Republic of the Philippines
CIVIL AVIATION AUTHORITY OF THE PHILIPPINES

Advisory Circular

AC 139 – AEP/HF - 01

HUMAN FACTOR PRINCIPLES
FOR
AERODROME EMERGENCY PLAN

February 2017

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AC- 139 – AEP/HF - 01
HUMAN FACTOR PRINCIPLES FOR AERODROME EMERGENCY PLAN

1.0 PURPOSE

This Advisory Circular is promulgated to provide guidelines to Aerodrome Operators in adopting policies and procedures on human factors principles in the provision of Aerodrome Emergency Services.

2.0 REFERENCES.

2.1 Civil Aviation Regulations governing Aerodromes (CAR-Aerodromes)
2.2 Manual of Standards for Aerodromes (MOS)
2.3 Memorandum Circular 009-17, Application of Human Factors for Aerodrome Emergency Plan
2.4 ICAO Doc 9683- ICAO Human Factors Training Manual
2.5 ICAO Doc 9137 – Part 7 Airport Emergency Planning

3.0 BACKGROUND

Emergency planning is the process of preparing the aerodrome to cope with an emergency occurring at the aerodrome or in its vicinity. The objective of the emergency planning is to minimize the effect of an emergency particularly in respect of saving lives and maintaining aircraft operation.

The overall safety and efficiency of the civil aviation system depends on human operators as the ultimate integrators of the numerous system-elements. This dependence is unlikely to decrease, and may even increase in unanticipated ways, as additional advanced technology is implemented. To a greater extent, understanding and accounting for the role of humans, including their positive and negative contributions, will be important to maintaining and improving safety while improving efficiency.

Human Factors is about people in their living and working situations; about their relationship with machines, with procedures and with the environment around them; and also about their relationships with other people. "Human Factors is concerned to optimize the relationship between people and their activities, by the systematic application of human sciences, integrated within the framework of systems engineering".

The human sciences study the structure and nature of human beings, their capabilities and limitations, and their behaviors both singly and in groups. The notion of integration within systems engineering refers to the Human Factors practitioner's attempts to understand the goals and methods as well as the difficulties and constraints under which people working in interrelated areas of engineering must make decisions. Human Factors uses this information based on its relevance to practical problems.

The industry need for Human Factors is based on its impact on two broad areas, which interrelate so closely that in many cases their influences overlap and factors affecting one may also affect the other.

These areas are:

a. Effectiveness of the system
   i. Safety
   ii. Efficiency

b. Well-being of operational personnel.

4.0 GUIDANCE AND PROCEDURES

4.1 Definitions

Human Factors Principles mean principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

4.2 General

The human factors concept concerns the interaction between:

a. People and people
b. People and equipment
c. People and the environment
d. People and procedures

4.3 Three key concepts are involved in human factors understanding and eventual implementation. These are; Human-centered Automation, Situational Awareness and Error Management.

4.3.1. Human-centered Automation

Automated aids can be designed from a technology-centered perspective or from a human-centered perspective. A technology-centered approach automates whatever functions it is possible to automate and leaves the human to do the rest. This places the operator in the role of custodian to the automation; the human becomes responsible for the "care and feeding" of the computer. In contrast, a human-centered approach provides the operator with automated assistance that saves time and effort; the operator's task performance is *supported*, not *managed*, by computing machinery.

4.3.2. Situational Awareness

Situational awareness (SA), can be defined as the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future. Thus, the most important Human Factors issue in regards to human-technology interface is the ability of the human operator to maintain situational/system awareness. It is an established fact that human-technology interfaces have not always been intuitive. Non-intuitive, 'opaque' interfaces lead to operational complexity which often forces the operator to allocate increased attention to maintain an adequate mental model of the situation/system status. This becomes the breeding ground for loss of situational awareness, decreased system performance and eventually human error and safety breakdowns.

Elements of Situational Awareness

The elements listed below are highly dynamic and present subtle to large changes that may occur at short notice, and that can or will influence how an employee works or performs at any particular moment. How these changes interact with an employee's SA may only be recognized after having gained considerable experience in general, and at a specific location in particular:

i) personal factors
ii) weather
iii) airport infrastructure
iv) individual differences
v) traffic
vi) operators and pilots
vii) environment
viii) navigational aids
ix) aircraft performance
x) equipment

xi) adjacent units.

4.3.3. Error Management.

It has always been considered that human error was an individual trait that could be prevented by the right training, attitudes or by automating as many human tasks as possible. However this has not been able to eliminate error. The aviation industry thus shifted its focus from *eliminating* error to *preventing* and *managing* error. Human error is recognized as an inevitable component of human performance. Complex socio-technological systems therefore should take this into account by design. The concepts of *error tolerance* and *error resistance* in technology design best exemplify this new focus. The following are some of the causes of error:

a) Lack of Communication
b) Lack of Knowledge
c) Complacency
d) Distraction
e) Lack of Teamwork
f) Fatigue
g) Lack of Resources
h) Pressure
i) Lack of Assertiveness
j) Stress
k) Lack of Awareness
l) Norms

Error management has two components: *error reduction* and *error containment*. Error reduction comprises measures designed to limit the occurrence of errors. Since this will never be wholly successful, there is also a need for error containment — measures designed to limit the adverse consequences of the errors that still occur. Error management includes:

a) measures to minimize the error liability of the individual or team;
b) measures to reduce the error vulnerability of particular tasks or task elements;
c) measures to discover, assess and then eliminate error factors within the workplace;

d) measures to diagnose organizational factors that create error-producing factors within the individual, the team, the task or the workplace;

e) measures to enhance error detection;

f) measures to increase the error tolerance of the workplace or system; and

g) measures to make latent conditions more visible to those who operate and manage the system;

4.4 The Aerodrome Operators in developing policies, procedures and guidelines for Aerodrome Emergency Services shall take into account human factors principles as described in this circular.

5.0 THE NEED FOR HUMAN FACTORS IN AERODROME EMERGENCY PLANNING

This need for Human Factors is based on its impact on two broad areas, which interrelate so closely that in many cases their influences overlap and factors affecting one may also affect the other. These areas are:

5.1 Effectiveness of the system

5.1.1 Safety

The SHEL model provides a conceptual framework to help understand Human Factors. It illustrates the various constituents and the interfaces — or points of interaction — which comprise the subject. According to SHEL's model Human Factors elements can be divided into four basic conceptual categories:

***Software*:** documentation, procedures, symbols, etc.
***Hardware*:** machinery, equipment, etc.
***Environment*:** both internal and external to the workplace
***Liveware*:** the human element.

Liveware-Liveware (L-L)
Communication skills
Listening skills
Observation skills
Operational management skills – leadership and followership

Problem solving
Decision-making

Liveware-Hardware (L-H)
Scanning
Detection
Decision-making
Cockpit adjustment
Instrument interpretation/situational awareness
Manual dexterity
Selection of alternative procedures
Reaction to breakdowns/failures/defects
Emergency warnings
Workload physical, allocation of tasks
Vigilance

Liveware-Environment (L-E)
Adaptation
Observation
Situational awareness
Stress management
Risk management
Prioritization and attention management
Coping/emotional control Decision-making

Liveware-Software (L-S)
Computer literacy
Self-discipline and procedural behavior
Interpretation
Time management
Self-motivation
Task allocation

5.1.2 Efficiency

a. Application of group interaction principles.
b. The proper layout of aerodrome facilities, access points and performance of fire tenders promotes and enhances effectiveness.
c. Properly trained and supervised fire crew members are likely to perform more efficiently.

d. From the perspective of efficiency, standard operating procedures (SOPs), are developed to provide the most effective methods of operations, and should be regarded as a means of measuring the performance of all members involved in emergency exercise.

5.2 Well-being of operational personnel:

Fatigue Fatigue may be considered to be a condition reflecting inadequate rest, as well as a collection of symptoms associated with displaced or disturbed biological rhythms. Acute fatigue is induced by long duty periods or by a string of particularly demanding tasks performed in a short term.

Body rhythm disturbance. Safety, efficiency and well-being are affected by the disturbed pattern of biological rhythms typical of today's long-working hours.

Health and performance. Certain pathological conditions — gastrointestinal disorders, heart attacks, etc. — have caused sudden failure on human performance.

Stress. Stress can be found in many jobs, and the aviation environment is particularly rich in potential stressors. Of main interest is the effect of stress on performance. In the early days of aviation, stressors were created by the environment: noise, vibration, temperature, humidity, acceleration forces, etc., and were mainly physiological in nature. Today, some of these have been replaced by new sources of stress: irregular working and resting patterns and life events.

In the center of the model is a person, the most critical as well as the most flexible component in the system. Yet people are subject to considerable variations in performance and suffer many limitations, most of which are now predictable in general terms. The edges of this block are not simple and straight, and so the other components of the system must be carefully matched to them if stress in the system and eventual breakdown are to be avoided.

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