



# Human Factors in Aircraft Maintenance

# HUMAN FACTORS IN AIRCRAFT MAINTENANCE

## 1. MODULE SUMMARY

### Aims and Target Groups

Psychological, physical and social factors can all have an impact on human performance and behaviour. This module aims to provide students with an understanding of human factors and considers their impact on safety and security in the aviation industry. Students will gain an understanding of the need to take human factors into account in relation to maintenance procedures and practices.

A student taking this module would typically be training to become an Aircraft Maintenance Engineer Technician through a B1/B2 EASA license.

This module will meet **EQF<sup>1</sup> level 4**.

### Duration

It is recommended that **50** hours of contact should be allocated for this module.

### Required pre-requisite knowledge

A working knowledge of aircraft maintenance processes.

## 2. TEACHING, LEARNING AND ASSESSEMENT

### Intended Learning Outcomes

Upon successful completion of this module, students should be able to understand:

1. Why human factors are important in aircraft maintenance (EQF IV knowledge) [10%]
2. How psychological, physical and social factors affect and limit human performance (EQF IV knowledge and skills) [20%]
3. How physical aspects of the working environment affect human performance (EQF IV knowledge) [10%]
4. How tasks can affect human performance (EQF IV knowledge) [10%]
5. Risk assessments in aeronautical engineering environments (EQF IV skill) [15%]
6. Communication in the workplace (EQF IV knowledge) [10%]
7. Causes of human error (EQF IV knowledge) [10%]
8. Human factors aspects of aircraft incidents (EQF IV skill) [15%]

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<sup>1</sup> European Qualifications Framework (EQF) is a translation tool that helps communication and comparison between qualifications systems in Europe. Its eight common European reference levels are described in terms of learning outcomes: knowledge, skills and competences. For more information please go to: [https://ec.europa.eu/ploteus/search/site?f%5B0%5D=im\\_field\\_entity\\_type%3A97](https://ec.europa.eu/ploteus/search/site?f%5B0%5D=im_field_entity_type%3A97)

### Proposed teaching and learning methods

Teaching will be delivered through a combination of traditional classroom lectures and practical work. The module can be enhanced by e-learning used either during the classroom teaching or as guided study to reinforce the learning.

Study Activity	Learning Hours
On-Line Material - Learning Objects	10
Classroom Teaching	25
Guided and self-study.	10
Assessment	5
<b>Total</b>	<b>50</b>

### Method of Assessment

The assessment strategy comprises of a multi-choice test which is a common technique used for obtaining an EASA license. However to aid learning, this module also incorporates a small formative case study report to enable students to develop work on a relevant topic depending on their work environment. This case study may be carried out as an individual or group activity and can be used to encourage further discussion on the subject.

Assessment Task	Assessment Description	Intended Learning Outcomes assessed	Formative (F) and / or Summative (S)	Contribution to module mark	Indicative time taken to carry out assessment task (hours)
1	1 case study report related to a Human Factor Maintenance Activity	8	F	0	5
2	Multiple Choice Examination	all	S	100%	1

Summative assessments (S) will be marked and the marks will contribute directly to the overall pass requirement for the module.

Formative assessments (F) are intended to enable the student to learn from carrying out the assessment and receiving feedback, but any marks are indicative of performance only and do not contribute directly to the overall pass requirement for the module.

Reassessment is by new test.

### Attendance Requirement

80% minimum attendance required for all classroom teaching activities.

## Indicative Content

### 1. Why human factors are important in aircraft maintenance

- Outline a typical organisation and the maintenance section
- Define: SHEL model, 'Murphy's Law' and anthropometry
- Safety of employees, passengers and people on the ground
- Safety of aircraft and equipment
- Working environment, social habits, work load, and communication
- Health of employees

### 2. How psychological, physical and social factors affect and limit human performance

- Information processing, human error and reliability
- Fitness and health, stress, workload, fatigue, medication, environment
- The nature of tasks: physical work, visual inspection, complexity and repetition, shift cycles : [lesson 1 : Human Error in Aviation Maintenance]
- Work and communication within and between teams
- Maslow's hierarchy of needs
- Sharing knowledge and experience
- Difference between management and supervisor roles
- Inspection and reporting on the work of others : [lesson 2 : Case Study – Helios Airways 522]
- Characteristics of motivation and de-motivation: Individual motivation, Motivation by management
- Conformity and non-conformity
- How company culture can compromise best working practices
- Leadership
- Structure of the eye, seeing in high and low light, peripheral vision, interpretation, long and short sight
- Structure of the ear and the effects of noise: prolonged high intensity, varying pitch, Tinnitus
- Legal requirements for hearing protection
- Fatigue, stress and causes, deadlines, low concentration, cutting corners : [lesson 1 : Human Error in Aviation Maintenance + lesson 3 : Dirty Dozen]
- Age, illness
- Complexity of information, overconfidence, boredom
- Claustrophobia, Access limitations Fear of heights
- Legal requirement for physical and mental fitness
- Effects of toxins: carbon monoxide, alcohol, drugs, alcohol limits

### 3. How physical aspects of the working environment affect human performance

- Concentration, Communication
- Oxygen levels
- Ability to see detail: Use of spectacles and magnifiers, strobe effect, moving between light and dark
- Optimum lighting for typical tasks
- Cold/wet, warm/dry, hot/humid environments
- Working at height
- Unsteady platforms
- Use of rotating and percussive tools
- Vibration White Finger
- Layout: Cleanliness, Movement between areas, Noise, Temperature
- Tasks, tools and information

### 4. How tasks can affect human performance

- Personal skills and proficiency
- Work environment
- Physical effort required
- Understanding the system
- Pooling of knowledge and skills
- Need for clear and comprehensive information and guidance.
- Defining the resources required
- Twelve most common factors influencing maintenance: The dirty dozen (e-leaning)

### 5. Risk assessments in aeronautical engineering environments

- Hazard and risk, eliminating or reducing to an acceptable level
- Severity and likelihood
- The 'Swiss Cheese Model' : [lesson 1 : Human Error in Aviation Maintenance]
- Identifying hazards
- Evaluate risks and decide on precautions
- Safety Management System
- Review and update
- Anonymous and blame-free reporting
- Management of workplace emergency situations such as fire, spillage, personal injury

### 6. Communication in the workplace

- Verbal, written, body language, workplace social culture
- Maintaining good working relations
- Organisational efficiency

- Formal work logging
- Inspection : [lesson 2 : Case Study – Helios Airways 522]
- Communication within the organisation
- Reading briefing material, notices and amendments to maintenance procedures
- Prevention of accidents
- High performance teams: features and development process

## 7. Causes of human error

- Induced
- Variable
- Slips, lapses and mistakes : [lesson 1 : Human Error in Aviation Maintenance]
- Complacency
- Environmental issues
- Rule, knowledge and skill based errors : [lesson 1 : Human Error in Aviation Maintenance]
- Cognitive biases
- Violations: origin and escalation : [lesson 1 : Human Error in Aviation Maintenance]
- Individual practices and habits
- Errors associated with visual inspection
- Latent/active errors : [lesson 1 : Human Error in Aviation Maintenance]
- Self-discipline
- Training
- Logging and analysis
- Human error in Aviation Maintenance (e-learning)

## 8. Human factors aspects of aircraft incidents

- Using extracts from reports
- Filtering out irrelevant detail
- How, why, when where, who : [lesson 2 : Case Study – Helios Airways 522]
- Identification of what should have been done
- Analysing information and identifying contributing factors including where possible:
- Personal behaviour, Environmental conditions, Management, Organisational culture
- Including where necessary, brief details of: Nature and mix of allocated tasks,
- Recommendations for preventative action
- Case study: The Helios Airways S22 (e-learning)

### 3. MODULE RESOURCES

#### Essential Reading

##### Course materials

The three AIRVET (<http://airvet-project.eu/>) developed e-learning lessons specifically to support the teaching on this module:

- Human error in Aviation Maintenance – definition of error types, introduction to the organisation accident model and a description of typical maintenance errors and factors influencing technician performance.
- Case study: The Helios Airways S22 – analysis of operator’s error and analysis of latent causes at organisational and procedural levels.
- The ‘Dirty Dozen’ – description of the dirty dozen and strategies/recommendations to help manage these factors in the workplace.

#### Required Reading

- *Handbook of Aviation Human Factors (2009)* by John A. Wise, V. David Hopkin, Daniel J. Garland. CRC Press: USA
- *Applied Human Factors in Aviation Maintenance (2004)* by Manoj S. Patankar and James C. Taylor. Ashgate Publishing Limited: USA
- *Implementing Safety Management Systems in Aviation (2011)* by Alan J. Stolzer, Carl D. Halford and John J.

#### Required Equipment

Access to on-line teaching materials