THE OVERALL REVIEW OF AICRAFT ACCIDENT CAUSES SINCE YEAR 2000 WITHIN THE HUMAN FACTOR

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This article is dealing with a human factor and the effects of the human factor on aircraft accidents. This paper contains definitions of an aircraft accident and discusses the types and an origin of errors within the frame of human factor. Another part of this report frames the theoretical basis and main concepts associated with an error and human factor, like the SHELL model, Reason's model, as well as CRM and MCC systems which are very important when defining this issue. This paper contains graphic illustration of aircraft accidents that took place in Slovakia since the year 2000. In the final part, serious global accidents are mentioned of which all have a common denominator, and that is the absence of a team work. This part of the paper includes change propositions which should benefit in elimination of the errors, and therefore, in cut-down of human factor proportion in aircraft accidents.

K e y w o r d s. human factors, accident, SHELL model, model of reason, errors, teamwork

1 INTRODUCTION

In the public eye, the presence of errors in aviation is closely associated with accidents or their presumption. Errors might indeed, but do not necessarily have to lead to aircraft accidents. Before the accident occurs, various conditions must take place. An accident does not have to be a result of one faulty act, but rather a series of faulty actions on the one hand, and insufficient defence mechanisms and termination of its development – a chain of errors.

As to civic aviation transport, safety is considered the most important component of aircraft service. Despite low accident rate of aviation transport, the consequences of accidents are mostly catastrophic and have large-scale character. There are various causes of the accidents from the effect of the weather, through technical errors, to errors of human factor. Technical errors were the most common problem in aviation before a huge technical progress in 1960's. Pilots had to rely on their own judgment and had only a little simple equipment available to them. Today, technology is more advanced. One of the most significant components is the possibility for aviation personnel both in the air and on land to communicate.

In spite of this, accidents still take place and their investigation and final reports referring to the causes of the accidents often reveal an error of the pilot or the maintenance technicians. This paper is focusing on errors caused by human factor, and interprets specific accidents caused by this fact.

2 AIRCRAFT ACCIDENT

When defining an aircraft accident, it is important to realize that even if we understand the meaning of these words, aviation regulations discuss other situations entitled aircraft accidents including:

- an incident – an event, different from aircraft accident, coherent with aircraft maintenance which can or could have an effect on safety of air navigation
- exceptional air incident, incident – general term for identification of aircraft accident or serious incident or incident
- aircraft accident, accident – an event associated with aircraft service which occurs from after any subject enters the aircraft with intentions of performing/accomplishing/making a flight, up to when they leave the aircraft and where:

a) a subject is fatally or severely injured in consequence of their presence in the aircraft or in consequence of direct contact with any part of the aircraft, except when they cause the injury themselves

b) a damage or breakdown of aircraft construction occurs

c) aircraft is missing or when aircraft is situated at an unknown place. (1)

2.1 Mistake of aviation

Influence of human factor on accidents is even today still the most extensive. Failure of

human factor is credited four from five accidents. Issue of human factor in aviation we perceive as a technology, which connects theoretical knowledge about a human with real operation of aeroplanes.

Cognitive mistakes, or ways how we are considering, have strong influence on decision making and they are connected with ability to adapt to risky situations. In some cases we cannot attribute the error to a person because on people also a team impacts except the environment. Therefore we also define group conformity which is group thinking in which a mistake is due to the pressure of a group and precisely the tendency to adjust the majority.

Today requirements on pilots and crew members increase as the physical and mental as well as professional skills. Of course technology is progressing as well which helped the reduction of air accidents. Between other possible causes which are attributed to pilots are included: aircraft on the ground and in the air, inattentive monitoring techniques and in exceptional cases, alcoholism or side effects of drugs, or physical or mental illness.

With regard to maintenance and preparing of aircraft, the principles of safety are the most important. Even if this kind of maintenance and preparation is mostly characterized as technical preparation, maintenance for carelessly performed work or because of insufficient repairs of defects, or in the manufacture of aircraft parts, the error will be attributed to the technical staff, not technology.

Taxonomy of human errors, on the principles of human factor-based understanding, must be supported by unquestionable psychological theory; a reliable database containing detailed objective information about all connections identified incidents analyzed and validated measures of intervention effectiveness eliminating defined risks. Tested in aviation and partially proven in accident prevention are methods based on analysis of the processing of information, situational awareness and risky procedures. Although all were focused on the causes of failure of pilots and air traffic controllers, practically are useful for failure analysis and prevention of aircraft maintenance.(5)

2.2 The theoretical base

The Model SHELL describes the general issue of human factor. The human factor which is in the middle is influenced by other factors around. The name of the model SHELL is based on four English words, software, hardware, environment, liveware, basically elements of that model.

Reason's model is looking for sources of failure not just in the end of the organizational structure but also on all levels of the system. The core of Reason's model and a source of failures are primary blocks and their interface. It rates in a detail the interface, management and performance of the people in that system. (2) Reason defines a human error as a generally used expression which includes all of the occasions where planned sequence of mental or physical activities are less than intended results, and since those failures cannot be charged on the notch of interventions of some random action.(3)

The model of Swiss cheese developed by J. Reason is in use to analyse reasons of system falls or accidents in aviation, engineering and health services. It describes the cause of the accident as a set of occasions occurring in the exact order and an accident which occurs in a certain way can be compared with several unique pieces of Swiss cheese. All system looks like slices of that cheese.

The holes are chances for a system falls and accidents and slices of cheese are creating a sort of layers of all systems.

The hole allows to pass a problem through one hole in the layer, but in other layers the holes are in different places, so it avoids the problem to go on. Every layer is protected against potential problems.

CRM – Crew Resource Management means development and application of non-technical abilities using all available information, instigation, equipment, human resources and other available tools for securing and successful fulfilment of goals. (4)

The training course MCC which is being carried out in order to train pilot students and pilots to work professionally as a part of the crew manages areas of communication, task distribution, using control sheets, mutual supervision and support. Multi Crew Cooperation

is cooperation within more members of the crew. To understand this correctly it is necessary to introduce the difference between CRM and MCC:

- CRM – as mentioned earlier, it is a merger of crew member's activities for the sake of securing the steering, controlling and navigation of the aircraft.
- MCC – refers to the activity of piloting itself, therefore, with the goal of more crew members steering and controlling the aircraft securely.

3 STATISTICS OF AIRCRAFT ACCIDENTS IN SLOVAKIA

Concerning the air-traffic service in the Slovak Republic, there are more aircraft accidents within commercial flights than there are in a private sector as it is less frequented.

The statistics of the Ministry of Transport, Construction and Regional Development of the Slovak Republic discuss about 2369 exceptional incidents, but do not speak about the accident causes. Unfortunately, it is known from other sources that 80% of these accidents were caused by human factor failure, which includes not only the failure of the aircraft crew, but involves failure of maintenance, or communication. The analysis of aircraft accidents following overall statistical summary can contribute to prevention, and therefore, reduction of the accident rate.
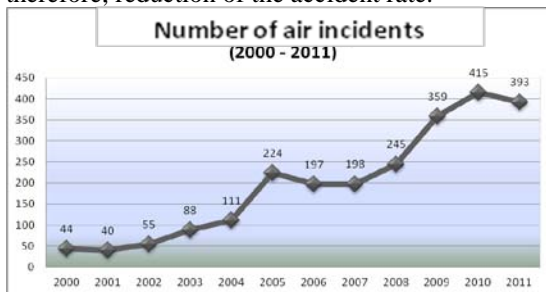
Graph 1 Number of special incidents

In the following period, from year 2000 – 2011, special incidents have an increasing character, as it is illustrated in **Graph 1**. Following this graph, it is obvious that within this period of the year 2001 has historically lowest accidental rate. On the contrary, the most accidents took place in 2010. The year 2005 illustrates certain leap where aircraft accidents increased in over 100%

compared to the previous year and the year 2009 is similar. Although, obviously, increasing tendency of aircraft accidents is affected by the fact that the frequency of flying has increased within the last years.

4 SERIOUS AIRCRAFT ACCIDENTS AND PROPOSALS

This part of the article focuses on the most serious accidents, selected from a worldwide database. These accidents have been selected from the database from aviation safety network, and final reports of accidents. For illustration, we have chosen the most serious accident caused by human factor that has common denominator which is teamwork.

Basic information about aviation accidents:

1.On August 23 2000 near Muharraq, Bahrajn at 19:30 LT Airbus A320-212, flight number 072 crashed into Arabian Gulf. The aircraft had been operated by Gulf Air airline and was flying from Egypt to Bahrajn. All of the 143 people on board died from which 8 were members of the crew.

2.On March 6 2003 by Tamanrasset, Algeria at 3:45 LT Boeing 737-200, flight number 6289 crashed. The aircraft had been operated by Air Ageria airline and was flying within Algeria from Tamanrasset to Ghardaia. 102 people died of which 6 were members of the crew. One passenger survived the accident.

3.On May 25 2002 at 15:30 LT, Boeing 747-209B, flight number 611 flying from Taiwan to Honk Kong crashed 20 minutes after the take-off to Taiwan Strait. 225 people died in the accident. The crew consisted of 19 people. No one survived the accident. The mentioned aircraft had been operated by China Airlines and that was its last flight before being sold to Orient Thai Airlines.

4.On January 8 2003 at 8:49 LT aircraft Beechcraft 1900D, flight number 5481 flying from North Carolina to South Carolina crashed into a hangar of the departure airport Charlotte-Douglas International Airport. Subsequently, it caught on fire. It took place 37 seconds after the start and 19 passengers and 2 crew members died.

4.1 Suggestions for changes

The suggestion for changes is a subject for an exact definition of problems that have caused analyzed accidents. It is clear from the previous part that the first two accidents were caused by the same problem. One of the main reasons was the inability to work as a team. Captains and co-pilots did not know how to use the knowledge of CRM, or they were not possibly trained enough from the CRM issues. Also the communication between the crew members had failed, what led to formation of accidents.

That's why it is so important for pilots to get trained for teamwork from the very beginning. The system of education should get some changes in the following way :

- do the simulations of common situations in the cockpit, more often
- do the simulations of unusual situations at the cockpit, more often
- random grouping of unknown students and letting them face the critical situations
- simulate the unexpected situations during the training
- teach students the effectiveness of cooperation in a team and communication skills in stressful situations
- teach the students how to solve conflict situations in rush
- work as a team, listen to each other during the special situations, communicate clearly and be understandable
- be assertive
- analyze the correctness and accuracy of the information under duress
- learn from others mistakes

If we follow these steps, it is possible to eliminate even a small part of accidents caused by misunderstandings inside the team. It is important to remember the mistakes, learn from them and not to repeat them.

From accidents 3 and 4 we can clearly see the proportion of maintenance technician failures which caused aircraft accidents. Since the maintenance technicians are the usual cause to the aviation accidents, it is useful to change some of the approaches, even if it is very complex to do during the maintenance performance. The training should also get some changes in the following way :

- apply the theoretical knowledge to different situations when the maintenance is performed
- face the mistakes that lead to aviation accidents and report the reason why the repair wasn't sufficient
- teach the students how to concentrate for work only
- always use the appropriate tools and new components

During the maintenance it is important to know that the technician should be even tempered and calm, so he can concentrate on his job. That's why the chiefs should not push on technicians when they are in rush. It is necessary to have enough time for plane repairs and maintenance, to reach the best final result. These suggestions for changes can also help to decrease the amount of aviation accidents which are caused by maintenance mistakes.

Unfortunately, there is no way to completely remove the human factor errors these days, but thanks to technology progress these errors can be at least eliminated. Also, the very important factor in aviation is an observance of rules, testing the knowledge and practical experience. (5)

5 CONCLUSION

Despite the fact that air traffic itself is the safest way of travel, its consequences are usually very severe. According to the statistics 80% of all aircraft accidents are caused by human factor. Errors which result from this fact should not reappear. Not being able to work as a part of the team is often a cause. CRM systems include team work in their training. Unfortunately, both pilots and maintenance technicians underestimate this fact. However, there is a possibility for changes. It is important to pay more attention to this problem. Suggestions of this paper should alter the training, although, it is obvious, that an absolute solution does not exist in this case.

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