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# THE POSSIBILITY OF INCREASING AIR TRANSPORT SECURITY VIA SIMULATOR TRAINING

**Summary**. This article is dedicated to the art of improving safety in aviation in response to stress in the aviation sector, as well as the impact of stress on aviation and communications errors caused by ignorance of communication skills needed at the required level. The first part is dedicated to safety management systems, the second part is devoted to stress and the third part explores communication errors, which have resulted in aviation accidents. The paper concludes with a preview of a possible solutions known as "Virtual Airport", which enables you to use simulator systems in order to increase the effectiveness level of training.

**Keywords:** air transport; security; safety; simulator; training

## 1. INTRODUCTION

The aim of this article is to explain the fundamental concepts and analysis of observed facts in order to enhance the level of safety in flying, especially with regard to novice pilots.

Working as a professional pilot or an air traffic control officer is undoubtedly stressful, being exposed to and possibly causing real threats to human life.

With increasing traffic in the airspace, there is a greater risk of conflict, which in turn increases the intensity of crisis situations. This can result in a situation that is unbearable, such that the body to react by experiencing stress.

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## 2.  SAFETY MANAGEMENT SYSTEMS

Having a safety management system (SMS) is a new requirement for organizations providing courses leading to the issuance of appropriate licenses. The National Security Programme for Civil Aviation in the Slovak Republic defines the concept as: "A systematic approach to safety management, which includes the necessary organizational structures [to] establish liability [and] determine the principles and practices" [5,6].

An organization involved in civil aviation must have in place a management system that is integrated and has clearly defined responsibilities, as well as identifying who has direct responsibility for security, describing the approaches and principles of the organization in this field, establishing a security policy etc.

An SMS comprises:
- Regulations governing operational safety (safety regulation)
- Safety monitoring (safety oversight)[1]
- Incident and accident investigation
- Analysis of data security (safety data analysis)
- Safety enforcement (safety promotion) [5,6]

Among the benefits for an organization resulting from its integration of an SMS into everyday activities are:
- Improved safety and reduced costs associated with aviation accidents and incidents
- Safety as a priority, which boosts morale among employees
- Increased effectiveness, which is associated with a reduction in costs
- An efficient system, which increases credibility
- Effective control of the risks, thereby lowering insurance costs [5,6].

To ensure the successful operation of the introduced system, it is necessary to ensure its continuous development in all respects, as well as facilitate effective methods of communication between all levels of the organization.

Each SMS system must be prepared by the personnel management. Any organization that wants to meet the requirements of regulations and be approved by the competent authority must appoint an officer who is responsible for security, usually the head of security. This is essential if an organization is to comply with established safety regulations. A committee for the review of safety or, where appropriate, an action group for safety should be established.

The principal tasks are to:
- Report to and receive strategic guidance from the committee
- Monitor operating safety
- Address the identified risks
- Evaluate the impact of changes to operational safety
- Ensure that security measures will be implemented within the agreed time intervals
- Examine the effectiveness of previous recommendations [4]
- Meanwhile, an SMS ensures the following:
- A security policy
- The extent of liability regarding the responsible head of security
- The range of responsibilities of the key personnel in the field of security
- Procedures for managing documentation
- Scheme hazard identification and management of security risks
- Planning security activities

- A process for reporting and investigating incidents
- Planning responses in the event of an emergency
- Management of change
- Supporting safety
- Tracking system conformity

## 3. STRESS IN AIR TRANSPORT

Stress is a response of the organism to adverse effects under burdensome conditions. It is thus a response to internal or external stimuli, which disrupt normal, stabilized operation functions of the organism, or even endanger them. Triggering elements of stress are called stressors.

Among the most important stressors in aviation is the risk of a traumatic experience. But stress can also elicit outwardly less severe stressors, such as hunger, disease and difficulty in solving complex problems.

However, in today's aviation world, it is only in very rare situations where we encounter threats to life. Usually, pilots and dispatchers refer to high physical and mental demands, in which bodies react differently to burden. The difference between load and stress is quite striking. In long-term and repeated stressful situations, a human's health demonstrably deteriorates, due to a load that may be impossible to bear. Furthermore, some humans can resist a stressful load, thus postponing the time when the impact of stress will be felt. On the other hand, in air transport, we certainly encounter an extraordinary load.

Such a load can be divided into:
- Physiological:
    o dragging
    o climate extremes
    o disruption of biorhythms
- Psychosocial:
    o responsibility
    o a life-changing event
    o poor social networks

Stress at the start of training is normal for pilots. Initially, students are receiving a considerable amount of information in the course of undertaking various tasks, which is a situation that their organism has never before encountered. Understandably, it is natural for them to feel under stress. However, this stressful condition must be mastered in the shortest possible time, so as not to cultivate fear or nervousness in ongoing training.

Each pilot must fully understand the airplane that he or she wants to fly. As part of basic training, they must show that they can cope with mandatory actions. That is to say, there is an exact algorithm that the pilot must fully adhere in order to maintain control during the individual phases of a flight. Such procedures must be mastered by each pilot before entering the booth. A student can master the mandatory actions perfectly in turn, but, once on board the plane, he or she may become confused.

The explanation is quite simple. As it is a completely new environment for the student, the organism has not yet become used to the procedures that accompany it. A relatively significant role is played by euphoria. Since the student has reached a long-awaited goal, or fulfilled a dream, the organism produces a feeling of happiness. Such an influence significantly decreases

concentration, which is why the student begins to feel confused. Experiencing all this in the first days of training may influence stress, with the amount of short-term concentration among pilots increasing on the job. However, this increase is usually short lived and followed by stress.

Fear is one of the most significant stressors during basic training. In the main, trainee pilots will have had no previous practical experience. Thus, any unexpected changes can induce a stress reaction in the form of starting to fear. Such a situation may cause, for example. an unexpected rotor turbulence.

However, in the beginning, a pilot can also experience a fear of the ground. This is a situation when the aircraft, in final approach mode with landing configurations in place, substantially hurtles directly to ground. Such a stressor is manifested when the pilot subconsciously "overloads" an action, which he or she must then correct, thereby further increasing stress. The resulting application of thrust risks the air stream on the wings being too great, causing a "hard" landing.

## 4. COMMUNICATIONS AND ERRORS

Communication in aviation a century ago was not taken for granted. As an airplane in the sky was unique, it was neither necessary to observe any separation, nor heed the danger of collisions between aircraft. After World War II, however, the situation changed; with an increasing number of aircraft and the formation of the first commercial companies, the sky gradually began to fill up with planes, such that it was necessary to regulate these aircraft.

In today's world, communication is a necessity in order to ensure the minimum degree of separation for aircraft coming into land.

We must realize that an airplane moves in three-dimensional space. Flights and routes involving commercial aircraft, despite pilots having received the most advanced training and access to sophisticated apparatus, can often occur in some of the worst weather conditions. This means that the pilot may not actually be able to see where he or she is flying, which means that his or her safety is in the hands of the control centre dispatcher.

The dispatcher's job then is to ensure the minimum degree of separation between aircraft and to gradually enable them to safely reach their intended destination. In other words, the job is more than just communicating.

Communication is primarily an information transfer. The basis of communications between people is speech transmission. In classical communications, a number of inaccurate and ambiguous concepts are used, whose meanings can take several forms and are therefore not clear. Hence, within a professional communication context, standardized procedures have been produced, such that a given application or an answer to a question can be accurately determined by a specific formula and not "on the hoof".

Of course, cases occur when the standardized formulations are avoided; but, in conventional processes, these are unlikely to happen. Furthermore, aviation involves precisely fixed radio communications, which pilots must control according to Regulation JAR-FCL 1 and Regulation L9432 [1,2,3].

Novice pilots who are receiving their initial private pilot's licence training initially communicate with the help of instructors. Obviously, in Slovakia, pilots engaged in basic training use Slovak to communicate. It is highly advantageous if pilots can communicate in their native language to minimize confusion about what message is being conveyed.

Air communications in Slovak requires a Slovak radiotelephony alphabet, which each cadet should be familiar with prior to control training. However, while acquiring this knowledge is

required before a pilot's certificate can be issued, so that pilots can use a radiotelephone on their first solo flight, at the start of their training, they do not even know the call sign of their aircraft.

It is very important for communications training to be ongoing. The exact phraseology regarding air communication, according to which pilots interact, is described in Regulation L9432 on radiotelephone procedures and air phraseology. It is important, then, for flying schools to teach their students how to communicate and how much time they should spend on improving their skills in this area.

In the history of aviation, there have only been a few large or small accidents, whose partial or total cause was an error in communications. One of such regulations issued on the basis of the investigation of air accidents is also a prescription issued by ICAO, wherein after 'aircraft specifically calls for knowledge of the English language at the appropriate level The effort of this Regulation is to avoid misunderstandings and erroneous understanding that result from communication errors at the level of international aviation.

## 5. VIRTUAL AIRPORT OF COMPANY LET'S FLY

The simulation is often used for training civilian and military personnel. This usually occurs in the event that it is too expensive or too dangerous for students use the actual device in the real world. Getting some valuable experience in "a secure" virtual surroundings. Preferably, also the errors that the system in training in safety - critical systems allows. But there is nevertheless a difference between sham used for training and instructional simulations.

Flight simulators (FSTD) are used to train pilots on the ground. In comparison to training in a real airplane, enables the stimulation training practice different maneuvers or situations that are for practicing airplane impractical (or even dangerous) in which pilot and instructor are in an environment which can be characterized as an environment with minimal risk. E.g. failure of electrical systems, failure of equipment, the failure of hydraulic systems, or even a failure to control the flight can be simulated without endangering the pilot or aircraft.

"Virtual airport" is conceived as a classroom for education and training aviation specialists. The principal elements are:
– Desktop System simulator 1-4,
– A simulator system C172 BITD (Basic Instrument Training Device),
– Control Instructor workplace,
– Transfer system.

Between various elements of the system is to help the computer network Internet or Intranet.

The transmission system is designed to allow interconnection at management and data transfer between subsystems specified. The transmission is duplex, interacting, what is needed mainly for interconnection of instructor workplace with individual subsystems.

On this basis, a "virtual airport" convenient to use for simulating teaching and training:
– Radiocommunication on different types of airports and language versions,
– operating procedures,
– Coordination of pilots in the airport area.

Fig. 1 Virtual airport – small simulators
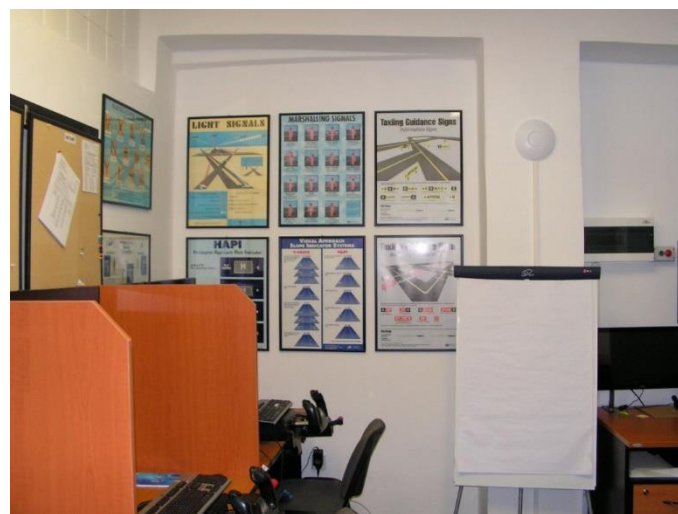

Fig. 2 Virtual airport – instructor station


Fig. 3 Virtual airport – papers information

Fig. 4 Virtual airport – simulator C 172

## 6. CONCLUSION

Everyone handles stress differently and particular situations can bring about different degrees of difficulty for different people. For example, working under a strict timeline can be a stressor for one person and normal for another. People cope with stress in many different ways. Specialists say that the first step is to identify stressors and the symptoms that occur after exposure to those stressors. Other recommendations involve development or maintenance of a healthy lifestyle with adequate rest and exercise, a healthy diet, limited consumption of alcoholic drinks, and avoidance of tobacco products. The profession professional pilot or the air traffic control officer is undoubtedly stressful profession. Historically, twenty percent of all accidents are caused by a machine failure, and eighty percent of all accidents are caused by human factors.

Current solutions and technology like Safety Management System concept and Simulator Trainings are helping pilots with improving safety and stress mitigation. A lot of research and development in this area has been already made however new technology and future transport challenges demands to continue scientific researches.

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