues (MRM).

But it has a much larger knowledge base and application range. Studies on human factors look at how humans can use tools and equipment safer, more comfortable, and more successful. Human factors in aviation are concerned with combining humans and technology. This knowledge is then used to improve human performance through new designs, training programs, policies, and processes. (Subramaniam, C., 2004) Aviation Despite rapid technological improvements, the aviation industry's success and safety, rely on people, not robots. During this time, the sector is investing heavily in personnel, equipment, and systems.

The industry can no longer make human performance decisions based on experience and intuition since technology is changing quicker than the human ability to predict human interaction. Design, training, and operations all have implications for human performance, necessitating the establishment of a solid scientific foundation. New human-aircraft interfaces and procedures for pilots and maintenance employees are being developed to reduce the number of commercial aviation accidents on the ground. When it comes to the human performance of the plane, Boeing is constantly testing and perfecting the design. Experts in operational safety and human factors collaborate to help operators manage the risks associated with human error. Specialized teams must collaborate closely with engineers, safety experts, test and training pilots, mechanics, and cabin crew members to successfully integrate human factors into all Boeing aircraft designs.

Literature Review:

Human Factors in Aviation, written by Earl Wiener and David Nagel, was published in 1988 and is considered a classic in the field. When the stealth bomber, the Hubble telescope, and the perestroika were still cutting-edge concepts, this significant book revolutionized the ion industry's perspective on human aspects. There was no such thing as a "human factor" when aviation and human factors were first entwined. Human factors research, which can trace its roots back to the 1920s, had already established itself as an essential tool for enhancing aviation safety. Human factors have hitherto been viewed as a remedial science rather than an integral part of the design process for aircraft design and aviation operations. Human factors research was able to grow because of this newly developed role. Aside from cockpit and cabin technology, other significant themes were being studied in addition to crew interaction and crew fitness, judgment, and automation in the early years of the industry's development. Overall, their book is an essential contribution to aviation research. For the first time, it offers human aspects of subjects pertinent to aviation in a way that is understandable to pilots, aviation industry employees, and people who are just curious about the subject matter.

From around 1487 onwards, Leonardo DiVinci focused his attention on anthropometrics and began conducting experiments. Leonardo da Vinci presents anthropometric standards in his most famous drawing, the Vitruvian Man. At the same time, he began to investigate bird flight. He realized this was impossible because people were too heavy and weak to fly with wings linked to their arms. Consequently, he sketched out an apparatus in which the aviator is supported by two enormous, membranous wings and moves them with hand levers, foot pedals, and a pulley mechanism. Human anthropometry is increasingly essential in computer design, design for access and maintainability, simplicity of instructions, and ergonomics. By reducing human error in medicine in the early 1900s, industrial engineers Frank and Lillian Gilbreth sought to improve the quality of care. Using callbacks to communicate in the operation room was a new idea that they pioneered. When the doctor says "scalpel," the nurse repeats "scalpel" and then passes it to the doctor. The challenge-response system is the name for this type of system.

In addition to reinforcing what instrument is required, speaking aloud also allows the doctor to address any misunderstandings. (Mikkelsen, D. S.1998) Today, the same verbal protocol is employed in the aircraft industry. For safety reasons, air traffic controllers (ATC) need pilots to read back any instructions or clearances they have given them so that they can make corrections if the information is incorrect. For their work on fatigue, Frank and Lillian Gilbreth are also well-known. In the early 1900s, Orville and Wilbur Wright became the first to fly a powered aircraft and pioneered several human factors considerations. To build the first viable human-interactive controls for aircraft pitch, roll and yaw while others worked on Devil Hills, North Carolina, near Kitty Hawk. On December 17, 1903, they flew their Wright Flyer four times over Kitty Hawk's dunes under their power. Later, they created effective in-flight control of engine power and an angle of attack sensor and a stick pusher that reduced pilot strain. Thanks to the Wright brothers' 1908–1909 flights in the United States and Europe, a new age of controlled flying was dawning. A rudder boost/trim control was also invented by Orville, which allowed the pilot more control over the plane. The Wright brothers' Dayton, Ohio, flight school featured an original Wright Brothers design for a flying simulator. Practical airplane and flight control technologies developed by the Wright brothers were patented, and many of these are still in use today. (Mullen, J., 2004).

Flight 410 of Colombia's Avianca airline went down in the mountains in March of that year, killing everyone on board (Aviation Safety Network, n.d.). The official cause of the crash was ruled to be a controlled flight into the terrain. – Wikipedia Distractions in the cockpit, particularly those from non-flying members of the crew, contributed to this incident. Following compliments for the first edition's effect, mentioning the sadness of this accident. Human factors in aviation can be characterized at each given point in time by the progress that has been accomplished and the chances for the future that have arisen. Our goal is a quick overview of human aspects in aviation since the first version of this book. Here are a few key themes that demonstrate the progress made so far. Since the first edition in aviation research. Human factors professionals, pilots, teachers, and maintenance personnel will next discuss our opportunities.

Research methodology:

Whenever the pilot’s decisions are directly or indirectly blamed for an accident, we say "pilot error." However, we can also say that a pilot's actions or decisions were negligent, in which case we say "pilot failure." There are two types of errors: intentional ones and accidental ones. The pilot mistake can occur due to weariness, workload, concern, cognitive overload, poor interpersonal communications, inaccurate information processing, and faulty decision making. We call this type of mistake "human error" since it has the potential to harm the system even though it was not done intentionally. There are three types of human error:

Using data from the National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System, Lyman and Or lady (1981) found that fatigue-related performance declines resulted in significant potentially dangerous circumstances in the aviation system. According to the research, work and sleep schedules were the most important determinants. There were many reports on many sleep and work patterns during the first 18 months of the British Confidential Human Factors Incident Reporting Program (CHIRP). "The relevance of interrupted sleep as a causative component in accidents may have been underestimated," said a CHIRP administrator (Green, 1985, p. 638).

Managers and aviation safety professionals can better understand the industry and the specifics of their organizations by mapping these human variables and understanding their implications on pilot safety behavior. Sixteen helicopter pilots of various levels of expertise and experience were questioned to understand better which human variables were most important to their safety. According to the findings, Brazil's offshore aviation industry is unique and precarious. Especially when human factors have a detrimental impact on profitability, offshore aviation businesses disregard human factors. Since they don't want to see the current rate of mishaps produce an intolerable number of accidents due to human factors, those businesses must address aviation safety thoroughly and meticulously.

When the individual has a hard time coping with the demands of their job, stress sets in. Anger and irritation in an individual's personal life can negatively impact teamwork and hurt their lives. Burnout or depression can result from a lack of self-management or exhaustion in one's personal and professional life. Depression, on the other hand, has been classified as a mental illness, whereas burnout is not. Such a condition is disqualified according to EASA regulations. The pilot's medical license might be suspended if they have any mental illness, putting everyone's safety in danger.

A novel method to pilot mental health: peer intervention:

The mental health of the flight crew has come under scrutiny since the German wings 9525 disaster. It was necessary to take preventative measures and deal with the fallout, as with any other aviation tragedy. As part of the EASA's Task Force and Action Plan, the critical areas of attention were recognizing and educating on mental health issues, increased training, and help. Taking preventative measures, such as coordinating with necessary medical authorities, the Civil Aviation Authorities (CAA) Peer intervention programs and programs with specialists have been proposed. Several European television programs have been in existence for some time now. By EASA's mandate, all of its members and related operators must implement.

A review of recent findings and perspectives on the future:

Pilots who participated in a BALPA poll found that 88% of their coworkers were already exhausted when they began their shifts (Coombes, 2017). Burnout is seen in 19% of airline pilots. This percentage is higher than the national average of 4% and the 11-14% of health care workers. Short-haul pilots, who frequently fly on many sectors in a day, are most at risk. A pilot's risk of burnout increases as the number of hours they log in the air increases, as with the pilot's age (between the ages of 30 and 40) and whether or not they are an "evening type." Commercial pilots believe that weariness, stress, depression or burnout is extremely dangerous to the compassionate aviation environment. As a result, additional field research, crew education about potential hazards and mitigation strategies, and peer intervention programs are all needed to pinpoint the system's flaws.

Thus, it is critical for an airline pilot to be aware of the dangers and know how to mitigate or prevent them. By building up their resources rather than waiting for the corporation to adapt its organizational structure, an individual can benefit themselves or themselves. When the stress of the job is gone, and one's readiness has returned to that of a restressed or, one has recovered from it (Demerouti, 2015). It's best to avoid talking about work or doing job-related duties when relaxing. Finding a pastime or other leisure activity that enhances your well-being, such as meditative practices, is crucial. The capacity to form and sustain strong, mutually beneficial connections is also critical. Emotional weariness and family conflict can be avoided by talking about good thoughts and feelings rather than expressing negative opinions.

Ethical Consideration:

Maintenance is critical to aviation safety. If it is not done correctly, it adds to many aviation accidents and incidents. Parts that are poorly installed, missing parts, and checks that are not completed are all examples of maintenance faults. The faults of an aviation maintenance technician (AMT) are more difficult to identify than many other aviation safety risks. Several defects can impair the safe operation of airplanes for long periods since they are there but not visible. In the aviation industry, (Skorupski, J., & Wiktorowski, M., 2015). AMTs face a particular set of human factors. They frequently work late into the night or early in the morning, in cramped quarters, on high platforms, and in unfavorable temperatures and humidity levels. Even though the task might be physically taxing, it also calls for meticulousness. (Subramaniam, C.,2004)"As a result of their work, AMTs sometimes spend more time planning and preparing than performing tasks. AMTs frequently apply as much time informing repairs fuels as they look the work. Correct papers of all repairs work are critical.

Better quality, a safer workplace for employees and aircraft, and a more engaged and accountable workforce can result from a human factors mindset. Additionally, even minor errors can have demonstrable benefits, including cost savings, fewer missed deadlines, fewer work-related injuries, and fewer warranty claims and fewer more significant occurrences connected to maintenance errors. (Skorupski, J., & Wiktorowski, M., 2015). Human considerations in aviation maintenance are covered extensively in this chapter. There is a discussion of the most prevalent human variables and measures to decrease the likelihood of them evolving into a problem. The most direct link between aviation maintenance and human factors can be found at https://hfskyway.faa.gov. Several Federal Aviation Administration (FAA) human factor materials are offered.

What do you mean when you talk about human factors? As the commercial aviation industry learns that human error, rather than mechanical failure, is the root cause of most aircraft accidents and incidents, human factors have grown more prevalent. (Subramaniam, C., 2004) Psychology, engineering, industrial design, statistics, operations research and anthropometry are part of this interdisciplinary field. For this definition, "human factor engineering" is a catchall term that incorporates all aspects of human capabilities, research, development, implementation, and the science and art of successfully integrating these concepts inside an operations environment. Human factors can have a significant impact on aircraft maintenance and work performance. Many people face a wide range of difficulties, and each person is unique in their set of abilities, strengths, weaknesses, and limitations in dealing with those difficulties. Aviation maintenance tasks that don't consider human limits might lead to mistakes and injuries (Goode, J. H., 2003). —some of the human elements that affect AMTs. When you combine three or four of the less-serious causes, you usually end up with a condition contributing to an event.

Tools for improvement:

Human-airplane interactions and events for flying teams and repairs specialists are significant in the industry's efforts to lower commercial aviation accident rates. In addition, Boeing continues to evaluate human routine throughout the plane to increase usability, maintainability, dependability, and ease. Human factors experts are also involved in operational safety analysis and the development of methodologies and tools to assist operators in better managing human mistakes. All Boeing planes must properly incorporate human components, which needs a tight alliance between specialists and engineers, safety experts, test and training pilots, mechanics, and cabin teams for this to happen. They must take into justification the needs of others.

The design of the flight deck:

Due to safer and more reliable designs, there has been a significant decrease in accidents during the previous few decades. This accomplishment would not have been possible without the advancements in engines, systems, and structures. Furthermore, design has long been acknowledged as human error prevention and mitigation. When a new project is launched, past operational experience, objectives, and scientific knowledge play a role in Boeing's human factors design criteria. Various design options are evaluated to see how well they fit these requirements using analytical methods like mockups or simulators. Over many years and millions of flights, a human-centered design philosophy has been proven to be a sound one. If you're looking for a design that meets validated requirements, this method is for you.

Customer feedback.

Boeing collaborates with potential customers to identify high-level design requirements and integrate human factors principles. The 777 is an excellent example of how airlines were significantly involved in the design. Boeing's flight and maintenance crews helped design every part of an airplane's systems. Eleven initial operators took part in early flight deck design assessments. A team of outside human factors experts reviewed the results in parallel. Flight crews and other operators used the 777 engineering flight simulator to test the design in various situations. These tests validated the solution's pilot-flight deck interface and ensured that operator needs were met.

The right amount of automation.

Boeing flight decks are fitted with automated technology to help, but not change, the flight team. Flight crew errors arise when the unit is unaware of an issue and fails to address it quickly enough to prevent a worsening situation. As a result, Boeing cockpits have intuitive controls. These systems use visual and tactile motion cues and instrument displays to decrease human error when deciding which automated functions. The 777's back-driven controls provide visible and tactile motion indications. These controls help keep the crew informed of the plane's state and flight direction in automatic and manual flights.

The capability of crew interaction.

Audio, visual, and tactile means of communication are all used by the flight crew. All of these ways of communication must be appropriately used while flying. Communication between the plane's staff and its passengers and between its team and its passengers falls under this category. Consequently, all Boeing planes have integrated flight controls. Each flight crew member can see the other's control inputs since both control wheels turn together when one is moved. Column movements are the same. Interlinkage provides pilots with tactile and visual feedback that is more immediate than verbal coordination, allowing them to assist each other in time-critical situations.

Participation of the chief mechanic.

All succeeding aircraft programs (737-600/700/800/900, 757-300, 767-400 Extended Range [ER]), including the 777, were assigned a chief mechanic in a position modeled after the chief pilot's. It's the mechanic's job to represent the interests of those they work with, much as the pilot. The hiring of a head mechanic was prompted by the realization that airline operations rely heavily on the safety and on-time performance provided by the maintenance community. The chief mechanic manages the deployment of all maintenance-related aspects, drawing on airline and production mechanics' expertise, reliability and maintainability engineers, and human factors specialists.

Maintenance design software that is run on a computer.

These mockups were used to test if a mechanic could access an airplane part for removal and reinstallation. Boeing now uses human models in CATIA (computer-aided three-dimensional interactive application). A larger electrical/electronic bay was required to handle the new flight deck concept's increased wire bundles—human issues experts' demeanor ergonomic tests to assess human abilities to do repairs tasks in various settings. The force required to turn a valve, for example, must be inside a mechanic's ability when in a difficult position. Maintaining equipment in bad weather, such as at night, requires careful footing and handling forces to avoid falling or injuring oneself.

The team that gathers and analyses data on vehicle malfunctions (FIT).

Human maintenance difficulties influenced FIT creation. Boeing developed it to better exhibit BITE and documentation for the 737-600, 700, 800, and 900. The FIT charter now includes design and maintenance standardization. The objective is to help mechanics. Engineers, maintenance, and operators make up this team. The team oversees and updates standards for all Boeing aircraft maintenance displays. Boeing has built templates with typical problem menus to standardize language across platforms. (Efremov, A. V., Tyaglik, M. S., Irgaleev, I. K., Efremov, E. V., & Voronka, T. V. 2020). The interface should be the same regardless of who designed the component. System designers cooperate with the FIT on BITE and upkeep. The FIT helps engineers create effective, consistent mechanic displays by analyzing all mechanic information, including placard and manual transmission. It also aids in meeting Boeing's design specifications.

Error Control

Failure to follow protocols is prevalent in flight operations, maintenance issues, and accidents. However, the industry has no idea why this happens. There has not been a regular and systematic method for investigating these instances. Boeing has developed recommendations for systemic improvements by using human factors techniques to understand better why errors occur. The CIRA technique when Air Company employees (either flight teams or technicalities) commit mistakes, paying issues in the work situation is part of the whole chain. Two of the tools operate on this idea. Identifying and eliminating or mitigating the causes that lead to these errors is essential to preventing them in the future. The equipment is readily available. (Efremov, A. V., Tyaglik, M. S., Irgaleev, I. K., Efremov, E. V., & Voronka, T. V. 2020).

RECOMMENDATION AND CONCLUSION

Aviation safety can be improved with the help of Boeing's expertise in human factors. When it comes to preventing takeoff runway accidents and mishaps, the company's involvement with the aviation industry is an excellent example. Boeing sponsored and spearheaded an industry-wide initiative to develop a training tool. Team members conducted scientifically-based simulation tests to examine how well crews might cope with this safety risk using training assistance. A collaboration between flight instructors, human factors engineers, and aerodynamics engineers led to the development of the controlled flight into terrain training devices.

Advanced automation like autopilot, autonomous throttle control, and flight management computers might confuse pilots. A lack of mode awareness causes this. Computers can be unpredictable in today's digital offices and flights. Boeing's human factors department is working hard to prevent automation surprises and ensure flight crews understand aircraft modes. The project's first phase aims to improve automated system principles communication, flight crew automation knowledge, and systematic documentation. Boeing and NASA experts are involved. Flight crew training and crewmember-automation interface designs will be improved due to the study.

Several vital functions are performed by human beings regularly in the aviation industry. Therefore, human physiological constraints should be taken into account to decrease tiredness and promote regional flight safety.

Human errors in the cockpit can be reduced by providing crew schedules that allow for adequate rest and proper nutrition. The majority of airline operations take place around the clock. There are no weekends or bank holidays. Hence there is no regular work schedule. Even if a pilot is not on duty, resting, or on vacation, the corporation can still reach out to them. Due to this, it's nearly hard to unplug your phone when you're "out of the office." In addition, workdays frequently exceed the eight-hour mark. In contrast to long-haul pilots, short-haul pilots must contend with several flights per day or consecutive early beginnings before 6 a.m. Sleep deprivation and weariness build up throughout a workweek due to the heavy workload of five or six straight days, or longer in the case of long-haul crews. Fatigue-related symptoms, such as cognitive slowness and poor performance, increase error rates over time.

Despite the new EASA's Flight Time Limitations, risks are linked with the new regulations' legal foundation. Increasing pilot fatigue due to excessive or unmanageable task requirements Crews are unable to recuperate from lengthy shifts, early starts, or frequent time zone shifts due to lack of regulation. Both exhaustion and exhaustion are common in burnout and depression. Overlapping factors make it a step closer to depression, a disqualifying criterion in aviation, which burnout is.

Contrary to high-performance management positions, mistakes and limits of the human body are accepted. In the aviation industry, for example, safety is paramount. However, how can we tell if a person is vulnerable to or experiencing stress or other life-management challenges separate from their mistakes? Furthermore, how can we help pilots who are facing challenging life circumstances instead of allowing them to worry about losing their jobs? Professional piloting has become highly stressful due to aviation's evolution into a demanding profession. Consequently, this article suggests further discussion on the LASA Task Force and its subsequent Action Plan and extended field research that would identify peer intervention programs that were established by the LASA Task Force and its later Action Plan.

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