

## THE HUMAN FACTOR IN THE AERONAUTICAL ENVIRONMENT

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**Abstract:** *The human factor in the aeronautical environment has been analyzed in the most frequent cases of flight crew errors and air traffic control. The human factor directly causes many aviation accidents. Studies show that 80% of aviation errors involve human factors. If not detected in time, it can cause accidents. Awareness of the role of the human factor leads to an improvement in the quality of professional and personal activity, to an environment that facilitates the continuous safety of people or aircraft, and to more involvement and responsibility. Reducing the number of errors offers various benefits, from reducing accidents at work to decreasing the number of significant events. Most of the time the human factor is approached in relation to ways of mitigating the risk, preventing the development of problems. The paper aims to highlight multiple interpretations of the human factor in order to become aware of its value and complexity.*

**Keywords:** *human factor, aeronautical environment, performance and human limits*

### 1. INTRODUCTION

The human factor approach is multidisciplinary incorporating contributions from psychology, engineering, industrial design, statistics, operational research and anthropology. The human factor refers to human abilities, their valorization in the design and development of systems and services in the aeronautical environment, and the art of successfully ensuring the relationship between person, the environment in which he works and the aircraft used.

The human factor is not only about person, but also about what he creates, uses and evaluates. It is complex and essential in both the civil and military environment and refers to the challenges to which person responds differently, both with qualities and with vulnerabilities.

The human factor highlights human or technological performance and limits. The study of human factors is a difficult process because there is no single way to analyze how people are affected by certain conditions or situations, as demonstrated by the multitude of studies on this issue.

Human factor research in the aeronautical environment has the general purpose of identifying and optimizing the factors affecting human performance in maintenance and inspection, then in the preparation, conduct and evaluation of flight. The main focus is on flight technicians and engineers but then extends to the entire organization.

This optimizes understanding of how people can work effectively and maintain work performance. Operating an aircraft requires pilots to manage a significant amount of information, which creates a high load of working memory (Rongjuan Zhu, Xiaoliang Ma, Xuqun you, 2023).

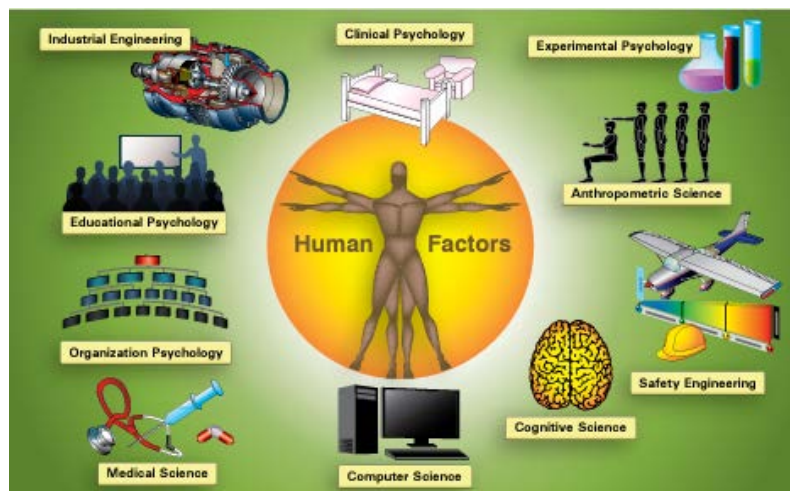
## 2. THE COMPLEXITY OF THE HUMAN FACTOR

In understanding the human factor, psychology makes significant contributions by assessing and preventing physical and mental dysfunction to promote human well-being (mental, affective and behavioral) and personal or professional development. Clinical psychology helps people cope with stress, adverse situations, the effects of poor self-image, and criticism from work colleagues. Experimental psychology allows the study of a variety of behavioral processes that can occur in the aeronautical environment, such as: Sensation, perception, memory, language, thinking, motivation and will. Experimental studies help measure performance, productivity and deficiencies of the human factor.

Anthropology facilitates the study of the dimensions and abilities of the human body. This is essential in the aeronautical environment. Men and women have different height and weight, which leads to the appearance of various modes of action. Although both genres are able to perform the same task with a high level of competence, they operate effectively with tools and equipment adapted to their size.

Computer science allows the study of the theoretical and practical foundations of information and calculation, implicitly of the practical techniques for their implementation. It is important that the human has comfortable and reliable computerized workstations. Software and equipment should be easy to learn and use. It takes time and money to train a man who has to fly on a new aircraft. With advanced technology adapted to the current aeronautical environment, the performance of the human factor can be improved.

As you can see, there are many aspects that can be analyzed in the approach of the human factor, so a responsibility and assumption of everything that means the study, knowledge and exploitation of the human factor (Fig. 1) is necessary.



**FIG.1.** Complex approaches to the human factor in the aeronautical environment ([www. faasafety.gov](http://www.faasafety.gov))

Cognitive science provides analysis of how information is processed represented and transformed into a nervous system or machine (for example, a computer).

Therefore, a person must have problem solving skills quickly and efficiently. People constantly have to solve various situations and react quickly to them. This creates stress and creates different states of manifestation. Those who have trained over time in efficient information processing are more successful in aeronautical activities. Some who have not emphasized the development of cognitive processes manage to respond to professional demands through seriousness, involvement and effort.

Others, who do not find it necessary to invest in their intellectual potential, will encounter various difficulties in adapting to tasks and responding immediately to requests. It is always recommended to learn, to get involved in all sorts of activities and to develop both professional and cross-cutting skills.

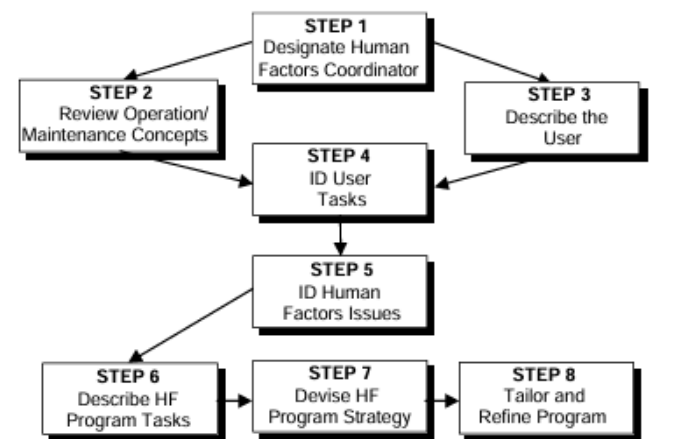
Mood and physical well-being, implicitly and psychic, are very important and are directly correlated with the human factor. Everyone deserves to work in a safe environment. Safety and health at work are becoming paramount in the aviation environment. People’s productivity and job satisfaction depend on specialists in the effective approach to the human factor.

Every organization must consider factors such as the size of each person’s strength, age, and ability to perform tasks. To all this is added the environment and technology with which they work, whether in the hangar, on the track or within the organization. The aeronautical environment involves the valorization of teamwork, each being dependent but also responsible for the involvement of others.

### 3. THE STUDY OF HUMAN FACTORS PROCESS

The human factors process consists of four management actions: Manage the human factors program, Establish human factors requirements, Conduct human factors integration, Conduct human factors test and evaluation (FAA System Safety Handbook, 2000).

Manage the human factors Program refers to the system that needs to be purchased to increase performance and reduce development and lifecycle costs. Because each program is unique in terms of cost, size, complexity and human interfaces, it is necessary to always be adapted to the requirements of the aeronautical environment (**Fig. 2**). Changes, adaptations and improvements will be required during the course of the program’s evolution. Any problem in the program must be solved in an optimal time.



**FIG.2.** Developing the human factors program (FAA System Safety Handbook, 2000)

The program must always be structured and adapted to the requirements of the aeronautical environment. There is a strong link between the program documentation and the planning, organization and implementation of the program. In program management, the focus is on control and evaluation to always have feedback about the usefulness and performance of the program. The documentation supporting the program shall describe the performance requirements and capabilities that the program must meet, the approach to be taken and the specific activities to be performed during the design and development of the program.

It also requires a continuous development of the person, with everything that means knowledge, skills, ways of achieving performance.

Human factors reviews and demonstrations should be planned and conducted to coordinate and verify that requirements are being met. The role of man is essential to facilitate the safety of the aeronautical system, while ensuring human well-being and performance (Koglbauer, 2023, Lazaro, Nogueira, Melicio, Duarte Valerio, 2024).

Integrating the human factor into the program's development and management process can be difficult due to the risks and problems specific to the evolution of the people involved in the process. This is why a continuous assessment of aeronautical personnel is recommended by means of check sheets, tests and spontaneous execution of specific program tasks. Based on these assessments, they will adapt continuous methods for selecting, training, and evaluating operators and teams, policies and procedures will ensure the appropriate use of the new automation and effective human performance and team coordination, standards and measures need to be applied to ensure safety and efficiency. The process has proven to be successful in lowering lifecycle costs, improving overall system safety and performance, and reducing program technical risks (FAA System Safety Handbook, 2000).

#### **4. CONCLUSIONS**

Successful human factor programs carefully analyze all the actions that people need to perform in order to work efficiently and safely at work. The aeronautical environment is extremely complex, requiring collaborative teamwork under time constraints and difficult working conditions (Rajee Olaganathan, 2024).

The human factor is a multidisciplinary effort that is based on information about human performance and limits and that emphasizes everything that means the environment, aircraft, equipment, systems, software, and the environment. Federal Aviation Administration order 9550.8 Human factors Policy. The human factor is concerned with optimizing the relationship between people and their activities, through the systematic application of the human sciences, integrated within the framework of systems engineering. Lack of communication, teamwork, fatigue, lack of resources, stress, lack of assertiveness and awareness (Pereira, Gomes, Melicio, Mendes, 2021) generates a greater effort by specialists oriented toward a safety-oriented culture, thus reducing the trend for errors and substantially improving the operational safety parameters (Lázaro, Nogueira, Melicio, Duarte, Santos, 2024).

The study of human factors examines how people interact with cars and other people (pilots, air traffic controllers, or design and procurement personnel) and determines whether procedures and regulations take into account human abilities and limitations. Identifying the chances of human error can reduce the need for replacement or subsequent modification of equipment and procedures.

The human factor affects the aeronautical environment, the acquisition of equipment and the safety of the people involved (Daisuke Karikawa, 2024). That is why it is necessary to focus on the design of the necessary equipment and technology, the performance of the operators, the management and training of the personnel, the transdisciplinarity of the training of specialists thus reducing the risks specific to the human-machine interaction (Mygal, Protasenko, 2022) minimizing errors, respecting a safety culture.

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