

**YANGON UNIVERSITY OF ECONOMICS  
MASTER OF PUBLIC ADMINISTRATION PROGRAMME**

**A STUDY ON AIRWORTHINESS REQUIREMENTS OF  
MYANMAR AVIATION INDUSTRIES**

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**MASTER OF PUBLIC ADMINISTRATION PROGRAMME**

**A STUDY ON AIRWORTHINESS REQUIREMENTS OF**  
**MYANMAR AVIATION INDUSTRIES**

A thesis submitted in partial fulfillment towards the requirements for the degree of  
Master of Public Administration (MPA)

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## ABSTRACT

This study examines how well Approved Maintenance Organizations of the airlines prepared airworthiness in Myanmar aviation industries. In particular, the study examined the development of airworthiness requirement in aviation industries and evaluated whether airlines meet the level of compliance with airworthiness by using simple random sampling method. As the findings of the study, the fact that employees are graduated people is the sign of development in aviation industry. Another fact of development concerning with airworthiness is that majority of respondents had the update and recurrent training plan. The respondents mostly used email in communicating between departments. Most of the respondents experienced un-airworthy situations. The most probable un-airworthy situations are caused by human. The lack of care in employees' working place can be seen in the environmental factors respondents feel. In the aspect of evaluating whether airlines meet the level of compliance with airworthiness, the findings showed that most respondents' organizations had some audit team and fair plans in their organization for compliance with Myanmar Civil Aviation Requirements (MCA). It was also found that most of the audits had been made by giving notices. Getting information concerning with airworthiness procedure requirements from Myanmar Department of Civil Aviation (DCA) was the proof of the fact that airlines meet the airworthiness requirements. Concerning with giving specific training, majority of respondents responded that they have complete training and human factor trainings were given enough. The findings of the study clearly depict the current airworthiness preparedness of the airlines and could contribute to the enhancement of existing training programs approved by Europe Aviation Safety Agency (EASA). Moreover, a better integrated communication system involving all organizations operating at the airlines is in a wanting situation to sustain airworthiness more effectively. It is evident that airlines AMOs are doing all that is necessary to meet the acceptable international standards. However, at present although there is a training center but it cannot run fully to meet all functions of airworthiness training.

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# TABLE OF CONTENTS

	<b>Page</b>
<b>ABSTRACT</b>	<b>i</b>
<b>ACKNOWLEDGEMENTS</b>	<b>ii</b>
<b>TABLE OF CONTENTS</b>	<b>iii</b>
<b>LIST OF TABLES</b>	<b>v</b>
<b>LIST OF FIGURES</b>	<b>vi</b>
<b>LIST OF ABBREVIATIONS</b>	<b>vii</b>
<b>CHAPTER 1 INTRODUCTION</b>	<b>1</b>
1.1 Rationale for the Study	1
1.2 Objectives of the Study	2
1.3 Method of Study	2
1.4 Scope and Limitations of the Study	3
1.5 Organization of the Study	4
<b>CHAPTER 2 LITERATURE REVIEW</b>	<b>5</b>
2.1 Overview of Airworthiness	5
2.2 International Organizations for Aircraft Regulations	7
2.3 Continuing Airworthiness	18
2.4 Airline Safety Reliance	19
2.5 Worldwide Accident Summary	20
2.6 Conceptual Framework	22
2.7 Review on Previous Studies	23
<b>CHAPTER 3 AIRWORTHINESS REQUIREMENTS OF MYANMAR AVIATION INDUSTRIES</b>	<b>25</b>
3.1 Myanmar DCA	25
3.2 Airlines in Myanmar	36
3.3 Aircraft Related Occurrences, Accidents and Incidents in Myanmar	39

	3.4	Approved Maintenance Organization (AMO) Structure and Airworthiness Function of Myanmar Airlines	40
	3.5	Airworthiness Preparedness in Myanmar (Maintenance)	42
	3.6	The Evaluation of AMO for Airworthiness	42
<b>CHAPTER 4</b>		<b>SURVEY ANALYSIS</b>	<b>45</b>
	4.1	Survey Profile and Design	45
	4.2	Survey Data Interpretation and Discussion	45
<b>CHAPTER 5</b>		<b>CONCLUSION</b>	<b>60</b>
	5.1	Findings	60
	5.2	Recommendations	63
		<b>REFERENCES</b>	<b>64</b>
		<b>APPENDICES</b>	<b>68</b>

## LIST OF TABLES

<b>Table No</b>	<b>Title</b>	<b>Page</b>
Table 2.1	The current list of ICAO Annexes	9
Table 2.2	Worldwide accident summary by injury and damage	20
Table 3.1	The organization chart of the Myanmar DCA	28
Table 3.2	Airline in Myanmar	37
Table 3.3	Number of occurrence, incident and serious incident (2010-2018)	38
Table 3.4	Aircraft Accidents in Myanmar	39
Table 3.5	Bird-aircraft strike in Myanmar, 2010-2018	40
Table 4.1	Demographic Profile of Employee in AMOs	46
Table 4.2	Airworthiness Requirement Knowledge and Information	48
Table 4.3	The role of respondents' department in forming airworthiness of aircrafts	51
Table 4.4	Level of compliance with airworthiness requirement	52
Table 4.5	Frequency of training plan for regulation (airworthiness)	52
Table 4.6	Communication ways of organization to employee	53
Table 4.7	Ways of auditing	53
Table 4.8	Types of training employees receive	54
Table 4.9	Level of airworthiness requirement	54
Table 4.10	Functions performed for compliance with airworthiness regulation	55
Table 4.11	The most probable un-airworthy situations in respondents' organization	56
Table 4.12	The rate of airworthiness standard	56
Table 4.13	Handling aircraft emergency of respondents' organization	56
Table 4.14	The use of approaches to investigate human error in respondents' organization	57
Table 4.15	The environmental factors that respondents feel affected their job performance	57
Table 4.16	The options of respondents' AMO airworthiness requirement	59

## LIST OF FIGURES

<b>Figure No</b>	<b>Title</b>	<b>Page</b>
Figure 2.1	Flight safety represented as three links in a chain	6
Figure 2.2	Regulations Structure of EASA (EASA, 2010)	16
Figure 2.3	Main Players in Continued Airworthiness	19
Figure 2.4	10-year Accident rates by Type of Operation Fatal and Hull Loss Accidents Worldwide Commercial Jet Fleet 2008 through 2017	21
Figure 2.5	Conceptual Framework of Airworthiness	23
Figure 3.1	Organization Chart of Airworthiness Division	30
Figure 3.2	Legislation & Regulations Framework in Myanmar	31
Figure 3.3	Level of Effective Implementation of ICAO audit areas by Myanmar	42

## LIST OF ABBREVIATIONS

AD	Accidental Damage
AD's	Airworthiness Directives
AED	Aircraft Engineering Division
AFI	After Flight Inspection
AID	Aircraft Inspection Division
AMOs	Approved Maintenance Organizations
AMTO	Approval for Maintenance Training Organization
AN(OT)O	Air Navigation (Overseas Territories) Order
ARC	Airworthiness Review Certificate
AWD	Airworthiness Division
BFI	Before Flight Inspection
BOAC	British Overseas Airways Corporation
CAA	Civil Aviation Authority
CofA	Certificate of Airworthiness
CDCCL	Critical Design Configuration Control Limitations
CMR	Certificate of Maintenance Review
CMR's	Certification Maintenance Requirements
DI	Daily Inspection
EASA	European Aviation Safety Agency (EASA),
ECOSOC	Economic and Social Council
ED	Environmental Damage
FAA	Federal Aviation Agency
GMs	Guidance Materials
IAL	International Aeradio Limited

ICAO	International Civil Aviation Organization
JAA	Joint Aviation Authorities
JARs	Joint Aviation Requirements
LLP	Life Limited Parts
MAI	Myanmar Airways International
MAIB	Myanmar Accident Investigation Bureau
MCAR	Myanmar Civil Aviation Requirement
MDCA	Myanmar Department of Civil Aviation
MNA	Myanmar National Airlines
MOE	Maintenance Organization Exposition
MOT	Ministry of Transportation
OC	On Conditioning
OTARS	Overseas Territories Aviation Requirements
PICAO	Provisional International Civil Aviation Organization
TC	Type Certificate
USOAP	ICAO's Universal Safety Oversight Audit Programme
YIA	Yangon International Airway

# CHAPTER 1

## INTRODUCTION

### 1.1 Rationale for the Study

As the global economy is becoming more and more connected, the aviation industry is one of the fastest transportation sectors. Air transportation also plays an important role for tourism, contributing to economic growth, especially in developing countries. Air transport also provides entrance to international markets and assists in the progress of world trade. Contrary to road or rail transportation, the aviation industry has to pay most of its own infrastructure and maintenance such as aircraft, runways, terminals.

Aviation industry is complex but safety is first priority. Although the air transportation system cannot be completely free of hazards and associated risks, its goal is to reduce aircraft accidents or incidents at a minimum rate. Since there is no guarantee that human-built systems will be completely free from operational errors and their consequences, safety has to become paramount in the aviation industry.

“Business first, safety always” is a how to go about business in aviation industry in the 21st century through safety management systems. It cannot be doubtful that the main purpose for a commercial airline operation is to make money. Thus safety comes along in the process. It is always spoken that safety is the first. The safety level of an aircraft relies in their intrinsic characteristics the maintenance technicians and operating personnel. In order to guarantee equivalent levels of safety of the aircraft, it will be necessary to provide internationally accepted standard and recommended practices to access the safety of its vehicle and its operation. It will be important to enforce the qualifications for the maintenance and operating personal through a proper operation and maintenance, it can be said that it is vital to keep intrinsic airworthiness continuously. Every country in which air transportation is the safest mode emphasizes to fulfill airworthiness requirements. Therefore, this title was chosen to study how airlines meet the level of compliance with airworthiness and the development of airworthiness requirements in Myanmar aviation industries.

As aeronautical technology becomes high, complex aircrafts have been manufactured in these days. This is how airworthiness regulations have been always changed. Equally important for the study was how well MDCA was meeting international airworthiness standards based on the level of enforcement of the standards at the airlines.

The study of airworthiness at Myanmar Department of Civil Aviation (MDCA) is of great important not only to those working in the field of airworthiness, but also to the people worked at the airlines. This study determined the strengths and weaknesses of the current airworthiness regulation capabilities of MDCA and explored the opportunities for improving the effectiveness of standard Airworthiness organization in this area. Research of this nature will contribute to the field of airworthiness management at all levels of government, but in particular value to the executive level and airworthiness instructors by providing an independent and impartial analysis of the current capabilities level of approved maintenance organization(AMO) at local airlines as well as recommended enhancements.

The anticipated outcome of this endeavor is the development of a more proactive and consistent approach to airworthiness within MDCA that can be emulated by next generation from the airworthiness field. By conducting this study deep, understanding of the preparedness capacity will be realized and the study may be used to enhance or to advance the existing framework strategies at MDCA and if such strategies are applied the potential effects of airworthiness will be maximized. Since the airworthiness management policies and framework are still at the infant stages in Myanmar, it is expected that this study will contribute to the aviation technological academia in the country, especially in airlines related to incidents and accidents, further contributing to the airworthiness information databases for further references and studies.

## **1.2 Objectives of the Study**

The objectives of the study are:

1. To examine the development of airworthiness requirement of Myanmar Aviation industries.
2. To evaluate whether airlines meet the level of compliance with airworthiness.

## **1.3 Method of Study**

The descriptive method is used based on quantitative and qualitative data using questionnaires. In order to precisely understand the question to airworthiness at Myanmar

Aviation Industries with regard to engineer and maintenance personnel in airlines, it is necessary to use quantitative data of social investigation. The quantitative data was used for three AMO of Myanmar airlines (domestic, international and both) to fill the questionnaires. One representative from one of the AMOs was interviewed in this study by using simple random sampling method. The secondary data were collected from related airworthiness reports, accidents and incidents reports, documents, articles, papers and websites, etc.

#### **1.4 Scope and Limitations of the Study**

The study of airworthiness is a large extent and is mainly concerned with two parts to comply with its requirements: aircraft operations (pilot) and aircraft maintenance (engineers). But, this study is focused on airworthiness regulation MDCA and how compliance can be effective to Myanmar Airlines excluding operating personnel and organization, emphasize to maintenance organization, included such as maintenance person, tools, accommodation, documentation, tech recording system, etc. After getting approval by officer in charge of DCA, Ministry of Transportation, the survey was conducted for two or weeks. The size of the sample selected for this study was 120 due to time and resource constraints of the researcher.

A sample frame is a list of all departments of AMOs operating at airworthiness directly involved in airline operation such as:

1. Quality Assurance Department
2. Line Maintenance Department
3. Engineering Services Department
4. Materials and Logistics Department

From the AMO of airline operators, respondents were chosen from Myanmar Airways International (only International Airline), Myanmar National Airlines (Domestic and International Airline), Air KBZ (only Domestic Airline).

## **1.5 Organization of the Study**

This thesis is organized into five chapters. Chapter one is Introduction, Chapter two is Literature Review including significant Airworthiness, International Civil Aviation Organization (ICAO), Aircraft regulations of European Aviation Safety Agency (EASA), Continuing Airworthiness, Airline safety reliance, worldwide accident summary. Chapter three covers a study on airworthiness requirements of Myanmar Aviation industries. Chapter three also pointed out on the theory. Chapter Four analyzes into the data analysis and discussion. The analyzed data is presented in charts, bar graphs, tables in frequencies and percentages where applicable. Collected data is analyzed and discussion on the results initiated. Chapter five is the Conclusion of the present findings and recommendations.

## **CHAPTER 2**

### **LITERATURE REVIEW**

This chapter presents a review of literature on airworthiness. It examines the various issues raised by the existing literature on airworthiness and airworthiness regulation of ICAO as a theoretical framework for the study.

#### **2.1 Overview of Airworthiness**

Airworthiness is the measure of an aircraft's suitability for safe flight. Certification of airworthiness is conferred by a certificate of airworthiness from the state of aircraft registry national aviation authority, and is maintained by performing the required maintenance actions.

Airworthiness has a number of aspects which relate to the legal and physical state of an aircraft. According to the FAA (1998), the term Airworthy “is when an aircraft or one of its component parts meets its type design and is in a condition for safe operation.”

A definition used by the UK MOD includes a wider definition, which includes people on the ground (third parties) – “Airworthiness is the ability of an aircraft or other airborne equipment or system to be operated in flight and on the ground without significant hazard to aircrew, ground crew, passengers or to third parties; it is a technical attribute of materiel throughout its lifecycle.” (Ref: MAA 02 Glossary)

Webster's Dictionary gives a far simpler definition of airworthiness as “*Fitness to fly*” but raises the question of what fitness actually means.

Filippo De Florio (2006) stated that, there are three main conventional flight safety factors: man, the environment, and the machine. These factors act in series, not in parallel, just like three links of chain representing flight safety, which is illustrated in Figure 2.1.

**Figure 2.1 Flight safety represented as three links in a chain**



Source: (Filippo De Florio, 2006)

From the above definitions, airworthiness is a baseline, in other words, a series of minimum requirements for an aircraft's manufacturer and operator to meet.

Additionally, an aircraft must be operated within the limits laid down in the Flight Manual; an aircraft which exceeds any limit may compromise its airworthiness. In service, an aircraft must also be maintained according to its Approved Maintenance Schedule for it to remain airworthy; through-life maintenance would be included in the term Continuously Airworthiness.

The connection between airworthiness and flight safety is an obvious but complex one. The design activity, besides meeting the applicable certification code, often seeks to improve the aircraft's economics and cost benefit to both the manufacturer and the operator. Certification authorities will therefore examine all aspects of the design and construction of an aircraft, even when there is apparent improvement to minimum standards. When an aircraft type is first judged to meet all the certification requirements it will be issued with a Type Certificate (TC). Deficiencies in airworthiness may be indicated following an in-service incident or accident. These may relate to unknown failures, errors or limitations of the Type design and/or failure to meet the conditions for safe operation.

The first defense is the process of aircraft type certification, leading to the issue of the Type Certificate. This work is documented so that it remains an accessible foundation for the continuing airworthiness of the aircraft type thereafter. Wherever practicable, the original design will embody redundancy features; i.e. an allowance for

the failure of a system or component without any reduction in airworthiness. In some cases, the failure only becomes observable after an aircraft has landed, and requires rectification before further flight.

In more extreme cases a major failure, such as an in-flight failure of an engine on a multi-engine aircraft, should not lead to an accident - the design combined with the training of the crew should allow safe continuation of the flight. The same criteria apply to flight in adverse weather and when affected by human factors in either operations or maintenance.

High standards of flight crew training, proficiency and crew resource management can also serve to minimize the incorrect management by flight-crew of the onset of any in-flight reduction in airworthiness. A full understanding of the human factors issues involved in engineering and maintenance is therefore valuable.

The effective management of continuing airworthiness is an excellent defense. Defined as “all of the processes ensuring that, at any time in its operating life, the aircraft complies with the airworthiness requirements in force and is in a condition for safe operation” [EC, 2014]. As part of continuing airworthiness management, each aircraft must hold a Certificate of Airworthiness (C of A) to prove that it conforms to the certificated Type Design and is in a condition for safe operation. In Myanmar, likewise in EU all aircraft must also be subject to a regular audit which leads to an airworthiness review certificate (ARC).

The regulator will require that the operator has in place a system to ensure compliance with the activities below. Some airworthiness authorities cover the following items with the term Certificate of Maintenance Review (CMR)-

1. Compliance with the maintenance program.
2. Embodiment of Mandatory Modifications and Inspections.
3. Rectification of reported defects and investigation of adverse reliability matters.

## **2.2 International Organizations for Aircraft Regulations**

International Civil Aviation Organization (ICAO) is the regulatory body which laid down the international regulations for aviation industries in the world and European Aviation Safety Agency (EASA) is also the regulatory body which laid

down the regulations for European aviation industries based on ICAO. The following described are the essential airworthiness requirements laid down by ICAO and EASA.

### **2.2.1 International Civil Aviation Organization (ICAO)**

Aviation is a global activity and it is therefore necessary to have a set of rules and procedures which are common across this international industry to ensure the safe and expeditious operation of aircraft.

This was recognized by the Chicago Convention on Civil Aviation which established the concept of an International Civil Aviation Organization(ICAO)which would be required to develop a framework within which international air transport could grow safely and effectively. The Convention was signed on 7 December 1944 by 52 States. Pending ratification of the Convention by 26 States, the Provisional International Civil Aviation Organization (PICAO) was established. It functioned from 6 June 1945 until 4 April 1947. By 5 March 1947 the 26th ratification was received. ICAO came into being on 4 April 1947, in October of the same year, ICAO Council (ECOSOC). As of November 2017, there are 192 ICAO members, consisting of 191 of the 193 UN members but Dominica, Liechtenstein country are not member state of ICAO.

To achieve this, ICAO, in consultation with its member states, has produced a number of Annexes to the Convention. Each Annex is dedicated to a specific aspect of the aviation industry and together they provide an integrated set of regulations designed to safeguard the essential elements that support the global aviation industry. The conventions on International Civil Aviation Organization are;

1. Original version. Signed at Chicago on 7 December 1944
2. First edition. Signed at Chicago on 7 December 1944. (Doc 7300)
- 3 Certificate of Authenticity. 13 April 1948
- 4 Amendments. 12 December 1956
- 5 Second edition, 1959. (Doc 7300/2)
- 6 Addendum No. 1. 15 September 1961. (Doc 7300/2 Addendum No. 1)
- 7 Third edition, 1963. (Doc 7300/3)
- 8 Fourth edition, 1969. (Doc 7300/4)
- 9 Fifth edition, 1975. (Doc 7300/5)
- 10 Sixth edition, 1980. (Doc 7300/6)

- 11 Seventh edition, 1997. (Doc 7300/7)
- 12 Eighth edition, 2000. (Doc 7300/8)
- 13 Ninth edition, 2006. (Doc 7300/9)
- 14 Corrigendum. 26 November 2007
- 15 Corrigendum No. 2. 3 December 2010

Each Annex identifies a minimum set of requirements known as standards which are mandatory upon member states and recommended practices which optional measures intended to enhance the level of safety provided by the standards. Collectively they are known as ICAO's Standards and Recommended Practices or SARPs. The Myanmar is a signatory to the Chicago Convention and is therefore bound by the ICAO Standards.

In addition to the ICAO Annexes, the Overseas Territories are also subject to the requirements of the Air Navigation (Overseas Territories) Order [AN(OT)O] and through it, the Overseas Territories Aviation Requirements (OTARS) which are the vehicles for the application of the ICAO Annexes within the Cayman Islands Legal System. In some cases, the OTARS amplify or enhance the requirements of the Annexes and they should be read in conjunction with the relevant Annex.

The following table is the current list of ICAO Annexes.

**Table 2.1 The current list of ICAO Annexes**

<b>ICAO Annexes</b>	<b>Name</b>
Annex 1	Personnel Licensing
Annex 2	Rules of the Air
Annex 3	Meteorological Services
Annex 4	Aeronautical Charts
Annex 5	Units of Measurement
Annex 6	Operation of Aircraft
Annex 7	Aircraft Nationality and Registration Marks
Annex 8	Airworthiness of Aircraft
Annex 9	Facilitation
Annex 10	Aeronautical Telecommunications
Annex 11	Air Traffic Services
Annex 12	Search and Rescue
Annex 13	Aircraft Accident and Incident Investigation
Annex 14	Aerodromes
Annex 15	Aeronautical Information Services
Annex 16	Environmental Protection
Annex 17	Security
Annex 18	The Safe Transportation of Dangerous Goods by Air
Annex 19	Safety management

Annexes (Annex 1 and Annex 8) which are directly concerned with airworthiness in this study are described in the following orders.

**(a) Annex 1 - Personnel Licensing**

As long as air travel cannot do without pilots and other air and ground personnel, their competence, skills and training will remain the essential guarantee for efficient and safe operations. Adequate personnel training and licensing also instill confidence between States, leading to international recognition and acceptance of personnel qualifications and licenses and greater trust in aviation on the part of the traveller.

Standards and Recommended Practices for the licensing of flight crew members (pilots, flight engineers and flight navigators), air traffic controllers, aeronautical station operators, maintenance technicians and flight dispatchers, are provided by Annex 1 to the Convention on International Civil Aviation. Related training manuals provide guidance to States for the scope and depth of training curricula which will ensure that the confidence in safe air navigation, as intended by the Convention and Annex 1, is maintained. These training manuals also provide guidance for the training of other aviation personnel such as aerodrome emergency crews, flight operations officers, radio operators and individuals involved in other related disciplines.

Today's aircraft operations are so diverse and complex that protection must be provided against the possibility, however remote, of total system breakdown due to either human error or failure of a system component.

The human being is the vital link in the chain of aircraft operations but is also by nature the most flexible and variable. Proper training is necessary so as to minimize human error and provide able, skillful, proficient and competent personnel. Annex 1 and ICAO training manuals describe the skills necessary to build proficiency at various jobs, thereby contributing to occupational competency. The medical standards of the Annex, in requiring periodic health examinations, serve as an early warning for possible incapacitating medical conditions and contribute to the general health of flight crews and controllers.

The Human Factors program addresses known human capabilities and limitations, providing States with basic information on this vital subject as well as the material necessary to design proper training programs. ICAO's objective is to improve

safety in aviation by making States more aware of, and responsive to, the importance of human factors in civil aviation operations.

Licensing is the act of authorizing defined activities which should otherwise be prohibited due to the potentially serious results of such activities being performed improperly. An applicant for a license must meet certain stated requirements proportional to the complexities of the task to be performed. The licensing examination serves as a regular test of physical fitness and performance ensuring independent control. As such, training and licensing together are critical for the achievement of overall competency.

One of ICAO's main tasks in the field of personnel licensing is to foster the resolution of differences in licensing requirements and to ensure that international licensing standards are kept in line with current practices and probable future developments. This is ever more crucial as the flight crew will be exposed to increasing traffic density and airspace congestion, highly complicated terminal area patterns and more sophisticated equipment. To accomplish this task, Annex I is regularly amended to reflect the rapidly changing environment.

International SARPs are established for licensing the following personnel:

1. Pilot
2. Flight Navigator
3. Flight Engineer
4. Aircraft Maintenance Engineer / Technician / Mechanic
5. Air traffic controller
6. Flight Operations Officer / Flight Dispatcher
7. Aeronautical Station Operator

Some States have decided to require licensing for other categories of personnel in their national regulatory scheme, such as Air Traffic Flow Managers, Flight Information Service Officers, Cabin Crew, etc.

In the majority of cases the right to exercise the privileges given by the license requires that the license holder meets certain appropriate medical requirements which are specified as three classes of medical assessment. The period of validity of the medical assessment may differ for the different license types and is likely to differ according to the age of the holder as well.

Any State, having issued a license, must ensure that the privileges granted by it, or by attached ratings, are not exercised unless the holder maintains competency

and meets the requirements for recent experience established by that State. To renew a license, the holder must have exercised the privileges to specified minima during the period prior to intend renewal and/or pass appropriate proficiency examinations conducted by or under the authority of the license issuing authority.

**(b) Annex 8 – Airworthiness of Aircraft**

In the interest of safety, an aircraft must be designed, constructed and operated in compliance with the appropriate airworthiness requirements of the State of Registry of the aircraft. Consequently, the aircraft is issued with a Certificate of Airworthiness declaring that the aircraft is fit to fly.

To facilitate the import and export of aircraft, as well as the exchange of aircraft for lease, charter or interchange, and to facilitate operations of aircraft in international air navigation, Article 33 of the Convention on International Civil Aviation places the burden on the State of Registry to recognize and render valid an airworthiness certificate issued by another Contracting State, subject to the condition that the airworthiness requirements under which such a certificate is issued or rendered valid are equal to or above the minimum standards which may be established by ICAO from time to time pursuant to the Convention. These minimum standards are contained in Annex 8, the first edition of which was adopted by the Council on 1 March 1949.

Annex 8 includes broad standards which define, for application by the national airworthiness authorities, the minimum basis for the recognition by States of Certificates of Airworthiness for the purpose of flight of aircraft of other States into and over their territories, thereby achieving, among other things, protection of other aircraft, third- parties and property. It is recognized that ICAO Standards would not replace national regulations and that national codes of airworthiness containing the full scope and extent of detail considered necessary by individual States would be required as the basis for the certification of individual aircraft. Each State is free to develop its own comprehensive and detailed code of airworthiness or to select, adopt or accept a comprehensive and detailed code established by another Contracting State. The level of airworthiness required to be maintained by a national code is indicated by the broad standards of Annex 8 supplemented, where necessary, by guidance material provided in ICAO's Airworthiness Technical Manual (Doc 9760).

Annex 8 is divided into four parts. Part I includes definitions; Part II deals with procedures for certification and continuing airworthiness of aircraft; Part III includes technical requirements for the certification of new large aeroplane designs; Part IV deals with helicopters.

One of the supporting clauses in the definitions used in the Annex defines the environment in which an aircraft is expected to perform as "anticipated operating conditions". These are conditions which are known from experience or which can be reasonably envisaged to occur during the operational life of the aircraft, taking into account the operations for which the aircraft is made eligible. They also include conditions relative to the weather, terrain surrounding the aerodromes from which the aircraft is expected to operate, functioning of the aircraft, efficiency of personnel and other factors affecting safety in flight. Anticipated operating conditions do not include those extremes which can be effectively avoided by operating procedures and those extremes which occur so infrequently that higher levels of airworthiness to meet them would render aircraft operations impracticable.

Under the provisions related to continuing airworthiness of aircraft, the State of Registry must inform the State of Design when it first enters in its register an aircraft of the type certified by the latter. This is to enable the State of Design to transmit to the State of Registry any generally applicable information it has found necessary for the continuing airworthiness and for the safe operation of the aircraft. The State of Registry must also transmit to the State of Design all continuing airworthiness information originated by it for transmission, as necessary, to other Contracting States known to have on their registers the same type of aircraft.

To assist States in establishing contact with appropriate national airworthiness authorities, necessary information has been provided in an ICAO circular (Circ 95) which is available on the ICAO-Net.

The technical standards dealing with certification of aeroplanes are limited at present to multi-engine aeroplanes of over 5700 kg maximum certificated takeoff mass. These standards include requirements related to performance, flying qualities, structural design and construction, engine and propeller design and installation, systems and equipment design and installation, and operating. Limitations including procedures and general information to be provided in the aeroplane flight manual, crashworthiness of aircraft and cabin safety, operating environment and human factors and security in aircraft design.

The performance standards require that the aeroplane shall be capable of accomplishing the minimum performance specified in the Annex at all phases of flight, in the event that the critical power-unit has failed and the remaining power-units are operated within their take-off power limitations, be capable of safely continuing or abandoning its take-off. After the initial take-off phase, the aeroplane must be capable of continuing climb up to a height at which the aeroplane can continue safe flight and landing, while the remaining power-units are operating within their continuous power limitations.

The aeroplane must be controllable and stable under all anticipated operating conditions without exceptional skill, alertness or strength on the part of the pilot, even in the event of failure of any power-unit. Furthermore, the stall characteristics of the aeroplane must be such as to give the pilot clear warning, and it should be possible for the pilot to maintain full control of the aeroplane without altering engine power.

Requirements for detailed design and construction provide for a reasonable assurance that all aeroplane parts will function reliably and effectively. Functioning of all moving parts essential to safe operation must be demonstrated by suitable tests, and all materials used must conform to approved specifications. Methods of fabrication and assembly must produce a consistently sound structure which must be protected against deterioration or loss of strength due to weathering, corrosion, abrasion or other causes, which could pass unnoticed. Means must be provided which will automatically prevent emergencies or enable the crew to deal with them effectively, and design should minimize the possibility of in-flight fires, cabin depressurization and toxic gases in the aeroplane and the aircraft against lightning and static electricity.

Special consideration is given to requirements dealing with design features which affect the ability of the flight crew to maintain controlled flight. The layout of the flight crew compartment must be such as to minimize the possibility of incorrect operation of controls due to confusion, fatigue or interference. It should allow a sufficiently clear, extensive and undistorted field of vision for the safe operation of the aeroplane.

Aeroplane design features also provide for the safety, health and well being of occupants by providing an adequate cabin environment during the anticipated flight and ground and water operating conditions, the means for rapid and safe evacuation in emergency landings and the equipment necessary for the survival of the occupants

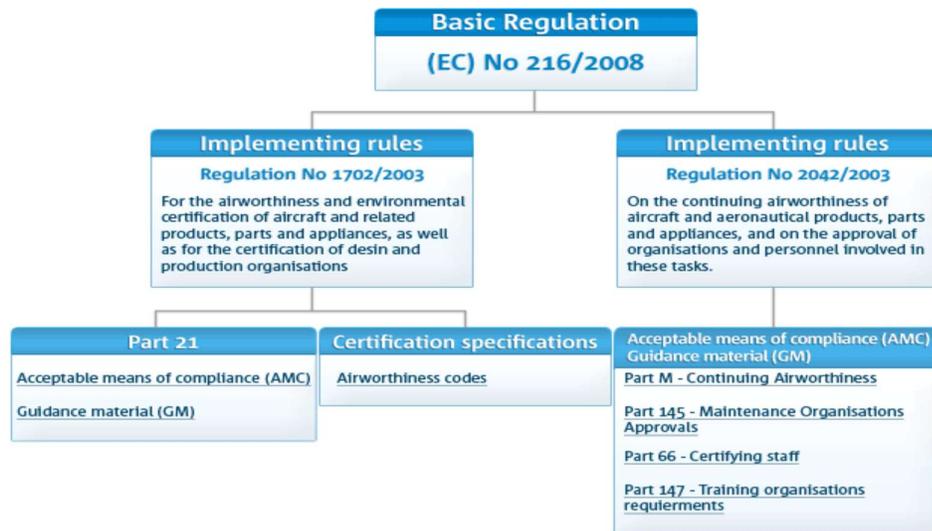
following an emergency landing in the expected external environment for a reasonable time-span.

Requirements for the certification of engines and accessories are designed to ensure that they function reliably under the anticipated operating conditions. An engine of the type must be tested to establish its power or thrust from characteristics, to ensure that operating parameters are satisfactory and to demonstrate adequate margins of freedom from detonation, surge or other detrimental conditions. Tests must be of sufficient duration and must be conducted at such power and other operating conditions as are necessary to demonstrate the reliability and durability of the engine.

### **2.2.2 Aircraft Regulations of European Aviation Safety Agency(EASA)**

When talking about the European Aviation Safety Agency (EASA), the Joint Aviation Authorities (JAA) has to be mentioned. Before EASA, the competent authority was JAA, which established and implemented the Joint Aviation Requirements (JARs), and enabled the collaboration among member states, as well as external authorities. (EASA, available at: <http://easa.europa.eu/home.php>). However, JAR was not able to perform legally to every member states within JAR. Member states needed to develop their own aviation regulation systems, which delayed the integrity of European Union in a certain level. In that condition, EASA was organized as an independent European legal body, which administrates and issues requirements in a legal level. EASA takes responsibility for drafting new legislation, implementing safety rules, issuing approvals for products and organizations, and authorizing non-EU operators. EASA's regulation structure could be clearly illustrated in the figure below.

**Figure 2.2 Regulations Structure of EASA (EASA, 2010)**



Source: European Aviation Safety Agency (EASA, 2010)

The Basic Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 Feb 2008 states common rules in the field of civil aviation and establishes the EASA. It is applied to design, production, maintenance and operation of aeronautical products, parts, appliance, and personnel and organizations involved in these procedures as well. And the principal objective is to establish a high uniform level of civil aviation safety in Europe. (The European Parliament and the Council, 2008)

The EASA airworthiness codes, which are Certification Specifications, derived from and have replaced JARs step by step since the establishment of EASA. The CS codes are compulsorily prescribed and implemented by the authority. The technical requirements defined in CS codes are mostly impact on aeronautical products' design and manufacture phase, which is considered as initial airworthiness stage.

The CS-25, Certification Specification for Large Aeroplanes, altogether with its AMCs and GMs (which will be introduced later on) have been taken into the author's study. The particular clauses will be list later in this chapter. The Regulation (EC) No 2042/2003 is the Implementing Rule on the Continuing Airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organizations and personnel involved in these tasks. It establishes common technical

requirements and administrative procedures for the Continuing Airworthiness of aeronautical products. Annex I, Part-M, Continuing Airworthiness management and Annex II, Part-145, Maintenance Organization Approval, is both closely related to the author's work. The Annex III, Part-66, Certifying staff and Annex IV, Part-147, Training organizations requirements are both involved in the study as well.

**(a) Part M – Continuing Airworthiness**

Part-145 is the Annex II of Regulation (EC) No 2042/2003. It presents the requirements for the maintenance organizations to get qualified as approved maintenance organizations from the Continuing Airworthiness point of view, and activities and procedures the competent authorities would take to have a maintenance organization under certification due to different conditions.

Part-145 regulates applicant organizations from aspects of, such as, personnel, facilities, system (including data transfer and occurrence reporting, etc.), quality, etc. Likewise, ACMs and GMs to Part-145 are important supplement and directive material during the process of study.

**(b) Part-145 Maintenance Organization Approval**

Part-145 is Annex II of Regulation (EC) No 2042/2003. It presents the requirements for the maintenance organizations to get qualified as approved maintenance organizations from the Continuing Airworthiness point of view, and activities and procedures the competent authorities would take to have a maintenance organization under certification due to different conditions. Part-145 regulates applicant organizations from aspects of, such as, personnel, facilities, system (including data transfer and occurrence reporting), and quality. Likewise, ACMs and GMs to Part-145 are important supplement and directive material during the process of study.

**(c) Part 66 Certifying Staff**

Section A (Technical requirements), "define the aircraft continuing license and set the requirements for its application, dispatch and continuity of its validity".

The Section B (Procedures for the competent authority) "establishes the procedures, requirements, administrative requirements, measurement and control of compliance with Section A of Part 66".

**(d) Part 147 Training Organizations Requirement**

Section A (Technical requirements), "establishes the requirements that must be fulfilled by the organizations that request authorization to carry out training courses and specific examinations in Part 66".

Section B (Procedures for competent administration) "establishes the administrative requirements that must be followed by the competent authorities for the application of section A of this part".

The Annex V bis (Part T); Section A (Technical requirements), "establishes the requirements to ensure maintenance of the continuing airworthiness of the aircraft referred to in Article 1, letter b), in accordance with the fundamental requirements set out in Annex IV of the Regulations (EC) No. 216/2008. The conditions to be had by the people and organizations responsible for managing the maintenance of airworthiness and the maintenance of the aircraft in question are also specified". The Section B (Procedures for Competent Authorities) "establishes the administrative procedures that must be followed by the competent authorities in charge of the application and compliance of Section A of Part T".

The Annex VI contains only a table of correspondence between Regulation (EC) No. 2042/2003 and these regulations.

**2.3 Continuing Airworthiness**

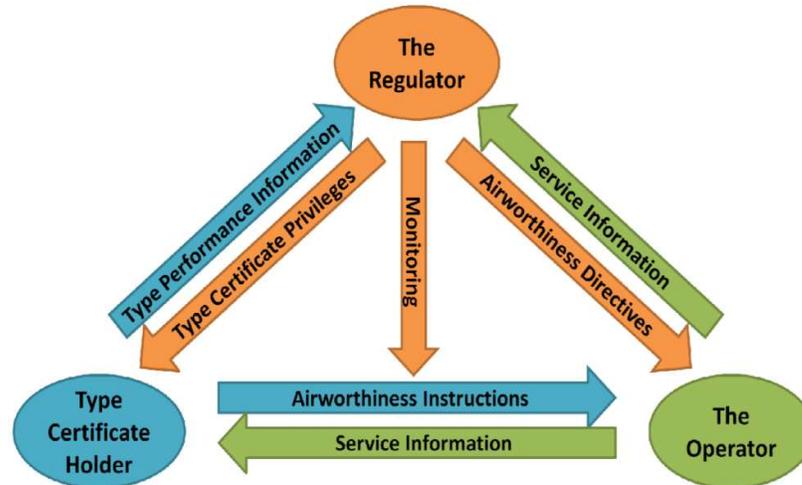
As previously mentioned, safety is what airworthiness always focus on, undoubtedly not only temporarily, but also continuously. Ever since the issuing of Type Certificate and the delivery to the owner/operator, the aircraft must be maintained in the same airworthiness condition as when it was certified.

Generally speaking, the ultimate objective of Continuing Airworthiness is to keep the aircraft (or other aeronautical products) maintained at the Type Certificate airworthiness standard throughout the whole operational life. The following is an official definition of Continuing Airworthiness.

“Continuing or continued airworthiness is all of the processes ensuring that, at any time in its life, an aircraft complies with the technical conditions fixed to the issue of the certificate of airworthiness and is in a condition for safe operation”– ICAO DOC 9713(John W Bristow and Simon Place, 2010)

Figure 2.3 shows the relationship and collaborative type of the three main participants (the Regulator, the Type Certificate holder, and the operator) of Continuing Airworthiness.

**Figure 2.3 Main Players in Continued Airworthiness**



Source: John W Bristow and Simon Place, 2010

With the definition of Continuing Airworthiness and the relationship of Continuing Airworthiness participants shown in Figure 2.3, it won't be too hard to get a conceptual realization of what Continuing Airworthiness aims to (to keep the aircraft airworthy), who does Continuing Airworthiness (Certificate Holder, operator and competent authority – there will be maintenance and management organizations due to further investigation), and how to implement Continuing Airworthiness.

## 2.4 Airline Safety Reliance

The accident is the great public relation challenge that any airline can expect to encounter. Most people can accept that the accident has occurred; none will accept the low compliances of the airworthiness. As the number of travellers increases, the potential for major accident must increase proportionally. The traveller can choose the most reliable airline which is safe to fly among air lines. This is particularly true for more compliance with airworthiness requirement, for service providing passengers, for good reputation and competency of airline.

Since 1998, there have been 61 air accidents across the globe, and a simple calculation reveals that there is an average of almost one air accident each month

(Owen, 2003). In some of the cases, a number of planes crash in a single day. It should be mentioned that most of the recorded accidents involved civilian aircrafts.

## 2.5 Worldwide Accident Summary

Commercial air transport evolves in a very dynamic environment. Today's operational conditions bear little resemblance to those at the beginning of the jet age. As a consequence, in the following charts 58 years frame is used.

**Table 2.2 Worldwide Accident Summary (worldwide) by Injury and Damage**

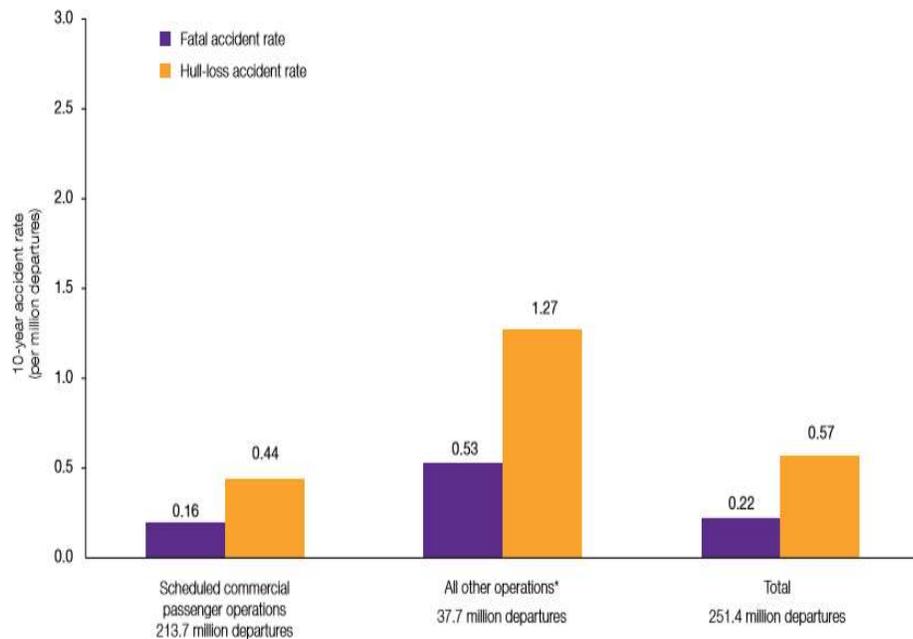
Type of Operation	All Accidents		Fatal Accidents		Onboard Fatalities		Hull-Loss Accidents	
	1959-2017	2008-2017	1959-2017	2008-2017	1959-2017	2008-2017	1959-2017	2008-2017
<b>Passenger</b>	1585	316	500	37	29,298 (803)	2,199 (67)	730	101
<b>*Scheduled</b>	1462	299	453	35	25,101	2,166	659	95
<b>*Charter</b>	123	17	47	2	4,197	83	71	6
<b>Cargo</b>	281	61	82	15	282 (385)	45 (58)	188	35
<b>Maintenance test, ferry, positioning, training, and demonstration</b>	123	10	44	3	208 (66)	17 (0)	75	7
<b>Total</b>	1,989	387	626	55	29,788 (1,254)	2,261 (125)	993	143
<b>U.S. and Canadian Operator</b>	581	65	182	9	6,202 (381)	26 (4)	234	25
<b>Rest of the world</b>	1,408	322	444	46	23,586 (873)	2,235 (121)	759	118
<b>Total</b>	1,989	387	626	55	29,788 (1,254)	2,261 (125)	993	143

Source: Aviation Safety (Boeing Commercial Airlines)

Though airworthiness regulations has been prescribed and followed by respective community, accidents and incidents that make great loss may occur yearly. The above table is the worldwide summary of accidents occurred during 58 years that showed the cause of event happened. Loss of aircraft was found out because of maintenance test, ferry, positioning, training and demonstration.

Beyond the size and nature of the fleet,a number of evolutions took place at the air transport system level impacting its safety, hence its accident rate. Technology has evolved in different areas like aircraft, simulators, airports,air traffic control, weather forecasting etc.In parallel, qualitative progress has been achieved in the governance airlines and authorities. Accidents are rare occurrences; consequently their number may vary considerably from one year to the next. Therefore, focusing too closely on a single year’s figure may be misleading.As a consequence, in the following charts a 10 year moving average is used i.e for any given year;the accident rate is the average of the yearly accident rates over the 10 preceding years.A hull loss is defined as an event in which an aircraft is destroyed or damaged beyond economical repair. The threshold of economical repair is decreasing with the residual value of the aircraft.Therefore,as an aircraft is ageing,an event leading to a damage economically repairable years before may be considered a hull loss

**Figure 2.4 10-year Accident rates by Type of Operation Fatal and Hull Loss Accidents Worldwide Commercial Jet Fleet 2008 through 2017**



Source: Aviation Safety (Boeing Commercial Airlines)

## 2.6 Conceptual Framework

Underlying the airworthiness initiative is the concept that accident risk is not caused by hazardous events, but is rather historically constructed through human activities and processes. As such the risk of death in accident is only partially dependent on the presence of physical phenomenon such as aircraft collision on ground or in flight.

Concept of airworthiness is not just reactive action and manner, but especially proactive action for preventing undesirable accidents and incident. It is vital for up-righting compliance with existing airworthiness requirements that prescribing for maintenance personnel, infrastructures for each AMO departments, procedure and effective training for AMO personnel.

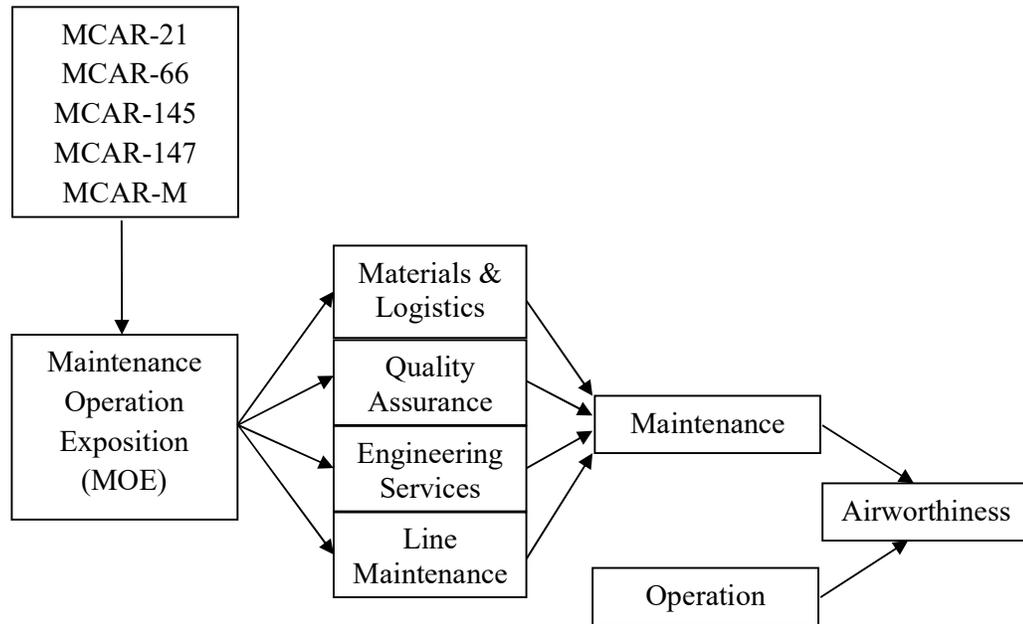
Different levels of airworthiness standard will be achieved through how compliance with existing regulation and enforcements of AMO in airlines. So, countries with similar levels of physical exposure to a given hazard experience have widely differing levels of airworthiness.

To fulfill airworthiness it is a large extent to undergo. In the aspect of maintenance organization, they must follow the rules and regulation laid by DCA which are the adaptation of EASA regulations. In the following figure, MCAR Part 21 is concerned with the requirements of Certification of aircraft and components that is need in maintenance. MCAR Part 66 is concerned with certifying staff that part explained what type of certificate holder can work in maintenance industry for which type of aircraft. MCAR Part 145 is related to the requirements and procedures necessary for the approval of maintenance organizations of aircraft. And MCAR Part 147 is relevant to training organizations requirements. The last one MCAR Part M is directly related to the requirements and procedures necessary to Continuing Airworthiness Management.

Theses MCAR Parts are the basic and necessary requirements to appear Maintenance Organization Exposition (MOE) which is followed by the respective maintenance community. The four departments of maintenance organization such as Materials and Logistics Department, Quality Assurance Department, Engineering Services Department and Line Maintenance Department carry out their procedures in accordance with Maintenance Organization Exposition (MOE) which is based on MCAR Parts approved by DCA. Aircraft maintenance (engineers) and aircraft operation (pilot) are the two main parts which is need to make an aircraft safely fly in

the air. In other words, it is essential maintenance and operation of aircraft to fulfill airworthiness. This can be seen clearly in the figure below.

**Figure 2.5 Conceptual Framework of Airworthiness**



Source: Own Compilation

## 2.7 Review on Previous Studies

FeiGao (2011) from School of Engineering Aircraft Design (Cranfield University) did a research on “Continuing Airworthiness Policy and Application to Flying Crane Aircraft”. This research project was part of a collaborative MSc training programme between the Aviation Industries of China (AVIC) and Cranfield University. The arrangement of the research project was that all students started with a Group Design Project which is based on the Flying Crane Project provided by AVIC. In this research airworthiness requirements are applied and the methodology of the Maintenance Steering Group logic (MSG-3) was used in the Flying Crane Project. Two aspects of continuing airworthiness have been investigated. With MSG-3 logic, the author developed the maintenance plan for three structural components (fuselage skin panel, wing root joint, and fin-fuselage attachment) and one air frame system based on results from the Group Design Project.

Another research that is not fully concerned with this research is “A Study on Disaster Preparedness in Myanmar Airports (A Case Study of Yangon International Airport)” conducted by Nyein Chan Zaw, EMPA-31(11<sup>th</sup> Batch)(2015). The study analyzed the relationship that exists between past disaster preparedness experiences, increasing disaster management complexity at airports. The study also found out that YIA could not handle a large-scale disaster in terms of facilities and trained personnel and that the disaster preparedness policies and strategies for YIA are not very clear toward many of the respondents.

Thet Thet Latt, EMPA-48 (11<sup>th</sup> Batch)(2015) conducted a research “A Study on Public Private Partnership of Air Transportation in Myanmar”. The study analyzed the public private partnership arrangement in air transportation sector of Myanmar by implementing the Management Contract in case of Yangon International Airport and Build Operate Transfer Contract in case of Naypyitaw International Airport. In this study, it was found that PPP is the allocating of risk to transfer the private sector and YIA faces land risk and Naypyitaw International Airport also faces with demand risk of international flights and passengers.

While the research fields of these previous studies researches are airworthiness policy from another countries, disaster preparedness and public private partnership from our country, airworthiness requirements are used in this present study as a research field. There is no research study on the field of airworthiness in our country before. That is the reason to conduct research on this subject. Simple random sampling method is used to analyze the data found in this study of airworthiness requirements of Myanmar aviation industries.

## **CHAPTER 3**

### **AIRWORTHINESS REQUIREMENTS OF MYANMAR AVIATION INDUSTRIES**

#### **3.1 Myanmar DCA**

During the pre-independence period, the British Overseas Airways Corporation (BOAC) took responsibility for carrying out all of Myanmar's civil aviation functions and after independence it was considered not appropriate for the aeronautical communications functions under the management of BOAC and through the efforts of efficient young communication engineers, the International Aeradio Limited (IAL) was contacted and Myanmar's aeronautical communication functions were contracted to IAL and so the foundations for the future of Myanmar's civil aviation communication sector was laid. International Aeradio Limited (IAL) was contacted and Myanmar's aeronautical communication functions were contracted to IAL and so the foundation for the future of Myanmar's civil aviation communication sector was laid.

With a view for the systematic development of international civil aviation, the Chicago Convention was signed at Chicago on April 4, 1947 and the International Civil Aviation Organization (ICAO) was formed. Myanmar became a member state of the ICAO on August 8, 1948. Air transport has become increasingly important to the economy of Myanmar. The aviation sector in Myanmar has had significant growth in the recent past, both in tourism and cargo transport. Myanmar Airways International, the national carrier, is among the airlines (in the region) with extensive route network in South East Asia, ensuring their dominant position in providing essential regional air transport services. Myanmar Airways International currently provides serving 6 destinations in ASEAN countries. ([https://en.m.wikipedia.org/wiki/Department-of - Civil-Aviation-Myanmar](https://en.m.wikipedia.org/wiki/Department-of_Civil-Aviation-Myanmar))

However, the current air transportation makes an annual capacity of 2.7 million passengers and presently doubles that volume. The aviation of

Myanmar is increasing the design capacity to 6 million annual passengers and providing improved airworthiness in order to comply with International Civil Aviation Authority standards. Tourists travel to Myanmar to see its abundant and cultural heritage of Myanmar, to experience the natural beauty of the land, and to enjoy Myanmar's colorful, multifaceted culture. The number of visitors who travelled out through YIA increased. Most international visitors are European tourists, Koreans, Japanese and some are from ASEAN countries. Traffic on the ASEAN member countries routes consist mainly of foreign expatriates based in Bangkok, Singapore travelling to Myanmar for vacation, Myanmar who work in the South East Asian region, and family visitors and business travellers between Myanmar and ASEAN. When the airlines check their aircrafts to be airworthy, approved maintenance organization (AMO) has to make inspection for all aircrafts which fly into and out of Myanmar.

The Myanmar Aircraft Act 1934 (XXII of 1934), the Myanmar Carriage by Air Act 1934 (XX of 1934), the Myanmar Aircraft Rules 1937, the Myanmar Aircraft Rules 1920 (Part IX) and the Myanmar Aircraft Public Health Rules (1946) have being promulgated before Myanmar gained independence on 4th January 1948.

According to the Myanmar Adaptation Laws Order 1948, the above Myanmar Aviation Acts and Rules are accepted and in operation effecting throughout the Republic of the Union of Myanmar relating to the control of the manufacture, possession, use, operation, sale, import and export of aircraft apply also to citizens of the Union wherever they may be, and persons on aircraft registered in the Union, wherever they may be. The Myanmar Aircraft Act and Rules were last amended on 25th August 2004.

It was officially declared on 29th May 2008 that the State Constitution of the Republic of the Union of Myanmar has been ratified and promulgated by the approval of National Referendum. In this Constitution, Section 96 of Chapter IV - Legislature states that the PyidaungsuHluttaw (Parliament) shall have the right to enact laws for the entire or any part of the Union related to matters prescribed in Schedule One of the Union Legislative List. In this List Air transport and Air navigation, control and airfields construction are covered under the Transport, Communication and Construction Sector item (h) and item (i). PyidaungsuHluttaw may authorized to issue rules, regulations and by-laws concerning that law to any Union level organization

formed under the Constitution and to issue notifications, orders, directives and procedures to the respective organization or authority.

Also the PyidaungsuHluttaw shall give the resolution on matters relating to ratifying, annulling and revoking from international, regional or bilateral treaties and agreement submitted by the President. In addition, the PyidaungsuHluttaw may confer the authority to conclude, annul and revoke any kind of international, regional or bilateral treaties and agreement without the approval of the PyidaungsuHluttaw.

On the early day, Myanmar Airworthiness System is based on the CAA UK and the current regulation is based on EASA. To promote and harmonize Myanmar Airworthiness System to international standard, the new Airworthiness system is launched for Myanmar Aviation.

This requirement is based on the EASA Requirements and address to the Aircraft Maintenance Organization(AMO) and Air Operator to standardize the International Airworthiness capabilities. It is also prepared to be in line with the Standard and Recommended Practices of ICAO Annex 1, Annex 8.

This part prescribes the requirements governing the issue of aircraft maintenance licenses and the privileges, limitations and recent experience of those licenses.

### **3.1.1 Myanmar's Ratification / Accession of ICAO Conventions**

Myanmar ratified ICAO aviation conventions however not all conventions were not ratified. By ratifying like this, Myanmar is bound to follow these conventions. A list of Aviation related International Convention applicable to Myanmar is as follows.

1. Convention on International Civil Aviation Chicago, 7/12/1944 (49th State in ICAO)
2. Article 93 bis Montreal, 27/5/1947
3. Article 48 (a), 49 (e) and 61, Montreal, 14/6/1954
4. Article 50 (a), New York, 12/3/1971
5. Article 56, Vienna, 7/ 7/1971
6. Article 83 bis, Montreal, 6/10/1980
7. Article 50 (a), Montreal, 26/10/90
8. Article 48 (a), 49 (e) and 61, Montreal, 14/6/1954

### 3.1.2 The Establishment of the Department of Civil Aviation (DCA)

The Department of Civil Aviation is headed by the Director General (DG) and is a subordinate organization under the Ministry of Transport (MOT), the Government of the Union of Myanmar.

The Department of Civil Aviation (DCA) is one of the 10 departments and 2 institutes under the Ministry of Transport established by Executive Section of the Republic of the Union of Myanmar Constitution of 2008. The DG is empowered by the Myanmar Aircraft Act 1934 and Myanmar Aircraft Rules 1937 generally for regulating Civil Aviation Activities in Myanmar. The DG, being the head of the DCA, is authorized by the President and Minister of Transport for the purpose. The DG may further delegate the powers vested in him to other DCA officers to fulfill the obligations for effective safety oversight.

**Table 3.1 The organization chart of the Myanmar DCA**

Regulatory Body	
SSOD	Standards and Safety Oversight Division
AWD	Airworthiness Division
FSD	Flight Standards Division
ANSD	Air Navigation Safety Division
ASSD	Aerodrome Standards and Safety Division
ASD	Aviation Security Division
Service Providers	
CATI	Civil Aviation Training Institute
YIA	Yangon International Airport
MIA	Mandalay International Airport
AOP	30 Aerodrome Operators
CNSD	Communication, Navigation and Surveillance Division
ATMD	Air Traffic Management Division
AISD	Aeronautical Information Services Division
Supporting Body	
ATD	Legal and Air Transport Division
APD	Administration and Planning Division

Source: Department of Civil Aviation, Myanmar(MDCA) (2018)

### **3.1.3 Airworthiness Division of Myanmar DCA**

The Myanmar Department of Civil Aviation (MDCA) is the competent aviation authority in Myanmar. Within effective years, Myanmar has established her own airworthiness regulation and management system. The structure of Myanmar's airworthiness regulation, MCARs, is built mainly based on the ICAO Annexes and Myanmar Aircraft Act and Rules by adapting EASAs Regulation, and being synchronously updated where applicable as well.

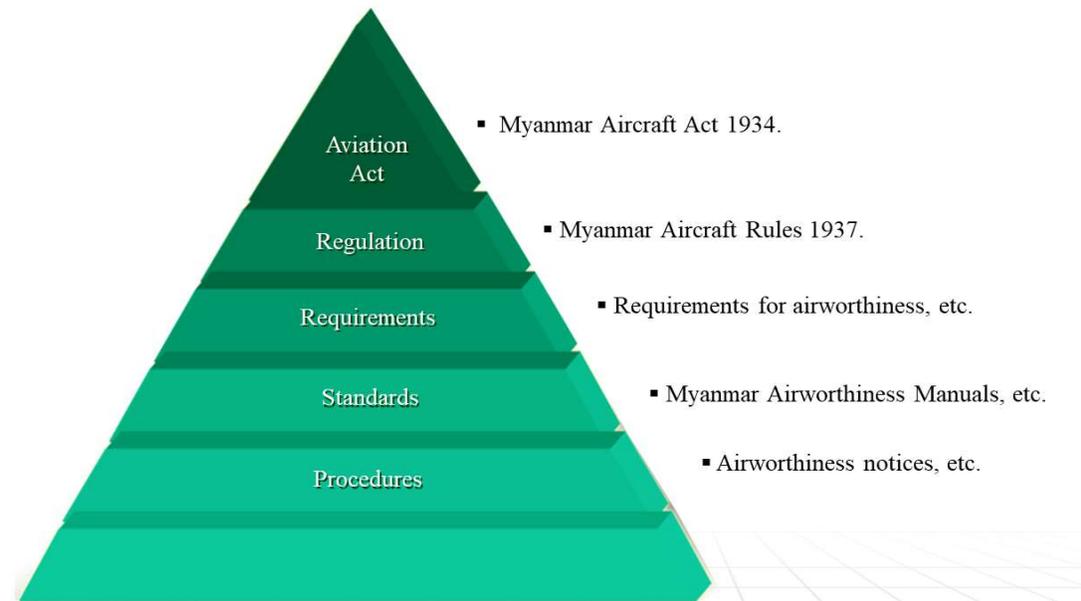
Within Myanmar Department of Civil Aviation (MDCA), Airworthiness Division (AWD) is established to perform the functions of Aircraft Inspection Division (AID). Up to now, being Myanmar does not have Aircraft and Aircraft Parts Design and Manufacturing Organization, Aircraft Engineering Division (AED) has not been established in Airworthiness Division. Some functions of AED related to continuing airworthiness are assigned to one inspector who has completed Safety Oversight Inspector (Engineering) course. In 2009, Airworthiness Division Standard Operating Procedures was reviewed and duties and responsibilities of Airworthiness Inspector were reassigned in line with DCA Departmental Exposition.



### 3.1.4 The Function of Airworthiness Division

The AWD is responsible for the airworthiness control of aircraft registered and/ or operated in Myanmar, recommendation to issue of certificates of registration, maintaining the national registry of civil aircraft, recommendation to issue of certificates of airworthiness, licensing of aircraft maintenance engineers, inspection and certification of maintenance organization, conducting of operator certification inspections related to airworthiness in cooperation with the Flight Standard Division, Recommendation to cancel or revoke and amend or suspend the airworthiness related Approvals, licenses and Certificates. The Regulatory framework of airworthiness control for air operators in Myanmar are;

**Figure 3.2 Legislation & Regulations Framework in Myanmar**



Source: Airworthiness division of Department of Civil Aviation, Myanmar(MDCA) (2018)

1. Myanmar Aircraft Act 1934
2. Myanmar Aircraft Rules 1937
3. ICAO Annex 1 - Personnel Licensing
4. ICAO Annex 8 - Airworthiness of Aircraft
5. MCAR Part 1 (Air operator Certificate)
6. MCAR Part 21 (Airworthiness)

7. MCAR Part 66 (Aircraft Maintenance License)
8. MCAR Part 145 (Approved Maintenance Organization)
9. MCAR Part 147 (Approved Maintenance Training Organization)
10. MCAR Part M (Continuing Airworthiness)
11. Myanmar Airworthiness Manuals Handbook
12. Airworthiness Notice

Myanmar Aircraft Act was passed in 1934 as Myanmar Aviation Act. Myanmar Aircraft Rules were passed as Myanmar Aviation Regulations in 1937. As Myanmar ratified ICAO conventions, Myanmar is bound to follow ICAO Annex 1 and 8. Myanmar Civil Aviation Requirements (MCARs) are made based on the above facts. Since Myanmar is not fully qualified to create own requirements, EASA requirements are adapted to comply with traditions in our country. Myanmar Airworthiness Manuals Handbook was created based on MCAR Parts 1, 21, 66, 145, 147 and Part M. Airworthiness notices are passed depending on the time and circumstances of the situations.

**(a) Applicability of MCAR Part 21 (Airworthiness)**

This Part lays down common technical requirements and administrative procedures for the airworthiness of products, parts and appliances and;

1. shall apply to aircraft registered in a contracting state and operated pursuant to an agreement for the lease, charter or interchange of the aircraft or any similar arrangement by an operator who has his principal place of business, or, if he has no such place of business, his permanent resident in Myanmar, provided that an agreement has been reached between the government of the State of registry of the Aircraft and the Government of Myanmar in regard to transfer of functions and duties pursuant to Article 83 bis of the Convention. The extent of application of this part to such aircraft shall be as per the agreement between the two Governments.
2. shall not apply to aircraft registered in Myanmar and operated pursuant to an agreement for the lease, charter or interchange of the aircraft or any similar arrangement by an operator who has his principal place of business, or, if he has no such place of business, his permanent resident

in a contracting State, provided that an agreement has been reached between the Government of Myanmar and the Government of that contracting state in regard to transfer of functions and duties pursuant to Article 83 bis of the Convention. The extent of non-application of this part to such aircraft shall be as per the agreement between the two Governments.

All Myanmar Registered aircraft shall meet all the requirements related to airworthiness specified in Myanmar Aircraft Rules, Myanmar Civil Aviation Requirements and in addition to this Part.

**(b) Applicability of MCAR Part 66 (Aircraft Maintenance License)**

To promote and harmonize the Myanmar Aircraft Engineer Licensing System to international standard, the new licensing system is launched for Myanmar Aircraft Maintenance Engineer. This requirement is based on the EASA 66 Licensing Requirements and address to the persons who will intend to be Myanmar Aircraft Maintenance Engineer License holder. It is also prepared to be in line with the Standard and Recommended Practices of ICAO Annex 1. This part prescribes the requirements governing the issue of aircraft maintenance engineer licenses and the privileges, limitations and recent experience of those licenses. This edition supersedes all the previous editions and effective from the date printed on each page. The maintenance personnel for the qualification of MCAR 145 certifying staff for certification authorization, any person meeting the prescribed requirements in terms of experience and knowledge may apply for a license.

Maintenance experience should be written up in a manner that the reader has a reasonable understanding of where, when and what maintenance constitutes the experience. A task-by-task account is not necessary but at the same time a bland statement “X years maintenance experience completed” is not acceptable. A logbook of maintenance experience is desirable and some competent authorities may require such a logbook to be kept. It is acceptable to cross-refer in the CA 131 to other documents containing information on maintenance. Applicants claiming the maximum reduction in the total experience based upon successful completion of approved basic training should include the Part-147 certificate of recognition for approved basic training. Applicants claiming reduction in the total experience based upon successful completion of technical training in an organization or institute

recognized by the competent authority as a competent organization or institute should include the relevant certificate of successful completion of training. An applicant for the grant of an aircraft maintenance engineer license shall be completed application form CA 131 and practical maintenance experience log book or schedule of maintenance work form CA 192 and submitted to the DCA, together with the statutory fees. An application for the change to an aircraft maintenance engineer license shall be made to the DCA. In addition to the documents required in points 66.10(a), 66.10(b), as appropriate, the applicant for additional basic categories or subcategories to an aircraft maintenance engineer license shall submit the application form CA 132 together with his/her current original aircraft maintenance engineer license to the DCA. 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.

**(c) Applicability of MCAR Part 145 (Approved Maintenance Organization)**

This requirement has been prepared for the use and guidance to get Approval for Maintenance Organization from DCA Myanmar. MCAR 145 establishes measures to be taken and facts to be provided to get approval for Maintenance Organization. It also specifies the conditions to be met by the Organization involved in Maintenance of Myanmar Registered Aircraft. This requirement is revised to reflect the EASA Part - 145, issued on November 2010. 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. Applicability of Aircraft Maintenance License are;

1. This Part prescribes the requirements for issuing approvals of Organizations to carrying out the maintenance of Myanmar Registered Aircraft and related aeronautical products and the general operating rules for an Approved Maintenance Organization (AMO). An AMO shall also comply with all the requirements prescribed in MCAR Part–M and MCAR Part–21 respectively.
2. The Maintenance Organizations having their principal place of business located in foreign country must have been previously approved by Civil Aviation Authority of such country.

**(d) Applicability of MCAR Part 147(Approved Maintenance Training Organization)**

This requirement has been prepared for the use and guidance to get Approval for Maintenance Training Organization from Myanmar DCA. MCAR 147 establishes measure to be taken and facts to be provided to get approval for Maintenance Training Organization. It also specifies the conditions to be met by the Organization that involved in Training of Civil Aircraft Maintenance Personnel. It is emphasized that the Organization intended to get Myanmar Approved Maintenance Training Organization shall need to apply all the requirements specified in this part.

This MCAR-147 establishes the requirements to be met by organizations seeking approval to conduct:

1. Training and examination as specified in MCAR-66.
2. training and examination for qualifying certifying staff of MCAR-145 organizations holding Class C ratings.

An application for the issue, variation or renewal of a MCAR-147 maintenance training organization approval shall be made on CA form 199 and submitted with a copy of the maintenance training organization exposition described in MCAR 147.140 or any amendment thereto.

- (i) The potential AMTO certificate holder must submit its application for Training Organization Approval completed by the accountable manager to the DCA prior to 90 days before tentative date of opening (as a minimum).
- (ii) An AMTO certificate holder must submit its request for renewal no later than 90 days before the current certificate expires.
- (iii) An AMTO certificate holder must submit its request for amendment at least 90 days in advance.

**(e) Applicability of MCAR Part M(Continuing Airworthiness)**

MCAR Part M specifies certain technical requirements to be complied by organizations and personnel involved in the continuing airworthiness management of aircraft and aeronautical products, parts and appliances in order to demonstrate the capability and means of discharging the obligations and associated privileges thereof. All Myanmar Registered aircraft shall meet all the requirements specified in

Myanmar Aircraft Rules, Myanmar Civil Aviation Requirements and in addition to this requirement. The MCAR Part M is applicable to all operators of Myanmar registered aircraft irrespective of whether such aircraft are maintained by their own organization or by other approved maintenance organization. For organization operating aircraft, compliance with this part is mandatory. The compliance will also depend upon the size of the organization. The applicability will include private operators, flying training schools or institutes etc.

This Part establishes common technical requirements and administrative procedures for ensuring the continuing airworthiness of aircraft, including any component for installation thereto, which are:

1. Registered in Myanmar; or
2. Registered in a third country and used by an operator for which Myanmar ensures oversight of operations.

### **3.2 Airlines in Myanmar**

Myanmar has 39 airfields and out of them 35 airports are used as commercial airports. These airports handle international flights, Yangon International Airport, Mandalay International airport and Nay Pyi Taw International Airport. The Airlines are operated in our nation and the history and background of the airlines are shown in table (3.2).

Nowadays, there are 9 airlines which run 41 aircrafts and 3 helicopters in Myanmar Aviation. Out of them 8 airlines are used for Public Transportation and the last one is used for aerial work which is Myanmar Aviation Academy. MAI is only international airline, MNA is both domestic and international airline, MAA is aviation academy and the rest are only domestic airlines. In the Appendix B, the category A is the national owned aircraft and B is the leased aircraft type from another countries.

**Table 3.2 Airline in Myanmar**

<b>Airline</b>	<b>Commenced Operations</b>	<b>Ceased Operations</b>	<b>Note</b>
Union of Burma Airways	1948	1972	Rebranded as Burma Airways
Burma Airways	1972	1989	Rebranded as Myanmar Airways
Myanma Airways	1989	2014	Rebranded as Myanmar National Airlines
Air Bagan	2004	2018	
Air Inlay			Never launched
Air Mandalay	1994	2018	
APEX Airlines	2015	2018	
FMI Air	2012	2018	
Shwe Myanmar Airways	2012	2012	Rebranded as Golden Myanmar Airlines
Golden Myanmar Airlines	2012		
Myanmar National Airlines	2014		
Air KBZ	2010		
Asian Wings Airways	2010		
Mann Yadanarpon Airlines	2014		
Myanmar Airways International	1998		
Yangon Airways	1996 re-operate in		

Source: Department of Civil Aviation, Myanmar (MDCA)

### 3.3 Aircraft Related Occurrences, Accidents and Incidents in Myanmar

Myanmar has experienced quite a number of occurrences, accidents, incidents happened in all forms of transportation such as inland-river, off rain of trains, numerous road accidents and aircraft crashes all claiming thousands of lives. All these have not resulted in a properly well thought of national airworthiness regulation. Although the best regulations have been passed, there may be such kinds of incidents when there is no enforcement. It is natural that there are defaults how regulations and human factor are the best. People damaged by aircraft crashes are rarer than by shark bite. In the following table, it is illustrated the number of occurrences, accidents and incidents data from 2010 to 2018.

**Table 3.3 Number of occurrence, incident and serious incident (2010-2018)**

<b>Airline</b>	<b>Occurrence</b>	<b>Incident</b>	<b>Serious Incident</b>
Myanmar National Airline	20	82	20
Myanmar Airways International	6	16	4
Air Bagan	14	12	11
Air KBZ	4	40	4
Asian Winds	-	3	2
Air Mandalay	1	7	10
Golden Myanmar Airlines	-	4	2
Yangon Airliways	2	16	3
Mann Yadanarpon Airlines	-	4	1
Total	47	184	57

Source: Myanmar Accident Investigation Bureau(MAIB)

Most aircraft accidents occur during take-off and landing (ASN,2018). Most of these accidents happen within the precincts of airport, which render further justification for the study of airworthiness in Myanmar's Airline.

Air transport has made the world a global village and has spurred growth in many nations of the world. Air-related occurrences, accidents, incidents have also been on the increase due to the increase in the number of operational aircraft with

large and complex aircraft being designed and the volume of the passengers on the increase. So, preparedness to be airworthy is vital for any business sustainability.

**Table 3.4 Aircraft Accidents in Myanmar**

<b>Date</b>	<b>Aircraft Type</b>	<b>Registration No</b>	<b>Operator</b>	<b>Fatality</b>	<b>Location</b>
7-6-2017	Y-8F	5820	Air Force	122	near Dawei
10-2-2016	Beech 1900D	4601	Air Force	5	Naypyidaw
24-7-2015	ATR-72	XY-AIH	Air Bagan	0	Mingalardon
14-4-2014	Airbus A319	XY-AGR	M.A.I	0	Mingalardon
14-4-2014	Airbus A320	XY-AGT	G.M.A	0	Mingalardon
10-6-2013	XiMA60	XY-AIP	M.A.I	0	Kawthaung
16-5-2013	Xian MA60	XY-AIQ	M.A.I	0	MongHsat
25-12-2012	Fokker 100	XY-AGC	Air Bagan	2	near Heho
17-2-2012	ATR 72	XY-AIT	Air KBZ	0	Thandwe

Source: Myanmar Accident Investigation Bureau (MAIB)

Adequate Approved Maintenance Organizations are required at all airlines in Myanmar to reduce the risk of occurrences, accidents, incidents in all flight. Training was also cited as lacking in departments such as maintenance, planning and tech record departments which give the approved training course, knowledge examinations, practical assessment. It is necessary to practice international Standards of Airworthiness regulation and requirement not to have the above weaknesses.

National Airlines are necessary to repute in the world of air transportation industry. Myanmar Air operators are geared more towards human transport than cargo. As such, a major airplane crash will exact a heavy emotional and monetary toll on society. The human cost to victims and survivors and their families is immeasurable. The direct cost of just one fatal commercial airplane crash can total hundreds of millions of dollars.

In the case of air-related accident, every time that one happens it leads to issues being raised on the country's state of airports and airstrips in particular and airworthiness requirement in general. At the level of airworthiness preparedness, issues have been raised on the efficacy of equipment as well as availability of effective facilities at the airlines. Other aspects like appropriate training have also been raised. Air related accidents and incidences in Myanmar have therefore not been left out and have been quite prominent. In addition to the common causes of air accidents found in other parts of the continent, Myanmar has also experienced other causes of air accidents, namely those caused by birds. Table (3.6) shows statistical data of bird-aircraft strike in Myanmar (64 cases), 2010-2018.

**Table 3.5 Bird-aircraft strike in Myanmar, 2010-2018**

<b>Airline</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>Total</b>
Myanmar National Airline			2	1			6	5	10	24
Myanmar Airways International	2	1		1	1	1	1		1	8
Air Bagan	1									1
Air KBZ			1		2	1	2		2	8
Asian Winds			1	1						2
Air Mandalay										
Golden Myanmar Airlines						6	2	1		9
Yangon Airliways										
Mann Yadanarpon Airlines				2		1	3		1	7
APEX							1			1
FMI							4			4
<b>Total</b>	<b>3</b>	<b>1</b>	<b>4</b>	<b>5</b>	<b>3</b>	<b>9</b>	<b>19</b>	<b>6</b>	<b>14</b>	<b>64</b>

Source: Myanmar Accident Investigation Bureau (MAIB)

### **3.4 Approved Maintenance Organization (AMO) Structure and Airworthiness Function of Myanmar Airlines**

Though such many departments supported for the successfully operation, there is competition for their reputation of commercial airlines in Myanmar aviation industry. Departments such as operation and maintenance departments in handling the aircrafts are involved in frontier lines prevention of direct accident whilst marketing,

sale-ticket, passenger services, ramp department not involved in direct accident prevention. Qualified Pilots in operating the aircraft using proper and updated flight manuals can fulfilled the safe operation of aircraft and passenger lives. However, complex maintenance process of maintenance organization such as LLP (Life Limited Parts) andOC(On Conditioning) components monitoring and replacement ,many inspection types line maintenance (BFI,DI,AFI, weekly check, snag rectification, modification etc.), Base Maintenance (overhaul, structure check etc.)is vital in conformity with airworthiness for safe operation of Airlines.Such the commitment of maintenance head and personals, their qualification, efficiency, proper training, conformity function with airworthiness of each departments in maintenance organization can reduce or mitigate and prevent the undesirable accidents and incidents.

The organizational structure and procedure of AMO are formulated in compliance with MCAR145. The requirements of AMO are:

1. Facility Requirements
2. Personnel Requirements
3. Equipment Tools and Material Requirements
4. Certifying Staff and Category B1 and B2 Support Staff Requirement
5. Acceptance of Components Requirement
6. Maintenance Data Requirement
7. Production Planning Requirement
8. Certification of Maintenance Requirement
9. Maintenance Records Requirement
10. Occurrence Reporting Requirement
11. Safety, Training, Quality Policy, Maintenance Procedures and Quality System Requirement

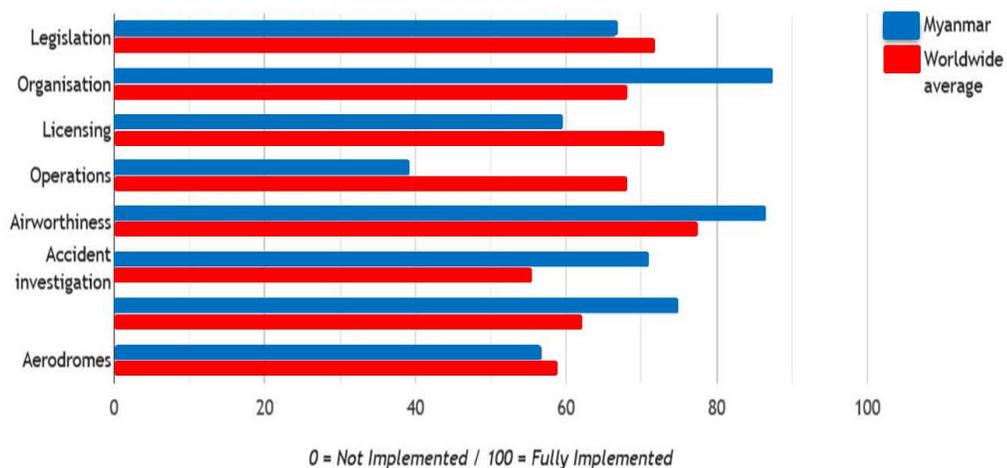
The duties and responsibilities of AMO as per MCAR 145 requirements are shared and served between 4 departments such as;Quality Assurance Department, Line Maintenance Department, Engineering Services DepartmentMaterials and Logistics Department.

### 3.5 Airworthiness Preparedness In Myanmar(Maintenance)

Approved Maintenance Organization MCAR Part 145(third edition 2011) indicates that the Maintenance Organization Exposition (MOE) will be coordinated with and disseminated by the Airworthiness Division Director to all the accountable managers of all airlines. The above 4 departments of AMO and other safety departments must be coordinated with each other to ensure airworthiness of all the flight. Airworthiness division of DCA will audit annually and make surprise check to AMO of all airlines to make sure all parties are familiar with their responsibilities. The advanced courses are given whenever it is necessary to approve their maintenance organization.

The ICAO's Universal Safety Oversight Audit Programme (USOAP) made audit how MDCA evaluate the level of effectiveness of regulations in all airlines. The result of the audit team is shown. Myanmar airworthiness level is more effective than worldwide average airworthiness as in the figure (3.3).

**Figure 3.3 Level of Effective Implementation of ICAO audit areas by Myanmar**



Source: ICAO's Universal Safety Oversight Audit Programme (USOAP), (Dec, 2018)

### 3.6 The Evaluation of AMO for Airworthiness

Airworthiness preparedness in Myanmar is divided into various groups. There are

1. granting of Approvals to carry out an airworthiness related activity,
2. examination/licensing of maintenance engineers/technicians

3. approval of designs and modifications
4. routine Surveillance and Audit,

The specific duties and responsibilities of individual airworthiness Inspectors will vary somewhat depending on their technical specialty; (i.e., powerplants, avionics, airframes, etc.) which in general terms should include at least the following:

1. conduct inspections and carry out auditing functions;
2. prepare detailed reports on inspections and auditing activities;
3. enforce compliance with airworthiness regulations and directives;
4. report breaches of regulations and directives to the appropriate authority within the DCA;
5. report defects noted to aircraft operators / owners / type certificate holders and approved airworthiness organizations for remedial action;
6. conduct, in co-operation with members of the DCA Operations Directorate, operator certification inspections;
7. inspection of aviation fueling equipment and procedures;
8. monitoring airworthiness certifications and ensuring that they are carried out by persons who are properly authorized, and that the certifications made are for the purpose and in accordance with the requirements of the applicable airworthiness regulations;
9. monitoring the implementation of the relevant airworthiness regulations issued by the DCA;
10. familiarizing himself with the content of all Airworthiness Directives, service bulletins and similar documents in respect of the aircraft (including powerplants) and equipment and monitoring the extent of implementation;
11. reviewing engineering procedure manuals, making recommendations in respect of amendments which may be required by the DCA prior to approval of the manual;
12. undertaking liaison with other inspectors regarding recommendations in respect of issue and renewal of Certificates of Airworthiness, checking all documents associated with the above including the flight manual amendment status and airframe and engine log books. Checking that all relevant work carried out, and authorizing release for test flight of aircraft and avionics installation, ensuring that the

resulting reports are satisfactory and in accordance with the DCA requirements;

13. approval of preventive maintenance programs.
14. monitoring approved operator maintenance training programs; and
15. conducting inspections of operator's route station facilities.
16. adherence to and responding promptly where necessary to all orders/notices/circulars issued by the Director of Airworthiness
17. Using initiative to pursue any matter that needs to be attended to by the DCA in the interest of air safety and for efficiency of the system.
18. Ensuring that confidentiality is always maintained.
19. Maintaining a constant dialogue with operators and officials in the aviation industry on professional matters in order to keep up to date with latest developments.
20. Approval of major modification and repair.

In Myanmar aviation industry has 10 AMOs which are located in Myanmar and 23 AMOs which are located in other countries. In 10 AMOs, 8 airlines have AMO, Air Mandalay and Yangon Aircraft Engineering Co, ltd which have no aircraft have only AMO. Only Asia Wings Airline does not have AMO, but it makes aircraft maintenance at Yangon Aircraft Engineering Co.ltd. All of them are approved by airworthiness division of MDCA. Such AMO are shown in the following table. Airworthiness division of MDCA audited those AMOs annually. The audit findings of AMO are show in Appendix C.

In an organization like AMO, each and every department is vital in the attainment of the overall airline airworthiness, particularly in combing airworthiness for Myanmar aviation. Myanmar aviation industry services over 25 international airlines and 8 national airlines and one is the Aviation Academy, providing a perfect working conditions and high alert for them. The 33 airlines and 33 AMOs have to work together by polling resources, which may include joint training and safety as they all continually affect each other and operate towards a common purpose.

Therefore there is need to have all appropriate accident prevention and recovery strategies in the aviation industry. This theory is used in this study to assess the combined capacities and capabilities at AMO and other respondent with respect to airworthiness of all airlines.

## **CHAPTER 4**

### **SURVEY ANALYSIS**

#### **4.1 Survey Profile and Design**

In this study the descriptive method was used in determining whether airlines meet the level of compliance with airworthiness. The number of respondents who were asked to answer survey questions was 120 respondents who are from three airlines out of seven airlines: Air KBZ (28 respondents out of 45 persons), Myanmar National Airline (56 respondents out of 92 persons) and Myanmar Airways International (36 respondents out of 60 persons). Respondents who are concerned with this study were from Quality Assurance Department, Line Maintenance Department, Engineering Services Department, and Materials and Logistics Department of Airline AMOs. A convenience sampling method was used to select the specific groups of individuals that would have a shared view about continuing airworthiness in aviation sector. The survey questions were well prepared questions. After collecting data from 120 respondents through sample survey, descriptive analysis has been used to analyze data.

#### **4.2 Survey Data Interpretation and Discussion**

To achieve the identified aim and objectives of this study, an extensive study was carried out at three airlines in Myanmar. This chapter therefore presents analyzed results of the research conducted on 120 respondents from three airline which are Myanmar Airways International, Air KBZ, Myanmar National Airlines.

##### **4.2.1 Demographic Profile of Respondents**

In this survey information on the basic characteristics of the respondents is essential for the interpretation of the findings presented in this report. The specific characteristics of these respondents are presented in the presentations and discussions that follow.

**Table 4.1 Demographic Profile of Employee in AMOs**

<b>Sr. No</b>	<b>Particular</b>	<b>Number</b>	<b>Percentage</b>
1	<b>Gender</b>		
	Male	105	87.50
	Female	15	12.50
<b>Total</b>		120	100
2	<b>Age</b>		
	21-30	48	40
	31-40	48	40
	41-50	21	17.50
	Above 50	3	2.50
<b>Total</b>		120	100
3	<b>Education</b>		
	Engineering	94	78.33
	Post engineering	6	5
	Other graduate	20	16.67
<b>Total</b>		120	100
4	<b>Type of airline</b>		
	International airline	36	30
	Domestic airline	28	23.33
	Both	56	46.67
<b>Total</b>		120	100
5	<b>Type of department where respondents work at</b>		
	Quality assurance department	5	4.17
	Line maintenance department	84	70
	Engineering service department	14	11.67
	Materials and logistics department	17	14.16
	Other	-	-
<b>Total</b>		120	100
6	<b>Aviation experience years</b>		
	Less than 1	-	-
	1-5	45	37.50
	6-10	50	41.68
	11-15	11	9.16
	16-20	11	9.16
	More than 20	3	2.50
<b>Total</b>		120	100

Source: Survey Data

In this Table 4.1, respondents to survey questions were 87.50% males and the females were 12.50%, among this group, both males and females were well represented. This brings to focus the gender issues as far as the kinds of jobs taken up

by the different genders at the airlines. From the findings, respondents 87.50% are male. This fact states that only male can perform well in maintenance organizations.

Among the respondents, the majority 40% can be seen in two age groups. These were followed by the age group of between 41 and 50 (17.50%). And the least age group is above 50 (2.50%) This indicates that people of all ages were fairly distributed. Two age groups (21-30) and (31-40) are the same 40%. It shows most of the respondents are young and active and also they can work in hard conditions effectively.

78.33% of respondents are holding engineering degrees while 5% of the respondents were educated to post graduate levels. Among them, 16.67% of the respondents got other degrees of their level of formal education. This indicates that the study was dealing with well educated respondents. It was important in this study to seek information on education levels because it is assumed that the workers who are more educated are likely to get information about airworthiness and can mitigate against them than workers who are less educated. It can also be assumed that employees in AMOs should be upgraded to the post level graduate level.

The respondents' airline of maintenance operation was analyzed. Majority 46.67% of the core respondents were from both international and domestic airline, being the highest while 30% from international airline and 23.33% were from domestic airline respectively.

Overall 70% of respondents were from line maintenance department which is the highest percentage. About 14.16% were from materials and logistics department and 11.67% from engineering service department. Only 4.17% were from quality assurance department which is the least.

We have found that most of the respondents 41.48 % have work experience from 6 to 10 years while 37.50% are between 1 to 5 years, both 11-15 years and 16-20 years are 9.16% respectively. Only 2.50% of respondents have more than 20 years of aviation experience. In the aspect of respondents' aviation experience years, most of the respondents have experience years between 6 and 10 years. It can be said that such kind of experiences should have at least in this field.

#### **4.2.2 Airworthiness Requirement Knowledge and Information**

The Airworthiness Requirement Knowledge and Information of respondents contained the following table.

**Table 4.2 Airworthiness Requirement Knowledge and Information**

<b>Particular</b>	<b>Yes</b>	<b>No</b>	<b>Not sure</b>
Plan for airworthiness requirement	119 99.17%	-	1 0.83%
Airworthiness Regulatory training for AMO departments	109 90.84%	10 8.33%	1 0.83%
Training plan for regulation	113 94.17%	7 5.83%	-
Use of maintenance schedule and plan	115 95.83%	2 1.67%	3 2.50%
Coordination plan of departments	117 97.50%	1 0.83%	2 1.67%
Does your organization have any audit team and fair plan for compliance with MCAR?	117 97.50%	1 0.83%	2 1.67%
Has your organization been audited by other audit team and airworthiness inspector of MDCA for continuous airworthiness?	118 98.33%	-	2 1.67%
Success of training	116 96.67%	1 0.83%	3 2.50%
There is a standard procedure for airworthiness	117 97.50%	1 0.83%	2 1.67%
Getting information concerning with airworthiness procedure requirement from MDCA	116 96.67%	4 3.33%	-
Have you ever been experienced in un-airworthy situations and acts in your organization?	62 51.67%	40 33.33%	18 15.00%
Each department of your organization has reliability and good coordination	107 89.17%	2 1.67%	11 9.16%
Has your organization given you specific training for dealing with plane crash or other emergencies at airline?	65 54.17%	21 17.50%	34 28.33%
Can your AMO be available to repair immediately when there is an error in the aircraft?	82 68.33%	5 4.17%	33 27.50%
Does your company have a training plan for human factor previously?	119 99.17%	-	1 0.83%

Source: Survey Data

As shown in the above Table 4.2, 99.17% indicated that their departments have plans and procedures for compliance with airworthiness requirement. Only

0.83% answered they are not sure about this. It can be said that respondents' departments have good plan.

It is also described whether respondents' AMO departments have airworthiness regulatory training. According to the following, 90.84% of respondents reported that they have received airworthiness regulatory training at the same time 8.33% responded they have no training and 0.83% shows no their interest in it.

The update and recurrent training plan the respondents have for regulation (airworthiness) was stated in the table. 94.17% of the respondents indicated that their organization offered some form of airworthiness training. But 5.83% respondents responded they had no airworthiness training plan. In this regard, they have good training.

The fact that whether respondents' organization has used the update maintenance schedule and data is also shown. The respondents 95.83% answered that their organization always uses the update schedule and data in maintenance to be airworthy. While 1.67% responded they have no use update maintenance, 2.50% of respondents showed no interest.

The table describes the coordination plan between the departments of respondents concerning with compliance of airworthiness. Overall 97.50% respondents respond their organization has coordination plan with other departments. Only 0.83% have no that plan. 1.67% respondents show they are not sure about this coordination plan. It is regarded that the organizations have the spirit of togetherness to cooperate with each other.

Whether the respondents' organization has any audit team and fair plan for compliance with MCAR is demonstrated. 97.50% of respondents answered that they had some audit team and fair plans in their organization for compliance with MCAR. 0.83% answered that their organization did not have such plan. Another 1.67% was not sure.

The fact of being audited by other audit team and airworthiness inspector of MDCA for continuous airworthiness is stated. 98.33% respondents reported that their organization had been audited by other teams to meet airworthiness standards. Only 1.67% showed that they were not sure about this.

The fact that the training given by the respondents' organization supported airworthiness of aircraft successfully is demonstrated in the above table. 96.67% of

the respondents answered that the training given to them was successful while 0.83% answered it was not successful and 2.50% responded they were not sure respectively.

The data from the table shows if there is a standard procedure for airworthiness in the organization of respondents. Majority 97.50% of respondents indicated that their organization had a standard airworthiness procedure to meet international standards. The rest 0.83% were negative and only 1.67% were not sure. 97.50% of respondents answered that there was a standard procedure for airworthiness. In this part it can be said that their organization meets the airworthiness requirements.

Whether the respondents get information concerning with airworthiness procedure requirements from MDCA is stated. 96.67% respondents got information about airworthiness requirements from MDCA regularly. Only 3.33% did not get enough information.

This table indicated the experiences the respondents have in un-worthy situations in their organization. 51.67% experienced un-airworthy situations and acts while 33.33% did not have such experiences. Respondents 15% were not sure about this. Most of the respondents experienced un-airworthy situations.

The above Table 4.2 states reliability and good coordination of departments in respondents' organization. 89.17% of respondents believe that their organization has reliability and good ordination between each department. While 9.16% was not sure, the other 1.67% of respondents answered that they did not have reliability and good coordination between their departments.

To emphasize the need for appropriate training, respondents were asked to whether they were given specific training for dealing with plane crash or other emergencies at their airlines. Majority of the core respondents 54.17% reported that they have been trained while about 17.50% reported that they were not trained as in the table. Only 28.33% did not know about specific training.

Table 4.2 also gives a brief account of if the respondents AMO can be available to repair immediately when there is an error in the aircraft. Respondents 68.33% reported that their AMO could repair the aircraft when an error occurred. Only 4.17% answered that they had requirements to repair immediately because there was formal reporting system to the high authority. 27.50% respondents did not show their interest. Pertaining to repair, 68.33% of respondents reported that their AMOs can make immediate repair. It can be said that it is well prepared in this regard.

This table depicts about the previous training plan the respondents have for human factor. Approximately 99.17% of the core respondents have responded their organization has a training plan for human factor previous terms while 0.83% is not sure whether their company has a training plan for human factor.

In this above table, majority of survey questions have good reliable answers. In respondents' organizations, necessary trainings, update maintenance schedule and data are given enough to meet the airworthiness requirements. The respondents were ready prepared to repair the aircraft immediately if an emergency occurred. Some respondents experienced un-airworthy situations. Trainings given to employees were successful because of standard procedures. With regard to training plan, frequency of it, use of maintenance schedule and coordination plan between departments for airworthiness requirement, majority of respondents answered that they have done these facts. This means it is good for employees at AMOs but training should be given 100%. AMO audit teams make audit in return for each other. Besides, information can get easily because of good coordination between departments. Then, the spirit of togetherness that depicted team work of respondents can be seen.

**Table 4.3 The role of respondents' department in forming airworthiness of aircrafts**

<b>Department in forming airworthiness of aircrafts</b>	<b>Number</b>	<b>Percentage</b>
Primarily responsible for forming all airworthiness requirement and procedure with minimal input from other department	77	64.17
Airworthiness requirement and procedures with equal input from other department	35	29.16
Advises other departments that are primarily responsible for forming airworthiness requirement and procedure	8	6.67
No role in airworthiness requirement	-	-
<b>Total</b>	120	100

Source: Survey Data

In the Table 4.3, the majority of respondents reported that their department played some role in forming their organizations' airworthiness requirement of aircraft. 29.16% of respondents indicated their department formed airworthiness requirement and procedures with equal input from other departments. And then 6.67% respondents showed that other departments were primarily responsible for forming airworthiness

procedures. Respondents 64.17% responded that their department was primarily responsible for forming all airworthiness requirement and procedures with minimal input from other department.

**Table 4.4 Level of compliance with airworthiness requirement**

<b>Level of compliance</b>	<b>Number</b>	<b>Percentage</b>
Very well	53	44.17
Well	52	43.33
Neutral	15	12.50
Not well	-	-
Not at all	-	-
<b>Total</b>	<b>120</b>	<b>100</b>

Source: Survey Data

Table 4.4 compares the respondents' perception concerning with their organizations' compliance with airworthiness requirement. Overall, respondents perceive their organizations to be better prepared for airworthiness. Most respondents believed that their organizations were very well 44.17% or well 43.33%. About 12.50% expressed they do not want to answer about this. In level of compliance with airworthiness requirement, 44.17% of respondents responded that 'very well'. In other words, it is more needed to be compliance with airworthiness requirement according to this percentage.

**Table 4.5 Frequency of training plan for regulation (airworthiness)**

<b>Frequency of training plan</b>	<b>Number</b>	<b>Percentage</b>
1 year	56	46.67
2 years	58	48.33
3 years	-	-
4 years and above	6	5
<b>Total</b>	<b>120</b>	<b>100</b>

Source: Survey Data

The data from Table 4.5 demonstrated how often the organization of respondents had the update and recurrent training plan for regulation of airworthiness. Respondents 48.33% have update airworthiness training plan every two year. Every year 46.47% of respondents have recurrent training while only 5% have every four years and above.

**Table 4.6 Communication ways of organization to employee**

<b>Communication ways</b>	<b>Number</b>	<b>Percentage</b>
All staff e-mail to communicate plan	83	69.17
All staff meetings to communicate plan	25	20.83
Information in employee handbook	5	4.17
Information on company web site or internet	-	-
Magnet, wallet card or other method employee can carry or bring home information	-	-
Posted information in the workplace	7	5.83
Other	-	-
<b>Total</b>	<b>120</b>	<b>100</b>

Source: Survey Data

The above Table 4.6 depicts how the organization of the respondents communicates with their employee in case of airworthiness emergency. Communication strategies most frequently cited by the respondents included all staff email 69.17%, all staff meetings was 20.83% and 4.17% of the respondents knows through employee handbook or posted information in the workplace 5.83%. In communication, the respondents mostly used email. This indicates information can get easily in this way and employees can do what it needs in time.

**Table 4.7 Ways of auditing**

<b>How do they audit?</b>	<b>Number</b>	<b>Percentage</b>
Giving notice	114	95
Making surprise check	6	5
<b>Total</b>	<b>120</b>	<b>100</b>

Source: Survey Data

Table 4.7 shows how respondents' organization has been audited by other audit team and airworthiness inspector of MDCA. 95% of respondents were given notice when their organization had been audited by other audit team and airworthiness inspector of MDCA for airworthiness matters while 5% were audited by making surprise check. Although AMO organizations of respondents have audit team and have been audited by other teams for compliance with MCAR, the audit mostly has been made by giving notices. Only 5% of audits were made by making surprise check. This fact points out that it is still needed to make more surprise check for airworthiness matters.

**Table 4.8 Types of training employees receive**

<b>Types of training</b>	<b>Number</b>	<b>Percentage</b>
Complete	87	72.50
Incomplete	33	27.50
<b>Total</b>	120	100

Source: Survey Data

Table 4.8 depicts the types of training the respondents receive. The majority 72.50% of the respondents were likely to have complete trainings in their place as described in the above table. Of the 27.50% of respondents indicated that they have not been complete in all training programs. Concerning with giving specific training, majority of respondents responded that they have complete training. It can be supposed that giving training is successful for airworthiness.

**Table 4.9 Level of airworthiness requirement**

<b>Requirement for airworthiness</b>	<b>Very well prepared</b>	<b>Well prepared</b>	<b>Neutral</b>	<b>Not well prepared</b>	<b>Not at all prepared</b>
Facility requirements	11 (9.17%)	53 (44.17%)	44 (36.66%)	12 (10%)	-
Personnel requirements	13 (10.83%)	65 (54.17%)	42 (35%)	-	-
Equipment tools and material requirements	22 (18.33%)	68 (56.67%)	30 (25%)	-	-
Certifying staff and category B1 and B2 support staff requirement	14 (11.67%)	89 (74.17%)	17 (14.17%)	-	-
Acceptance of components requirement	21 (17.5%)	73 (60.83%)	26 (21.67%)	-	-
Maintenance data requirement	31 (25.83%)	79 (65.83%)	10 (8.34%)	-	-
Production planning requirement	10 (8.34%)	80 (66.66%)	29 (24.16%)	1 (0.83%)	-
Certification of maintenance requirement	18 (15%)	78 (65%)	23 (19.16%)	1 (0.83%)	-
Maintenance records requirement	19 (15.83%)	68 (56.67%)	33 (27.5%)	-	-
Occurrence reporting requirement	11 (9.17%)	62 (51.67%)	47 (39.16%)	-	-
Safety, training, quality, policy, maintenance procedure and quality system requirement	15 (12.5%)	75 (62.5%)	25 (20.83%)	5 (4.17%)	-

Source: Survey Data

Table 4.9 gives a brief overview of level of airworthiness requirement of the respondents, what they have prepared or not prepared. In the overview of airworthiness requirement, many organizations well prepare their best to meet the requirements while a few does not prepare enough. But facility requirements and personal requirements are needed more because most of the respondents answered ‘neutral’.

#### 4.2.3 Information about Approved Maintenance Organization (AMO) of airline in conducting procedures to be airworthy

In this part, functions performed for compliance with airworthiness regulation, the most probable un-airworthy situations in respondents’ organization, the rate of airworthiness standard, handling aircraft emergency of respondents’ organization, the use of approaches to investigate human error in respondents’ organization, the environmental factors that respondents feel affected their job performance and the options of respondents’ AMO airworthiness requirement are analyzed as in the following tables. Then the facts found out are also described.

**Table 4.10 Functions performed for compliance with airworthiness regulation**

<b>Functions performed for compliance with airworthiness regulation</b>	<b>Number</b>	<b>Percentage</b>
Communicates information about available assistance programmes	6	5.00
Communicates plans and procedures to employees	113	94.17
Coordinates trainings to prepare in case of emergency	1	0.83
<b>Total</b>	120	100

Source: Survey Data

The functions performed by the respondents’ department in their organization for compliance with airworthiness regulation were depicted in Table 4.10. Communication of information about available assistance programmes is 5%. Plans and procedures which were communicated to employees is 94.17%. Only 0.83% of respondents have coordinating trainings to prepare in case of emergency. It means that it can be avoid misinformation by communicating plans and procedures to employees as in the table.

**Table 4.11 The most probable un-airworthy situations in respondents' organization**

<b>The most probable un-airworthy situations in respondents' organization</b>	<b>Number</b>	<b>Percentage</b>
Machine	9	7.50
Human	84	70
Media	2	1.67
Environment	13	10.83
Other	12	10.00
<b>Total</b>	<b>120</b>	<b>100</b>

Source: Survey Data

As shown in Table 4.11, 70% of respondents experienced the most probable un-worthy situations in their organization of human. 7.50% have experience in un-airworthy situations of machine while 10.83% un-airworthy situations were caused by environment as well as 10% by other factors. Only 1.67% of respondents' organization was experienced un- airworthiness by media. Most of the respondents experienced un-airworthy situations. The most probable un-airworthy situations are caused by human. That highlights human factor training needs to be given.

**Table 4.12 The rate of airworthiness standard**

<b>The rate of airworthiness standard</b>	<b>Number</b>	<b>Percentage</b>
Satisfactory	116	96.67
Unsatisfactory	4	3.33
<b>Total</b>	<b>120</b>	<b>100</b>

Source: Survey Data

The Table 4.12 compares the rate of airworthiness standard. Of the 96.67% respondents answered they were satisfied with the airworthiness standard. Some of the respondents 3.33% showed their interest was not in satisfactory level concerning with airworthiness.

**Table 4.13 Handling aircraft emergency of respondents' organization**

<b>The situation of handling aircraft emergency</b>	<b>Number</b>	<b>Percentage</b>
Very well equipped	43	35.83
Fairly equipped	76	63.33
Not at all equipped	1	0.83
<b>Total</b>	<b>120</b>	<b>100</b>

Source: Survey Data

The situation of handling aircraft emergency of respondents in their organization is stated in Table 4.13. The core respondents 35.83% responded that their maintenance organization was very well equipped while 63.33% reported that fair equipments are provided to their AMO. Only a few respondents of 0.83% are not at all equipped. It can be hypothesized that organizations should be very well equipped because it is concerned with human lives.

**Table 4.14 The use of approaches to investigate human error in respondents' organization**

<b>The use of approaches to investigate human error</b>	<b>Number</b>	<b>Percentage</b>
Maintenance Error Decision Aid (MEDA)	100	83.33
Human Factors Analysis and Classification System (HFACS)	1	0.83
Our own modification of MEDA	2	1.67
None	17	14.17
<b>Total</b>	<b>120</b>	<b>100</b>

Source: Survey Data

How the respondents' organization uses the approaches to investigate human error is shown in the above Table 4.14. There were 83.33% of respondents who used Maintenance Error Decision Aid (MEDA) when only 0.83% used Human Factors Analysis and Classification (HFACS). Own modification of MEDA is used only 1.67% and the rest 14.17% does not use any approaches described below. When MEDA method is mostly used, it is helpful to employees not to make maintenance error when they are in repairing of aircraft.

**Table 4.15 The environmental factors that respondents feel affected their job performance**

<b>The environmental factors that respondents feel affected their job performance</b>	<b>Number</b>	<b>Percentage</b>
Noise, Inadequate light, Too hot, Vibration, Inadequate ventilation, High humidity	112	93.33
Quiet, Too cold	8	6.67
Other	-	-
<b>Total</b>	<b>120</b>	<b>100</b>

Source: Survey Data

The environmental factors that respondents feel affected their job performance are described in the Table 4.15. 93.33% of the respondents feel disturbed of noise,

inadequate light, too hot, vibration, inadequate ventilation, high humidity. And 6.67% respondents feel that they are at ease when their environment is quiet and cool. The lack of care in employees' working place can be seen in the table of environmental factors respondents feel. This implies that employers of airlines should give enough care (health care) for employees' job performance.

To emphasize the options of airworthiness requirements, the respondents were asked to give opinion of this as in the above Table 4.16. Several areas of airworthiness requirement were assessed as mentioned: (a) general airworthiness preparedness information, (b) airworthiness preparedness training and capacity development and (c) airworthiness preparedness facilities and equipment. In aspect of the options on respondents' airworthiness requirement, respondents answered mostly "agree and strongly agree", but there was still "neutral" answer. It means respondents need some required qualifications. Besides, most respondents did not agree with the fact that foreign trainer workers are better equipped to handle airworthiness than locally trained workers. Thus, trainings which are internationally approved should be given in our country.

In summary, the results presented and discussed above clearly outline many challenges in airworthiness requirements at airlines. From the respondents, it is evident that airlines are fairly prepared to handle any un-airworthy situations. It is found that there is need to provide fully tools and equipments and approved trainings are by EASA are in demand although necessary trainings are given. The next chapter presents the overall conclusion and put forward in line with the general objectives of the study.

**Table 4.16 The options of respondents' AMO airworthiness requirement**

<b>Statements</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Strongly Disagree</b>
Our AMO's airworthiness preparation plan helps deal with every flight related emergency	31 (25.83%)	74 (61.67%)	15 (12.5%)	-	-
I have sufficient information or training about incident occurrences of aircraft	16 (13.33%)	69 (57.50%)	29 (24.17%)	6 (5%)	-
Our AMO is well prepared and has well trained manpower and calibration equipment to handle airworthiness	34 (28.33%)	64 (53.33%)	22 (18.34%)	-	-
I am well prepared to handle any kind of occurrences here at our aircraft	10 (8.33%)	76 (63.33%)	31 (25.84%)	3 (2.50%)	-
Foreign trained workers are better equipped to handle airworthiness than locally trained workers	21 (17.50%)	14 (11.67%)	55 (45.83%)	28 (21.33%)	2 (1.67%)
There are food refresher courses and training procedures offered at AMO to handle airworthiness	31 (25.83%)	63 (52.50%)	20 (16.67%)	6 (5%)	-
Our AMO has used the update software and necessary tools and equipments are well completed	23 (19.17%)	64 (53.33%)	28 (23.33%)	5 (4.17%)	-
Our AMO well supports safety equipments for employee within time scale	29 (24.17%)	52 (43.33%)	29 (24.17%)	10 (8.33%)	-
Our AMO well follows rules and regulations issued by MDCA	38 (31.67%)	67 (55.83%)	11 (9.17%)	4 (3.33%)	-
Quality Assurance Department makes audit thoroughly in accordance with schedule and procedure	37 (30.83%)	66 (55%)	17 (14.17%)	-	-

Source: Survey Data

## **CHAPTER 5**

### **CONCLUSION**

This chapter provides the conclusion and recommendations drawn from the findings to explain the implications of airworthiness requirement of Myanmar Aviation Industry.

#### **5.1 Findings**

The main objective of the study was to find out the development of airworthiness requirement of Myanmar aviation industries. In this part of development, some facts were found to be improved. As the level of education, most respondents are graduated from engineering academic. The percentage is the highest but post engineering is the least. The fact that employees are graduated people is the sign of development in aviation industry, but it can be assumed that employees in AMOs should be upgraded to the post level graduate level.

The update and recurrent training plan the respondents have for regulation (airworthiness) is another factor of development. The coordination plan between the departments of respondents concerning with compliance of airworthiness can describe how much the teams work. It is noticeable that the organizations have the spirit of togetherness to cooperate with each other.

In the regard how the organization of the respondents communicates with their employee in case of airworthiness emergency, the respondents mostly used email. This indicates information can get easily in this way and employees can do progressively what it needs in time. Most of the respondents experienced un-airworthy situations. The most probable un-airworthy situations are caused by human. That highlights human factor training needs to be given.

When MEDA method is mostly used to investigate human error, it is helpful to employees not to make maintenance error when they are in repairing of aircraft. This is one of the facts of development in the aspect of airworthiness requirement. The lack of care in employees' working place can be seen in the table of environmental factors respondents feel. This implies health care system is still under development.

In aspect of the options on respondents' airworthiness requirement, some respondents still need some required qualifications. Besides, most respondents did not agree with the fact that foreign trainer workers are better equipped to handle airworthiness than locally trained workers. Thus, trainings which are internationally approved should be given in our country. In conclusion, financial support is still weak since our country is one of the developing countries to keep in breast with other countries. It is difficult to get fully airworthiness. Approved trainings of airworthiness given by EASA and facilities are still in demand.

To fly an aircraft in the air, it is needed to be airworthy. That is why airworthiness is important. Airworthiness requirement is needed to meet the international standards. Another objective was to evaluate whether airlines meet the level of compliance with airworthiness. In the question of whether the respondents' organization has any audit team and fair plan for compliance with MCAR, most of the respondents answered that they had some audit team and fair plans in their organization for compliance with MCAR. It is clearly that AMOs meet the airworthiness requirement.

In level of compliance with airworthiness requirement, minority of respondents responded that 'very well'. In other words, it is more needed to be compliance with airworthiness. Despite AMO organizations of respondents have audit team and have been audited by other teams for compliance with MCAR, the audit has been mademostly by giving notices. Only a few audits were made by making surprise check. This fact points out that it is still needed to make more surprise check for airworthiness matters. In other words, it means we cannot check airworthiness standards fully. If we want to comply with airworthiness requirements, there should be a surprise check of it.

Concerning with giving specific training, majority of respondents responded that they have complete training and human factor trainings were given enough. It can be supposed that giving training is successful for airworthiness. From the respondents, their organization gives trainings to the employees but there should be effective training plans. Most of the airlines conduct their airline procedures in accordance with ICAO approved regulations, they all should try to obtain to the level of EASA approved standards. In this study, it can be seen that employees from AMO departments of the airlines follows the guidelines of MOE prescribed by DCA. Most of AMO employees assume they are primarily responsible of airworthiness. It can be

aware of the fact that AMO has regulatory, update and recurrent training plan. Despite update and recurrent training plan are given every one or two year as described, some employees do not acquire fully training as procedures.

In the overview of airworthiness requirement, many organizations well prepare their best to meet the requirements while a few does not prepare enough. But facility requirements and personal requirements are needed more because most of the respondents answered 'neutral'. In spite of the organizations meet the requirement, there is lack of some facts to fulfill. Getting information concerning with airworthiness procedure requirements from MDCA is the proof of the fact that airlines meet the airworthiness requirements.

The functions performed by the respondents' department in their organization for compliance with airworthiness regulation were in the ways of plans and procedures. Majority of respondents answered they were satisfied with the airworthiness standard. It also depicts the fact that it meets the requirements.

In the situation of handling aircraft emergency of respondents in their organization, majority of respondents reported that fair equipments are provided to their AMO. It can be hypothesized that organizations should be very well equipped because it is concerned with human lives.

In aspect of the options on respondents' airworthiness requirement, most respondents answered "agree and strongly agree", but few respondents responded "neutral" answer. It means respondents need some required qualifications. Besides, most respondents did not agree with the fact that foreign trainer workers are better equipped to handle airworthiness than locally trained workers.

It can be noticed that using update maintenance schedule and data makes airworthiness situations to bring more. Besides, there is audit team and fair plan. And again DCA makes regular audit to develop continuous airworthiness. Requirements from AMO are expressed like 'well prepared' when respondents answered to survey questions. It should be 'very well prepared' because respondents work where aircraft maintenance is made. Production planning is found a little vulnerable. In spite of the fact that air transport is one of the perceived safest mode of transportation in the world, occurrences, accidents and incidents will continue to occur but with lessened impact as a result of doing better airworthiness regulations.

## 5.2 Recommendations

From the study findings and the conclusion made, the following recommendations are put forward for the improvement of airworthiness preparedness.

This should be a priority in airlines policy planning. From the study findings, the majority of the airlines respondents have been trained on airworthiness. But there should be better international approved trainings. All airlines should provide effective trainings completely for airworthiness preparedness.

MDCA should cooperate with AMOs from other countries in providing trainings. Consequently, it will promote the spirit of togetherness and make the workforce more effective. A high level of airworthiness cannot be attained by any single respondent since the level of airworthiness preparedness at the airlines is, to a large extent, governed by the interaction of AMO departments.

A better integrated communication system involving all organizations operating at the airlines is thus needed. In the end, respondents should have regular meetings and use a common information system. All participating organizations could be connected to this system and capture information about air and ground incidents into a common database. This information exchange and regular meetings provide the necessary premises for their implementation of measures.

Employees under AMO should follow exactly the airworthiness regulation because they are the ones who work near aircraft. Responsible person from respective airlines must issue safety equipments constantly for their maintenance employees who work in a risky condition. Employees from line maintenance need to make installations and repairing to be perfect for a flight. Health care should be provided to workers under AMOs hence they feel environmental impacts such as noise, hot, etc. It can be supposed that human factor can be utilized completely if there is a transportation system for employees.

Myanmar DCA is now undergoing adaptation of EASA standard regulation likewise other countries to fulfill ICAO standard. As airworthiness department, it is handling what to take action in the findings as shown in current audit. However, it should be made evaluations during an audit to confront the challenge of a surprise check. Aviation Training Center which was established in 2015 to improve AMO standards needs to be upgraded to comply with EASA standard. National instructors in this center should be advanced like foreign trained instructors.

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## APPENDICES A - Survey Questionnaires

### Questionnaire for Approved Maintenance Organization employees of Airlines

#### Instructions

1. Please respond to all question and kindly note that all responses are valued
2. For questions where there are no options, you are to answer in own words.

#### Section A: Background Information

- (1) Gender  
 Male  Female
- (2) Age  
 21-30  31-40  41-50  
 Above50
- (3) What is your highest level of formal education?  
 Engineering  Post Engineering  Other Graduate
- (4) What type of airline maintenance operation do you work for?  
 International Airline  Domestic Airline  Both
- (5) Working at  
 Quality Assurance Department  
 Line Maintenance Department  
 Engineering Services Department  
 Materials& Logistics Department  
 Other

- (6) How many years of aviation experience do you have?
- Less than 1 year
  - 1-5 years
  - 6-10 years
  - 11-15 years
  - 16-20 years
  - More than 20 years

**Section B: Airworthiness Requirement Knowledge and Information**

- (7) Does your Department have any plan, procedure for compliance with Airworthiness requirement? Do you know your duty and responsibility involved in Maintenance Organization Exposition (MOE) which approved by DCA?

Yes                       No                       Not Sure

- (8) Does your organization have regulatory training for each department concerning with Myanmar Civil Aviation Requirements (MCAR)?

Yes                       No                       Not Sure

- (9) What role does your department play in forming your organization's requirement for airworthiness of aircraft?

Primarily responsible for forming all airworthiness requirement and procedure with minimal input from other department

Airworthiness requirement and procedures with equal input from other department

Advises other departments that are primarily responsible for forming airworthiness requirement and procedure

No role in airworthiness requirement

- (10) Overall, how would you rate your organization's compliance with airworthiness requirement?
- Very well
  - Well
  - Neutral
  - Not well
  - Not at all
- (11) Does your organization have the update and recurrent training plan for regulation (airworthiness)?
- Yes             No
- (12) How often does your organization have the update and recurrent training plan for regulation (airworthiness)?
- 1 Year             2 Years             3 Years
  - 4 Years and above
- (13) Has your organization used update maintenance schedule and data?
- Yes             No             Not sure
- (14) Does your organization have coordination plan between each department?
- Yes             No             Not sure
- (15) What does your organization's coordination plan consist of and how does your organization communicate its coordination plan to employee?
- All-staff e-mail to communicate plan
  - All-staff meetings to communicate plan
  - Information in employee handbook
  - Information on company Web site or internet
  - Magnet, wallet card or other method employee can carry or bring home information
  - Posted information in the workplace
  - Other

- (16) Does your organization have any audit team and fair plan for compliance with MCAR?  
 Yes                       No  
 Not Sure
- (17) Has your organization been audited by other audit team and airworthiness inspector of MDCA for continuous airworthiness?  
 Yes                       No  
 Not Sure
- (18) When your organization has been audited by other audit team and airworthiness inspector of MDCA for airworthiness matters, how do they audit?  
 Giving Notice                       Making Surprise Check
- (19) What type of special training do these employees receive? (Please select all that apply)  
 General familiarization  
 On Job Training  
 Company Procedure  
 Human Factor  
 Basic Training  
 Type Training  
 Software Handling Training
- (20) Have the above trainings given by your organization supported for Airworthiness of aircraft successfully?  
 Yes     No  
 Not Sure

(21) What is your level of airworthiness requirement?

Requirement for Airworthiness (AMO)	Very well prepared	Well prepared	Neutral	Not well prepared	Not at all prepared
Facility Requirements					
Personnel Requirements					
Equipment Tools and Material Requirements					
Certifying Staff and Category B1 and B2 Support Staff Requirement					
Acceptance of Components Requirement					
Maintenance Data Requirement					
Production Planning Requirement					
Certification of Maintenance Requirement					
Maintenance Records Requirement					
Occurrence Reporting Requirement					
Safety, Training,, Quality Policy, Maintenance Procedures and Quality System Requirement					

**Section C: Information about Approved Maintenance Organization (AMO) of airline in conducting procedures to be airworthy**

- (22) Do you think there is a standard procedure for airworthiness(AMO)in your organization?  
 Yes       No       Not sure
- (23) Do you get information concerning with airworthiness (AMO) procedure requirement from MDCA?  
 Yes       No       Not sure
- (24) What functions does your department perform in your organization compliance with airworthiness regulation?  
 Communicates information about available assistance programmes  
 Communicates plans and procedures to employees  
 Coordinates training to prepare employees in case of emergency
- (25) Have you ever been experienced in un-airworthy situations and acts in your organization?  
 Yes       No       Not sure
- (26) What are the most probable un-airworthy situations at your organization?  
 Machine     Human     Media  
 Environment  Other
- (27) Do you believe that each department of your organization has reliability and good coordination?  
 Yes       No       Not Sure
- (28) How do you rate airworthiness standard?  
 Satisfactory       Unsatisfactory
- (29) Has your organization given you specific training for dealing with plane crash or other emergencies at airline?  
 Yes       No       Don't Know
- (30) Can your AMO be available to repair immediately when there is an error in the aircraft?  
 Yes       No       Not Sure

- (31) If yes, how technically is well equipped in handling aircraft emergency?  
[        ] Very well equipped            [        ] Fairly equipped  
[        ] Not at all equipped
- (32) What is your organization's approach to human error investigations? Which of the following approaches does your operation use to investigate human error? (Please select all that apply.)  
[        ] Maintenance Error Decision Aid (MEDA)  
[        ] Human Factors Analysis and Classification System (HFACS)  
[        ] Our own modification of MEDA  
[        ] None
- (33) Does your company have a training plan for human factor previously?  
[        ] Yes            [        ] No            [        ] Not Sure
- (34) Check any of the environmental factors that you feel affected your job performance?  
[        ] Noise  
[        ] Quiet  
[        ] Inadequate light  
[        ] Too hot  
[        ] Too cold  
[        ] Vibration  
[        ] Inadequate ventilation  
[        ] High humidity  
[        ] Other (list)

(35) Mark in the appropriate box, your option on your AMO airworthiness requirement?

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Our AMO's airworthiness preparation plan helps deal with every flight related emergency					
I have sufficient information or training about incident occurrences of aircraft					
Our AMO is well prepared and has well trained manpower and calibration equipment to handle airworthiness					
I am well prepared to handle any kind of occurrences here at our aircraft					
Foreign trained workers are better equipped to handle airworthiness than locally trained workers					
There are good refresher courses and training procedures offered at AMO to handle airworthiness					
Our AMO has used the update software and necessary tools and equipments are well completed					
Our AMO well supports safety equipments for employee within time scale					
Our AMO well follows rules and regulations issued by MDCA					
Quality Assurance Department makes audit thoroughly in accordance with schedule and procedure					

Thank You

**APPENDICES B-Aircraft in Myanmar**

No	Registration	Aircraft	Type	Operator	Category
1	XY-AMB	Grand Caravan	Aircraft	Myanmar National Airway	A
2	XY-AMC	Grand Caravan	Aircraft		A
3	XY-AEZ	ATR 72-212	Aircraft		A
4	XY-AIA	ATR 72-212	Aircraft		A
5	XY-AGP	Embraer ERJ 190	Aircraft		B
6	XY-AGQ	Embraer ERJ 190	Aircraft		B
7	XY-AJN	ATR 72-212A	Aircraft		B
8	XY-AGY	ATR 72-212A	Aircraft		B
9	XY-AJZ	ATR 72-212A	Aircraft		B
10	XY-AME	ATR 72-212A	Aircraft		B
11	XY-AMI	ATR 72-212A	Aircraft		B
12	XY-AMJ	ATR 72-212A	Aircraft		B
13	XY-AMK	ATR 72-212A	Aircraft		B
14	XY-AML	ATR 72-212A	Aircraft		B
15	XY-ALB	Boeing 737-800NG	Aircraft		B
16	XY-ALC	Boeing 737-800NG	Aircraft		B
17	XY-ALF	Boeing 737-800NG	Aircraft		B
18	XY-ALG	Boeing 737-800NG	Aircraft		B
19	XY-AIS	ATR 72-212A	Aircraft	Asian Wings	A
20	XY-AIU	ATR 72-212A	Aircraft	Asian Wings	A
21	XY-AFI	Airbus Helicopter AS 350	Helicopter	AMAS	A
22	XY-AFJ	Airbus Helicopter AS 350	Helicopter		A
23	XY-AFK	AW-139	Helicopter		A
24	XY-AIM	ATR 72-212	Aircraft	Yangon Airways	B
25	XY-AIN	ATR 72-212	Aircraft		B
26	XY-AJI	ATR 72-212A	Aircraft		B
27	XY-AJE	ATR 72-212A	Aircraft	Air KBZ	A
28	XY-AJT	ATR 72-212A	Aircraft		B
29	XY-AJJ	ATR 72-212A	Aircraft		B
30	XY-AJW	ATR 72-212A	Aircraft		B
31	XY-AMA	ATR 72-212A	Aircraft		B
32	XY-AME	ATR 72-212A	Aircraft		B
33	XY-AGR	A319-112	Aircraft	MAI	A
34	XY-AGO	A320-214	Aircraft		B
35	XY-AGU	A319-111	Aircraft		B
36	XY-AGV	A319-111	Aircraft		B
37	XY-AJF	DA 40 NG	Aircraft	MAA	A
38	XY-AJG	DA 40 NG	Aircraft		A
39	XY-AJH	DA 40 NG	Aircraft		A
40	XY-AMD	DA 42 NG	Aircraft		A
41	XY-AJP	ATR 72-212A	Aircraft	Mann Yadanabon	A
42	XY-AJO	ATR 72-212A	Aircraft		A
43	XY-AJM	ATR 72-212A	Aircraft	GMA	B
44	XY-AJS	ATR 72-212A	Aircraft		B

Source: Department of Civil Aviation, Myanmar (MDCA)

**APPENDICES C- The audit findings of AMO**

Approved Maintenance Organization (AMO) Name	Country	2016		2017		2018	
		Number of Finding	Level	Number of Finding	Level	Number of Finding	Level
Myanmar National Airline	Myanmar					1	1
		14	2	8	2	6	2
Myanmar Airways International	Myanmar	3	2	5	2	4	2
Air KBZ	Myanmar	2	2	6	2	2	2
Air Mandalay	Myanmar	1	1				
		6	2	9	2	4	2
Golden Myanmar Airlines	Myanmar	2	2	2	2	4	2
Yangon Airliways	Myanmar	4	2			3	2
Mann Yadanarpon Airlines	Myanmar	3	2	7	2	4	2
Air Myanmar Aviation Services (AMAS)	Myanmar	1	2	5	2	3	2
Yangon Aircraft Engineering Co.ltd	Myanmar	3	2			8	2
Myanmar Aviation Academy	Myanmar	7	2	2	2	4	2
Vector Aerospace Engine Services (VAESA)	Canada					NIL	
GAMECO	China	1	2	3	2	NIL	
STAECO	China	2	2	NIL		4	2
Air France	France	3	2	NIL		NIL	
Vector Aerospace	France					NIL	
Lufthansa Technik	Germany	NIL		NIL		NIL	

GMR Aero Technic Ltd	India			1	2	1	2
Air Works Commercial MRO	India	NIL		1	2	1	2
Garuda Maintenance Facility (GMF)	Indonesia	2	2	3	2	NIL	
SAE	Malaysia	NIL		3	2	NIL	
Airod Aerospace Technology SdnBhd	Malaysia	2	2	5	2	2	2
Asia Aero Technic	Malaysia					2	2
Airbus Helicopter	Malaysia	3	2	3		1	2
Agusta Westland Malaysia SDN.BHD	Malaysia					NIL	
SIAEP	Philippines	NIL		4	2	4	2
SIAEC	Singapore					1	2
ST Aerospace	Singapore					NIL	
Fokker Services Asia PTE Ltd	Singapore					NIL	
ST Aerospace Engines Pte Ltd	Singapore	1	2	NIL		NIL	
Pratt & Whitney	Singapore			NIL		NIL	
Honeywell Aerospace Singapore Pte Ltd	Singapore			1	2	1	2
Dallas Airmotive	USA			NIL		NIL	
VAECO	Vietnam	3	2	2	2	2	2