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**The analysis of the principles of flight safety in accordance with NATO regulations and
its integration in the Hungarian regulatory system**

The author's summary and the official reviews of the Ph.D. thesis

1. The topicality, purpose and method of the research

The topicality of the research

Ever since its existence, flight safety has been in close contact with the principles and methods of labour safety and protection. The ability to recognise and prevent danger has been an outstandingly important element of human activity in general, which has had an impact on the development of flying from the very beginning. Only by learning, by the development of empathic skills, and by gaining practical experience can this ability become an effective weapon -strongly affected by disciplines like risk management and system theory- in the fight against unexpected, unpredictable events or series of events.

Flying is a system process which can be easily distinguished by sub-systems and embedded system parts. The system process starts by choosing, designing, producing, procuring, maintaining, and preparing for the given task the device to be deployed and with regards to the performance during teaching, training, and preparation designating the necessary crew. It is terminated by turning of the engines at the dispersal and by evaluating the accomplished task. In the complicated process of flying this phase of planning is exceedingly demanding in time, space, and in both human and financial resources.

The purpose of the research

1. I seek to relate the national theory and practice to international standards by giving a historical overview of the development of safety systems.
2. I seek to introduce flying as the operation of a system process through the relations of the elements of the structure and by showing the emergence of flight events and to make the effects and the consequences of the system insufficiencies widely understood, thereby knowable, and processable.
3. By introducing the theory and the practical methods of risk analysis I would like to point out one of the most important elements of accident prevention and I try to find the position of the process in the comprehensive function of the flight safety system. Taking all these into consideration I wish to prove that it is possible to prevent recurrent detrimental effects by preventive activities and consistent flight safety work.
4. Illustrated by a practical example, with the examination of the elements of the system, with the introduction of the risk factors and with the help of the analyses

and the conclusions and recommendations different from those of the original investigation I want to throw light on the fact that the effect of unplanned, unpredictable events can be reduced to acceptable risk level.

5. Through presenting the determinant factors of a professional investigation applied in the flight safety organisation of the US ARMY, which I adopted to be compatible with domestic conditions I wish to prove that with a small scale reform in the present structure and without raising the costs it is possible to incorporate these principles to the domestic regulatory system.

The method of the research

To achieve my scientific objectives in my research I used the method of investigation, deduction, adaptation and the analysis of various documents.

In order to achieve my aims:

- I acquired and studied all available Hungarian and foreign literature relevant to the topic;
- I studied freely accessible professional materials published in electronic form on the Internet;
- I took part in the Flight Safety Company Officers' course organised in the Flight Safety Centre of the Land Forces of the United Nations of America, where I got basic training, and gained professional experience in employing safety systems, the later showing great difference from the Hungarian practice. I used the experience I gained to work out my own system concept.
- I published my theory in publications and in lectures delivered in scientific conferences. These publications and lectures clearly show the evolutionary process of my theory.
- I made use of my experience gained and my conclusions drawn in the course of analysing accidents and air traffic events.
- I capitalized on the experience I acquired during my 32 years of flying.

2. The structure of the thesis

In proportion with the development of this branch of science both civilian and military flight safety gains greater and greater influence in the control of flight related

everyday activities. What gave me the incentive for this thesis was the possibility to introduce an aspect of this branch of science, which is new both nationally and internationally. In the course of this:

In chapter one I introduce the historical background of the analysis of human activity related accidents and the development of the phenomenon of safety. I give a brief outline from the antiquity to the present age of the findings of early research into reasons leading to accidents.

I present H. W. Heinrich's model, which played a decisive role in the development of behaviour-based safety programmes.

I introduce the philosophy of some behaviour-based programmes with the intention of trying to point at the fact that safety programmes can only be effective if the participants are constantly motivated in their operation.

I mention some fundamental concepts from Hungarian research to help develop the approach which plays a decisive role in my thesis.

I give an overview of the factors influencing flight safety to this day, which cannot be ignored without jeopardising the safety of flying. I outline the bases of preventive activities, which nowadays apart from exerting their effect through the analyses of events and their conclusions, by extending the above factors also put the emphasis on the preventive controlling activity.

I look at the research programmes concerned with new flight safety procedures striving to answer the challenges of the future, the most striking element of which is the analysis and management of system inherent risks.

In the final parts of the chapter I deal with the circumstances of establishing and the bases of activities of national and international specialist organisations. I look at the place, role and tasks of manufacturers, maintainers and operators in the process of the system of flight safety.

In chapter two I analyse the factors having a decisive effect on the occurrence of accidents. Among these the human error has the highest percentage. However, according to my findings, investigators often err, when setting the boundaries of this area of investigation. In the majority of the cases they limit their enquiries to the crew playing an active role in the flying activity. The role of the other two factors is not fully investigated in all cases. The

reason for this can be the lack of proper training, but in some cases the harmful presence of preconception can also be discerned. It is mostly the scrutiny of the environmental effects that lags behind the accepted level. I mention the example of the definition of the level of electromagnetic disturbance, which is an indispensable element of investigation in case of modern aircraft like JAS-39. The intricate electronic system of the fourth generation aircraft most probably cannot tolerate the „pollution” generated by the several ten thousand-volt high voltage transmission lines during flying at low altitude.

In chapter three I examine the process leading to the accidents. The pre-flight period and the deviations emerging during flight play a crucial role in this process. I prepared a diagram to illustrate the elements of the system the deviations emerging in the process of flying and the expected consequences of these.

I outline the factors affecting the process leading to the accidents. Without the knowledge and in case of an event the analysis of these it is impossible to conduct preventive activities. I expound the importance of the connections between human efficiency and performance, the physical and mental factors and the recognition and taking of risk.

I deal with the role of sound judgement and the effect of knowledge and skill on the decision making process. These elements are parts of the operating process, which in my judgement have a decisive effect on the process leading to an accident.

In chapter four I place special emphasis on the factors affecting the process leading to accidents, as the basic elements of prevention. Unfortunately, the primary source of information for accident prevention activities is the accident itself and the lessons learned during the investigation. The accidents provide the most obvious and irreversible proof of how serious the risk is. The disastrous human and financial implications of the consequences of accidents can become a major incentive in raising the funds for accident prevention programmes.

Both during investigation and in prevention the main criterion is that all available information with regard to all factors should be collected and analysed without delay.

The further process of the investigation should concert its efforts in the interest of prevention according to the regulations of professional investigations. This applies to authorities in the first place but to the professional organisations of operators also.

In disclosing the circumstances and reasons of the event the order of the primary interests of the society and within this the state is worth reconsidering.

In chapter five I deal with the theoretical bases of risk management and I introduce the procedures in practice at the Land Forces of the United States of America.

First I outline the possible sources of risk information and the elements of the risk decision making process. I explain the difference between the phenomena of risk management and risk taking. I deal with the components of risk and the issues of their social acceptance and acknowledgement. I examine the process of risk management, concentrating on focal points and the different levels of risk.

In chapter six I give an overview of the investigation process. I introduce the procedures and techniques in practice at the Land Forces of the United States of America from planning and organisation to the activities following deployment to the site.

I examine the tasks of the head and the members of the professional investigation committee in the different phases of the investigation.

I introduce the basic rules of conducting a professional investigation with regard to the fact that since two identical accidents are practically impossible to occur there are no generally applicable effective investigation procedures.

In the rest of this chapter I re-examine an earlier air traffic accident to prove the practical applicability of the branch of science which I chose as the object of my studies. The conclusion which I drew from my investigation and the suggestions I make throw light on the importance of regular (once every five years) re-examination of earlier investigations parallel to the development of the branch of studies.

3. The scientific achievements of the thesis and suggestions for utilization

Summary of the findings of the research

1. The system which I created - with the help of my diagram – is able to simultaneously illustrate deviations occurring in human, material-technical and environmental factors;
2. By using the theory, the examination and management of the presumable effects of deviations occurring in the system become programmable. In the first place it can have an effect on working out procedures with the objective of extending available time at the same time it can motivate developing methods reducing the real time of the crew;
3. Creating the phenomena of original safety level and psycho-physiological condition and the method of their calculation provides the leaders of air traffic organisations with a

tool that tailored to the individual needs makes it possible to predict the successful accomplishment of the task;

4. By clarifying and systematising the phenomena used in flight safety I provide the experts researching into the emergence air traffic events with a clear and easy to understand picture;

5. By defining and examining the phenomena of available time and real time of the crew I gave insight into the state that directly precedes the accident. Further examination of these two factors will make it possible to discover elements endangering flight safety, which at present are unknown to researchers.

Such is the mathematical definition of available time in a given physical environment;

6. By proving the change of condition and by assessing the value of the damage caused in the accident the definition and the categorisation of the events occurring in national air traffic can be simplified.

My research is not finished; I wish to continue my scientific work by analysing further factors of flight safety. Based on my findings I suggest further studies in the following areas:

- Defining available time in cases when the aircraft has great energy content.
- Conducting experiments – on a voluntary basis for the time being – to define the P_k value of aircraft crews in simulator.

Further utilisation of the results of the thesis

The thesis can **contribute** to the creation of a new approach and investigation procedure in flight safety;

- can **promote** the work of the commanders, the staffs and the staff of the flying units in the early phase of planning;
- can **provide the basis** for flight safety experts and researchers to discover further risk elements, and to work out procedures to eliminate them;
- can be **used** in compiling the material for flight safety training, in college and university basic training, in aircraft pilots pre- and further training;
- can **help** the work of experts in their future research.