



AIRWORTHINESS

ADVISORY

CIRCULAR

CIVIL AVIATION AUTHORITY OF BOTSWANA

CAAB Document AAC-012

HUMAN FACTORS IN AIRCRAFT MAINTENANCE

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1. PURPOSE

This Airworthiness Advisory Circular (AAC) provides information and guidance as well as serving as an acceptable means of compliance with Regulation 21.(6)(d) of the Civil Aviation (Approved Maintenance Organisations) Regulations, 2012 on Human Factors requirements and training for personnel within Approved Maintenance Organisations.

2. STATUS OF THIS ADVISORY CIRCULAR

This AAC is an original issuance.

3. EFFECTIVE DATE

This AAC becomes effective immediately.

4. APPLICABILITY

This AAC is applicable to Approved Maintenance Organisations (AMOs) and personnel involved in aircraft maintenance.

5. RELATED REGULATIONS

Copies may be obtained from the Government Printer.

- Civil Aviation (Approved Maintenance Organisations) Regulations.
- Civil Aviation (Personnel Licensing) Regulations
- Civil Aviation (Approved Training Organizations) Regulations
- Civil Aviation (Airworthiness) Regulations
- Civil Aviation (Air Operator Certification and Administration) Regulations

6. RELATED PUBLICATIONS

- ICAO HF Digests and Training Manual

Copies may be obtained from Document Sales Unit, ICAO, 999 University Street, Montreal, Quebec, Canada H3C 5H7.

For further information on this subject, operators are advised to review the following publications -

- EASA Part 145, and AMC and GM
- UK CAA CAP 716 Human Factors in Maintenance

7. DEFINITIONS AND ACRONYMS

7.1 The following definitions are used in this circular

‘Human Factors’ means 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 of human performance.

‘Human performance’ means human capabilities and limitations which have an impact on the safety and efficiency of aeronautical operations

7.2 The following acronyms are used in this circular

AAC Airworthiness Advisory Circular

AMC Acceptable Means of Compliance

Advisory Circulars (ACs) are intended to provide advice and guidance to illustrate an acceptable means, but not necessarily the only means, of complying with the regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material. Where a regulation contains the words “prescribed by the Authority,” the AC may be considered to prescribe a viable method of compliance, but status of that “prescription” is always “guidance” (never regulation).

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|-------------|---|
| AMO | Approved Maintenance Organisation |
| CAA | Civil Aviation Authority |
| CAAB | Civil Aviation Authority of Botswana |
| EASA | European Aviation Safety Agency |
| GM | Guidance Material |
| ICAO | International Civil Aviation Organization |

8. BACKGROUND

Regulation 21.(6)(d) of the Civil Aviation (Approved Maintenance Organisations) Regulations, 2012 requires an AMO's training program to provide indoctrination training for employees that includes at least forty (40) hours of instruction in various subjects including maintenance human factors with the elements focusing on aviation maintenance and safety related issues.

Information in this AAC is based on best practice such as EASA Part 145 and its AMC and Guidance material. The UK CAA publication CAP 716 provides useful additional guidance for Human Factors in Approved Maintenance Organisations, and should be read in conjunction with this AAC.

9. HUMAN FACTORS IN ORGANIZATIONS

9.1 All staff should be able to demonstrate an understanding of human factors and human performance issues in relation to their job function and be trained in accordance with the guidelines stated in Para 9.2 and Appendix A.

9.2 Human factors elements in Maintenance

In respect to the understanding of the application of human factors and human performance issues, all Approved maintenance organisation personnel should have received initial and continuation human factors training. This should involve:

- Post-holders, Managers, Supervisors;
- Certifying staff, support staff and mechanics;
- Technical support personnel such as planners, engineers, technical record staff;
- Quality control/assurance staff;
- Specialised services staff;
- Human factors staff/human factors trainers;
- Store department staff, purchasing department staff;
- Ground equipment operators.

9.3 Initial human factors training should cover all the topics of the training syllabus specified in Appendix A either as a dedicated course or integrated within other training. The syllabus may be adjusted to reflect the particular nature of the organisation, and may also be adjusted to meet the particular nature of work for each function within the organisation. For example:

- (a) small organisations not working in shifts may cover in less depth subjects related to teamwork and communication;
- (b) planners may cover in more depth the scheduling and planning objective of the syllabus, and in less depth the objective of developing skills for shift working.

- 9.4 All personnel, including personnel being recruited from any other organisations, should receive initial human factors training compliant with the new organisation's training standards prior to commencing actual job function, unless their competence assessment justifies that there is no need for such training.
- 9.5 Newly directly employed personnel working under direct supervision may receive training within six (6) months after joining the approved maintenance organisation.
- 9.6 The purpose of human factors continuation training is primarily to ensure that staff remains current in terms of human factors and also to collect feedback on human factors issues. Consideration should be given to the possibility that such training has the involvement of the quality department. There should be a procedure to ensure that feedback is formally passed from the trainers to the quality department to initiate action where necessary.
- 9.7 Human factors continuation training should be of an appropriate duration in each two year period in relation to relevant quality audit findings and other internal/external sources of information on human errors in maintenance available to the organisation.
- 9.8 Human factors training may be conducted by the maintenance organisation itself, or independent trainers, or any training organisations acceptable to the CAAB.
- 9.9 The human factors training procedures should be specified in the Maintenance Procedures Manual (MPM) as outlined in Appendix 1 of CAAB Airworthiness Advisory Circular (AAC) 002.

10. CONTINUATION TRAINING

- 10.1 Continuation training is a two way process to ensure that certifying staff remain current in terms of procedures, human factors and technical knowledge and that the organisation receives feedback on the adequacy of its procedures and maintenance instructions.
- 10.2 Due to the interactive nature of this training, consideration should be given to the possibility that such training has the involvement of the Quality department to ensure that feedback is actioned. Alternatively, there should be a procedure to ensure that feedback is formally passed from the Training department to the Quality department to initiate action.
- 10.3 Continuation Human Factors training should cover changes in relevant requirements such as Civil Aviation (AMO) Regulations, Civil Aviation (AOC) Regulations, changes in organisation procedures and the modification standard of the products being maintained plus human factor issues identified from any internal or external analysis of incidents. It should also address instances where staff failed to follow procedures and the reasons why particular procedures are not always followed.
- 10.4 In many cases, the continuation training will reinforce the need to follow procedures and ensure that incomplete or incorrect procedures are identified to the company in order that they can be corrected.
- 10.5 The continuation Human Factors training should be of sufficient duration in each two (2) year period to meet the intent of Civil Aviation (Approved Maintenance Organisations) Regulations 2012, Regulation 21.(8) and may be split into a number of separate elements. It should keep certifying staff and other employees updated in terms of relevant technology, procedures, and human factors issues which means it is one part of ensuring quality. Therefore, sufficient duration should be related to relevant quality audit findings and other internal/external sources of information available to the organisation on human errors in maintenance. This

means that in the case of an organisation that maintains aircraft with few relevant quality audit findings, continuation training could be limited to a few days, whereas a similar organisation with a large number of relevant quality audit findings, such training may take place over a longer period.

NOTE: The frequency at which the training is conducted would be left to the AMO to determine based on the competence of their staff. The period in between trainings must not exceed 2 years.

- 10.6 For an organisation that maintains aircraft components, the duration of continuation training would follow the same philosophy but should be scaled down to reflect the more limited nature of the activity. For example, certifying staff who release hydraulic pumps may only require a few hours of continuation training whereas those who release turbine engine may only require a few days of such training.
- 10.7 The content of continuation training should be related to relevant quality audit findings and it is recommended that such training is reviewed at least once in every twenty-four (24) month period.
- 10.8 The method of training is intended to be a flexible process and could, for example, include an Approved Training organisation continuation training course, aeronautical college courses, internal short duration courses, seminars, etc.
- 10.9 The elements, general content, and length of such training should be specified in the approved maintenance organisation exposition.
- 10.10 The programme for continuation training should list all certifying staff and support staff and when training will take place, the elements of such training and an indication that it was carried out reasonably on time as planned. Such information should subsequently be transferred to the certifying staff and support staff training records.

11. AUDIT

An AMO's human factors training should be subject to the AMO's internal quality audit process.

12. TRAINING RECORDS

- 12.1 The following minimum information as applicable should be kept on record in respect of each staff and support staff:
 - (a) Name
 - (b) Date of Birth
 - (c) Basic Training
 - (d) Type Training
 - (e) Continuation Training
 - (f) Experience
 - (g) Qualifications relevant to the authorisation
 - (h) Scope of the authorisation
 - (i) Date of first issue of the authorisation
 - (j) If appropriate – expiry date of the authorisation
 - (k) Identification Number of the authorisation
- 12.2 The record may be kept in any format but should be controlled by the organisation's quality department. This does not mean that the quality department should run the record system.
- 12.3 Persons authorized to access the system should be maintained at a minimum to ensure that records cannot be altered in an unauthorized manner or that such confidential records become accessible to unauthorized persons.

- 12.4 The CAAB is authorized to investigate the records system for initial and continued approval or when the CAAB has cause to doubt the competence of a particular person.


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For/Civil Aviation Authority of Botswana



End of Advisory Circular

APPENDIX A

Example Training Syllabus for Initial Human Factors Training

1. The AMO may combine, divide, change the order of any subject of the syllabus to suit its own needs, as long as all subjects are covered to a level of detail appropriate to the organisation and its personnel.
2. Some of the topics may be covered in separate training (health and safety, management, supervisory skills, etc.) in which case duplication of training is not necessary.
3. Where possible, practical illustrations and examples should be used, especially accident and incident reports.
4. Topics should be related to existing legislation, where relevant. Topics should be related to existing guidance/ advisory material, where relevant (e.g. ICAO HF Digests and Training Manual).
5. Topics should be related to maintenance engineering where possible; too much unrelated theory should be avoided.

The training syllabus below identifies the topics and subtopics that should be addressed during the human factors training.

1. General / Introduction to human factors

- 1.1 Need to address human factors
- 1.2 Statistics
- 1.3 Incidents

2. Safety Culture / Organisational factors

3. Human Error

- 3.1 Types of errors in maintenance tasks
- 3.2 Violations
- 3.3 Implications of errors
- 3.4 Avoiding and managing errors
- 3.5 Human reliability

4. Human performance & limitations

- 4.1 Vision
- 4.2 Hearing
- 4.3 Information-processing
- 4.4 Attention and perception
- 4.5 Situational awareness
- 4.6 Memory
- 4.7 Claustrophobia and physical access
- 4.8 Motivation
- 4.9 Fitness/Health
- 4.10 Stress
- 4.11 Workload management
- 4.12 Fatigue
- 4.13 Alcohol, medication, drugs
- 4.14 Physical work
- 4.15 Repetitive tasks / complacency

5. Environment

- 5.1 Peer pressure (pressure from superiors in organisation)
- 5.2 Stressors
- 5.3 Time pressure and deadlines
- 5.4 Workload

- 5.5 Shift Work
- 5.6 Noise and fumes
- 5.7 Illumination
- 5.8 Climate and temperature
- 5.9 Motion and vibration
- 5.10 Complex systems
- 5.11 Hazards in the workplace
- 5.12 Lack of manpower
- 5.13 Distractions and interruptions

- 6. Procedures, information, tools and practices**
- 6.1 Visual Inspection
- 6.2 Work logging and recording
- 6.3 Procedure – practice / mismatch / norms
- 6.4 Technical documentation – access and quality

- 7. Communication**
- 7.1 Shift / Task handover
- 7.2 Exchange of information
- 7.3 Cultural differences

- 8. Teamwork**
- 8.1 Responsibility
- 8.2 Management, supervision and leadership
- 8.3 Decision making

- 9. Professionalism and integrity**
- 9.1 Keeping up to date; currency
- 9.2 Error provoking behaviour
- 9.3 Assertiveness

- 10. Organisation's Human Factors program**
- 10.1 Reporting errors
- 10.2 Disciplinary policy
- 10.3 Error investigation
- 10.4 Action to address problems
- 10.5 Feedback

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