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### **Human performance as a casual factor of aircraft accidents**

*The article deals with issues concerning human factors are affecting how people do their jobs. They are the social and personal skills, such as communication and decision making which complement our technical skills. These are important for safe and efficient aviation. Human Factors is the focus of so much attention today because human error has contributed to over 80% of aviation accidents.*

The study of human factors involves applying scientific knowledge about the human body and mind to help understand human capabilities and limitations. Human factors knowledge can be used to reduce the likelihood of errors and build more error tolerant and more resilient systems.

Human Performance in the working environment has become popularly referred to as Human Factors (HF). It underlies the focus of the applied science of ergonomics which is usually considered to cover the adaptation of work or working conditions to enhance performance of the worker. Generally and historically, the measure of such performance has been seen as efficiency or productivity and as an adaptive response rather than a core element of initial design. Of course in the context of aviation and similar safety-critical activities where optimum human performance is equated specifically with operational safety standards rather than strictly with business efficiency, it is not surprising that the wider descriptive term HF has gained particular currency.

Human Factors in its widest definition describes all the many aspects of human performance which interact with their (aviation) environment to influence the outcome of events. These may be related to either the physiological or psychological aspects of human capability, both of which are able to directly affect the way in which the human operator performs in different circumstances.

Since front line aviation personnel are rarely fulfilling their duties as isolated individuals, it is obvious that the human factor plays an outstanding role in aviation. Recent years have seen the widespread introduction by aircraft operators, by ATM and by aircraft maintenance organisations of Crew Resource Management (CRM) and Line Oriented Flight Training (LOFT) for pilots, Team Resource Management (TRM) for ATCOs and Maintenance Resource Management (MRM) in aircraft maintenance [4].

The term "human factors" has grown increasingly popular as the commercial aviation industry has realized that human error, rather than mechanical failure, underlies most aviation accidents and incidents. If interpreted narrowly, human

factor is often considered synonymous with crew resource management (CRM) or maintenance resource management (MRM). However, it is much broader in both its knowledge base and scope. Human factor involves gathering information about human abilities, limitations, and other characteristics and applying it to tools, machines, systems, tasks, jobs, and environments to produce safe, comfortable, and effective human use. In aviation, human factor is dedicated to better understanding how humans can most safely and efficiently be integrated with the technology. That understanding is then translated into design, training, policies, or procedures to help humans perform better.

However the term "human error" does not help in the prevention and investigation of aviation events; although it shows us where the system failed it does not tell us anything about the causes that led to the failure. Also the term "human error" hides the latent factors that should be revealed in order to prevent aviation accidents. For example, errors attributed to individuals may actually be caused by design flaws, poor training, incorrect procedures or operating manuals. In the modern approach to aviation safety, human error is not the end but rather the starting point in investigating and preventing aviation events [3, p. 1].

Other early concerns in human factors were related to the effects on the human body of factors such as noise, cold, heat, vibrations and accelerations [1, 2, 5]. In time, the study of the human factor has expanded and developed to include aviation maintenance activities. In approximately 75- 80% of aviation mishaps the main cause was a decrease in human performance. Aviation engineers and mechanics are subject to the influence of a unique set of human factors that can lead to errors in aircraft maintenance working at heights, in difficult weather conditions, in an environment where the noise level is very high or under time pressure. A scientific paper presented at a conference of the Royal Aeronautical Society shows the growing trend of maintenance occurrence of errors per million flights. The number of errors has almost doubled in a period of 10 years [3, p. 1]

*Shell model.* For a better understanding of human factors, a gradual approach needs to be taken with the help of the "SHELL" theoretical model (fig. 1). The figure below illustrates this model using squares representing different elements of human factors. The model name comes from the initials of the components: Software (procedures, symbols), Hardware (machines, aircraft), Environment (environment, the context in which L-H-S system works) and Liveware (the human). This model has only a didactic value and aims to facilitate a better understanding of human factors.



Fig. – Hawkins model

A. Liveware. The center of this model is the human, the most sensitive and flexible system component. People, however, are subject to considerable variation in performance and its limitations, most of which are predictable in general terms. Liveware is the core component of the model; all the other components should be adapted to "fit" with it [2]. B. Liveware-Hardware. This interface is most often considered when talking about man - machine system: designing seats depending on human body characteristics, designing displays depending on the characteristics of sensory information processing, or the cockpit controls with proper control.

C. Liveware-software. This interface is about man and procedures, manuals and checklists, symbology and computer software.

D. Liveware-environment. This interface was among the first addressed. Initially, the first steps were to adapt human to the environment (helmets, flight suits, oxygen masks). After that the trend reversed to adapt the environment to humans by introducing pressurization and air conditioning, soundproofing. This includes also perceptual illusions generated by environment, but also aspects of political and economic constraints. E. Liveware-Liveware. This interface is about interpersonal relationships [3, p. 3].

*The importance of human factors.* About three in four accidents result from human error made by individuals apparently healthy and with the necessary qualifications. The source of these errors can result from improper design of equipment / procedures, from inadequate operating instructions or deficient training. The human and financial costs of low performance have become so big that an unprofessional approach to human factors is no longer possible [2]. The system need for human factors is determined by their impact in two major areas which interact so closely together that factors influencing one implicitly affect the other area. These areas are:

- System efficiency;

- The health of operational personnel;
- System efficiency Safety.

To demonstrate the impact of human factors on aviation safety we will present some examples of aviation accidents in which they played a decisive role:

1. In 1974, a B-707 crashed during approach at Pago-Pago in Samoa, with a loss of 96 lives. A visual illusion related to the black-hole phenomenon was a cause factor (NTSB/AAR 74-15);

2. In 1974, a B-727 approaching Dulles Airport in Washington crashed into Mount Weather, with a loss of 92 lives.

Lack of clarity and inadequacies in air traffic control procedures and regulations led to the accident. The absence of timely action of the regulatory body to resolve a known problem in air traffic terminology was also listed as a factor (NTSB/AAR 75-16);

3. In 1977, two B-747s collided while on the runway at Tenerife, with a loss of 583 lives. A breakdown in normal communication procedures and misinterpretation of verbal messages were considered factors (ICAO Circular 153-AN/98).;

4. In 1982, a B-737 crashed after take-off in icing conditions in Washington. Erroneous engine thrust readings (higher than actual), and the co-pilot's lack of assertiveness in communicating his concern and comments about aircraft performance during the take-off run were among the factors cited (NTSB/AAR 82-08) [4].

Efficiency. The need for human factors is not reduced only to aviation safety. Work efficiency is also affected by not applying or lack of knowledge about human factors. Proper placement of displays and controls in the cabin also improves performance. If crew members are well trained and evaluated they will have better performance. The health of operational personnel Among the factors that affect the health of operational personnel we encounter fatigue, circadian rhythm disturbance and sleep deprivation. Other factors affecting the physical or mental health are: temperature, noise, humidity, light, vibration, workplace design and space. Fatigue. It is considered a condition resulting from insufficient rest, but also a range of symptoms associated with circadian rhythm alterations. Acute, chronic or emotional fatigue can lead to dangerous situations and loss of efficiency. Hypoxia and noise are also contributing factors [5, 6].

. The second direction in controlling error is to reduce the consequences of persistent human error using cross-monitoring through cooperation between crew members and designing equipment to allow reversibility. Training and evaluation. Education and training are seen here as two separate elements of the training process. Education encompasses a broad set of knowledge, values, attitudes and skills required to build a psychological skill foundation on which later the

professional skills will be acquired. Training is a process focused on the development of skills, knowledge and attitudes specific to a particular job or to the execution of a particular task. Adequate and effective training can not be achieved if through education was not created an appropriate foundation of knowledge, attitudes and skills [3, p. 4-5].

### **Conclusions**

Knowing how people function is very important in aircraft accident and incident investigation. The main goal of human factors application is to understand why people and organizations involved in design, manufacture maintenance and management of aircraft operations make errors that may have the potential to lead to aircraft accidents. The purpose of understanding why people make errors is to produce safety reports and recommendations that will help prevent aircraft accidents. The study of human-machine interaction transposed in theoretical models, helps us to achieve a systematic and thorough understanding of why humans make errors.

### **References**

1. Cioaca, C., Panta, R., Bocoianu, M., An Analysis of the Possibilities to Improve the Human Factor Efficiency in Air Traffic Management. 16th International Conference The Knowledge Based Organisation, “Nicolae Balcescu” Land Force Academy, Sibiu (2010).
2. Civil Aviation Safety Authority Australia (2013). Safety Behaviours: Human factors for engineers. Disponibil la adresa [http://www.casa.gov.au/wcmswr/\\_assets/main/lib100215/hf-engineers-res.pdf](http://www.casa.gov.au/wcmswr/_assets/main/lib100215/hf-engineers-res.pdf)
3. Dumitru J.M., Boşcoianu M. Human factors contribution to aviation safety // International conference of scientific paper, 2015 Brasov, 28-30 May 2015. – 5 p.
4. Human Factors // Sky Bray.–[Text].–[Access mood]: [https://www.skybrary.aero/index.php/Human\\_Factors](https://www.skybrary.aero/index.php/Human_Factors)
5. ICAO - International Civil Aviation Organization (1989). Human factors digest no 1. Fundamental human factors concepts. Circular 216-AN/131. ICAO (Montreal, Canada), 1989.
6. United Kingdom Civil Aviation Publication (CAP) 716: Aviation Maintenance Human Factors (EASA Part145).–[Text].–[Access mood]: [www.caa.co.uk/docs/33/CAP716.pdf](http://www.caa.co.uk/docs/33/CAP716.pdf).