STATISTICAL APPROACHES TO AEROSPACE RISK MANAGEMENT

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Abstract: *Training staff on the safety line is essential to prevent and minimize losses of any kind. Safety culture is designed to motivate staff to identify risks of any kind, to report them to improve the quality of activities and to eliminate stress levels. This culture is mainly based on education focused on training courses, motivation, discipline, attitudes and understanding the concept that any member of an organization has the role of protecting and increasing the quality of life, of the goods that they exploit and that others will exploit. Understanding these concepts prepares a safe environment for everyone around you, increases trust in the collective and decreases the level of stress in carrying out activities.*

Keywords: *awareness, culture of safety, pilot inspections*

Acronyms

EPAS	European Plan for Aviation Safety	ICAO	International Civil Aviation Organization
NASA	National Aeronautics and Space Administration	NTSB	National Transportation Safety Board
SOP	Standard Operating Procedure	TRL	Technical Readiness Level

1. INTRODUCTION

There is an old saying: „A smart person learn from the others mistakes, meanwhile a naive one learns from his owns”. The educational process begins at an early age and the more we assimilate,our body improves its qualities.

Involving active in the educational process we improve our life quality and also those around. Children are watching us and learn because they want to pass on genetically the assimilated information. The educational process it’s very complicated, the eforts are very big for a positive rezult. There are very well trained and passionated theachers who put maximum effort so the information transmitted is understood.

If the education and self-esteem are important in our lives, the level of safety will be bigger. Safety is everywere and is part of our lives, that’s why, the main ideea of this article is safety, safety culture and airspace security.

The purpuse of safety education is to create awareness of staff in all sectors to prevent dangerous situations. The exercises and trainings have the role of creating a calm workplace in order to solve a real dangerous situation.

2. CULTURE OF SAFETY

The manager of the organization has the role of encouraging the safety culture in order to increase the quality of life but must pay special attention to not create any confusion with the idea of doing negative things.The fear of reporting can be eliminated when the manager appreciates and encourages any risk reporting of any kind, even be the initiator of this reporting model.

The safety culture must be implemented at any hierarchical level and at any age and must be understood. Organizational experience should not be an advantage in the line of safety, but must increase its level.

Lessons learned from voluntary reporting are subject to the safety culture because it better describe the risks in which the members of the organization have been subjected and must be analyzed down to the smallest detail.

The "Swiss cheese" analysis mode shows the shortcomings in a system, but also the fact that the model of the lessons learned has not been fully applied. In conclusion, if a mistake has been repeated, it means that a link in the chain of lessons learned has been broken.

2.1.Pilot inspections

When relations between crew members and ground maintainers are good, it turns into a partnership. The more the pilots adopt a friendly relation with the members of the technical team, the greater the rateof mutual trust. Engineers seek to develop relations and interests in long-term aircraft operation, while pilots seek to execute a safe flight. And then, why are they looking for or discovering, problems at the inspection of entry into service? They may discover problems and the flight may be cancelled and passengers may have their flight postponed. This is one reason why pilots fall into the trap of evasively taking over the aircraft. For fear of flight cancellation or delay, many pilots or engineers overlook some problems. But can't this lead to a catastrophe? Strengthening the safety culture must start from this level even if the aircraft needs additional work or the pilots do not feel at full capacity.

From the point of view of the commanding pilot, the aircraft must comply with the minimum criteria of flight safety, otherwise it will order the cancellation of the mission due to the possibility of endangering human lives.

This model could work for many years, but let's think about another aspect. We can look at flight safety as a pyramid, made up of many blocks of stone. Each block of stone is a risk factor for flight safety. If a few blocks are missing, the pyramid becomes unstable and can overturn. If the base of the pyramid is missing a few blocks, the pyramid can not be built, so the flight can not be complited.

2.2.The link between chaos theory and aviation events

The basic idea of this article is to analyze the probability of occurrence of an event. Therefore, we present some definitions:

Event: An event means performing an action regardless of the result achieved. Events can be: possible (the action has been fully performed), impossible (the action cannot take place) and random (the action may or may not take place).

The probability of an event occurring is defined as the number of favorable occurrence cases relative to the number of possible occurrences of an event. Most aviation events are reported per 100,000 hours of operation resulting in a safety indicator also called the dispersion of events.

ICAO (International Civil Aviation Organization) statistics show that in 2020, being the first year of the pandemic, the number of people who used the plane as a mean of transport was 1.8 billion, compared to 2019 when there were 4.5 billion. In the same report, the link between the number of people and the events recorded is observed. From 2019 to 2020, there is a 58% decrease in the total number of accidents. The global accident rate of 2.14 accidents relative to the number of takeoffs in 2020 decreased by 20% compared to 2019, when there were 2.94% accidents on the number of takeoffs. In conclusion, the probability of occurrence of events is related to the number of possible situations. That is, a higher number of takeoffs, a higher percentage of accidents.

The aeronautical safety model that we can approach in this theme is a pyramidal model, having at the base of the pyramid the aeronautical safety culture that is formed by basic aeronautical training courses (navigation, aerodynamics, regulations, etc.), and at the top is the finality of the aeronautic activity, that is, the disembarkation of passengers.

Knowing and understanding the situation leads to good situational awareness. An NTSB (National Transportation Safety Board) study states that a significant percentage of the number of accidents is caused by "*poor monitoring of attention*". The premise is simple: Monitoring is only effective if pilots recognize and understand what they are "monitoring." That is why training in all areas is very important. The better aviation personnel know the procedures, the greater the rate monitoring.

Solving a special situation during activities has positive results only if the staff knows the possibility of that situation occurring. In other words, a person must always be prepared to intervene in the event of a special situation. When pilots become distracted or inattentive to monitoring, they are prone not to recognize potential errors. NTSB researchers point out the importance of recognizing initial problems (cues), that is, the fact that a problem provides signals of early occurrence.

Early signals are often neglected because pilots do not give them the necessary importance. For example, a common mistake that multi-engine aircraft pilots make is the misinterpretation of the misalignment of the engine speed. This was the cause of the crash of a civilian aircraft in 1982 when the loss of both engines at a B 737 could be predicted because engine indicators were low from normal (but not below limits) and the indications fuel installations were different from normal (but not below limits).If the crew had been more rigorous in understanding the errors and not only scanned the indications, the crash would not have occurred. This is an example of continuous monitoring of attention.

A NASA report on situational awareness using an NTSB study based on accidents between 1978 and 1990 shows that most fatal accidents in civil aviation are the result of the action or inaction of the crew (the human factor has a large share). On a one-off basis, out of 302 errors identified from 37 accidents analysed, the NTSB reported that 84% of them were monitoring and situational awareness errors.It is important to note that no crew member from the analyzed accidents performed activities that could have distracted them – that is, all flights were routine flights. In other words, crew members did not monitor flight activity with maximum attention and were surprised by the appearance of a special case as if it could never happen. The basic idea is that we must carry out our work as if a special situation could arise at any time.

The same study shows that 80% of monitoring (flight surveillance) errors occurred in the approach phase for landing of the flight and at the pilot who is not at the controls on that segment. Flight experience (number of hours) was not a significant factor. In most accidents, the NTSB identified 2 major problems: inattention due to poor monitoring of the devices and errors in the decision-making process of the pilot who is not at the controls. [1, 2, 3]

2.3.Prevention

The way we can improve the quality of aeronautical safety training and culture is by adding elements in the preparation of the mission such as:

a) During the briefing setting a high tone of the officer's voice with aeronautical safety;

b) Insisting on safety features during the mission briefing on all participants in the activity;

c) Insisting on the use of SOPs in order not to omit any details;

d) Abandoning one's own idea in case of identifying better ideas;

e) Opening free discussions regardless of its nature;

f) We ask the question: "How could we have done better?"

g) Discussion about what is right and not about who is right.

3. AVIATION SAFETY

3.1.Human error

It is easy to understand that the human factor plays an important role in flight safety due to latent behavior and psychological factor. ICAO defines error as “The action or inaction performed by an organization or person that causes damage or deviations from normal behaviors.

Human error is the most common cause of aviation accidents. Even if the action is unintentional and causes damage it is considered a determining factor. In any case, uncertain conditions, regulatory violations, errors and weaknesses in a system always lead to failure. These errors, somethimes individual, create niches or holes that cause failures in the operation of the system that will inevitably collapse. Moreover, latent conditions are sometimes created by engineers or ground personnel who superficially perform tasks because they are not directly involved in the flight activity. [4, 5, 6, 9]

Table 1 Analyzes the main types of human errors in terms of intent

Type of error	**Physical factors**	**Physiological factors**	**Psychological factors**	**Psychosocial factors**
People	Physical size, Gender, Age, Strenght, Sensory limitations	Nutritional factors, Health, Lifestyle, Fatigue, Chemical dependency	Workload, Experience, Knowledge, Training, Attitude, Mental or emotional state	Interpersonal conflicts, Personal loss, Financial hardships, Recent divorce
	Physical		**Organizational**	
Environment	Weather, Location inside/outside, Workspace, Shift, Lighting, Sound level, Safety		Personnel, Supervision, Labor-management relations, Pressures, Crew structure, Size of company, Morale, Corporate culture	
Actions	Steps to perform a task, Sequence of activity, Number of people involved, Communication requirements, Information control requirements		Knowledge requirements, Skill requirements, Attitude requirements, Certification requirements, Inspection requirements	
Resources	Procedures/work cards, Technical manuals, Equipment, Tools, Computer/software		Ground handling equipment, Materials, Training, Quality systems	

3.2.Technical error

Technical errors can appear depending on the stage of technological maturity (TRL), see the figure 1, being directly proportional to the level of innovation, [7, 8]

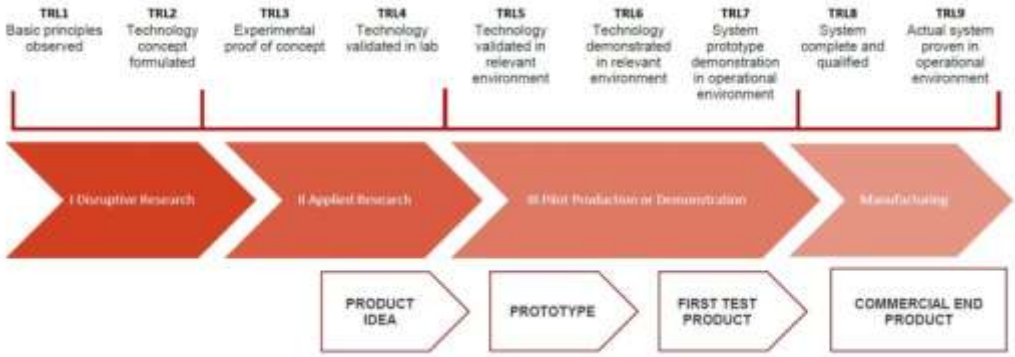

FIG. 1 Technical readiness level (TRL)

4. CONCLUSIONS

The pilots' association reports that 90% of space disorientation accidents are fatal. Spatial disorientation is a person's erroneous perception of position, attitude and acceleration relative to the outside environment. Moreover, disorientation can be recognized or go unnoticed by the affected person.

If a situation of disorientation is recognized early, there is an increased possibility of survival. Flight is not a natural state for the human body – we are not created by nature to fly. There are several causes that cause confusion such as angular acceleration, linear acceleration, vibrations, perception of movement, etc.

In any case, since flight is not a natural process for the senses of the human body, significant differences can occur between the expectations of the brain and the input information of the vestibular apparatus.

Recognizing the disorientation, the pilot can make the right decisions. About 90% of fatal accidents are due to the non-recognition of the occurrence of spatial disorientation due to poor training in this area.

Avoid using the words: "It's yours", "Did you take it?", "OK", but encouraging phrases like: "You took the commands!", "The aircraft is with you".

In conclusion, the thorough study of these phenomena through training courses significantly increases the quality of air safety.

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