AMROBA
AVIATION MAINTENANCE REPAIR & OVERHAUL BUSINESS ASSOCIATION, INC
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Submission to the Civil Aviation Safety Authority

AMROBA

PROPOSAL TO HARMONISE THE SKILLS OF AIRCRAFT MAINTENANCE PERSONNEL BY ADOPTING INTERNATIONAL TRAINING STANDARDS COMPARABLE WITH ICAO & EASA

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International Obligation?

ICAO ANNEX 1 – 4.2. – AIRCRAFT MAINTENANCE (~~TECHNICIAN~~/ENGINEER/~~MECHANIC~~)

***Note**. – The terms in brackets are given as acceptable additions to the title of the licence. Each Contracting State is expected to use in its own regulations the one it prefers. (Australia has used "**engineer**" for many decades.]*

4.2.1. Requirements for the issue of the licence

4.2.1.1 Age. The applicant shall be not less than 18 years of age.

4.2.1.2 Knowledge

a) The applicant shall have demonstrated a level of knowledge relevant to the [ICAO] privileges to be granted and appropriate to the responsibilities of an aircraft maintenance [engineer] licence holder, in at least the following subjects:

Air law and airworthiness requirements

b) Rules and regulations relevant to an aircraft maintenance [engineer] licence holder including applicable airworthiness requirements governing certification and continuing airworthiness of aircraft and approved aircraft maintenance organisation and procedures.

Natural science and aircraft general knowledge

c) Basic mathematics, units of measurement, fundamental principles and theory of physics and chemistry applicable to aircraft maintenance;

Aircraft engineering

d) Characteristics and application of the materials of aircraft construction including principles of construction and functioning of aircraft structures, fastening techniques; engines and their associated systems; mechanical, fluid, electrical and electronic power sources; aircraft instrument and display systems; aircraft control systems; and airborne navigation and communication systems.

Aircraft maintenance

Tasks required to ensure *the* continuing airworthiness of an aircraft including methods and procedures for the overhaul, repair, inspection, replacement, modification or defect rectification of aircraft structures, components and systems in accordance with the methods prescribed in the relevant Maintenance Manuals and the applicable Standards of airworthiness; and

Human performance

e) Human performance, including principles of threat and error management, relevant to aircraft maintenance.

Note**: - Guidance material to design training programs on human performance, including threat and error management, can be found in the* **Human Factors Training Manual (*Doc 9683)

4.2.1.3 – Experience

The applicant **shall** have had the following experience in the inspection, servicing and maintenance of aircraft or its components:

a) For the issue of a licence with privileges for the aircraft in its entirety, at least:

1) Four years; or

2) Two years if the applicant has satisfactorily completed an approved training course; and

b) For the **issue of a licence with [ICAO] privileges restricted in accordance with 4.2.2.2 a) 2) or 3,** a period of time that will enable a **level of competency equivalent to that required in a)** to be attained, provided that this is not less than:

1) Two years; or

2) Such a period as the State considers necessary to **provide an equivalent level of practical experience to applicants who have satisfactorily completed an approved training course**.

4.2.1.4 Training

Recommendation. - *The applicant should have completed a course of training appropriate to the [ICAO] privileges to be granted.*

Note. – *The* **Training Manual (Doc 7192), Part D-1**, *contains guidance material on a training course for applicants for an aircraft maintenance [engineer] licence.*

4.2.1.5 Skills

The applicant shall have demonstrated the ability to perform those functions applicable to the [ICAO] privileges to be granted.

4.2.2 Privileges of the holder of the licence

and the conditions to be observed in exercising such privileges

4.2.2.1 Subject to compliance with the requirements specified in 4.2.2.1 and 4.2.2.3, the **privileges** of the holder of an aircraft maintenance [engineer] licence **shall** be to **certify the aircraft or parts of the aircraft as airworthy after** an authorised repair, modification or installation of an engine, accessory, instrument, and/or item of equipment, and **to sign a maintenance release following** inspection, maintenance operations and/or servicing.

4.2.2.3 The **privileges** of the holder of an aircraft maintenance [engineer] licence **specified in 4.2.2.1 shall** be exercised only:

a) In respect of such:

1) Aircraft as are entered on the licence in their entirety either specifically or under broad categories; or

2) Airframe and engines and aircraft systems or components as are entered on the licence specifically or under broad categories; and/or

3) Aircraft avionic systems or components as are entered on the licence either specifically or under broad categories;

b) Provided that the **licence holder is familiar with all relevant information** relating to the maintenance **and airworthiness** of the particular aircraft for which the **licence holder is signing the Maintenance Release**, or such airframe, engine, aircraft system or component and aircraft avionic system or component which the **licence holder is certifying as being airworthy**; and

c) On condition that, within the preceding 24 months, the licence holder has **either had experience** in the inspection, servicing or maintenance of an aircraft in accordance with the privileges of the licence held for not less than 6 months, or has met the provision for the issue of a licence with the appropriate [ICAO] privileges, to the satisfaction of the Licensing Authority.

4.2.2.3 A Contracting State **shall** prescribe the scope of the [ICAO] privileges of the licence holder in terms of complexity of the tasks to which the certification relates.

4.2.2.3.1 Recommendation. *–Details of the certification privilege shall be endorsed on or attached to the licence, either directly or by reference to another document issued by the Contracting State.*

4.2.2.4 When a Contracting State authorises an approved maintenance organisation to appoint non-licenced personnel to exercise the privileges of 4.2.2, the person appointed **shall** meet the requirements specified in 4.2.1.

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Executive Summary

Maintenance employers have recognised the declining competency of aircraft maintenance engineers (AME) over the last couple of decades that has worsen since the introduction of CASR Part 66. Major changes imposed on the AME national vocational education training (NVET) system has failed to align AME training with international AME practical skill standards that underpins the licensing system.

EASR Part 66 "***LAME knowledge examinations***", in Europe, are basically the same as the current CAR 31 "*Basic Examinations*" provided by CASA or a CASA approved Examination Centre. The EASR Part 66 *knowledge examinations* are provided by an EASA-NAA or a NAA approved examination centre. EASR Part 66 examinations are independent to each country's AME trade training system.

CASA either intentionally or unintentionally imposed the "*EASR Part 66 licence knowledge examinations*" in to the MEA Aeroskills trade training packages. This has added a large knowledge component (EASR Part 66 – 2400 classroom hours) without any additional funding or classroom education time to learn LAME knowledge. The NVET system was already overloaded and had failed to maintain compatibility with international practical trade skills training standards.

The most cost effective method used in Europe to attain the knowledge to sit the LAMW examinations is self-study using an on-line training provider. Some on-line training providers also hold NAA Part 66 licence examination centre approval but they are more expensive than non-approved on-line training providers.

Previous regulatory lapses have also impacted on harmonising with international (ICAO) AME practical and knowledge standards. CASA's predecessors stopped promulgating the ICAO AME international training standards. In addition, the very important international safety LAME [ICAO] privilege to certify aircraft or parts of an aircraft as airworthy were also omitted during past regulatory change.

To correct the derogation of skills and return to international standards, AMROBA recommends adoption of at least seven omitted regulations from EASR Part 66 to improve AME practical skills and raise the knowledge levels of LAMEs.

Separating the knowledge elements in the same manner as EASR Part 66, will enable the AME MEA Aeroskills to upskill the AME practical skills to international training standards taken from the ICAO AME training manuals recommended in Annex 1, Chapter 4, para 4.2.1.4.

AMROBA calls on the CASA Board to make a major policy decision to adopt the missing regulations from EASR Part 66 that are highlighted in this paper to properly adopt the EASR AME licencing system and to once again promulgate the international training standards from the ICAO AME Training manual.

The right policy decision will enable the MEA Aeroskills training packages to provide industry skilled AMEs meeting international trade training standards of ICAO and for CASA or a CASA approved Part 147 *LAME examination centre*(s) to provide AME licencing examinations based on the EASR Part 66 system.

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Future Vision

To support the aviation MRO industry today and into the future, the industry needs highly competent AMEs that can apply practical skills across all aspects of aircraft maintenance irrespective of current discipline. In addition, AME's holding a licence will need additional diagnostic prowess, a high degree of technical knowledge, including airworthiness standards, supervisory and communication skills.

Students will need to be hands-on, detail-oriented and have a strong interest in aircraft from vintage aircraft to the most high-tech passenger aircraft. They will be able to use full time, part time and/or on-line training providers from within or outside Australia. International training providers are already available once EASR Part 66 licencing standards are properly adopted with minimal change. **Harmonisation**.

Adopting the EASR Part 66 method of LAME knowledge examination will enable the AME trade skills to once again be ICAO compliant. Missing EASR Part 66 requirements applied to CASR Part 66 with minimum change within the near future will mean some regulatory lapses over the last two decades will be corrected. Aviation is a global industry so minimum differences should exist in personnel skills, knowledge and licences.

In the future, acceptance of the knowledge that a student obtains under the secondary school system will provide credits under the NVET system for the international AME trade training skills. In the interim, CASA must promulgate the ICAO AME practical training standards until the Department of Education is officially responsible for providing academically competent AMEs.

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CASA or a CASA approved Part 147 examination centre will conduct all examinations on-line except for a small number of essay question to test a person's report writing capability.

EASR Part 66 currently has the flexibility in attaining experience and knowledge that must be adopted to enable and support the Australian industry maintaining vintage aircraft to high tech air transport aircraft.

> *"**There are two basic routes to an EASA Part 66 licence: the <u>self-starter</u> route and the EASA Part-147 <u>approved course</u> route**:*
>
> *<u>1. To complete the self-starter route</u> you need to study for the EASA examinations associated with the category of licence you are seeking and then sit the exams at an approved EASA examination centre. To gain the knowledge needed to take the examinations, you can self-study or complete short courses or distance learning courses; a lot of providers are available and these can be found on the internet. If you follow this route, you will need to gain five years of maintenance experience on the appropriate category of aircraft in addition to passing all of the examinations before you can apply for a licence.*
>
> *<u>2. The EASA Part-147 approved course route.</u> Part-147 approved courses are typically of two to three years duration. However, once you have completed the course, you only need to obtain two years' maintenance experience before applying to the CAA for your B Licence. Another benefit of this route is that the EASA assessment will normally be part of the course and based on the material you are taught. Also, when you are trying to get a job to obtain the required work experience, you are applying from a position of strength, having completed a worldwide, industry-recognised course."*

Proper adoption of the EASRs would not have disrupted the system, to any great amount, that was operating within Australia and had been operating successfully for many decades. The most cost effective system under EASR Part 66 was excluded.

Harmonising with EASR requirements will enable easy recognition of CASA issued licences by NAAs using the same licencing standards and, importantly, higher levels of international recognition of the CASA issued licence.

Major Issues

The CASA Board must make major policy change to complete the adoption of regulatory provisions from EASR Part 66 as proposed in this document. It will change the current inflexibility in CASR Part 66/147 to the more flexible requirements in EASR Parts 66/147.

1. ***Employers and operators have all raised concerns that skills being produced under the aircraft maintenance engineer (AME) national vocational education training system (NVET) are below international standard.***
    a. *Regulatory lapses over a couple of decades has resulted in no CASA promulgated AME ICAO international training standards.*
    b. *Integrating the EASR Part 66 licencing system further declined the practical trade skills of the AME and the knowledge of LAMEs.*

2. ***LAME knowledge supplements AME competency standards.***
    a. *MEA Aeroskills is basically to provide competent AME tradespersons. CASA integration of the EASA's LAME knowledge system into the AME competency based training packages has overloaded the NVET system that further declined AME skills and LAME knowledge output.*
    b. *EASA Part 147 full time training may provide the licencing knowledge and some add the AME practical trade training from the particular EU country. Trade training differs in European countries.*

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3. ***CASA approved MSA MEA developed competency units are now loosely based on "knowledge modules" & subjects from EASR Part 66/147***
    a. *EASR Part 66 separated knowledge skill training and practical training based on ICAO guidance documents.*
    b. *There is no clear current regulatory standard, like EASR, to meet practical skill standards and workplace experience.*

4. ***EASR Part 66 separates practical skills and knowledge in the same manner as ICAO.***
    a. *EASR 66 workplace experience requirements are not assessed by CASA as is done in Europe and elsewhere.*
    b. *Unlike EASA, CASA issues AME licences without any assessment of workplace experience or review of evidence of practical skills.*
    c. *Unique downgrade of the ICAO AME licence responsibilities.*

5. ***Harmonisation with the EASR Part 66 A & B requirements will meet the ICAO international knowledge and workplace experience and skill standards.***
    a. *EASR Part 66 missing provisions will correct some regulatory lapses.*
    b. *Separating LAME knowledge, practical skills and experience requirements will provide international LAME standards once again in Australia.*
    c. *Clearer definition of which aircraft requires a LAME specific aircraft rating.*
    d. *Maintenance certification and LAME (quality) support staff roles in base maintenance clarified.*

This document expands on these issues and also proposes solutions that will address these issues by applying international standards that will provide this industry with competent AMEs and knowledgeable LAMEs meeting international standards.

Background

CASR Part 66 and MoS lack of harmonisation.

This problem culminated in a paper tabled at the Deputy Prime Minister's Aviation Industry Consultative Committee meeting last January highlighting the lack of skills.

Instead of EASR Part 66 experience and knowledge learning flexibility, including the separation of licence knowledge requirements, CASA imposed a costly formal knowledge system that decreased the practical skill elements under the NVET system. EASR enables self-study or assistance from training providers, independent to the trade training system. Whether intentionally or unintentionally, CASR Part 66 implemented selective regulatory provisions of EASR Part 66 and attempted to combine the LAME knowledge examination system with the NVET trade training standards with disastrous outcomes.

There was already concerns being raised by mostly general aviation maintenance organisations with the declining general aviation and rotorcraft skills being produced since CASA's predecessor stopped promulgating the ICAO AME Training Manual syllabi. CASA's earlier predecessor was the chair of the ICAO working group that wrote the initial ICAO AME Training manual. We once met ICAO international training standards.

Without a promulgated national standard adopted from international standards, State RTOs training courses were developed to meet the largest maintenance organisation in the locality. The outcome was company skilled AMEs that were not employable in other sectors of the industry.

Unlike the many Asian countries that adopted the EASR Part 66 licencing system correctly, the current CASR system has not separated experience, knowledge and practical skills.

The EASR model enables experience to be attained by employment experience, reduced if a person had similar skills from an allied trade and further reduced if completing an apprenticeship. This flexibility is available in Europe and America. Why not here?

ICAO Annex 1 LAME privilege is to certify the aircraft or parts of aircraft as airworthy exists in EASRs and FARs with variable clarity – it does not exist in CAR/CASRs.

The EASR knowledge requirements also covers certifying to standards, including the Annex 8 airworthiness standards. Signing maintenance to approved maintenance data does not mean the aircraft continues to meet its design standards. It only means the maintenance was done iaw instructions.

There are at least seven (7) EASR Part 66 specific regulations that need adopting, with very minimal changes, to align CASR Part 66 with EASR requirements.

Each of those provisions will provide harmonisation and benefits to the MRO industry.

The EASR provisions will lower costs in training even though international practical skills and increased LAME knowledge will be the outcome.

The most cost effective LAME knowledge training available in Europe under the EASR Part 66 requirements is by self-study using an on-line training provider and passing knowledge examinations at a NAA or NAA approved examination centre.

AMROBA strongly recommends adopting the missing provisions of EASR Part 66

This industry needs MEA Aeroskills to concentrate on adopting the international practical skills to provide AMEs with international practical skills.

A more versatile AME with the broader practical skills specified in the ICAO AME Training Manual will provide the AME with flexibility in employment.

Harmonisation with EASR Part 66

The MEA Aeroskills training packages are currently subject to CASR Part 66.

Adopting the missing regulatory provisions of EASR Part 66 will remove the CASR Part 66 licencing imposition on the MEA Aeroskills trade training system.

Proper harmonisation will enable MEA Aeroskills to align with global AME trade skills.

Promulgation of the ICAO international practical skills will raise the AME skill levels.

The current MEA Aeroskills competency units are not well-matched with the Australian apprenticeship system or meeting international AME training standards.

Harmonisation Action 1. Amend CASR Part 66/MoS to adopt/adapt at least seven regulatory provisions from EASR Part 66, which are not in CASR Part 66, to provide greater flexibility in gaining experience and knowledge to pass EASR based licence examinations provided by CASA or a CASA approved examination centre. CASA should acquire an EASR Part 66 licence bank of questions and adopt the examination standards used in Europe. (***EASR Part 66 licence modular chart – Refer Attachment A***)

Harmonisation Action 2. Promulgation of the practical skills from the ICAO AME Training Manual will enable MEA Aeroskills to be packaged to provide trade skills that meet the ICAO international training standards. The ICAO manual also sets standards for RTOs that provide the practical skills training. The Education Departments should adopt these standards when they develop apprenticeship training programs. Federal trade training funding should be based on adoption of the international training standards.

Harmonisation Action 3. Put on hold the GA proposed "Group Ratings" proposal until the EASR regulation that implements "groups" and "limitations" on groups is inserted into the MoS and adapted to align with the proposed GA groups. The EASR missing regulatory provision should be in the MoS before this proposal is finalised. Implementing the proposal before the EASR regulation is included in the Part 66 MoS would mean major upheaval post adopting the EASR regulation.

Harmonisation Action 4. Once the missing EASR regulations are adopted, the Part 66 MoS Charts will also need considerable change to align with the EASA modularisation of the licence examination system. Adopting the EASR licencing system properly will reduce costs to applicants and employers alike.

The outcome of proper harmonisation will remove considerable red tape and government duplication in providing an internationally accepted qualified tradesperson and a CASA controlled licensing system at lower costs than is current or being proposed. The following depicts the outcome of the recommended changes in this paper.

EASA/ICAO	Requirement	Provider
AME Practical Skills **ICAO standards (CASA)**	**Apprenticeship/MEA Aeroskills** **Allied trade credits.**	**State RTOs**
Licencing Knowledge Skills **EASA modules** **ICAO standards**	**Available on-line – self study** **Credits granted for apprenticeships subjects – allied trade skills.**	**CASA-Part 147** **and/or on-line RTO** **– could be foreign?**
Industry Licencing Experience **EASA standards** **ICAO compliant**	**Evidence of each examinations** **Evidence of "work" Experience** **Adopt EASR 66 standards**	**CASA assessment.**

Harmonisation Timing

This proposal addresses a very complex problem arising from partial adoption of EASR Part 66 AME licencing system and previous regulatory lapses. To fix the deficiencies with CASR Part 66/MoS and previous regulatory lapses, it is imperative that 'missing provisions' from EASR Part 66 be adapted to provide an AME with applicable international practical skills, and a LAME with knowledge and attitude, compliant with ICAO/EASA international training standards.

This proposal is multifaceted and will take time to implement as new CASR Part 66/MoS provisions will withdraw the EASA AME licencing requirements from the MEA Aeroskills training packages thus enabling MSA to harmonise MEA Aeroskills training with the ICAO AME practical trade skills.

This proposal will enable the AME trade skills to be developed separately from the knowledge skills needed to be a LAME as has been done in Europe.

EASR Part 66 Schematic

EASA Part 66 AME Licencing **(Knowledge only - Separate to Trade Training)**	**EASR Lowest Cost**	**EASR Part 147 RTO**
EASA-NAA or NAA Approved Examination Centre *No aviation experience required to sit*	Self-Study sit NAA Exams	Can be an Approved Exam Centre
EASA LAME Knowledge Modular System Similar to CAR 31 Basic Examination System	Plus EASR Part 66 industry experience	Can Provide Knowledge Training
EU Member States Aviation Maintenance Trade Training System *Levels of trade training vary across Europe*	Trade Schools Allied Trades Experience	Can Include Trade Training

AME Knowledge Examination Centres

This proposal implements EASA required "knowledge module" examinations being provided by **either CASA or CASA approved examination centre[s]** that may be a Part 147 knowledge training provider.

Is Australia's aviation industry big enough to devolve this to multiple providers or, considering the use of modern IT systems, is it better for one examination centre?

Trade Skills

The trade training skills deficiencies has come about by overloading a government funded trade training system. By removing the LAME knowledge requirements, it will enable the MEA Aeroskills training packages to be based on international practical skills training standards.

This will improve the competence of tradespersons, apprentices or adult learners meeting aviation global trade training standards promulgated by ICAO.

As done in the past, CASA must promulgate the ICAO AME practical training standards. The MEA Aeroskills AME training packages can then be re-packaged. State and/or Territories RTOs will adopt MEA Aeroskills trade training packages and be audited by ASQA to provide the AME skill standards needed by industry.

It is a more cost effective system – reduces red tape – similar approach as EASA.

Licence Skills

Knowledge to attain a licence has always had flexible methods to attain that knowledge. Like EASR Part 66, it could be from self-study to doing formal training courses.

The removal of that flexibility, even though it is in the EASR Part 66 system, drastically increased costs to applicants. The EASR model enables less costly methods than what was adopted.

Proper adoption of EASR will provide more flexibility and lower cost options.

Though some would like to return to CAR31 provisions, this proposal includes harmonised learning/skilling flexibility outcomes that are available under EASR Part 66 regulations but not under CASR Part 66/MoS.

EASR AME Licence ratings – "groups"

This proposal also includes adapting the EASR Part 66 aircraft licence "groups" standards that specifies better parameters when a LAME specific aircraft type rating is required. The EASR split is not based on aircraft type certification weight basis as is current; it is based on aircraft complexity including, for instance, the ability to fly above FL290. The basis of the split may be slightly more complex than what is used under CAR31 but, with minor changes, can be adapted to meet both general aviation & air transport sectors, in CASR Part 66. **Harmonisation**.

EASR Part 66 Licence Modular Training Packages

EASR Part 66 created five streams of licence knowledge training with 17 knowledge training modules of which 10 are common across all five AME licence streams though taught at different levels for the licences.

It has to be adopted.

EASA Part 66 knowledge providers should be available for use by Part 66 licence applicants to study for the licencing knowledge examinations. This will also reduce costs.

EASR LAME knowledge modules can be passed over a 10 year period to attain an EASR Part 66 licence. Why don't we have the same regulation?

Aviation Industry Reference Committee

The role of the Education Department's Aviation Industry Reference Committee (IRC) is to provide direction for MEA Aeroskills training packages that provide skilled and competent AMEs. Adopting ICAO international training standards will provide AME AQF qualifications equivalent to other countries that also adopt the international training standards.

The knowledge requirements of a LAME should be considered for additional training standards at a knowledge level learning under a diploma that can be provided on-line. Credits should be given for the licencing modules covered by the AME training standards.

Ideally, the AQF 4 AME trade training course should enable additional licence learning for the issue of a diploma. The knowledge learning must be kept separate from the MEA Aeroskills training packages. It is a knowledge learning package tested by examinations, it is not a competency assessment system.

CASA's Influence

Promulgation of ICAO AME practical training guidance skills will ensure the MEA Aeroskills training packages provides the international skills. Separately adopting the EASR modular knowledge training system into CASR Part 66/MoS will provide improved LAME knowledge skills.

EASR Part 66 Knowledge Module 10 is an improvement to the old CAR31 'AA' examination.

Specific EASR/CASR Differences & Recommendations

There are a number of differences that, if adopted initially, would have supported GA. This is the time to rectify the omissions of the past. The transition to a harmonised system that is increasingly being used in Asian countries to our north must be adopted. The following are differences recommended for adoption as soon as possible.

1. The need for specific aircraft type rated licence. (Recommended)

EASA has a system more compatible with CAR31 than what was implemented under CASR Part 66. CASR Part 66 requires a specific aircraft rating for aircraft above 5700Kgs which is based on the aircraft type certification basis, not the complexity of the aircraft. EASR specific aircraft ratings are more harmonised internationally than the unique CASR Part 66.

66.A.5 Aircraft groups

For the purpose of ratings on aircraft maintenance licences, aircraft shall be classified in the following groups:

[Specific aircraft licence rating]

Group 1: complex motor-powered aircraft as well as multiple engine helicopters, aeroplanes with **maximum certified operating altitude exceeding FL290**, **aircraft equipped with fly-by-wire systems and other aircraft requiring an aircraft type rating** when defined so by the Agency.

[LWTR turbine aeroplanes and rotorcraft and piston rotorcraft]

2. Group 2: aircraft other than those in Group 1 belonging to the following subgroups:

— sub-group 2a: **single turbo-propeller engine aeroplanes**

— sub-group 2b: **single turbine engine helicopters**

— sub-group 2c: **single piston engine helicopters.**

[LWTR Piston aeroplanes]

3. Group 3: piston engine aeroplanes other than those in Group 1.

- EASR Part 66 **Group 1** aircraft requiring an appropriate aircraft type rating are prescribed in EASR 66.A.5 as follows:
    - Aeroplanes with maximum certified operating altitude exceeding FL290;
    - Aircraft equipped with fly-by-wire systems;
    - Complex motor-powered aircraft; and
    - Multiple engine helicopters.

This spilt makes more sense than a split based on the aircraft type certification standards of 5700Kg. Adoption of the EASR spilt will remove the concerns within the GA industry where there are no manufacturers' courses for some aircraft previously covered by CAR 31 Group ratings. EASR is/was more compatible to requirements in CAR31 than what has been implemented.

Recommendation: Adopt this standard without change.

- EASR Part 66 **Group 2** aircraft requiring an appropriate aircraft type rating, manufacturer sub-group rating or full sub-group rating are prescribed as follows:
    - **2 a:** single turbo-propeller engine aeroplanes.
    - **2 b:** single turbine engine helicopters.
    - **2 c**: single piston engine helicopters.

This split also makes more sense than the proposed group rating system being proposed by CASA. ***It will impact on the proposed GA Group ratings***.

Recommendation: Adopt this standard with minimum change.

- EASR Part 66 **Group 3** aircraft are endorsed with appropriate aircraft type rating (if complex) or full **group rating** for piston engine aeroplanes other than Group 1.

NB: In addition to the above group descriptors standards, EASA also applied the following "**limitations**" on their **group 3 rating** that are similar to CAR31 mechanical group ratings.

EASR ***66.A.45*** specifies endorsement of ratings, stating, for general aviation, the following:

- for category B1, unless the applicant provides evidence of appropriate experience, the **group 3 rating shall be subject to the following limitations**, which shall be endorsed on the licence:
  - **— pressurised aeroplanes**
  - **— metal structure aeroplanes**
  - **— composite structure aeroplanes**
  - **— wooden structure aeroplanes**
  - — aeropla**nes with metal tubing structure covered with fabric**.

Adoption of this regulatory provision would have made it much easier to develop the current GA sub group ratings. Adoption now will have an impact of the CASR Part 66 GA Group ratings proposal.

Recommendation: Adopt this standard with minimum change.

The EASA licence endorsements are internationally recognised, this provision must be adopted so Australian Part 66 licences have harmonised endorsements.

EASR 66.A.45 Endorsement with aircraft ratings

(a) In order to be entitled to exercise certification privileges on a **specific aircraft type**, the holder of an aircraft maintenance licence need to have his/her licence endorsed with the relevant aircraft ratings.

— For category **B1, B2** ~~or C~~ the relevant aircraft ratings are the following:

1**. For group 1 aircraft**, the **appropriate aircraft type rating**.

2**. For group 2 aircraft**, the **appropriate aircraft type rating, manufacturer sub-group rating or full sub-group rating**.

3. **For group 3 aircraft**, the **appropriate aircraft type rating or full group rating.**

— For category A, no rating is required, subject to compliance with the requirements of point 145.A.35 of Annex II (Part-145).

(b) The **endorsement of aircraft type ratings** requires the satisfactory **completion of the relevant category B1, B2 ~~or C~~ aircraft type training.**

In other words, CASA could have transitioned the CAR31 group rating systems into CASR Part 66/MoS and been more compatible with EASR Part 66 than the current system or proposal.

Note: This is/was similar to the CAR 31 mechanical group rating system.

Recommendation: Adapt this standard and then compare with proposed GA group ratings.

2. The privileges of an AME licence needs clarification. (Recommended)

One of the issues that places restrictions on industry is a lack of clarity of the LAME privileges. ICAO has two clear safety privileges that need clarification.

EASR Part 66 states one [ICAO] LAME privilege very clearly but is not so clear on the other [ICAO] LAME privilege because it is linked with EASA Part 145 organisations for airlines. We need this clarified for all sectors of the industry.

The most important ICAO LAME privilege is ensuring the aircraft is airworthy AFTER maintenance; i.e. perform airworthiness conformity inspections. This ICAO privilege requires certification that the aircraft continues to meet (Annex 8) airworthiness standards, i.e. the design standards. This was dropped from the requirements in 1990, it is a previous regulatory lapse.

CASR Part 66 needs to state that a LAME **can perform and certify** the completion of maintenance, **perform airworthiness conformity inspections** and issue a maintenance release (release to service) iaw ICAO Annex 1, 4.2.2.1 that states:

> "***the privileges of the holder of an aircraft maintenance [engineer] licence shall be to certify the aircraft or parts of the aircraft as airworthy after an authorised repair, modification or installation of an engine, accessory, instrument, and/or item of equipment, and to sign a maintenance release following inspection, maintenance operation and/or routine servicing***."

The "airworthy" privilege in the EASA system is covered by "**act as B1 or B2 support staff**" that only applies in the EASA Part 145 environment whereas it has previously applied across the whole industry in Australia as it is in most other mature aviation systems. These B1 & B2 LAMEs (support staff) perform airworthiness standards conformity (quality) inspections during base maintenance.

EASR 145.A.30(h) *1. in the case of base maintenance of large aircraft, have appropriate aircraft type rated certifying staff qualified as category C in accordance with Part-66 and point 145.A.35.* ***In addition the organisation shall have sufficient aircraft type rated staff qualified as category B1, B2 as appropriate in accordance with Part-66 and point 145.A.35 ~~to support the category C certifying staff~~.***

(i) B1 and B2 support staff shall ensure that all relevant tasks or inspections have been carried out to the required standard before the category C certifying staff issues the certificate of release to service.

This is further clarified in EASR Part 66.A.20 where it states the privileges of a LAME is to issue certificates of release to service (ICAO maintenance release) AND to "act as B1 or B2 support staff". B1/B2 LAME "support staff" have, in Australia, always provided quality control of aircraft maintenance. CAR's Schedule 6 requires "stage" inspections without explaining that "stage inspections" are "airworthiness conformity inspections".

Pre 1990 it was clearer in CAOs that required maintenance certifications and signatures that certified the aircraft, or parts of the aircraft, as airworthy. The FAA has clearer regulations.

EASR 66.A.20 Privileges

(a) The following privileges shall apply:

*2. A category **B1 aircraft maintenance licence** shall permit the holder to issue certificates of release to service and to **act as B1 support staff following:***

— maintenance performed on aircraft structure, powerplant and mechanical and electrical systems,

— work on avionic systems requiring only simple tests to prove their serviceability and not requiring troubleshooting.

Category B1 includes the corresponding A subcategory.

*3. A category **B2 aircraft maintenance licence** shall permit the holder:*

*(i) to issue certificates of release to service and to act as **B2 support staff** for following:*

— maintenance performed on avionic and electrical systems, and

— electrical and avionics tasks within powerplant and mechanical systems, requiring only simple tests to prove their serviceability; and

(ii) to issue certificates of release to service following minor scheduled line maintenance and simple defect rectification within the limits of tasks specifically endorsed on the certification authorisation referred to in point 145.A.35 of Annex II (Part-145). This certification privilege shall be restricted to work that the licence holder has personally performed in the maintenance organisation which issued the certification authorisation and limited to the ratings already endorsed in the B2 licence.

The category B2 licence does not include any A subcategory.

Recommendation: Adapt this into CASR Part 66 with better clarity by using ICAO/FAA words and terminology for the airworthy inspections and functions.

3. The need for licence modular knowledge learning. (Recommended)

EASR Part 66 mandates the use of a modular licence examination system that enables training providers to support each module of a licence stream being followed.

EASR Part 66 has a requirement to pass all modules applicable to one of the licences within 10 years prior to the application for a licence. The "common" modules are taught at different levels for different licences.

A knowledge modular examination system enables an applicant to study for and pass each module separately over a 10 year period. In addition, the modules enable an applicant to set their own study time by utilising on-line training providers. (***see Attachment C***)

Adopt the EASR Part 66 requirements for modular examination packages independent from MEA Aeroskills trade training system. The EASR system supports the knowledge aspects for the five different AME licences. Converting knowledge skills into competency units has failed. There are many academic reports that highlights knowledge training, such as done at universities, is not compatible with competency based training. It is knowledge that is needed to supplement the competency based trade skills attained during apprentice/trade training.

a) EASR Part 66 separates practical and knowledge skills. The modularisation of the knowledge requirements will work more efficiently in Australia with variable methods to provide the training.

b) Packaging the licencing modules the same as EASR Part 66 modules could enable distant learning to be attained from foreign on-line training providers supporting the EASR Part 66 licencing system. Competition for local providers.

c) EASA empowers training organisations to accept previous qualifications, this needs clarification under the Australian NVET system for education credits but not for assessment of foreign AME licences.

The following EASR provision provides clarity needed in CASR Part 66. It will enable knowledge providers, self-study, etc. to sit and pass the examinations of the knowledge modules.

The details in EASR Part 66B regulations relating to courses and training objectives should be the basis for the Aviation Industry Reference Committee to develop the MEA Aeroskills practical training packages.

The following EASR provision has greater flexibility:

EASR 66.A.25 Basic knowledge requirements

(a) An applicant for an aircraft maintenance licence, or the addition of a category or subcategory to such a licence, ***shall demonstrate by examination a level of knowledge in the appropriate subject modules*** *in accordance with the Appendix I to Annex III (Part- 66). The* ***examination shall be conducted either by a training organisation appropriately approved*** *in accordance with Annex IV (Part- 147)* ***or by the competent authority.***

(b) The training courses and ***examinations shall be passed within 10 years*** *prior to the application for an aircraft maintenance licence or the addition of a category or subcategory to such aircraft maintenance licence. Should this not be the case, examination credits may however be obtained in accordance with point (c).*

(c) The applicant may apply to the competent authority for full or partial examination credit to the basic knowledge requirements for:

1. basic knowledge examinations that do not meet the requirement described in point (b) above; and

2. any other technical qualification considered by the competent authority to be equivalent to the knowledge standard of Annex III (Part-66).

Credits shall be granted in accordance with Subpart E of Section B of this Annex (Part-66).

(d) Credits expire 10 years after they were granted to the applicant by the competent authority. The applicant may apply for new credits after expiration.

Recommendation: Urgently adopt this standard with minimum change

4. The need to separate practical skills & experience. (Recommended)

ICAO "Competency. A **combination** of **skills**, **knowledge** and **attitudes** required to perform a task to the prescribed standard." Separation of skills and knowledge is recommended by ICAO.

The current system does not require an applicant to be workplace skilled or having attained enough industry experience to hold a licence.

EASR 66.A.30 clarifies the experience requirements missing from the current CASR system. This will bring back experience and industry skills to perform the functions of a LAME safely.

66.A.30 Basic experience requirements

(a) An applicant for an aircraft maintenance licence shall have acquired:

1. for category A, subcategories ***B1.2 and B1.4*** *and ~~category B3~~:*

(i) ***3 years of practical maintenance experience on operating aircraft****, if the applicant has no previous relevant technical training; or*

(ii) ***2 years of practical maintenance experience on operating aircraft*** *and* ***completion of training considered relevant by the competent authority as a skilled worker****, in a technical trade; or*

(iii) ***1 year of practical maintenance experience on operating aircraft*** *and* ***completion of a basic training course approved*** *in accordance with Annex IV (Part-147); [apprenticeship]*

2. for category ***B2*** *and subcategories* ***B1.1 and B1.3****:*

(i) ***5 years of practical maintenance experience on operating aircraft*** *if the applicant has no previous relevant technical training; or*

(ii) ***3 years of practical maintenance experience on operating aircraft*** *and* ***completion of training considered relevant by the competent authority as a skilled worker****, in a technical trade; or*

(iii) ***2 years of practical maintenance experience on operating aircraft*** *and* ***completion of a basic training course approved*** *in accordance with Annex IV (Part-147); [apprenticeship]*

The above regulation is supported by other regulatory provisions in EASR Part 66, Part A and also Part B, regulations for competent authorities.

Recommendation: Adapt this standard with minimum change.

5. AME Licence Issue. (Recommended)

The EASR Part 66 system requires the NAA to issue a licence based on evidence provided to the NAA of 75% pass mark in the applicable knowledge modules for a particular AME licence and evidence of practical experience (Log of Experience) as above. This EASA system resurrects the Log of Experience that an applicant for a licence or additional rating had to provide to CASA pre CASR Part 66. As a Licencing Authority, it makes sense.

- A Log of Experience is not skills needed to meet a competency; it is industry experience on operating aircraft to meet experience requirement for a licence/rating issue.
- CASA, as the licencing authority, must confirm the applicant has enough workplace experience to be capable of being a safe LAME.
- CASA should interview all initial licence holders to ensure the applicant has the correct attitude to safety.

66.A.10 Application

(a) An application for an aircraft maintenance licence or change to such licence shall be made on an EASA Form 19 (see Appendix V) in a manner established by the competent authority and submitted thereto.

Form 19 is one page back to back.

(b) An application for the change to an aircraft maintenance licence shall be made to the competent authority of the Member State that issued the aircraft maintenance licence.

(c) In addition to the documents required in points 66.A10(a), 66.A.10(b) and 66.B.105, as appropriate, the applicant for additional basic categories or subcategories to an aircraft maintenance licence shall submit his/her current original aircraft maintenance licence to the competent authority together with the EASA Form 19.

*(f) **Each application shall be supported by documentation to demonstrate compliance with the applicable theoretical knowledge, practical training and experience requirements at the time of application.***

66.B.100 ***Procedure for the issue of an aircraft maintenance licence by the competent authority***

(a) On receipt of EASA Form 19 and any supporting documentation, the competent authority shall verify EASA Form 19 for completeness and ensure that the experience claimed meets the requirement of this Annex (Part-66).

(b) The competent authority shall verify an applicant's examination status and/or confirm the validity of any credits to ensure that all required modules of Appendix I have been met as required by this Annex (Part-66).

(c) When having verified the identity and date of birth of the applicant and being satisfied that the applicant meets the standards of knowledge and experience required by this Annex (Part-66), the competent authority shall issue the relevant aircraft maintenance licence to the applicant. The same information shall be kept on competent authority records.

Recommendation: Adapt this standard (provide evidence of 3 separate aspects.)

6. AME Licence Validity Confirmation. (Recommended)

There is a major concern in the industry that the perpetual AME licence issued by CASA will mean that nobody will ever know how many LAMEs are actually employed in the aviation industry. This should be as big a concern to CASA as it is to AMROBA. Many holders of AME licences no longer work in the industry but CASA is no longer aware if they are still in aviation.

AMROBA does not advocate changing the perpetual licence but we support a provision that states the licence becomes invalid if CASA has not been notified/confirmed every 5 years of the LAME's employment/address.

CASA's predecessors once had a reply paid form that notified the Department every two years of employer and personal address confirmation. This was a government post-paid card mailed to the LAME and returned to the Department.

Modern electronic notification is a simple process that CASA could implement.

- Automatic email to the LAME to access their personnel details on-line to confirm address and aviation employer every 5 years (EASA standard).
- Re-validation would need the LAME to update his/her details.

66.A.40 Continued validity of the aircraft maintenance licence

(a) The aircraft maintenance licence becomes invalid 5 years after its last issue or change, unless the holder submits his/her aircraft maintenance licence to the competent authority that issued it, in order to verify that the information contained in the licence is the same as that contained in the competent authority records, pursuant to point 66.B.120.

Recommendation: Implement a re-validation notification on-line system to address confirmation of LAME numbers.

Summary

This submission is submitted to address the decline in practical and knowledge skills that has happened over a couple of decades. It takes into consideration the demographics of Australia, the unique general aviation industry of Australia and recommends regulatory standards, based on EASR/ICAO that will enhance the system and can be complied with.

It enables Education's Industry Skill Committees to adapt the ICAO practical training standards into the trade training requirements and removes the LAME knowledge elements from the MEA Aeroskills training packages.

Licensing knowledge examination centres approved by CASA, in the same manner as EASA NAAs, will ensure that an applicant for an AME licence has the knowledge needed to exercise the ICAO privileges and responsibilities of an ICAO Annex 1 licence holder.

Implementing the same EASR/ICAO standards may enable the use of approved knowledge on-line providers from the UK that provide the same services in Asia.

AMROBA will provide its expertise to CASA and the industry IRC to develop and implement the AME training packages.

CASA should acquire an EASA Part 66 examination bank so Australian LAMEs are tested to the same standards as in Europe.

The adaption of the EASR missing provisions will enable a compatible training system to be created and implemented. It will provide the regulatory limitations for Education's Aviation Industry Reference Committee.

EASR 66.A.10 Application

*(f) Each application shall be supported by **documentation** to demonstrate compliance with the applicable **theoretical knowledge**, practical training and experience requirements at the time of application.*

The EASR Part 66 system is much more flexible because they keep practical skills and knowledge training separate – applicable EASR Part 66 provisions that needs adopting are highlighted in ***Attachment B***

AMROBA recommends this change in policy to CASA's Board.

Attachment A

EASA Modular Training Packaging.

The modular re-packaging of the MEA Aeroskills training packages will provide training pathways to support the 5 CASA Part 66 AME licences correctly. The modular elements comply with the international training standards of ICAO.

In addition, the CAA (UK) identified elements within each module that were not covered by previous training standards. These elements could be self-studied, pass a differences examination provided by the NAA that removed limitations/exclusions from a B1 or B2 licence. There was no formal training or recognised prior learning.

EASA Part 66 Appendix 1 – 2. Modularisation

Qualification on basic subjects for each aircraft maintenance licence category or subcategory should be in accordance with the following matrix, where applicable subjects are indicated by an 'X':

Module	Subject	A or B1 aeroplane with:		A or B1 helicopter with:		B2
		Turbine engine(s)	Piston engine(s)	Turbine engine(s)	Piston engine(s)	Avionics
1	**Mathematic**	X	X	X	X	X
2	**Physics**	X	X	X	X	X
3	**Electrical Fundamentals**	X	X	X	X	X
4	**Electronic Fundamentals**	X	X	X	X	X
5	**Digital Techniques, Electronic Instrument Systems**	X	X	X	X	X
6	**Materials and Hardware**	X	X	X	X	X
7	**Maintenance Practices**	X	X	X	X	X
8	**Basic Aerodynamics**	X	X	X	X	X
9	**Human Factors**	X	X	X	X	X
10	**Aviation Legislation**	X	X	X	X	X
11A	**Turbine Aeroplane Aerodynamics, Structures and Systems**	X				
11B	**Turbine Aeroplane Aerodynamics, Structures and Systems**		X			
12	**Helicopter Aerodynamics, Structures and Systems**			X	X	
13	**Aircraft Aerodynamics, Structures and Systems (Avionics)**					X
14	**Propulsion Systems (Avionics)**					X
15	**Gas Turbine Engine**	X		X		
16	**Piston Engine**		X		X	
17	**Propeller**	X	X			

Note: Practical skills and experience is covered separately in EASR Part 66.

Module LAME Examination Questions.

2.1. Subject Module 1 Mathematics:

- **Category A**-16 multi-choice & 0 essay Qs.
- **Category B1**-30 multi-choice & 0 essay Qs.
- **Category B2**-30 multi-choice and 0 essay Qs.

2.2. Subject Module 2 Physics:

- **Category A**-30 multi-choice and 0 essay Qs.
- **Category B1**-50 multi-choice and 0 essay Qs.
- **Category B2**-50 multi-choice and 0 essay Qs.

2.3. Subject Module 3 Electrical Fundamentals:

- **Category B1**-50 multi-choice and 0 essay Qs.
- Category B2-50 multi-choice and 0 essay Qs.

2.4. Subject Module 4 Electronic Fundamentals:

- **Category B1**-20 multi-choice and 0 essay Qs.
- **Category B2**-40 multi-choice and 0 essay Qs.

2.5. Subject Module 5 Digital Techniques/Electronic Instrument Systems:

- **Category A**-16 multi-choice and 0 essay Qs.
- **Category B1.1 & B1.3**-40 multi-choice and 0 essay Qs.
- **Category B1.2 & B1.4**-20 multi-choice and 0 essay Qs.
- Category B2-70 multi-choice and 0 essay Qs.

2.6. Subject Module 6 Materials and Hardware:

- **Category A**-50 multi-choice and 0 essay Qs.
- **Category B1**-70 multi-choice and 0 essay Qs.
- Category B2-60 multi-choice and 0 essay Qs.

2.7. Subject Module 7 Maintenance Practices:

- **Category A**-70 multi-choice and 2 essay Qs.
- **Category B1**-80 multi-choice and 2 essay Qs.
- **Category B2**-60 multi-choice and 2 essay Qs.

2.8. Subject Module 8 Basic Aerodynamics

- **Category A**-20 multi-choice and 0 essay Qs.
- **Category B1**-20 multi-choice and 0 essay Qs.
- **Category B2**-20 multi-choice and 0 essay Qs.

2.9. Subject Module 9 Human Factors

- **Category A**-20 multi-choice and 1 essay Q.
- **Category B1**-20 multi-choice and 1 essay Q.
- **Category B2**-20 multi-choice and 1 essay Q.

2.10. Subject Module 10 Aviation Legislation:

- **Category A**-30 multi-choice and 1 essay Q.
- **Category B1**-40 multi-choice and 1 essay Q.
- **Category B2**-40 multi-choice and 1 essay Q.

2.11. Subject Module 11a Turbine Aeroplane Aerodynamics, Structures and Systems:

- **Category A**-100 multi-choice and 0 essay Qs.
- **Category B1**-130 multi-choice and 0 essay Qs.

2.12. Subject Module 11b Piston Aeroplane Aerodynamics, Structures and Systems:

- **Category A**-70 multi-choice and 0 essay Qs.
- **Category B1**-100 multi-choice and 0 essay Qs.

2.13. Subject Module 12 Helicopter Aerodynamics, Structures and Systems:

- **Category A**-90 multi-choice and 0 essay Qs.
- **Category B1-**115 multi-choice and 0 essay Qs.

2.14. Subject Module 13 Aircraft Aerodynamics, Structures and Systems:

- **Category B2**-130 multi-choice and 0 essay Qs.

2.15. Subject Module 14 Propulsion:

- **Category B2**-25 multi-choice and 0 essay Qs.

2.16. Subject Module 15 Gas Turbine Engine:

- **Category A**-60 multi-choice and 0 essay Qs.
- **Category B1**-90 multi-choice and 0 essay Qs.

2.17. Subject Module 16 Piston Engine:

- **Category A**-50 multi-choice and 0 essay Qs.
- **Category B1**-70 multi-choice and 0 essay Qs.

2.18. Subject Module 17 Propeller:

- **Category A**-20 multi-choice and 0 essay Qs.
- **Category B1**-30 multi-choice and 0 essay QS.

EASA Section A – Part 66 Technical Requirements

SUBPART A *AIRCRAFT MAINTENANCE LICENCE*

66.A.1 **Scope**

This section defines the aircraft maintenance licence and establishes the requirements for application, issue and continuation of its validity.

66.A.3 **Licence categories**

(a) Aircraft maintenance licences include the following categories:

— Category A

— Category B1

— Category B2

— ~~Category B3~~

shall be supported by documentation to

— Category C

(b) Categories A and B1 are subdivided into subcategories relative to combinations of aeroplanes, helicopters, turbine and piston engines. These subcategories are:

— A1 and **B1.1 Aeroplanes Turbine**

— A2 and **B1.2 Aeroplanes Piston**

— A3 and **B1.3 Helicopters Turbine**

— A4 and **B1.4 Helicopters Piston**

~~(c) Category B3 is applicable to piston engine non-pressurised aeroplanes of 2 000 kg MTOM and below.~~

66.A.5 **Aircraft groups**

For the purpose of ratings on aircraft maintenance licences, aircraft shall be classified in the following groups:

[Specific aircraft licence rating]

1. Group 1: complex motor-powered aircraft as well as multiple engine helicopters, aeroplanes with **maximum certified operating altitude exceeding FL290**, **aircraft equipped with fly-by-wire systems and other aircraft requiring an aircraft type rating** when defined so by the Agency.

[LWTR turbine aeroplanes and rotorcraft and piston rotorcraft]

2. Group 2: aircraft other than those in Group 1 belonging to the following subgroups:

— sub-group 2a: **single turbo-propeller engine aeroplanes**

— sub-group 2b: **single turbine engine helicopters**

— sub-group 2c: **single piston engine helicopters.**

[LWTR Piston aeroplanes]

3. Group 3: piston engine aeroplanes other than those in Group 1.

66.A.10 **Application**

(a) An application for an aircraft maintenance licence or change to such licence shall be made on an EASA Form 19 (see Appendix V) in a manner established by the competent authority and submitted thereto.

(b) An application for the change to an aircraft maintenance licence shall be made to the competent authority of the Member State that issued the aircraft maintenance licence.

(c) In addition to the documents required in points 66.A10(a), 66.A.10(b) and 66.B.105, as appropriate, the applicant for additional basic categories or subcategories to an aircraft maintenance licence shall submit his/her current original aircraft maintenance licence to the competent authority together with the EASA Form 19.

(d) Where the applicant for change of the basic categories qualifies for such change via the procedure referred to in point 66.B.100 in a Member State other than the Member State which issued the license, the application shall be sent to the competent authority referred to in point 66.1.

(e) Where the applicant for change of the basic categories qualifies for such change via the procedure referred to in point 66.B.105 in a Member State other than the Member State which issued the license, the maintenance organisation approved in accordance with Annex II (Part-145) shall send the aircraft maintenance licence together with the EASA Form 19 to the competent authority referred to in point 66.1 for stamp and signature of the change or reissue of the licence, as appropriate.

(f) Each application demonstrate compliance with the applicable theoretical knowledge, practical training and experience requirements at the time of application.

66.A.15 **Eligibility**

An applicant for an aircraft maintenance licence shall be at least 18 years of age.

66.A.20 **Privileges**

(a) The following privileges shall apply:

1. A category A aircraft maintenance licence permits the holder to issue certificates of release to service following minor scheduled line maintenance and simple defect rectification within the limits of tasks specifically endorsed on the certification authorisation referred to in point 145.A.35 of Annex II (Part-145). The certification privileges shall be restricted to work that the licence holder has personally performed in the maintenance organisation that issued the certification authorisation.

2. A category B1 aircraft maintenance licence shall permit the holder to issue certificates of release to service and to act as B1 support staff following:

— maintenance performed on aircraft structure, powerplant and mechanical and electrical systems,

— work on avionic systems requiring only simple tests to prove their serviceability and not requiring troubleshooting.

Category B1 includes the corresponding A subcategory.

3. A category B2 aircraft maintenance licence shall permit the holder:

(i) to issue certificates of release to service and to act as B2 support staff for following:

— maintenance performed on avionic and electrical systems, and

— electrical and avionics tasks within powerplant and mechanical systems, requiring only simple tests to prove their serviceability; and

(ii) to issue certificates of release to service following minor scheduled line maintenance and simple defect rectification within the limits of tasks specifically endorsed on the certification authorisation referred to in point 145.A.35 of Annex II (Part-145). This certification privilege shall be restricted to work that the licence holder has personally performed in the maintenance organisation which issued the certification authorisation and limited to the ratings already endorsed in the B2 licence.

The category B2 licence does not include any A subcategory.

4. A category B3 aircraft maintenance licence shall permit the holder to issue certificates of release to service and to act as B3 support staff for:

— maintenance performed on aeroplane structure, powerplant and mechanical and electrical systems,

— work on avionic systems requiring only simple tests to prove their serviceability and not requiring troubleshooting.

5. A category C aircraft maintenance licence shall permit the holder to issue certificates of release to service following base maintenance on aircraft. The privileges apply to the aircraft in its entirety.

(b) The holder of an aircraft maintenance licence may not exercise its privileges unless:

1. in compliance with the applicable requirements of Annex I (Part- M) and Annex II (Part-145); and

2. in the preceding 2-year period he/she has, either had 6 months of maintenance experience in accordance with the privileges granted by the aircraft maintenance licence or, met the provision for the issue of the appropriate privileges; and

3. he/she has the adequate competence to certify maintenance on the corresponding aircraft; and

4. he/she is able to read, write and communicate to an understandable level in the language(s) in which the technical documentation and procedures necessary to support the issue of the certificate of release to service are written.

66.A.25 **Basic knowledge requirements**

(a) An applicant for an aircraft maintenance licence, or the addition of a category or subcategory to such a licence, shall demonstrate by examination a level of knowledge in the appropriate subject modules in accordance with the Appendix I to Annex III (Part- 66). The examination shall be conducted either by a training organisation appropriately approved in accordance with Annex IV (Part- 147) or by the competent authority.

(b) The training courses and examinations shall be passed within 10 years prior to the application for an aircraft maintenance licence or the addition of a category or subcategory to such aircraft maintenance licence. Should this not be the case, examination credits may however be obtained in accordance with point (c).

(c) The applicant may apply to the competent authority for full or partial examination credit to the basic knowledge requirements for:

1. basic knowledge examinations that do not meet the requirement described in point (b) above; and

2. any other technical qualification considered by the competent authority to be equivalent to the knowledge standard of Annex III (Part-66).

Credits shall be granted in accordance with Subpart E of Section B of this Annex (Part-66).

(d) Credits expire 10 years after they were granted to the applicant by the competent authority. The applicant may apply for new credits after expiration.

66.A.30 Basic experience requirements

(a) An applicant for an aircraft maintenance licence shall have acquired:

1. for category A, subcategories **B1.2 and B1.4** and category B3:

(i) 3 years of practical maintenance experience on operating aircraft, if the applicant has no previous relevant technical training; or

(ii) 2 years of practical maintenance experience on operating aircraft and completion of training considered relevant by the competent authority as a skilled worker, in a technical trade; or

(iii) 1 year of practical maintenance experience on operating aircraft and completion of a basic training course approved in accordance with Annex IV (Part-147);

2. for category B2 and subcategories B1.1 and B1.3:

(i) 5 years of practical maintenance experience on operating aircraft if the applicant has no previous relevant technical training; or

(ii) 3 years of practical maintenance experience on operating aircraft and completion of training considered relevant by the competent authority as a skilled worker, in a technical trade; or

(iii) 2 years of practical maintenance experience on operating aircraft and completion of a basic training course approved in accordance with Annex IV (Part-147);

3. for category C with respect to large aircraft:

(i) 3 years of experience exercising category B1.1, B1.3 or B2 privileges on large aircraft or as support staff according to point 145.A.35, or, a combination of both; or

(ii) 5 years of experience exercising category B1.2 or B1.4 privileges on large aircraft or as support staff according to point 145.A.35, or a combination of both;

4. for category C with respect to other than large aircraft: 3 years of experience exercising category B1 or B2 privileges on other than large aircraft or as support staff according to point 145.A.35(a), or a combination of both;

5. for category C obtained through the academic route: an applicant holding an academic degree in a technical discipline, from a university or other higher educational institution recognised by the competent authority, 3 years of experience working in a civil aircraft maintenance environment on a representative selection of tasks directly associated with aircraft maintenance including 6 months of observation of base maintenance tasks.

(b) An applicant for an extension to an aircraft maintenance licence shall have a minimum civil aircraft maintenance experience requirement appropriate to the additional category or subcategory of licence applied for as defined in Appendix IV to this Annex (Part-66).

(c) The experience shall be practical and involve a representative cross section of maintenance tasks on aircraft.

(d) At least 1 year of the required experience shall be recent maintenance experience on aircraft of the category/subcategory for which the initial aircraft maintenance licence is sought. For subsequent category/subcategory additions to an existing aircraft maintenance licence, the additional recent maintenance experience required may be less than 1 year, but shall be at least 3 months. The required experience shall be dependent upon the difference between the licence category/subcategory held and applied for. Such additional experience shall be typical of the new licence category/ subcategory sought.

(e) Notwithstanding point (a), aircraft maintenance experience gained outside a civil aircraft maintenance environment shall be accepted when such maintenance is equivalent to that required by this Annex (Part-66) as established by the competent authority. Additional

experience of civil aircraft maintenance shall, however, be required to ensure adequate understanding of the civil aircraft maintenance environment.

(f) Experience shall have been acquired within the 10 years preceding the application for an aircraft maintenance licence or the addition of a category or subcategory to such a licence.

66.A.40 **Continued validity of the aircraft maintenance licence**

(a) The aircraft maintenance licence becomes invalid 5 years after its last issue or change, unless the holder submits his/her aircraft maintenance licence to the competent authority that issued it, in order to verify that the information contained in the licence is the same as that contained in the competent authority records, pursuant to point 66.B.120.

(b) The holder of an aircraft maintenance licence shall complete the relevant parts of EASA Form 19 (see Appendix V) and submit it with the holder's copy of the licence to the competent authority that issued the original aircraft maintenance licence, unless the holder works in a maintenance organisation approved in accordance with Annex II (Part-145) that has a procedure in its exposition whereby such organisation may submit the necessary documentation on behalf of the aircraft maintenance licence holder.

(c) Any certification privilege based upon a aircraft maintenance licence becomes invalid as soon as the aircraft maintenance licence is invalid.

(d) The aircraft maintenance licence is only valid (i) when issued and/or changed by the competent authority and (ii) when the holder has signed the document.

66.A.45 **Endorsement with aircraft ratings**

(a) In order to be entitled to exercise certification privileges on a specific aircraft type, the holder of an aircraft maintenance licence need to have his/her licence endorsed with the relevant aircraft ratings.

— For category B1, B2 or C the relevant aircraft ratings are the following:

1. For group 1 aircraft, the appropriate aircraft type rating.

2. For group 2 aircraft, the appropriate aircraft type rating, manufacturer sub-group rating or full sub-group rating.

3. For group 3 aircraft, the appropriate aircraft type rating or full group rating.

— For category B3, the relevant rating is 'piston-engine non-pressurised aeroplanes of 2 000 kg MTOM and below'.

— For category A, no rating is required, subject to compliance with the requirements of point 145.A.35 of Annex II (Part-145).

(b) The endorsement of aircraft type ratings requires the satisfactory completion of the relevant category B1, B2 or C aircraft type training.

(c) In addition to the requirement of point (b), the endorsement of the first aircraft type rating within a given category/sub-category requires satisfactory completion of the corresponding On the Job Training, as described in Appendix III to Annex III (Part-66).

(d) By derogation from points (b) and (c), for group 2 and 3 aircraft, aircraft type ratings may also be granted after:

— satisfactory completion of the relevant category B1, B2 or C aircraft type examination described in Appendix III to this Annex (Part-66), and

— in the case of B1 and B2 category, demonstration of practical experience on the aircraft type. In that case, the practical experience shall include a representative cross section of maintenance activities relevant to the licence category.

In the case of a category C rating for a person qualified by holding an academic degree as specified in point 66.A.30(a)(5), the first relevant aircraft type examination shall be at the category B1 or B2 level.

(e) For group 2 aircraft:

1. the endorsement of manufacturer sub-group ratings for category B1 and C licence holders requires complying with the aircraft type rating requirements of at least two aircraft types from the same manufacturer which combined are representative of the applicable manufacturer sub-group;

2. the endorsement of full sub-group ratings for category B1 and C licence holders requires complying with the aircraft type rating requirements of at least three aircraft types from different manufacturers which combined are representative of the applicable sub-group;

3. the endorsement of manufacturer sub-groups and full sub-group ratings for category B2 licence holders requires demonstration of practical experience which shall include a representative cross section of maintenance activities relevant to the licence category and to the applicable aircraft sub-group.

(f) For group 3 aircraft:

1. the endorsement of the full group 3 rating for category B1, B2 and C licence holders requires demonstration of practical experience, which shall include a representative cross section of maintenance activities relevant to the licence category and to the group 3.

2. for category B1, unless the applicant provides evidence of appropriate experience, the group 3 rating shall be subject to the following limitations, which shall be endorsed on the licence:

— pressurised aeroplanes

— metal structure aeroplanes

— composite structure aeroplanes

— wooden structure aeroplanes

— aeroplanes with metal tubing structure covered with fabric.

(g) For the B3 licence:

1. the endorsement of the rating 'piston-engine non-pressurised aeroplanes of 2 000 kg MTOM and below' requires demonstration of practical experience which shall include a representative cross-section of maintenance activities relevant to the licence category.

2. unless the applicant provides evidence of appropriate experience, the rating referred to in point 1 shall be subject to the following limitations, which shall be endorsed on the licence:

— wooden structure aeroplanes

— aeroplanes with metal tubing structure covered with fabric

— metal structure aeroplanes

— composite structure aeroplanes.

66.A.50 **Limitations**

(a) Limitations introduced on an aircraft maintenance licence are exclusions from the certification privileges and affect the aircraft in its entirety.

(b) For limitations referred to in point 66.A.45, limitations shall be removed upon:

1. demonstration of appropriate experience; or

2. after a satisfactory practical assessment performed by the competent authority.

(c) For limitations referred to in point 66.A.70, limitations shall be removed upon satisfactory completion of examination on those modules/subjects defined in the applicable conversion report referred to in point 66.B.300.

66.A.55 **Evidence of qualification**

Personnel exercising certification privileges as well as support staff shall produce their licence, as evidence of qualification, within 24 hours upon request by an authorised person.

66.A.70 **Conversion provisions**

(a) The holder of a certifying staff qualification valid in a Member State, prior to the date of entry into force of Annex III (Part-66) shall be issued an aircraft maintenance licence by the competent authority of this Member State without further examination subject to the conditions specified in Section B Subpart D.

(b) A person undergoing a certifying staff qualification process valid in a Member State, prior to the date of entry into force of Annex III (Part-66) may continue to be qualified. The holder of a certifying staff qualification gained following such process shall be issued an aircraft maintenance licence by the competent authority of this Member State without further examination subject to the conditions specified in Section B Subpart D.

(c) Where necessary, the aircraft maintenance licence shall contain limitations in accordance with point 66.A.50 to reflect the differences between (i) the scope of the certifying staff qualification valid in the Member State before the entry into force of Regulation (EC) No 2042/2003 and (ii) the basic knowledge requirements and the basic examination standards laid down in Appendix I and II to this Annex (Part-66).

(d) By derogation to point (c) for aircraft not involved in commercial air transport other than large aircraft, the aircraft maintenance licence shall contain limitations in accordance with point 66.A.50 to ensure that the certifying staff privileges valid in the Member State before the entry into force of Regulation (EC) No 2042/2003 and the privileges of the converted Part-66 aircraft maintenance licence remain the same.

Attachment C

"Licence by Post" *– an on-line British LAME training provider.*

The EASA Part 66 Licence

The Part 66 licence is required for engineers to obtain 'approvals' to work on aircraft. These approvals are issued by companies (AMOs) who are themselves approved by the CAA (EASA Part 145) usually after 'type training'. The approved engineer can sign off work on the aircraft within his/her licence authority.

So for anyone who aspires to work on civil aircraft as a maintenance engineer the Part 66 is a must. This means passing all the modules that go to make up that particular licence.

The licence categories are:

Category A	Line mechanic (airframes and engines).
Category B1	Licensed engineer (mechanical, airframes and engines).
Category B2	Licensed engineer (avionics).
Category B3	Licensed engineer (piston engined aircraft of mass 2000kg and below).
Category C	Licensed engineer (base maintenance).

AMROBA

Category A

Issued after passing the appropriate modules and obtaining the appropriate experience. The person is allowed to sign for certain designated tasks only.

Not recommended as a 'stepping stone' to the B1 licence as all the module examinations will have to be taken again – to the higher level.

A1	Turbine Engined Aeroplanes
A2	Piston Engined Aeroplanes
A3	Turbine Engined Helicopters
A4	Piston Engined Helicopters

Experience requirements can vary but would be a maximum of 3 years maintenance experience on operating aircraft (certified in a record of experience log book).

Category B

The licence is issued after passing all the appropriate modules and obtaining the appropriate experience. Allows the engineer to sign the Certificate of Release to Service for the aircraft in the category for which he/she is licensed.

Experience required (gained within the 10 years preceding application):

B1.1	Turbine Engined Aeroplanes	5 years maximum
B1.2	Piston Engined Aeroplanes	3 years maximum
B1.3	Turbine Engined Helicopters	5 years maximum

B1.4	Piston Engined Helicopters	3 years maximum
B2	Avionic	5 years maximum
~~B3~~	~~Aircraft below 2,000kg mass~~	~~3 years maximum~~

At least 1 year of the experience shall be recent experience gained on aircraft type for which application is to be made.

Experience requirements stated above are based on no previous qualifying technical training or approved courses passed. If you have technical qualifications and/or passed an approved course then you may be eligible for a reduced experience requirement – in this case you should apply to the CAA for details/check their website. The experience requirement is based on appropriate maintenance engineering on operating aircraft. For UK service personnel with qualifying service experience this may count for all of the experience requirement except for 1 year – this will have to be gained on civil aircraft (all recorded in the log book of course).

~~*Category C*~~

~~Requires 3 years' experience as a B1.1, B1.3, or B2 engineer or 5 years as a B1.2 or B1.4 engineer.~~

Experience Requirements Clarification

There are no experience requirements to be allowed to *sit* the examinations, they apply only when licence *application* is made. As the individual module examination passes have a life of 10 years it is important that all the exams for a particular licence are passed within 10 years of passing the first module.

All the above experience requirements must include one year's recent experience and that experience must include equipment for which application is made. In other words if you are applying for the B1.1 licence mechanical jet engined aircraft the one year recent experience must be on this type of aircraft – not on helicopters for example.

The experience must include a representative cross section of tasks on operating aircraft* and should include, for the mechanical person, some experience on instrument, electrical and avionics systems. Experience in maintenance bays (engine bays, instruments bays, tyre bays etc.) is not considered appropriate.

* The term 'operating aircraft' means that the aircraft must be a flying aircraft and the servicing could include ramp/first line servicing and/or hangar maintenance.

The term 'operating aircraft' does not include work on gliders and UAVs (Unmanned Aerial Vehicles).

More from Aircraft licence distance learning

Click on the links below to learn in more detail about courses and the service we offer.

- **Aircraft Licences index**
  - **A complete study and tutorial service for the aircraft engineer**
  - **How to study for your aircraft licence**
  - **The EASA part 66 licence**
  - **Aircraft licence exams**

How to study for your aircraft licence

Of course, we would hope that you choose us as your study provider, but there are others in the field you might like to use. Methods/providers include:

- By yourself (*)
- **Part-time courses at local colleges or schools**
- **Distance learning (home study)**
- **On-line software based courses**
- Short full-time courses at local colleges or schools
- 2 or 4 year full-time courses at local colleges or schools (**)
- On-site courses arranged by your company
- Which One?

The above list is arranged in approximate cost order with (*) being the least expensive, followed by Distance Learning and, (**) being the most costly, but it is not as simple as that.

Distance learning (home study)

These are the most environmentally friendly learning systems available. There is no travel involved, congestion, traffic jams etc. There are no accommodation costs, nor the problems of living away from home. For some people studying at home/domestic accommodation is the best way, for some it can be difficult and the only option is a classroom based learning system.

Success rates for students that complete a structured study programme are high.

This company was formed by a group of college aeronautical engineering lecturers in 1992 to provide distance-learning material, initially, for the UK CAA Licence Without Type Rating (LWTR), then changed to the JAR66 and now called EASA Part 66.

We now have a student population (4600+) covering the globe, from Iceland to Japan, Brazil, The Americas, the Caribbean, The Middle East, Europe, Africa, Hong Kong, Malaysia, India, former Eastern Block countries and even the Antarctic (one lad over-wintered there – on a survey – and took our study programmes with him).

Other on-line providers also have many foreign NAA approvals.

Attachment D

Chapter 10 – 12- Practical AME Skills (ICAO Manual Doc 7192-Part-D1)

PRACTICAL AME MAINTENANCE SKILLS: AIRFRAME

10.1 INTRODUCTION (chapters 11 (engines) & 12 (avionics) virtually the same

10.1.1 *In order to be able to satisfactorily assimilate the training on individual aircraft and systems, the Aircraft Maintenance (Technicians/Engineers/Mechanics) (AMEs) must have good fundamental practical skills and understand the maintenance processes and principles generally used in aircraft hangars and workshops.*

10.1.2 *In order to be able to perform or supervise "hands-on" tasks of mechanic/technician on the aircraft, the aircraft engines and systems, the AME must have a very complete knowledge of all the tools and associated maintenance processes that are likely to be used in hangars and workshops.*

- In order to be able to perform or supervise "hands-on" tasks of mechanic/technician on the engines, propellers and systems, the AME must have a very complete knowledge of all the tools and associated maintenance processes that are likely to be used in hangars and workshops

10.1.3 *For future aircraft hangar and workshop technicians, their basic workshop training should commence with Phase Two — Skills and should be completed before the students begin working on airworthy aircraft, engines or equipment in Phase Three — Experience. For this purpose, the Performance parameters required to meet the Training Objectives outlined in 10.2 of this chapter are divided into two sections: Section a) requires basic manual skills and Section b) refers to the application of these skills to non-airworthy aircraft, components or specially-designed practice rigs. The level of manual skills to be developed also varies according to the category of technicians being trained. For example, bench fitting is of importance to all categories of technicians, while radio technicians may require skills in soldering but they only need an introduction to welding.*

- For this purpose, the Performance parameters required to meet the Training Objectives outlined in 11.2 of this chapter are divided into two sections: Section a) requires basic manual skills and Section b) refers to the application of these skills to non-airworthy engines, propellers, components or specially designed practice rigs. The level of manual skills to be developed varies according to the category of technicians being trained. For example, bench fitting is of importance to all categories of technicians, while radio technicians may require skill in soldering but they only need an introduction to welding.

10.1.4 *The recommended facilities, tools and equipment are described in Appendix 1 to this [each] chapter.*

10.2 TRAINING OBJECTIVES

Conditions:

The trainees will be provided with appropriate facilities; tools (both hand and machine); materials; a selection of airframe assemblies, component or parts; specially- made repair, assembly and rigging test exercises. (See Appendix 1 to Chapter 10.)

Performance:

a) The trainees will practice repair schemes on airframe components as well as assemble and adjust test exercise pieces and/or assemblies by using simple engineering drawings and aircraft maintenance test (real or simulated).

b) The trainees will practice fault finding, dismantling, inspecting, repairing, decision-making regarding repair or replacement, reassembly and testing. They will also use engineering drawings as well as engine manufacturers' maintenance, overhaul and repair manuals.

Standard of accomplishment:

During workshop training, the standard is a function of the variety of exercises completed and the time spent in workshop training. The trainees/students should work individually on airframe exercises so that they have "ownership" of the standard. If necessary, they should practice and repeat increasingly complex exercises to develop greater manual skills within their respective areas of competence. Finally, they should carry out tests or operate the system exercise rigs

.

10.3 BASIC WORKSHOP AND MAINTENANCE PRACTICES: AIRFRAME

10.3.1 Introduction

a) Training in workshop practice should begin with exercises in the use of hand tools to make a series of simple shapes to specified dimensions from various metals. Each shape should be progressively more complicated with more precise tolerances. From the start, instructors should ensure that students develop the habit of handling basic hand or machine tools in the correct manner, and action should be taken to correct any bad or potentially dangerous practices before they become habitual. At all times, and particularly during the early stages of training, the importance of producing accurate and careful work must be stressed. These exercises can be used to develop the trainees' inspection ability, i.e. the necessary judgement and sense of responsibility required to assess the accuracy of their own work and that of others.

b) It is desirable that licensed AME students should have the opportunity to remove and replace major components. Practice in inspection functions during simulated repair or maintenance activities is considered an important training element in this phase.

10.3.2 Bench fitting

- Cutting and filing: exercises in cutting metal with hacksaws; filing; drilling; drill grinding; thread cutting with taps and dies; and scraping
- Measurements: use of steel rule, dividers, calipers, micrometers, vernier, combination set, surface place, and dial test indicator

10.3.3 Forging, heat treatment, soldering and welding

- Forging by hand simple specimens such as chisels, punches and others
- Hardening and tempering carbon steel by using forge
- Tin soldering, tin-plating, and use of proper flux
- Silver soldering and brazing
- Welding: oxyacetylene and metallic arc welding of different materials
- Inspection of welded joints for flaws

10.3.4 Sheet metal work

- Sheet aluminium alloy: cutting, marking out, drilling, forming, bending, bending allowances, shrinking and flashing
- Forming sheet metal by pressing and rolling
- Riveting: types of rivets, riveting with hand tools, rivet spacing, countersinking and dimpling
- Use of pneumatic riveting hammer
- Blind riveting
- Inspection of rivets, removal of rivets, use of oversized rivet and rivet jackets
- Tube work: use of taper pins and tubular rivets
- Exercises in sheet metal patching and repair work
- Heat treatment of aluminum alloy and alloy rivets: use of salt baths and furnaces; annealing and solution treatment

10.3.5 Machine shop

- Drilling: using machine drills to drill close tolerance holes in various materials; reaming holes to close tolerances; others
- Turning: exercises in turning steel, aluminium alloy and brass parts; use of lathe for thread cutting; others
- Grinding: use of grinding wheels for tool sharpening

10.3.6 Woodwork

- Cutting and smoothing of wood: marking out, sawing and planing wood, and exercises in woodwork involving tenon and scarf joints
- Selection of aircraft woods: defects of timber, timber, tests for moisture content, and straightness of grain
- Plywoods and laminated woods: bending, patching, and standard repairs to aircraft

woodwork

- Gluing: approved glues (casein and synthetic resin); mixing; uses; drying times
- Varnishing and protection of aircraft woodwork
- Environmental aspects

10.3.7 Wire and cable work

- Inspection of aircraft cables for defects
- Splicing exercises
- Swagging exercise: attachment of standard end fittings to flying control cables
- Demonstration of proof test on flying control cable

10.3.8 Tube Work

- Tube bending, with or without heat treatment
- Tube flaring
- Fitting of different kinds of unions used in fuel, oil and hydraulic systems
- Inspection and testing of tubes and flexible hoses

10.3.9 Airframe familiarization

- Airframe structures: detailed examination of various types of wing and fuselage construction, including primary and secondary structures
- Use of forged, extruded, cast and sheet material
- Main joints: methods of riveting, spot welding, and adhesive bonding
- Doors and cut-outs, positions of inspection panels, removal of fairings, and methods of gaining access to all parts of structure
- Landing gear: examination of control system; checking of control surface movements and cable tensions; interconnections of autopilot to control systems; examination (by visiting airline, if necessary) of power-operated control systems

10.3.10 Ground handling of aircraft

- Pre-flight inspection with aircraft on apron
- Starting and running of engines and auxiliary power unit (APU); observation of instrument readings; function check(s) of electrical components and radios; stopping of engines
- Compass swinging and automatic direction finder (ADF) loop swinging
- Use of ground equipment for moving, lifting or servicing aircraft

10.3.11 Installation and testing of equipment

- Removal, replacement, in situ inspection, and function testing
- Testing for leaks, errors and electrical faults of electrical equipment, instruments, autopilots, communication and navigation equipment as appropriate

10.3.12 Small aircraft

- Dismantling of aircraft: removal of engine, control surfaces, landing gear, wings, tail plane and fin, and seats
- Inspection: inspection of condition of fuselage alignment checks, freedom from distortion, and symmetry
- Checking of wings and other airframe components for condition, and freedom from distortion
- Reassembly of aircraft: replace wings, empennage, control surfaces, and engine; check rigging angles of wings and tail plane; adjust flying controls and check control surface movements; replace landing gear and check alignment track

10.3.13 Fabric and dope

- Exercises in covering frames with hand-sewn fabric; doping; stringing; repairing cuts in fabric; patching

10.3.14 Wheels and tyres

- Complete wheel assemblies: dismantling, inspection (including crack detection of wheels) and reassembly
- Inner tubes: puncture repairs
- Outer covers: inspection, identification of defects, and spot vulcanizing
- Brake units: inspection and salvage of brake pads and discs
- Inspection and testing of anti-skid devices

10.3.15 Control surfaces

- Overhaul and repair: repairs to typical fabric-covered and metal-skinned ailerons, and elevators
- Hinges and actuating mechanisms: inspection, and renewal of ball races
- Correction of mass balance after repair
- Adjustment of balance tabs, and servo-tabs on aircraft (to correct for hinge moments and flying faults)

10.3.16 Multi-engined aircraft

- Simulated airline check: familiarization with maintenance schedule
- Performance of sequence of major periodic inspection by the students, including signing of check sheets for each job done and recording of and, if possible, rectification of all defects
- Full functioning checks after replacement of components, including ground testing of hydraulic system with retraction of landing gear and function testing of electrical system; ground running of engines; weighing of the aircraft and calculation of centre of gravity

10.4 BASIC WORKSHOP & MAINTENANCE PRACTICES: REPAIR, MAINTENANCE AND FUNCTION TESTING OF AIRCRAFT SYSTEMS/COMPONENT

10.4.1 Hydraulic systems

- Demonstration of hydraulic system rig
- Dismantling and reassembly of typical components such as hydraulic pumps, regulators, selectors, control valves, accumulators and actuators
- Dismantling and examination of control and actuating devices from powered flying control systems
- Dismantling, reassembly and recharging of selection of landing gear shock struts, nose-wheel steering mechanisms, anti-shimmy devices and other landing gear components

10.4.2 Pneumatic systems

- Demonstration of pneumatic system rig, examination of typical components such as compressors, regulators, selectors and actuators
- Dismantling, reassembly and testing of representative selection of pneumatic components: selectors, thrust reversal rams, and others

10.4.3 Environmental control systems

- Demonstration of pressurization system models or rigs
- Dismantling and reassembly of selected components such as cabin superchargers, mass flow controllers, cabin pressure controllers, discharge valves and safety valves
- Demonstration and partial dismantling of cabin heating, cooling and humidifying devices
- Dismantling, reassembly and testing of selected components
- Familiarization with the servicing and inspection of various types of pressure and mass flow control devices; heat exchangers, combustion heaters and electrical heaters; cold air units (air cycle machines), vapour cycle coolers, cabin temperature sensing and regulating devices; humidifying and dehumidifying equipment; crew and passenger emergency oxygen equipment

10.4.4 Fire control systems

- Inspection, weighing and recharging of fire extinguisher bottles
- Demonstration of fire detection and extinguishing system principles by using simulators, individual components, and operation
- Practice in controlling aircraft and shop fires
- Familiarization with different types of alarm systems, extinguishers and their uses

10.4.5 De-icing systems

- Demonstration of rigs and individual de-icing system components
- Dismantling, reassembly and testing of air control devices for mechanical de-icing systems; repairs to inflatable leading-edge overshoes/boots

- Hot air systems: overhaul procedures for combustion heaters, and hot air control valves
- Repair schemes for air-to-air heat exchangers, and mixing valves
- Repair schemes for electrically heated overshoes, and spray-mats

10.4.6 Miscellaneous systems

- Demonstrations and inspection of vacuum systems, water/methanol, drinking and washing water systems
- Inspection and tests, as necessary, of fuel system components: cocks, line booster pumps, filters, and refueling valves
- Tests and repairs, as necessary, of safety equipment: inspection of dinghies, life jackets, survival kits, safety belts etc.

10.5 JOB/TASK DOCUMENTATION AND CONTROL PRACTICES

10.5.1 Aircraft heavy maintenance check

- Preparation for Heavy Maintenance Check: documentation (task/job cards), logbooks, defect records, modification instructions; emptying and inserting fuel tanks, draining oil and other systems; selection and display of equipment; tools required
- Selected major operations: internal inspection of internal tanks; detailed examination of cabin structure followed by pressurization and leak rate test; change of main landing gear
- Adherence to aircraft maintenance manual and a typical airline major check schedule for each job
- Conclusion of Heavy Maintenance Check: replacement of components, function tests, restoration of internal and external finish, weighing and calculation of centre of gravity, preparation for flight test, and completion of documentation

10.5.2 Aircraft or helicopter repair

- Selection of repair scheme: damage to be studied and related to approved repair scheme as shown on manufacturers' drawings or structural repair manual (SRM)
- Selection of material to be checked for compliance with specification
- Embodiment of repairs according to prepared drawings or SRM
- Testing to destruction of selected repair specimens to demonstrate strength of repair
- Experience in workshop processes as applicable to repair and reconditioning of aircraft parts (e.g. enlargement or reduction of dimensions to accept oversized or undersized parts; chemical or electro-chemical treatments for the protection of metals; metal depositing processes; special methods of heat treatment; special methods of welding; advanced metal processing techniques, surface texture measurement)
- Acceptance tests and final inspection
- Completion of documentation

Chapter 11

PRACTICAL MAINTENANCE SKILLS: ENGINE AND PROPELLER

11.1 INTRODUCTION

- Basically the same as 10.1 above

11.2 TRAINING OBJECTIVES

- Basically the same as 10.2 above

11.3 BASIC WORKSHOP & MAINTENANCE PRACTICES: ENGINE AND PROPELLER

11.3.1 Introduction

Note.— The basic practical training specified in this section is very similar to that described in Chapter 10 for airframe trainees.

11.3.2 Bench fitting

- Cutting and filing: exercises in cutting metal with hacksaws, filing, drilling, drill grinding, thread cutting with taps and dies, and scraping
- Measurements: use of steel rule, dividers, calipers, micrometers, vernier, combination set, surface place, and dial test indicator

11.3.3 Forging, heat treatment, soldering and welding

- Forging by hand simple specimens such as chisels, punches and others
- Hardening and tempering carbon steel by using forge
- Tin soldering, tin-plating, and use of proper flux
- Silver soldering and brazing
- Welding: oxyacetylene and metallic arc welding of different materials
- Inspection of welded joints for flaws

11.3.4 Sheet metalwork

- Sheet aluminium alloy: cutting, marking out, drilling, forming, bending, bending allowances, shrinking and flashing
- Forming sheet metal by pressing and rolling
- Riveting: types of rivets, riveting with hand tools, rivet spacing, countersinking and dimpling
- Use of pneumatic riveting hammer
- Blind riveting
- Inspection of rivets, removal of rivets, use of oversized rivet and rivet jackets
- Tube work: use of taper pins and tubular rivets
- Exercises in sheet metal patching and repair work
- Heat treatment of aluminium alloy and alloy rivets: use of salt baths and furnaces; annealing and solution treatment

11.3.5 Machine shop

- Drilling: using machine drills to drill close tolerance holes in various materials; reaming holes to close tolerances; others
- Turning: exercises in turning steel, aluminium alloy and brass parts; use of lathe for thread cutting; others
- Grinding: use of grinding wheels for tool sharpening

11.3.6 Wire and cable work

- Inspection of aircraft cables for defects
- Splicing exercises
- Swagging exercise: attachment of standard end fittings to engine control cables
- Demonstration of proof test on engine control cable

11.3.7 Tube work

- Tube bending, with and without heat treatment
- Tube flaring

- Fitting of different kinds of unions used in fuel, oil and hydraulic systems
- Inspection and testing of tubes and flexible hoses

11.3.8 Familiarization

- Practical explanation of the mechanical arrangement of the engines available for work and practice (e.g. 2-stroke and 4-stroke spark ignition and compression ignition engines); air-cooled and water-cooled piston engines; piston aero engines of various types; turbojet, turboshaft, turbofan and turboprop aero engines; others

11.3.9 Initial inspection

- Examination of complete engine and propeller for identification to manufacturers' service publications
- Confirmation of external accessories and features
- Recognition of visible defects
- Ground run of engines (if possible) and recording of performance
- Ensured availability of manuals, workshop tools and equipment
- Identification of safety precautions to be observed

11.3.10 Dismantling

- Removal of accessories as appropriate (i.e. starters, generators and electrical equipment, pressure transmitters, transducers, thermocouples, magnetos, carburettors and spark plugs)
- Dismantling of core engine to a specified level according to manufacturer's service publications
- Complete dismantling of smaller engines: removal of all accessories, manifolds, cylinders, pistons, connecting rods, crankshaft and bearings; cleaning and laying out of these components for inspection
- Partial dismantling of larger engines: removal of accessories, reduction gear, cylinders, and pistons (without disturbing crankshaft or crankcase)
- Partial dismantling of gas turbines: removal of accessories, jet pipe assembly, and combustion chambers (without disturbing turbine/compressor assembly)

11.3.11 Inspection of dismantled engine

- Visual inspection in accordance to manufacturer's service publications
- Dimensional checks in accordance with procedures given in manufacturers' manuals for deterioration in accordance to manufacturer's service publications on blades, vanes, shafts, bearings, and connecting rods for wear, ovality, twist and distortion
- Checking of cylinder valves, pistons and piston rings as directed in overhaul manual: checking of fits and clearances; practise on repair schemes, as applicable
- Non-destructive crack detection: electromagnetic, dye penetrant, etc. on crankshafts and camshafts
- Checking for cracks and distortion on exhaust manifolds, jet pipes, and combustion chamber flame tubes
- Inspection of gas turbine and turbo-supercharger compressor and turbine assemblies; inspection of blades for deposits, damage and distortion

11.3.12 Repair and reconditioning of engine parts

- Repairs by machining and grinding; checks for fits and clearances; fitting of oversized or undersized parts
- Castings: checks and rectification of cracks, porosity and corrosion
- Rigid and flexible pipes and hoses: testing and reconditioning
- Inspection and repair of gears, accessory drives, and torque metre components
- Welding repairs to nickel alloy components (e.g. jet pipes)

11.3.13 Reassembly

- Rebuilding of totally or partially

dismantled engines (with particular attention to be paid to cleanliness, correct torqueing and safety, correctness of working clearances, and accuracy of valve and ignition timing)

11.3.14 Engine test bed running and fault finding

- Installation of engine on test bed, checking of instrumentation, control runs, and fuel supplies
- Fan testing of piston engines: calibration of test fan for test site, and engine type
- Full "after overhaul" test programme as specified in the State's airworthiness requirements and in the manufacturer's approved test schedule, using a method appropriate to the type of engine: initial test, strip inspection, reassembly and final test
- Interpretation of engine performance based on test results
- Experience in starting, running and ground testing of aero engines
- Inspection of powerplant installed in aircraft
- Fault finding and rectification

11.3.15 Aircraft installation

- Preparation of powerplant for installation in aircraft: functional checks on controls and interconnections
- Flow tests of fuel system
- Checks on pyrometry and on fire warning system
- Checks on engine bearers and alignment
- Slinging and installation of powerplant
- Ground running tests after installation

11.3.16 Storage and transit of engines

- Protection against corrosion
- Engine stands, crating, lifting and tie-down points
- Storage bags/covers and use of desiccant
- Preparation of engines for running after long-term storage

11.3.17 Propeller maintenance tasks

- Practice in removal and replacement of propellers on engine propeller shaft
- Dismantling and inspection of typical variable pitch propeller
- Checking of blades and blade root bearings for damage and permissible repairs
- Reassembly, resetting of blade angles, blade torque loadings, static balance of propeller, and inspection

11.4 BASIC WORKSHOP & MAINTENANCE PRACTICES: ENGINE/PROPELLER SYSTEMS/COMPONENTS & FUNCTION TESTING

11.4.1 Components: Ignition

- Dismantling, reassembly and testing of various kinds of magnetos and distributors
- Renewal of cables in an ignition harness
- Continuity and insulation tests
- Cleaning and testing of spark plugs
- Inspection and testing of igniter equipment for turbine engines
- Safety precautions associated with ignition equipment

11.4.2 Components: Fuel and control

- Float and injection carburettors: partial dismantling and inspection; reassembly and flow tests; others
- Propeller control devices, governors and feathering pumps: partial dismantling, reassembly and bench tests
- Fuel pumps, oil pumps, oil coolers, gearboxes, flow, pressure and other tests as specified in manufacturer's manuals
- Gas turbine fuel system components: pumps, pressure and flow control units, metering devices, automatic valves, and burners; partial dismantling to view and understand mechanism; reassembly testing; others

11.5 JOB/TASK DOCUMENTATION AND CONTROL PRACTICES

11.5.1 Heavy maintenance check or overhaul of engine/propeller

- Preparation for Heavy Maintenance Check: documentation (task/job cards), logbooks, defect records, modification instructions; draining oil and other systems; selection and display of equipment; tools required
- Selected major operations (e.g. turbine blade inspection either by dismantling or by optical probe techniques)
- Adherence to the aircraft maintenance manual and to a typical airline check or overhaul schedule for each job
- Conclusion of Heavy Maintenance Check or overhaul: replacement of components, function tests, restoration of internal and external finish, preparation for engine run, and completion of documentation

11.5.2 Engine/propeller repair

- Selection of repair scheme: damage to be studied and related to approved repair scheme as shown on manufacturers' drawings or repair manual
- Selection of material to be checked for compliance with specification
- Embodiment of repairs according to prepared drawings or repair manual
- Testing to destruction of selected repair specimens to demonstrate strength of repair
- Experience in workshop processes as applicable to repair and reconditioning of aircraft parts (e.g. enlargement or reduction of dimensions to accept oversized or under- sized parts; chemical or electrochemical treatments for the protection of metals; metal depositing processes; special methods of heat treatment; special methods of welding; advanced metal processing techniques; surface texture measurement)
- Acceptance tests and final inspection engine run
- Completion of documentation

Chapter 12

PRACTICAL MAINTENANCE SKILLS: AVIONICS — ELECTRICAL, INSTRUMENT, AUTOFLIGHT AND RADIO

12.1 INTRODUCTION

Note.— The basic practical training specified in this section is very similar to that described in Chapter 10 for airframe trainees.

12.2 BASIC WORKSHOP & MAINTENANCE PRACTICES: AVIONICS — ELECTRICAL

12.3.1 Lead acid batteries

- Checking of battery condition, adjustment of specific gravity of electrolyte, battery charging practice; capacity, discharge and insulation tests; others
- Overhaul procedures, including leak test of cells and cell replacement
- Safety precautions

12.3.2 Nickel cadmium batteries

- Checking of battery condition: determining state of charge, cell balancing, charging, etc.
- Checking of electrolyte level and insulation tests
- Safety precautions
- Cell replacement
- Deep cycling of nickel cadmium units

12.3.3 Wire and cable work

- Making up of wire lengths and specimen cable looms: soldering and crimping ends, identification of cables, using routing charts, and fitting plugs and sockets
- Cable tracing practise: continuity and insulation checks on cable runs
- Practice in aircraft wiring as carried out during modification or repair work: full tests of circuit

12.3.4 Bonding, continuity and insulation testing

- Bonding checks: use of bonding tester
- Continuity and insulation tests on aircraft circuit; use of Megger testers
- Millivolt drop checks at cable joints and terminal ends

12.3.5 Generators and electric motors

- Dismantling, examination and reassembly
- Demonstration of generator test

12.3.6 Voltage regulators, cut-outs and relays

- Partial dismantling, followed by examination and reassembly, of carbon pile and other types of voltage regulators
- Dismantling, examination and reassembly of accumulator cut-outs, reverse current relays, solenoids and relays from various circuits, and thermal circuit breakers

12.3.7 Generators and alternators

- Strip inspection: undercutting of commutators, checks for brush wear, brush spring loading and brush bedding
- Testing of generator elements: armature testing, continuity tests on field coils, armature shaft alignment, and wear of ball races and housings
- Reassembly and insulation test of generator
- Testing of generators and alternators on test rig
- Voltage regulators: overhaul procedure, correction of basic setting and adjustments making
- Adjustment and rig testing of cut-outs and relays
- Current balancing adjustments of DC power circuits on simulator of multi-engined aircraft electrical system
- Electromagnetic relays: inspection and polishing of contacts, setting and adjustment, and millivolt drop tests on

test rig

- Constant speed drives (CSD): removal from alternator and testing
- Integrated drive generator (IDG): dismantling, inspection, and overhaul

12.3.8 Electric motors

- Starter motors for piston and turbine aero engines: dismantling, examination for condition and wear, check for brush gear and commutator, check of clutches and geared drives; reassembly and test
- Dismantling, inspection, reassembly and test of motors for fuel line pumps, hydraulics, propeller feathering, and windscreen wipers
- Linear and rotary actuators: dismantling, reassembly, and bench testing

12.3.9 Inverters and converters

- Rotary inverters and converters: dismantling and check for brushes and commutators, cleaning and testing of armature, and reassembly and adjustment
- Testing: checking of input and output voltages; adjustment of frequency control
- Static inverters and converters: inspection, adjustment and testing of output voltage and frequency

12.3.10 Equipment

- Magnetos: overhaul and test procedure for high and low tension systems
- Spark/igniter plug testing, ignition lead testing and inspection, and booster coil testing
- Engine high-energy ignition units: overhaul and test procedure
- Safety precautions

12.3.11 Electrical circuit equipment

- Examination and partial overhaul of a wide range of miscellaneous electrical components such as transducers, magnetic amplifiers, rectifiers, transformers, Wheatstone bridge and other balancing devices, and sensing elements
- Adherence of all testing in accordance with manufacturers' instructions
- Dismantling (as appropriate), examination and reassembly of electrical components, including converters, inverters, switchgear, heating units, and actuators

12.4 BASIC WORKSHOP & MAINTENANCE PRACTICES: AVIONICS — INSTRUMENT

12.4.1 Pressure indication

- Mechanically-operated gauges (e.g. Bourdon tube gauges): partial dismantling, examination, strip inspection, reassembly and calibration with dead weight c tester
- Pressure transducers, electrically-operated transmitters, ratio metres, etc.: strip inspection, reassembly and calibration
- Electrically-operated gauges: strip inspection, reassembly and calibration

12.4.2 Flight instruments

- Calibration checks of flight instruments
- Pitot heads and static vents: maintenance checks
- Altimeters: dismantling, inspection, reassembly and calibration checks
- Air speed indicators (ASI): dismantling, inspection, reassembly and calibration checks
- Machmeters: dismantling, inspection, reassembly and calibration checks
- Rate-of-climb indicators: dismantling, inspection, reassembly and calibration checks

12.4.3 Gyroscopic instruments

- Air-driven gyroscopic instruments: partial dismantling, examination and reassembly
- Electrically-driven gyroscopic instruments: partial dismantling, examination and reassembly
- Artificial horizon: dismantling, inspection and reassembly

- Directional gyro: dismantling, inspection and reassembly
- Turn and bank indicator: dismantling, inspection and reassembly
- Zero reader: dismantling, inspection and reassembly
- Calibration checks on gyroscope test turntable

12.4.4 Engine speed indication (ESI)

- ESI generators (DC and AC types): partial dismantling, inspection and reassembly
- ESI gauges: partial dismantling, inspection and reassembly
- Engine speed synchronizing gear: examination and demonstration of principles
- Generators and gauges: dismantling, inspection, reassembly and calibration checks

12.4.5 Thermometers and temperature indication

- Engine temperature thermocouples: demonstration of cylinder head, jet-pipe temperature and other types
- Radiometer temperature gauges: partial dismantling, examination and reassembly of transmitter and indicator units
- Dismantling, reassembly and testing of temperature, and measuring instruments of various kinds
- Tests on various kinds of temperature sensing units (e.g. fire and overheating detectors, cabin air duct stats, and inching controls for cooler shutters)
- Use of portable test kits for checking gas turbine powerplant thermocouple installations

12.4.6 Fuel contents indication

- Float-operated desynn contents gauges: examination and demonstration of operation dismantling, inspection, reassembly and test
- Capacitance type contents gauges: examination and demonstration of operation reassembly and test
- Flowmeters: dismantling, inspection, reassembly and test

12.4.7 Compass systems

- Magnetic compasses: friction and damping tests, practice compass swing, and compensation
- Remote compass: examination and demonstration
- Tests of compass swinging site
- Swing of compass in available aircraft: compensation practice
- Remote compass: partial dismantling, inspection, reassembly and test

12.4.8 Miscellaneous instruments

- Examination and demonstration of other types of instruments (flowmeters, navigation and landing aid presentations)

12.5 BASIC WORKSHOP & MAINTENANCE PRACTICES: AVIONICS — AUTOFLIGHT

12.5.1 Autopilots

Examination and demonstration of autopilot mock-up and components

12.5.2 Flight control systems

- Autopilots (electrical or electronic): dismantling, examination of components, reassembly, and installation in aircraft or on simulator by following manufacturer's test programme; practise with portable test kit
- Autopilots (pneumatic or hydraulic actuation): dismantling of component parts, reassembly, installation in aircraft or simulator, and function tests
- Examination and testing of elements of flight director systems, automatic flare and automatic landing systems, as required

12.6 BASIC WORKSHOP & MAINTENANCE PRACTICES: AVIONICS — RADIO

12.6.1 Radio workshop: fundamental techniques

- Safety precautions associated with radio equipment hazards: high voltages, radio

frequency (RF) emissions and microwave emissions, electrostatic discharge, etc.

- Wiring and cabling: demonstration and practice in wiring and soldering radio circuits
- Multimeters, Megger and bonding testers: demonstrations and practice
- Identification and inspection of antenna: external wire aerials, blade, rod and rail aerials, D/F loops, and suppressed aerials; viewing on aircraft, and inspection for physical condition
- Aerial masts, static dischargers, etc.: inspection and servicing
- Chassis: sheet metalwork using drawings
- Simple receiver assembly kit: study of circuit, demonstration of assembly, operation and testing
- Measurements and experiments with circuit demonstration units simulating the following system elements:
  - TRF receiver
  - intermediate frequency amplifier
  - frequency converter
  - superheterodyne alignment
  - buffer-doubler amplifier
  - RF amplifier
  - modulation
  - transmission lines
  - reactance tube modulators
  - interference (filtering and shielding)
- Troubleshooting practice

12.6.2 Demonstration of test procedures on airborne equipment

- Identification: identity and location of principal types of airborne communication and navigation equipment: racking systems, power supplies, antennae and other interconnections
- Demonstrations of bench tests on sample equipment, including use of screened rooms

12.6.3 Wiring, cabling and soldering techniques

- Wiring: practice in stripping insulation; splicing; wiring to lugs; terminals and tube sockets; and dismantling, soldering and reassembly of connectors
- Cables: lacing of wires to form a cable, termination and soldering of cable ends, and serving of coaxial cables
- Soldering: practice with different sizes of soldering irons, different grades of solder, fluxes and types of connectors
- Micro-miniature precision soldering techniques
- Handling of electrostatic sensitive devices

12.6.4 Instrumentation

- Multimeter: practice in measuring and calculating series and parallel resistance; voltage and current measurements on various circuits; others
- Megger: continuity and insulation tests on aircraft cable assemblies structure; practice with circuit boards; others
- Simple valve voltmeter
- Frequency metres, absorption and heterodyne: practice in frequency measurement
- "Q" metres: practice in measuring L, R, C and Q
- Signal generators: demonstration of cathode ray oscilloscope; demonstration of use to examine wave- forms, wave envelopes, and DC measurements

12.6.5 Antennae

- External wire aerials: splicing, tensioning and making connections
- Static dischargers: inspection, servicing and renewal procedures
- Fibreglass and resin laminate aerial masts: maintenance and repair
- External blade, rod and rail aerials: removal, maintenance and repair, and replacement
- Suppressed aerials: care and maintenance, maintenance and repair of

dielectric covers

- DF loops: inspection, routine maintenance, ground calibration, and preparation of correction chart
- Reflectors and directors: care and maintenance

12.7 REPAIR, MAINTENANCE & FUNCTION TESTING OF AIRCRAFT SYSTEMS/COMPONENT: AVIONICS

12.7.1 Airborne and test equipment practice

- Use of representative airborne radio and radar equipment and practice in servicing, installation and overhaul according to procedures laid down in the manufacturers' approved manuals
- Removal and replacement of equipment from aircraft racks, checks on power supplies, and remote controls
- Routine maintenance inspections of equipment in situ
- Operational checks
- Bench tests, measurement of performance characteristics, tuning, adjusting, fault finding, aligning and repairing
- Understanding and use of remote specialist communications, navigation and radio test equipment for both ramp and workshop
- Understanding and use of system built-in test equipment (BITE), including comprehension of output data
- Power supplies, installation and wiring, signal tracing, and use of cathode ray oscilloscope (CRO)
- Audio amplifier, installation and wiring, fault tracing and rectification