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AIRCRAFT ACCIDENTS OCCURRING IN BRAZIL IN THE PERIOD 2007-2012: PRELIMINARY ANALYSIS OF THE MOST INCIDENT CONTRIBUTING FACTOR.

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Abastract: Much has been invested in technological improvements and professional training for those who are somehow involved in aerial activity. However, what has been observed, despite all these efforts, is that accidents continue to occur and, in Brazil, the contributing factor "Pilot Trial" has been presented as the most evident for some time. The objective of this article is to identify more specific characteristics of air accidents occurred in Brazil, from 2007 to 2012, which had "Pilot Trial" as a contributing factor, in an attempt to obtain a more detailed understanding of the events. The study, based on descriptive and documentary, focused on the analysis of the final reports (RF) issued by the Center for Research and Prevention of Aeronautical Accidents (CENIPA), made available electronically on the website. The main information collected in each report was arranged in a spreadsheet and the descriptions of "Pilot Trial", the main contributing factor indicated in 54.1% of the investigations, were analyzed and applied the classification suggested by the Federal Aviation Administration. As a result, 37.1% of the incidents pointed to aspects of the judgment related to the "Aircraft" sub-factor. In addition, 31.8% of these accidents involved pilots with less than 2,000 hours of flight experience. In the analysis performed, it can be concluded that there is a need to determine if there is a lack of knowledge about the aircraft. to better understand the operational context in which accidents occur in an attempt to identify constraints or pressures that the operators were subjected to in those scenarios that could contribute to their actions leading to accidents A systemic approach that identifies the operative modes in situations considered normal can elucidate how operators deal with the adversities of and do not constitute undesirable events.

Keys Words: Air Accidents, Ergonomics, Pilots, Accident Prevention, Air System

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1. INTRODUCTION

Much has been invested in technological improvements and professional training for those who are in some way involved in aerial activity. In fact, this area of human knowledge has evolved significantly, bringing air system users a service of greater quality, safety, efficiency and effectiveness.

However, what has been observed, despite all these efforts, is that accidents continue to occur, to a greater or lesser extent and impact, but, in both situations, undesirable.

In Brazil, this scenario is not very different and, in the statistics presented by the Center for Investigation and Prevention of Aeronautical Accidents (CENIPA), the percentage of accidents has increased in the last ten years, showing a growth of 260% (BRASIL, 2014).

Every year, CENIPA publishes a document that contains information from the last ten years and brings together statistical data relating to the aircraft and the occurrence.

In an attempt to minimize the occurrence of new events, the investigations carried out seek to identify the main factors that in some way contributed to such events and, consequently, safety recommendations are issued.

Even so, what is observed is that the contributing factor "Pilot Judgment" has been presenting itself as the most evident for some time. In this sense, it would be interesting to seek details of the accidents in which this factor was highlighted, with the aim of identifying other issues that could suggest proposals that minimize its recurrence.

2. OBJECTIVE

Therefore, the objective of this article is to present the results of a preliminary exploratory study developed based on the final reports (RF) of air accidents that occurred between 2007 and 2012, with the aim of identifying more specific characteristics of those who had "Trial of Piloting" as a contributing factor, in an attempt to obtain a more detailed understanding of the events.

3. THEORETICAL FRAMEWORK

In Brazil, the body that coordinates the investigation activities of aeronautical occurrences in the national territory is the Center for Investigation and Prevention of Aeronautical Accidents (CENIPA), through the System for Investigation and Prevention of Aeronautical Accidents (SIPAER), based in Brasília. . There are also seven Regional Services, SERIPAS, linked to it, responsible for sectorized investigations.

The guidelines for investigating an aeronautical occurrence (accident or incident) are defined in a CENIPA standard (BRASIL, 2014), as established by Annex 13 to the Convention on International Aviation (ICAO, 2010), of the International Civil Aviation Organization (ICAO - International Civil Aviation Organization - ICAO), a body of the United Nations, responsible for outlining guidelines for global air navigation.

Annually, CENIPA issues statistics relating to aeronautical occurrences over the last decade, pointing out areas, types of aircraft, types of occurrences, contributing factors, etc., raised in the investigations carried out.

Regarding the contributing factors, it has been observed that some of them appear to be repeat offenders, as is the case of the "Pilot Trial", which comes

remaining in first place for some time now (BRAZIL, 2010, 2012 and 2013).

A contributing factor is defined as a "condition, action, omission or combination thereof, which if eliminated, or mitigated, may reduce the probability of an aeronautical occurrence occurring, or reduce the severity of the consequences of that occurrence. Identification of the

contributing factor does not imply a presumption of guilt or civil or criminal liability" (BRASIL, 2014).

"Pilot Judgment" is defined as an "inadequate assessment of certain aspects related to the operation of the aircraft, made by the pilot qualified to operate it" (BRASIL, 2011; p. 105). This factor falls within the contribution area “Human Factors”, subclassified under “Operational Aspect”.

According to Jensen (1995), this factor is a mental process used by the pilot in making decisions, distinguishing between perceptual judgment and cognitive judgment. The final stage of this mental process corresponds to deciding the mode of action.

Perceptual judgment, such as judging distance, altitude, approach ramp, speed, etc., is very important in the aircraft control tasks carried out by the pilot, who, in turn, makes decisions based constantly on his perceptions. visuals. This perceptual judgment, unlike cognitive judgment, where there is a considerable increase in cognitive complexity, does not require many mental processes, being relatively easy to learn and execute consistently.

Jensen (1995) also adds that, in relation to the characteristics of cognitive judgment, when compared with perceptual judgment, it is clear that: the information available is more uncertain, it is common for the pilot to have more time to think, there are generally more than two alternatives, the risk associated with each alternative is more difficult to evaluate and the final decision is more easily influenced due to factors that are not related to the flight, such as financial pressures, personal commitments, stress, fatigue, etc. When the pilot has little training or experience, many of the decisions made in flight are cognitive, meaning they require a considerable amount of mental processes. As the crew increases experience and training, these decisions become perceptual.

According to the Federal Aviation Administration

(UNITED STATES DEPARTMENT OF

TRANSPORTATION, 2011), the American government entity responsible for regulations and all aspects of civil aviation in the United States, the pilot's judgment:

> is the process of recognizing and analyzing all available information about oneself, the aircraft, and the flight environment, followed by a rational evaluation of alternatives to implement a timely decision that maximizes safety. The pilot's judgment involves his own attitude towards taking risks, the ability to evaluate them and make decisions based on his own knowledge, expertise and experience. The judgment decision always involves a problem or choice, an unknown element, usually a short space of time and stress. (p. 2)

Based on this definition, the FAA suggests a subclassification (UNITED STATES DEPARTMENT OF TRANSPORTATION, 2011), in which the factor is divided into three areas of study, hereinafter referred to as subfactors, in which the pilot's judgment is influenced:

1. Pilot: judgment made about the pilot's own skills in a given situation, health status, level of fatigue, and other variables that could affect his performance.

2. Aircraft: judgment and decision-making are based on aspects of the aircraft, such as: weight and balance, airworthiness, fuel, equipment, power, etc.

3. Operational Environment: comprises all issues external to the aircraft judged by the pilot such as runway height, aerodrome temperature, take-off conditions, weather conditions, meteorological briefing (or lack thereof), air traffic control instructions, etc

The pilot's judgment may involve either a sub-factor or a combination of two or three of them.

It should be noted that the judgment that the pilot must make while carrying out tasks related to driving his aircraft occurs in a highly dynamic and extremely standardized operational environment, which involves multiple variables, be they personal, social, organizational, technological, among others. others. From this perspective, the complexity of the activity requires the pilot to have different demands, many of them cognitive, who must gather and synthesize large amounts of information, which, in turn, are not always clear enough to provide a correct response in such a short time. (RIBEIRO, 2007).

From an ergonomic point of view, these requirements function as elements that restrict the work process (contractors), causing the operator (pilot) to find their own ways to overcome them (VIDAL; CARVALHO, 2008), sometimes unsuccessfully,

which can lead to unwanted events, such as errors, incidents and even accidents.

4. METHODOLOGICAL PROCEDURES

The study adopted a quantitative approach, seeking to enumerate different characteristics of the accidents that occurred between 2007 and 2012, and a qualitative approach, in the sense that, by analyzing the information gathered in the descriptions contained in the final reports (RF), trying to achieve a more detailed understanding of the events in which "Piloting Judgment" was identified as one of the contributing factors. Based on its general objective, it is characterized as descriptive research, which, according to Gil (2010), aims to describe the characteristics of a phenomenon, a given population or establishing relationships between variables. Regarding the technical procedures used, the study followed the design of a documentary type research, as it focused on the analysis of reports issued by the Center for Investigation and Prevention of Aeronautical Accidents (CENIPA), made available only in electronic format on the website (http://www.cenipa.aer.mil.br/cenipa/paginas/relatorios/relatorios), from 2007 onwards. The difference observed between the total number of accidents and the number of final reports available is due to the complexity of the investigation, which varies from one to another, causing delays in its publication.

For data collection, a spreadsheet was designed that brought together the main information obtained in each report, such as: type of occurrence, aircraft, model, date, location, damage, information about the crew (flight hours), the factors highlighted in the report as main contributors, among others deemed relevant at the time of reading and analysis.

On the CENIPA website, until April 2015, 329 final investigation reports were available relating to the 781 aeronautical accidents that occurred on Brazilian soil (42.12%), distributed between 2007 and 2012. 87 simplified final reports were also available (SUMA) which, due to the fact that they were simplified, did not present information necessary for the analysis aimed at in this research, which is why they were not part of the study.

For a more specific understanding of the contribution of the "Pilot Judgment" factor, the accidents in which its participation was identified during the investigation were highlighted and a specific analysis was carried out.

5. RESULTS

After gathering the information obtained in the reports made available, it was identified that some issues

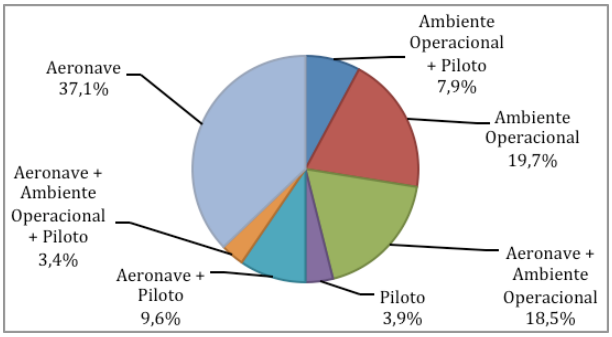
maintained the same trend in relation to the survey carried out by CENIPA in the period 2004-2013 (BRASIL, 2014), such as the location of most accidents (SP), the type of aircraft involved (plane), the aircraft category (Private) and the type of occurrence (Engine Failure in Flight), among others.

The present study analyzed the description presented in the selected period in each RF of the main contributing factor identified in 54.1% of investigations: "Pilot Judgment". This analysis was intended to deepen our understanding of the aspects that could influence the pilot's inadequate judgment and that could lead to an accident.

After selecting the accidents, the classification suggested by the FAA (2011) was applied to the descriptions, as they referred to issues related to the "Pilot", the "Aircraft" and/or the "Operating Environment".

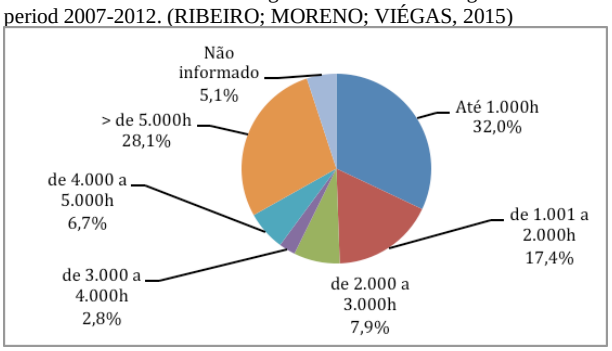
In this sense, of the 178 accidents that occurred in the period 2007-2012, in which the "Pilot Judgment" factor was identified as a contributor, after being classified according to the FAA proposal, 37.1% of the occurrences pointed to aspects of the judgment related to the “Aircraft” subfactor, followed by issues linked to the “Operational Environment” (19.7%) and in 18.5%, in the joint presence of the two subfactors (Figure 1).

Figure 1: Percentage distribution of sub-factors identified in accidents that had "Pilot Judgment" as a contributing factor in the period 2007-2012 (RIBEIRO; MORENO; VIÉGAS, 2015)



Still regarding the "Pilot Judgment" factor, it was observed that 49.4% of the pilots involved in these accidents had less than 2,000 hours of flying experience (Figure 2).

Figure 2: Percentage distribution of the number of pilots' flight hours in accidents that had "Pilot Judgment" as a contributing factor in the period 2007-2012. (RIBEIRO; MORENO; VIÉGAS, 2015)



Combining the two previous pieces of information, we obtain that 31.8% of the accidents that occurred in the period 2007-2012 in which "Pilot Judgment" was identified as a contributing factor, involved pilots with less than 2,000 hours of flight experience and who presented , according to the details of the RF, failures relating to an adequate understanding of aspects related to the aircraft they fly, denoting a possible lack of knowledge or forgetfulness of parameters necessary for a safe flight, as can be seen below in some details extracted from the RF.

> - - *The pilot did not check the amount of fuel in the tanks, as provided for in the company's checklist, and judged that there was a sufficient amount to carry out the flight.*
>
> - - *There was inadequate assessment of the aspects inherent to the landing, such as height, vertical speed, approach ramp and power available for corrections, allowing the aircraft to impact the ground with a high sink rate.*
>
> - - *Although the aircraft's flight manual recommends that the electric fuel pump should remain on during flights at low altitude, the pilot ignored the recommendation, opting to turn it off.*
>
> - - *The pilot inadequately assessed the emergency situation, failing to adopt the correct procedure, which would have been to perform a forward landing.*

However, these reports, in isolation, do not make clear the conditions or restrictions perceived and faced by the operators (pilots) so that their judgments led to the actions that culminated in the accident.

From the analysis carried out, it can be concluded that there is a need to better and more deeply understand the operational context in which the accidents occurred, in an attempt to identify which restrictions or pressures were involved in those scenarios that could contribute to the actions of operators were not as successful as expected and, consequently, led to accidents. Furthermore, understanding how operators deal with these restrictions and pressures in their daily work and which do not result in unwanted events, as proposed by current systemic approaches to accident prevention (HOLLNAGEL, 2015). This understanding could help in the development of strategies and tools that will promote changes in various aspects of Brazilian civil aviation and, consequently, a reduction in the analyzed situation.

6. CONCLUSION

Bearing in mind the recurrence of "Piloting Judgment" as the most evident contributing factor in less than 2,000 flight hours and that 31.8% of these presented failures regarding the adequate understanding of aspects related to the aircraft.

However, the possibilities of system failure cannot be attributed solely to the operator. The most recent models for studying human reliability in complex systems show that it is not enough to identify what went wrong and how it happened without taking into account the aspects that surround them and, mainly, understanding why and how the systems work in their activities. normal when the results are satisfactory (VIDAL, CARVALHO, 2008; HOLLNAGEL, 2015).

In this way, tools and strategies can be developed in such a way that, by creating barriers, defenses and contingencies, they strengthen the system, making it

safer and more reliable.

BRAZIL. Air Force Command. center of

air accidents that occurred in recent years in Brazilian territory, this article set out to present the results of a preliminary exploratory study developed based on the final reports (RF) of these events, from 2007 to 2012, with the aim of identifying more specific characteristics and, therefore, obtain a more detailed understanding of events.

After selecting the accidents and quantitatively surveying the main information provided by the RF, special attention was paid to the descriptions of the contributing factor investigated and the classification proposed by the FAA (2011) was applied.

The main results of this exploratory study were that 49.4% of accidents involved pilots who had Brazilian experience. (FCA 58-1) Brasília, DF. 2014.

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