1.0 PURPOSE

1.1 The purpose of this advisory circular is to provide guidance and information to the Air Navigation Service Provider (ANSP) on the development and application of human factors principles in the provision of Air Navigation Services.

1.2 The information is broad in nature and primarily intended to provide source material for the ANSP to develop its own human factors training programs and to ensure that when they develop procedures, checklists, programs, manuals and systems that they do so with proper consideration of Human Factors principles.

2.0 REFERENCES

2.1 The Civil Aviation (Certification of ANSP's) Regulations, 2017 as amended

2.2 The Civil Aviation (Air Traffic Services) Regulations, 2017 as amended

2.3 ICAO Doc 9758- Human Factors Guidelines for Air Traffic Management (ATM) Systems

2.4 ICAO Doc 9683- ICAO Human Factors Training Manual

2.5 Human Factors in Air Traffic Control (Circular 241)

2.6 Human Factors in CNS/ATM Systems (Circular 249).

3.0 BACKGROUND

Human error has been documented as a primary contributor to more than 70 percent of commercial airplane hull-loss accidents, and there is increasing evidence that human error may, in fact, contribute at a significantly higher rate. While typically associated with flight operations, human error has also recently become a major concern in aircraft maintenance practices and air navigation services including air traffic management.

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:

i) People and people

ii) People and equipment

iii) People and the environment

iv) People and procedures

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

4.3.1 Human-centred Automation

Automated aids can be designed from a technology-centred perspective or from a human-centred perspective. A technology-centred approach automates whatever functions it is possible to automate and leaves humans 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-centred 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 regard 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 grounds for loss of situational awareness, decreased system performance and eventually human error and safety breakdowns.

4.3.2.1 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 errors. The aviation industry thus shifted its focus from *eliminating* errors to *preventing* and *managing* errors. 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: -

i) Lack of Communication

ii) Lack of Knowledge

iii) Complacency

iv) Distraction

v) Lack of Teamwork

vi) Fatigue

vii) Lack of Resources

viii) Pressure

ix) Lack of Assertiveness

x) Stress

xi) Lack of Awareness

xii) Norms

4.3.3.1 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:

i) measures to minimize the error liability of the individual or team;

ii) measures to reduce the error vulnerability of particular tasks or task elements;

iii) measures to discover, assess and then eliminate error factors within the workplace;

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

v) measures to enhance error detection;

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

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

4.4 The ANSP shall provide training on human factors principles to ATS personnel and take into account human factors principles in developing operational policies, procedures and guidelines.

Tanzania Civil Aviation Authority