ADVISORY CIRCULAR

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HUMAN FACTORS PRINCIPLES IN CIVIL AVIATION	2016-02-29	000-03	1.0

NOTE: THIS ADVISORY CIRCULAR IS PUBLISHED TO PROVIDE REGULATORY INFORMATION AND DESCRIBE ACCEPTABLE MEANS OF COMPLIANCE WITH THE GENERAL AUTHORITY OF CIVIL AVIATION REGULATIONS (GACAR).

CHAPTER 1 – INTRODUCTION

1.1 Purpose.

The purpose of this advisory circular is to provide guidance and information on the development and application of Human Factors principles in those civil aviation organisations and operations where the General Authority of Civil Aviation Regulations (GACAR) require, and across the aviation industry in general. The information is broad in nature and primarily intended to provide source material for organisations to develop their 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.

1.2 Applicability.

This advisory circular is applicable to all civil aviation organisations exercising privileges under those GACAR requiring adherence to Human Factors principles.

1.3 Cancellation.

This is the first official version of this Advisory Circulars.

1.4 Related Regulatory Provisions.

All of the GACAR.

1.5 Related Reading Material.

ICAO Doc 9683 - Human Factors Training Manual
ICAO Doc 9758 - Human Factors Guidelines for Air Traffic Management (ATM) Systems
ICAO Doc 9806 - Human Factors Guidelines for Safety Audits Manual
ICAO Doc 9808 - Human Factors in Civil Aviation Security Operations
ICAO Doc 9824 - Human Factors Guidelines for Aircraft Maintenance Manual
ICAO Human Factors Digests:

- No. 1 - Fundamental Human Factors concepts
- No. 2 - Flight crew training: Cockpit resource management and line-oriented flight training
- No. 3 - Training of operational personnel in human factors
- No. 5 - Operational implications of automation in advanced technology flight decks
- No. 6 - Ergonomics
- No. 7 - Investigation of human factors in accidents and incidents
- No. 8 - Human factors in air traffic control
- No. 10 - Human factors, management and organization
- No. 11 - Human factors in CNS/ATM systems
- No. 12 - Human factors in aircraft maintenance and inspection
- No. 15 - Human factors in cabin safety
- No. 16 - Cross-cultural factors in aviation safety

1.6 Definitions of Terms Used in this Advisory Circular.

Affected parties should refer to Subpart A of GACAR Part 1 for a full listing of defined terms used in the new GACARs and specifically those related to safety management and Human Factors. This Advisory Circular may introduce several additional definitions to aid in a common understanding of the ideas presented in this document. In cases where the definitions in this document differ from an identical term defined in GACAR Part 1, the definition in GACAR Part 1 will prevail when interpreting regulatory requirements.

1.7 Approval.

This Advisory Circular has been approved for publication by the Assistant President, Safety, Security and Air Transport Sector of the General Authority of Civil Aviation.

CHAPTER 2 – HUMAN FACTORS PRINCIPLES IN CIVIL AVIATION

2.1 Introduction.

2.1.1 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.

2.1.2 The term 'Human Factors' refers to the wide range of issues affecting how people perform tasks in their work and non-work environments. The study of human factors involves applying scientific knowledge about the human body and mind, to better understand human capabilities and limitations so that there is the best possible fit between people and the systems in which they operate. Human factors knowledge can be used to reduce the likelihood of errors and at the same time build more error tolerant, and therefore more resilient, systems.

2.1.3 Human factors are the social and personal skills (for example, communication and decision making) which complement technical skills, and are important for safe and efficient aviation.

What are human factors?

2.1.4 Human factors specialists look at human capabilities and limitations and the manner in which these capabilities and limitations interact with complex systems, such as those in aviation. The goal is to minimise the likelihood of human error and to maximise performance to improve the overall safety of the system.

How do human factors affect you?

2.1.5 Safety management systems need to manage all areas of risk including those that increase the likelihood of human error. New regulations require pilots and engineers to receive training in human factors as part of minimising the likelihood and impact of human error.

Do I need to train my staff in human factors?

2.1.6 Various GACAR sections require organisations to either include human factors principles in their operations, or to specifically include Human Factors training for their staff – this includes human factors training for flight crew, cabin crew, flight operations officers, flight dispatchers, maintenance engineering staff, and air navigation services staff.

How do I find a human factors specialist for my organisation?

2.1.7 Human factors specialists work in high-reliability safety-critical industries (e.g., maritime, rail, oil/gas, nuclear/hydro power, aviation, mining, firefighting), in user-design roles (e.g., developing search engines, communication devices); as consultants, or as practitioners/academics in universities.

Is human factors the same as Human Resources (HR)?

2.1.8 No. Human factors is about humans interacting with systems. One HR element relevant to managing human performance, however, is training and assessment.

What is the cost benefit of addressing human factors?

2.1.9 There is a clear cost benefit for organisations in managing human factors and designing systems to be user-centric. Reducing the likelihood of error can have substantial cost savings in terms of reduced down-time, repair work and reduction in injury to personnel. Ultimately, reducing error reduces the likelihood of accidents.

2.2 Elements of Human Factors Training Program.

2.2.1 The key to implementing a human factors program in any organization is training. There are a number of elements that need to be considered in the development of a Human Factors training program. These should be tailored around the specific aviation industry sector, but should include:

Factor	Elements
Threats and errors	Definitions of human error Definition of threat Definition of threat and error management Types of threat and errors Threat identification Threat management strategies Error chain Error prevention and detection Error management strategies
Organisational factors	Definition of safety culture Elements of positive safety culture Reporting system as a function of overall safety management Use of safety data to rectify problems and reduce risks Organisational factors, latent risks Organisational risk tolerance SOPs development based on human factors Company culture re SOP adherence

Stress and fatigue	Definition of stress, stress management, and fatigue Identify stress Effects of stress Stress management techniques Fatigue and tiredness - causes and symptoms Circadian rhythms, biological clock, jet lag, etc.
Fatigue risk management systems (FRMS)	Management of fatigue at the individual and organisational levels
Information acquisition and processing	Definition of information acquisition, information processing Stages of information processing Attention and perception Types of memory Limitations and failures of memory Techniques for improving/enhancing memory Skill development

Situational awareness and workload management	Definition of situational awareness and workload management Types of situational awareness Components of situational awareness Activities to achieve situational awareness Loss of situational awareness - recognition and recovery Capacity limitations and cognitive overload Workload management strategies Prioritisation Managing distractions
Decision making	Definition of decision making Factors affecting decision making Bias Types of decision making Option generation Decision making skills Problem solving techniques Risk management

Communication	Definition of communication Modes of communication Factors affecting communication / barriers to effective communication Standard phraseology Listening Communication styles and techniques Internal and external communication Briefings
Leadership and team behavior	Definition of leadership and authority Attributes and qualities of good leaders Assertiveness Authority gradient Identify factors affecting team performance Define Crew Resource Management Methods of optimising CRM Group decision making – advantages and disadvantages Cooperation and team building Concept of management Conflict resolution Cultural differences

Automation, vigilance and monitoring	Definition of automation, vigilance and monitoring Guidelines on use of automation Mode awareness/understanding Automation complacency Redundancy and automation failure detection Intervention Need for active monitoring Techniques for improving monitoring Detection of failure Factors affecting vigilance

2.3 External Sources.

Further information on human factors in civil aviation can be found through a number of sources, and in a number of publications, including:

• International Civil Aviation Organization (ICAO) (www.icao.org/)

Documents - Refer Paragraph 1.5 of this AC.

• United Kingdom Civil Aviation Authority (UKCAA) (www.caa.co.uk/)

Document - CAP 715 An Introduction to Aircraft Maintenance Engineering Human Factors for JAR 66

Document - CAP 716 Aviation Maintenance Human Factors (EASA Part-145)

Document - CAP 718 Human Factors in Aircraft Maintenance and Inspection

Document - CAP 719 Fundamental Human Factors Concepts

Document - CAP 737 Flightcrew human factors handbook

Document - CAP1159 A strategy for human factors

Document - CAP1209 Human Factors: Action Plan

• Eurocontrol (www.eurocontrol.int/)

Location – Eurocontrol - Human Factors Library (www.eurocontrol.int/articles/human-factors-library)

Document - Human Performance in Air Traffic Management

• Skybrary (www.skybrary.aero/)

Document - Operators Guide to Human Factors in Aviation

Document - Human Factors Training

• European Aviation Safety Agency (EASA) (www.easa.europa.eu/)

Document - 2012 European Strategy for Human Factors in Aviation

Document - Regulatory Inspector Human Factors Competence Framework

• Federal Aviation Administration (FAA) (www.faa.gov/)

Location - Human Factors Group (www.hf.faa.gov/)

Location – Aviation Research Division – Human Factors Branch (ANG-E25) (www.hf.tc.faa.gov/)

Document - FAA Order 9550.8 Human Factors Policy

Document – Role of Human Factors in the FAA