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The Effect Of Human Factors In Avıatıon Accıdents

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ABSTRACT: *Conditions such as information, communication, fatigue and stress are very important in aviation. These conditions and many others are called human factors. Human factors directly or indirectly cause many accidents in aviation as well as on land. In the early days of aviation, the biggest risk was machinery, as technological developments were at a low level. With evolution of technology; Innovations in design and analysis tools, material sciences, manufacturing processes, electronics and communications have reduced the workload of pilots. With these developments, the biggest risk factor today has become humans. Unfortunately, risk will never be zero wherever there are people. However, if people receive good job training, it will reduce the likelihood of accidents. For this reason, human factors in aviation have become the first priority of companies and authorities in terms of life safety and reducing costs.*
Key Words: *Human Factors, Aviation, Air Travel, Dirty Dozen, Pilot Error, Accident Rates*

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I. INTRODUCTION

The first studies in the aviation sector started at the beginning of the 20th century and continued at an increasing pace over the following years. According to International Civil Aviation Organization (ICAO) data, the number of scheduled passengers, which was 100 million people in the 1950s, reached 4.5 billion people in 2019 with an increasing acceleration [1]. The concept of human factor was first introduced in 1969 to include only pilots[2]. Human factors causation of aircraft accidents. A review of 545 aircraft accidents revealed that over 50% were caused by human error[3]. A total of 221 mishaps were identified, of which 60.2% involved operations-related human causal factors[4]. Statistics show that up to 80 percent of all aviation accidents can be attributed to human error. The most dangerous times include takeoff and landing and the time periods before and after these events. Pilot error is thought to account for 53% of aircraft accidents, with mechanical failure (21%) and weather conditions (11%) following behind[5].

II. Human Factor in Aviation

Human factors (HF) provides a holistic approach to non-technical errors. Our expertise emphasizes operator behaviors and limitations such as stress and tension, fatigue, cognitive load, communication, distractions, focus of attention, situational awareness, and other critical variables required to maintain operational safety[6]. Human factors in aviation maintenance: Human error can play a part in a crash before the plane is even in the air. When aircraft maintenance is done incorrectly an aircraft part can malfunction without warning, causing catastrophe. In the 2003 crash of Air Midwest Flight 5481 at Charlotte/Douglas International Airport, an inexperienced and unsupervised crew of mechanics mis-rigged the elevator control of a Beechcraft 1900D, thus preventing the pilot from having full capability of lowering the nose if a climb was excessive. During the fatal takeoff in a fully loaded airplane, the airplane climbed very steeply, but because of the negligent maintenance of the elevator, the pilots could not stop the climb, and the airplane stalled and crashed, killing all the passengers and crew[7].

According to research, 70%-80% of aviation accidents are caused by human factors[9]. As technology developed, accidents caused by machinery decreased, but aircraft systems became more complex due to advancing technology. This causes people to make more mistakes.

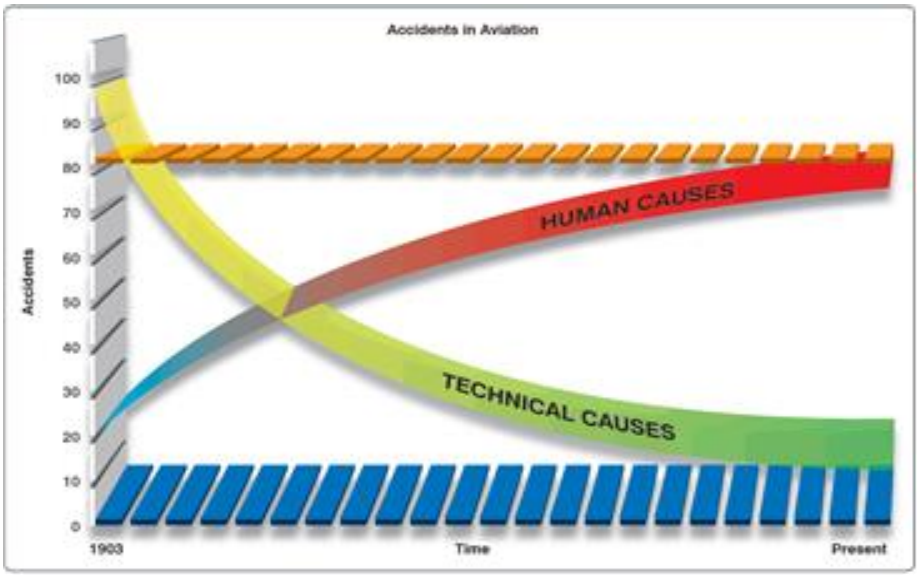

Figure 1. Statistical graph showing that 80 percent of all aviation accidents are caused by human factors[8].

III. How Safe is Air Travel?

Compare it to other major forms of transportation – with 0.04 deaths per 100 million miles traveled, train travel is much more dangerous than airplanes' 0.01 deaths per 100 million miles. However, air travel is only as safe as the operator, the equipment, and the training procedures that underlie the flight itself. Without stringent aviation safety training and controls, air travel is unsafe for private and commercial passengers.

IV. Look at Human Factors

Referring to Figure 8, the total environment within which aviation accidents happen is marked by the largest circle and represents the overall domain. The seven smaller circles within this domain represent seven possible sources from where the "holes in the cheese" can get triggered or generated. Each of these seven segments also needs to have closely knit coordination with rest of the segments to ensure that human errors are minimized and do not propagate through the system resulting in accidents and fatalities.

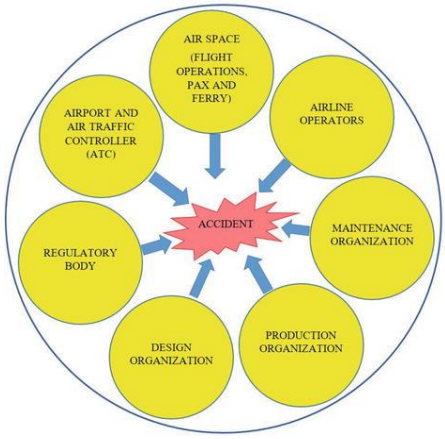

Figure 2. The seven-segment model[10].

V. Dirty Dozen of Human Factors

A large number of maintenance-related aviation accidents and incidents occurred in the late 1980s and early 1990s. Then, Transport of Canada identified twelve human factors that degrade a person's ability to perform tasks effectively and safely, which could lead to errors during aircraft maintenance. The Dirty Dozen list of human factors has raised awareness of how humans can contribute to accidents and incidents. These twelve factors are known as the "dirty dozen. This factors; 1. Lack of Communication, 2. Complacency, 3. Lack of Knowledge, 4.
Distractions, 5. Lack of Teamwork, 6. Fatigue, 7. Lack of Resources, 8. Pressure, 9. Lack of Assertiveness, 10. Stress, 11. Lack of Awareness, 12. Norms.

Avoid the Dirty Dozen according to the FAA, about 80 percent of aviation maintenance mistakes involve human factors, and if these mistakes are not detected, this would lead to accidents. There are 12 common causes of human factor errors. Let's understand one by one[11].

Figure 3. Dirty Dozen of Human Factors[11].

VI. Global Pilot Error Accident Rates

During 2004 in the United States, pilot error was listed as the primary cause of 78.6% of fatal general aviation accidents, and as the primary cause of 75.5% of general aviation accidents overall. For scheduled air transport, pilot error typically accounts for just over half of worldwide accidents with a known cause.

VI.I. Total Pilot Error

The total of all three types of pilot error. Where there were multiple causes, the most prominent cause was used.

VI.II. Other Human error

Includes air traffic controller errors, improper loading of aircraft, fuel contamination and improper maintenance procedures[12].

Table 1: Total pilot error and other human error accident rates in aviation[12].

Cause	1950s	1960s	1970s	1980s	1990s	2000s	All
Pilot Error	41	43	24	26	29	30	29
Pilot Error (weather related)	10	17	14	18	19	19	16
Pilot Error (mechanical related)	6	5	5	2	5	5	5
Total Pilot Error	56	65	43	46	53	54	50
Other Human Error	2	9	9	6	9	5	7

VII. Common Aviation Human Factors

The captain, first officer, crew members, and control tower must work together to ensure the safety of the flight and its passengers. Lack of respect, intimidation, distractions, pilot/co-pilot arguments and pride can get in the way and create serious problems that jeopardize lives. The following are examples of human factors that have contributed to some of the nation's worst disasters:

Man-machine interface, Loss of situational awareness, Crew coordination, Lack of proper training, Fatigue, Checklists, Air traffic controller error, Human factors in aviation maintenance, Crew negligence[13].

VIII. Overall Safety Performance Indicator(Global Accident Rate)

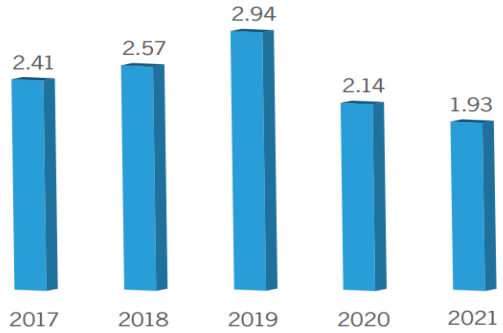

Figure 4. Global accident rates (accidents per million departures)[14].

ICAO's global accident rate provides an overall indicator of safety performance for air transport operation. The accident rate is based on scheduled commercial operations involving fixed-wing aircraft with a certified. Chart 5 below shows the global accident rate trend (per million departures) over the previous five years, with 2021 having an accident rate of 1.93 accidents per million departures, a decrease of 9.8 per cent from the previous year[14].

IX. Civil Aviation Accidents During The Last Eight Decades

Figure 1 shows the distribution pattern of the number of civil aircraft accidents from the year 1918 through 2022 [5]. Figure 2 shows the distribution pattern of the number of fatalities for the same period. Maximum peak is observed during 1940s, and there is a gradual decrease in the number of accidents from the year 1978. Fitting a linear trend line for the data between 2001 and 2022 would indicate a theoretical possibility of aircraft accidents tending to near-zero by mid 2040s[16].

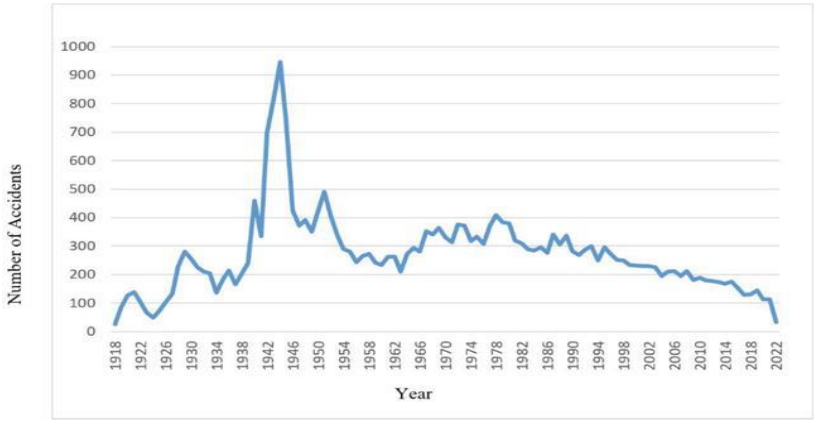

Figure 5. Distribution pattern of civil aircraft accidents from 1918 through 2022[16].

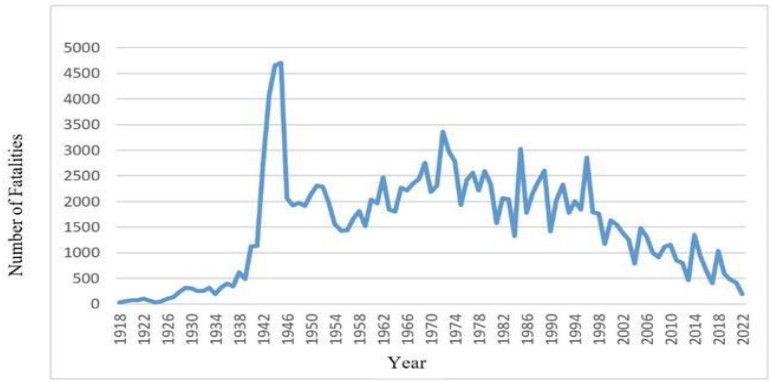

Figure 6. Distribution pattern of civil aircraft accident fatalities from 1918 through 2022[16].

X. Swiss Cheese Model

In the Swiss cheese model of accident causation various layers and many imperfections on these layers are defined. At the end of the day, the overlapping of these imperfections cause threats to materialize and accidents to happen. The Swiss cheese model is widely accepted and it is also known as the "cumulative act effect"[17].

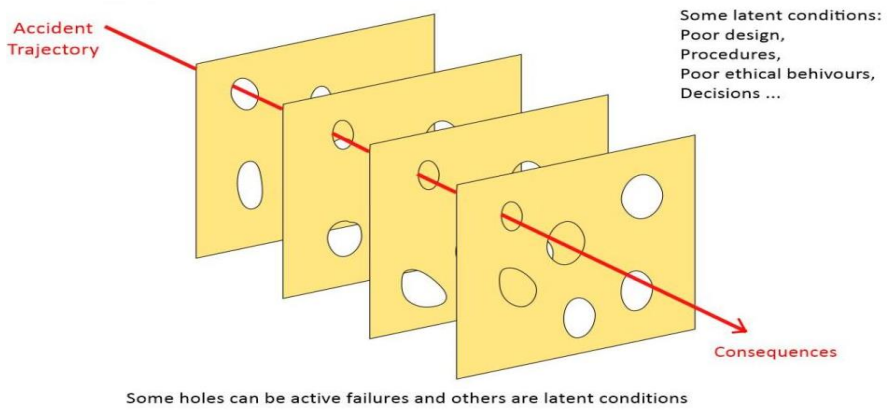

Figure 7. Swiss Cheese Model Diagram[17].

XI. Conclusion

The most important cause of accidents in aviation, which has been developing rapidly since the last century, is human-related. In preventing accidents, states, authorities and companies should maximize their awareness of human factors in both military and civil aviation. In order to prevent loss of life and financial losses, human factors training should be given to every employee working in the sector. Preventive maintenance procedures should be implemented with the work done. While new generation aircraft systems require a decrease in accidents, the reason for the increase in accidents is the lack of awareness about human factors. Traveling by aviation is one of the safest travel methods today. However, approximately 75 percent of civil and military aviation accidents worldwide are caused by human errors at various levels such as design, drawing, manufacturing, assembly, maintenance and flight operations. To prevent this, human-machine interface designs need to be reconsidered in the light of new technologies.

As a result, the human factors approach should not be taken less seriously than the physical integrity of the workplace, tools and equipment.

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