

Aircraft Maintenance Management – Role of Licence Aircraft Maintenance Engineer by Complying to Aviation Regulations to ensure a High Standard of Maintenance

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Abstract

Civil Aviation is a highly regulated industry. Complying to aviation regulations starts from the aircraft manufacturing process, aircraft maintenance and also the training and licensing of aircraft maintenance personal. The United Nations (UN) recognizes the International Civil Aviation Organization (ICAO) as a specialized agency for international civil aviation standards and Malaysia is one of the contracting states.

Malaysia being a sovereign country has formulated its own air legislation and regulations in line with the ICAO requirements through an Act of Parliament with the introduction of The Malaysian Civil Aviation Regulations (MCAIR). The MCAIR through the medium of Airworthiness Notices (AN) make provision for the adoption of the code of airworthiness certification and procedural requirements published as FAR's, JAR's and BCAR's as standards acceptable to DCA Malaysia. As a contracting States of ICAO, DCA Malaysia is subject to oversight (Audit) activities by ICAO to ensure compliance to ICAO Annexes, Standards, recommended practices, procedures and guidance materials.

This paper will discuss the role of Licence Aircraft Maintenance Engineers (LAME) on aircraft maintenance management, the ICAO Annex 1 and DCA Malaysia Airworthiness Notices (AN) which provide information and regulation on licensing of aircraft maintenance personal including their privileges and also the establishment of UniKL MIAT to train the aircraft maintenance workforce. The stringent adherence to regulations has in fact produced a safe and airworthy aircraft for passenger comfort.

1. INTRODUCTION

1.1 Aircraft as a Vehicle

Aircraft or Airplanes is the vehicle designed and built for commercial as well as private air transport operation. The aviation industry is the most highly regulated of all the transport industry.

Complying to aviation regulations starts from the aircraft manufacturing process and three certificates are necessary for full certification of the airplanes i.e. the Type Certificate, the Production Certificate and the Certificate of Airworthiness.

Documentation required for the maintenance of aircraft is voluminous. Most of these documents have standard revision cycle and changes are distributed on regular basis by the airframe manufacturer. LAMEs are responsible to ensure affected documents are to latest revision status, failing which will affect the aircraft maintenance program.

The maintenance of aircraft and also the training and licensing of aircraft maintenance personnel have to follow a considerable amount of regulations which must be approved and audited by the National Aviation Authority. In Malaysia the aviation authority is the Department of Civil Aviation, Malaysia.

This paper will mainly discuss on LAMEs role in Aircraft Maintenance Management and the Regulations particularly the following to be adhered which are explained as follows:

EASA Part 145/JAR 145

Prescribed the requirements for the organization to carry out maintenance of the aircraft or an aircraft components intended for fitment to aircraft.

EASA Part 66/JAR 66/BCAR Section L

Prescribed the requirements for the qualification of those personnel authorized by

a EASA Part 145 approved maintenance organization to issue Certificates of Release to Services (CRS).

EASA Part 147/JAR 147/AN 85

Prescribed the requirements to be met by organizations to conduct approved training of certifying staff as specified in EASA Part 66/JAR 66/BCAR Section L.

1.2 Civil Aviation Requirements, Laws and Regulations

International aircraft operations is governed by the rule of law. This is to ensure safety, regularity and efficiency of aircraft operation. Since the first flight by a heavier-than-air machine, a number of conventions, regulations, legislations, orders, agreements etc have been promulgated. The United Nations (UN) recognizes the International Civil Aviation Organization (ICAO) as a specialized agency for international civil aviation standards on guidance materials. Further, there are also regulatory requirements for the airline business.

ICAO, pursuant to the provisions of Article 37 of the Convention on International Civil Aviation, develops and adopts Standards and Recommended Practices or SARPs (Annexes to the Convention) as the minimum requirements for aircraft operations.

National Aviation Authority of individual states currently develop its own National Regulations on the basis of SARPs, with some variations to suit the specific requirements of individual states. However, international aircraft operations share many regulations, laws and statute such as the American FARs, JARs of Europe and BCAR's of United Kingdom.

The successful application of regulations concerning the safety and regularity of aircraft operation and the achievement of regulatory objectives depend greatly on the appreciation by all individuals concerned of the risks involved and on a full understanding of the regulations. This can only be achieved by well-planned and well-maintained initial and recurrent training programmes for all persons involved in aircraft operations. Aircraft maintenance personnel play a significant role in the safe operations of an aircraft, and the Annexes to the Convention on International Civil Aviation require that they be appropriately trained.

1.3 Civil Aviation Regulatory Framework

1.3.1 Department of Civil Aviation Malaysia (DCA)

The conduct of civil aviation in Malaysia falls under the jurisdiction of the Ministry of Transport. The Ministry of Transport has delegated its powers to the Department of Civil Aviation (DCA). The DCA administers national aviation safety and regulatory programme. It is primarily a government regulatory authority. Regulatory enforcement is via legislative means to ensure that aviation activities are conducted in accordance with the regulation. Malaysia being a sovereign country has formulated its own air legislation and regulations in line with the ICAO requirements through an Act of Parliament with the introduction of The Malaysian Civil Aviation Regulations (MCAR). The MCAR through the medium of Airworthiness Notices (AN) make provision for the adoption of the code of airworthiness certification and procedural requirements published as FAR's, JAR's and BCAR's as standards acceptable to DCA Malaysia. As a contracting States of ICAO, DCA Malaysia is subject to oversight (Audit) activities by ICAO to ensure compliance to ICAO Annexes, Standards, recommended practices, procedures and guidance materials.

1.3.2 The Joint Aviation Authorities (JAA)

Since DCA Malaysia has adopted JAR 145 of JAA for the standards of Maintenance Repair Overhaul (MRO), the following is the history of JAA which subsequently become EASA.

The Joint Aviation Authorities (JAA) is an associated body of the European Civil Aviation Conference (ECAC) representing the civil aviation regulatory authorities of a number of European States who have agreed to co-operate developing and implementing common safety regulatory standards and procedures. This co-operation is intended to provide high and consistent standards of safety and a "level playing-field" for competition in Europe. The JAA Membership is based on signing the "JAA Arrangements" document originally signed by the then current Member States in Cyprus in 1990.

1.3.3 History of European Standards

1970 Work started with development of airworthiness JARs and common certification process.

- 1989 JAA becomes associated body of ECAC. Interest from EU. Launching of FAA-JAA harmonization programme.
- 1990 Current Arrangement Document signed in Cyprus, covering airworthiness, maintenance, operations and licensing.
- 1991 Council Regulation (EEC) 3922/1991 adopted
- 1992 - Initiatives by ECAC/JAA and EU: drafting of a "JAA Convention", study on possible legal framework for a single authority
- 1995 Stop of work on JAA Convention
- 2000 Commission mandate; EASA to be established as a "new kind of Community agency"
- 19/00- EU Council & Parliament co-decision process and final adoption
- 09/02

2. TRAINING OF LICENCE AIRCRAFT MAINTENANCE ENGINEER (LAME)

The training of LAME requires the imparting of manual and intellectual skills, sound knowledge of basic theory and a comprehensive understanding of the aircraft or system upon which they will have to work. They should also develop an appreciation for the high value of and therefore treat accordingly the aircraft, test equipment and tool that they will use in their work.

Further they are guided on the various aspects of safety and safe working practices, including the precautions to be taken when working on aircraft and on electricity, gases, oils and chemicals.

Another mandatory subject introduced is Human Factors. Its aim is to optimize the performance of people. It involves performance of human being within the aviation system as lapses in human performance are cited as casual factors in majority of accidents.

2.1 Training consists of three phases:

Phase One – Knowledge/Theory

Consists of basic training, its completion ensures that a trainee has the necessary background in terms of knowledge to proceed to Phase Two of the training. The training specifications are basic principles corresponding to the knowledge common to all the task of an LAME job.

Phase Two - Skills

Consists of general maintenance practices, practical skills and attitude training in order to master essential skills before proceeding to work on airworthy aircraft or components.

Phase Three - Experience

Consists of applied practical on-the-job training (simulated or actual tasks under supervision) and job oriented maintenance experience. This phase may be arranged on the job or in the training centre.

Visits to aircraft maintenance hangars, workshops and manufacturers' plants are important in order to demonstrate practical application of theory and practice. The interdependence of LAMEs with pilots and other technical crew members should be explained by citing examples and bringing them frequently to the attention of trainees.

2.2 Background of Aircraft Maintenance Training Program and the Establishment of UniKL MIAT

Historically and traditionally in Malaysia, Aircraft Maintenance Training are carried out by the industries such as MAS, AIROD, MHS and TRANSMILE through an apprenticeship scheme at their own training school based on syllabus issued by our local DCA and thereafter sit for the Licence Without Type Rating (LWTR) examination conducted by DCA, Malaysia.

Courses are conducted on modular system and examinations are carried out after each phase of the module. This mode of training is considered suitable and feasible as the numbers of apprentices are small in number per intake.

The requirements for the Aviation industry human resources especially for the MRO have been projected by MIGHT from 6600 to 25000

for the period 2000-2020 and this lead to the establishment of UniKL MIAT which conduct courses on Aircraft Maintenance Training to prepare students to sit for the LWTR examination conducted by DCA, Malaysia and can accommodate 1000 students. Courses are conducted using the semester system.

UniKL MIAT aim is to produce graduates with internationally acceptable level of knowledge and competency. Therefore the need to obtain JAR Part 147 Training Organization approval from the JAA (Joint Aviation Authority) or (EASA) European Aviation Safety Agency is vital and is currently pursuing to obtain the EASA Part 147 Approval.

3. AIRCRAFT MAINTENANCE MANAGEMENT

Aircraft Maintenance Management starts with the establishment of Maintenance and Repair Organisation or MRO and under EASA ruling must be approved as per EASA Part 145 requirement.

Part 145 Approved MRO must have management personnel who are qualified and have sufficient experience and expertise to effectively organize, manage and control the maintenance program. Refer Table 1 of a Typical Organisation Structure of an MRO.

3.1

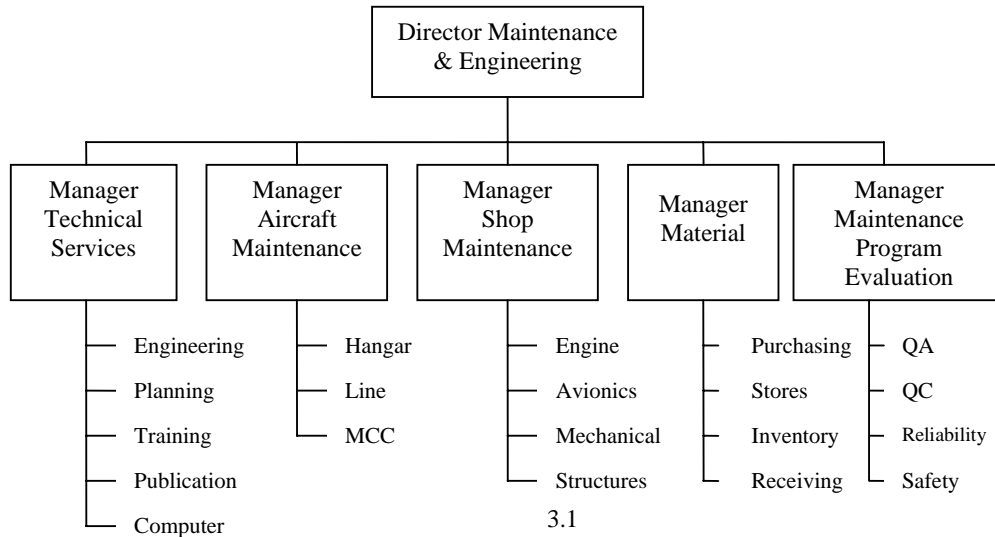


Table 1 Typical maintenance and engineering organization.

The LAMEs play an important role in MROs and in fact all the Managerial and Supervisory positions of various sections in MROs are LAMEs who start their career as maintenance staff and subsequently rose to Managerial and Supervisory positions.

Maintenance Organisation responsibilities include having all the Manufacturing Documentation, Regulatory Documents and generate its own operating procedure and documents. Refer Table 2 for all the documentation. Other activities are preparation of Aircraft Maintenance Schedule which must be approved by the Aviation Authority, Check Packages, Aircraft Technical Recording System, Material Support, Quality Assurance and Quality Control

All the above functions are the responsibilities of managerial and supervisory staff.

3.2 LAMEs usually specialize in a particular category or categories (e.g. airframes, engine, airships, electrical, instruments or radio systems). The method of performing specific duties may vary according to the type and make of aircraft; the duties and detailed tasks described in this paragraph represent typical examples of those performed by LAMEs specializing in the airframe category. It must be understood that the work of other categories may vary quite considerably from that of an airframe category. The following paragraphs are a general description of the types of tasks which are performed under the supervision of a licensed LAME.

- a) Responds to defects found and recorded by flight crew. Inspects and checks condition of aircraft parts (e.g. engines, wings, tail, fuselage and landing gear) etc for serviceability by inspecting the skin and noting condition of landing gear parts, leaking connections, correct fitting of parts, leaking connections and of operating controls. Attends to all other factors which can affect the safe operation of an aircraft. Determines whether adjustment, repair or replacement is necessary; and if necessary, makes adjustments to manufacturer's/company's maintenance schedule and to the instructions on use of appropriate equipment.
- b) When required to rectify a defect or to meet the Approved Maintenance

Programme, ensure the removal and replacement of parts as well as the opening of inspection panels in structure in order to inspect or disconnect control cables, fuel lines and electrical wiring. Determines when and how to support the aircraft on jacks in order to remove and replace major assemblies such as landing gear or powerplants from the aircraft.

- c) Ensures that adjustment and repairs are carried out as required; e.g. the replacement of cracked material in metal skin surfaces by cutting a new metal patch in accordance with the structural repair manuals from the Type Certificate holder. Reads engineering drawings in order to ensure that structural members are repaired to an approved standard in accordance with manufacturer's instructions.

- d) Supervises the performance of servicing activities such as oleo and tyre inflation, fuel/oil replenishment and lubricant cleaning of structure and mechanical components and replacement of light filaments. In accordance with the Type Certificate holder's instructions, a wide variety of tests equipment, hand and other tools are used for these tasks.

3.3 The following are the responsibilities of LAMEs who perform or supervise the aircraft maintenance workforce during aircraft maintenance visit at the hangar.

- a) Signing a maintenance release to certify that the maintenance work performed has been completed satisfactorily and in accordance with the procedures described.
- b) Ensuring that the maintenance release contains a certification which includes the details of the work, the date and identity of the organization and the signatory.

3.3.1 In order to sign the maintenance release or certify an aircraft as airworthy, the

3.3.2 LAMEs must supervise or perform inspections, repairs, replacements, modifications, overhauls and maintenance in such a way that they are able to take responsibility for the work and also issue a maintenance release on completion.

All LAMEs are issued with an Inspection Stamp. These stamps are numbered and

controlled. Work card or task card without the Inspection Stamp and signatory by the LAMEs

will invalidate the Aircraft Certificate of Airworthiness.

4. TABLE 2 DOCUMENTATION

4.1 Manufacturer's Documentation

Title	Abbreviation
Airplanes maintenance manual*	AMM
Component maintenance manual	CMM
Vendor manuals	VM
Fault isolation manual	FIM
Fault reporting manual	FRM
Illustrated parts catalog [▲]	IPC
Storage and recovery document [✦]	SRD
Structural repair manual	SRM
Maintenance planning data document	MPD
Schematic diagram manual*	SDM
Wiring diagram manual*	WDM
Master minimum equipment list	MMEL
Dispatch deviation guide	DDL
Configuration deviation list	CDL
Task cards*	TC
Services bulletins	SBs
Services letters	SLs
Maintenance tips	

* Customized to contain customer configuration.

[▲] Customized on request.

[✦] Information may be included in AMM for recent model aircraft.

4.2 Regulatory Documents

Title	Abbreviation
Aviation regulations	FARs, JAR, EASA, BCAR
Advisory circulars	ACs
Airworthiness Directives	ADs
Notice of proposed rule making	NPRM

4.3 Airline Generated Documentation

Title	Abbreviation
Operations specifications	Ops Specs
Technical policies and procedures manual	TPPM
Maintenance Organisation Exposition	MOE
Inspection manual	IM
Reliability program manual	RPM
Minimum equipment list	MEL
Task cards*	TC

- * May be manufacturer written, customer written, or a combination.
 † Issued for maintenance not identified in standard maintenance plan.

5. CONCLUSION

LAMEs worked on extremely sophisticated aircraft with complex integrated systems which are continuously upgraded and improved. The technological changes with respect to digital computer system and introduction of new materials requires the maintenance personnel to be trained to analyse, repair, inspect and certify for Release to Service of the aircraft in accordance with the quality standard as defined in the aircraft maintenance manuals and at the same time comply with applicable regulations by the Aviation Authority.

The initial training which follows the ready-made syllabus by ICAO and the Aviation Authority such as DCA, Malaysia, FAA of America and EASA of Europe has produced competent LAMEs. The mandatory requirement imposed to LAMEs to renew their license every two years to ensure they remain current on the technological advancement including new regulatory requirement has in fact produced a safe and airworthy aircraft for passenger comfort.

6. REFERENCES

- [1] Malaysian Civil Aviation Regulations (MCAR).
- [2] DCA, Malaysia Airworthiness Notice No. 3 – Licensed Aircraft Maintenance Engineers – Certification Responsibilities of Type Rated Engineers/Company Approval Holders/Authorization Holders in Relation to Malaysian Civil Aviation Regulations.
- [3] DCA, Malaysia Airworthiness Notice No. 5 – Applications for Malaysian Aircraft Maintenance Engineers Licensing's.
- [4] DCA, Malaysia Airworthiness Notice No. 10 – Aircraft Maintenance Engineers Licenses – Type Ratings.
- [5] DCA, Malaysia Airworthiness Notice No. 85 – Approval of Training Organisations.

- [6] International Civil Aviation Organization (ICAO) Annexes.
- [7] European Aviation Safety Agency (EASA Part 66, Part 145 and Part 147 Regulations)
- [8] Aviation Maintenance Management – Harry A. Kinnison, Ph.D, Mc Graw – Hill Companies, Inc.

7. BIOGRAPHICAL INFORMATION

Mr. Waris Sirat has more than 40 years of experiences in the aviation industry. Before joining UniKL MIAT, his last position in MAS is Head of Standards and Procedures. Currently he is the Technical Writer and Specialist, QA Dept, UniKL MIAT. His interest is in Air Legislation, Airworthiness Certification Programme, Standards and Procedures Documentation.

Mr. Zulkefli Harun graduated from University of Toledo, Toledo, Ohio, U.S.A. in electrical engineering. Obtain an Airframe & Powerplant License from Westwood College of Aviation at Houston Texas in 2000. Begin career as technical instructor for MIAT in 2001 and become a Section Head for Airframe and Powerplant Section since 2003 for UniKL MIAT. Attended Airworthiness Course at Brighton, U.K. on 2003 under CAA, U.K.