A Literature Based Examination of Human Error in Military Aviation Maintenance Management Programs

دراسة تستند إلى الأدب لخطأ بشري في برامج إدارة صيانة الطيران العسكري

by

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Abstract

This study examines human error associated with the military aviation maintenance management programs. The rationale behind this study was based on the rising human error that comes along with military aviation maintenances. To come up with a practical findings quantitative data were obtained by consulting military aviation technicians at MRO (Maintenance Repair and Overhaul) headquarters in Abu Dhabi, United Arab Emirates. The main data collection tool that was used for this study was questionnaires subdivided into two sections examining demographics of the respondents alongside the objectives. The results indicate that military aviation the industry is faced with fuel and the labor costs challenges that significantly contribute to human error in the management program. Neglect and less focus on the product as well as machine safety together with complexities such as poor training enhances errors in the military aviation programs. The study finally draws to conclusion that there are varied human error associated with the military aviation maintenance management programs most of which can be mitigated.

نبذه مختصره

تتناول هذه الدراسة الأخطاء البشرية المرتبطة ببرامج إدارة صيانة الطيران العسكري. يستند الأساس المنطقي وراء هذه الدراسة على ارتفاع الخطأ البشري الذي يأتي جنبا إلى جنب مع صيانة الطيران العسكري. وللتوصل إلى نتائج عملية ، تم الحصول على بيانات كمية من خلال استشارة فنيي الطيران العسكريين في مقر MRO (إصلاح الصيانة والإصلاح) في أبو ظبي ، الإمارات العربية المتحدة. كانت أداة جمع البيانات الرئيسية التي تم استخدامها لهذه الدراسة عبارة عن استبيانات مقسّمة إلى قسمين يفحصان التركيبة السكانية للمجيبين إلى جانب الأهداف. وتشير النتائج إلى أن الطيران العسكري يواجه الصناعة مع تحديات تكاليف العمالة وتكاليف العمالة التي تساهم بشكل كبير في الخطأ البشري في برنامج الإدارة. الإهمال والتركيز الأقل على المنتج بالإضافة إلى سلامة الماكينة بالإضافة إلى التعقيدات مثل سوء التدريب يعزز الأخطاء في برامج الطيران العسكري. في النهاية ، توصلت الدراسة إلى استنتاج مفاده أن هناك خطأ بشريًا متنوعًا يرتبط ببرامج إدارة صيانة الطيران العسكرية التي يمكن التخفيف منها بشكل كبير.

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Chapter 1: Introduction

1.1 Background of the Study

The military ability to maintain effective battlefield mobility is defined by many factors; key amongst these factors is the availability of the right aviation assets. In military aviation for instance, military research publications have effectively concluded that the successes of its various operations are hinged on the relevance of tools such as war crafts and submarines to their specific task. But other than having the right military equipment, scholars aver that there is need to ensure that these assets are effectively maintained and repaired to enhance their performance in their assignments. In this discourse on aviation maintenance, Simões, Gomes, & Yasin (2011) noted that the relevance of maintenance of the military hardware is to ensure that they perform optimally in the execution of their tasks. Panagiotidou & Tagaras (2007) add onto this by noting that it is important if routine repairs and maintenance services are offered to military assets to ensure that any chance of error is effectively eliminated. In this regard, it is conclusive to admit that maintenance is a central component of military aviation that cannot be overemphasized.

1.2 Maintenance Management

Aviation management, in its broadest term, entails all those activities that are riveted on enhancing the performance of all the operations in the industry (Simões, Gomes, & Yasin, 2011). It entails harnessing all the necessary resources to ensure that operations in the sector always at the highest operation efficiencies. In military aviation, maintenance is the one of the most important aspects of ensuring efficient operations and performance of designated military tasks (Rashid, Place, & Braithwaite, 2014). According to Dekker (2014), maintenance in military aviation entails an integrated system where all the military hardware engaged in aviation is regularly serviced to ensure that they remain actively engaged in operations. This is further corroborated by Panagiotidou & Tagaras (2007) who noted that the whole concept of maintenance management is hinged on two very critical issues - safety and efficiency. Safety in this regard entails the activities undertaken to ensure that all the operations in the industry are not life threatening. Moreover, efficiency in the sector is to ensure that all these operations achieve the intended purpose within the intended time (Simões, Gomes, & Yasin, 2011).

All military operations, aviation or otherwise, consider maintenance as a very essential component of their operations (Doyle, 2004). The military has fully operational maintenance unit to facilitate

the operations of the maintenance department. This rubric offers a maintenance schedule and other variants considered essential in the maintenance of its assets. Moreover, the military is engaged in intermittent review of its safety management and maintenance procedures as a way of dealing with new threats since human errors are considered as not static but rather very dynamic (Doyle, 2004).

There is a logical inference to the assertion that the military aviation operations will be hampered and ineffective if maintenance is not included in its operations (Panagiotidou & Tagaras, 2007). The risks of operating without effective maintenance thus necessitate the military to engage in an effective management plan (Rashid, Place, & Braithwaite, 2014). With the immense relevance of maintenance as a concept of enhancing safety and efficiency, there a need to ensure that an extensive plan is put into place to facilitate military maintenance. Research conducted on global military operations even at the superficial level indicates the extent to which the concept of maintenance of military operations is undertaken. There is obviously a lot of emphasis on the need to ensure that strategic programs for safety are put into place through effective management procedures.

1.2.1 Types of Maintenance

Types of aviation maintenance include corrective maintenance which focuses on ensuring that the defects in the aircraft are corrected (Simões, Gomes, & Yasin, 2011). In addition, preventive maintenance ensures that a certain level of operations of the aircraft is to be maintained. Rashid, Place, & Braithwaite (2014) also notes that there is predictive maintenance which is to constantly assess the status of the aircraft and it capacity of operation as a way of ensuring that it operates within the established threshold. Meanwhile, overhaul entails a complete review of the equipment before any type of failure is noticed.

1.2.2 Evolution of Aviation Maintenance

The aviation industry experiences a lot of changes in the maintenance of their systems. As established by Wohl (2015), one of the most salient issues faced by the industry is the fact that there are not so many professionals in the industry who offer these services at competitive prices. In his assessment of the job market for aeronautical engineers in the US, Chen et al (2016) established that not so many professionals exist in the market. In this regard, the cost implications of maintaining the equipment used in the industry is so high. Block et al (2014) succinctly puts it that there is insufficient supply of skilled labour in the market. With a huge demand for their

services, their costs tend to be very high. Moreover, Panagiotidou & Tagaras (2007) disclose that the costs of purchasing spare parts, other than labour are quite exorbitant thus pushing higher the operational costs of maintaining aircrafts in the aviation industry.

The fast changing technology in the industry has been equally noted to be having negative implications on maintenance management in the industry (Simões, Gomes, & Yasin, 2011). The fast changing technology requires prompt adjustments especially in terms of the mechanics. For the industry, this pushes further the costs since the mechanics have to be trained intermittently to ensure that they remain abreast with the first changing technology (Wohl, 2015).

1.2.3 Models of Maintenance Optimization

Maintenance optimization models, as described by Aditya et al (2015), entail those decision models that can be effectively used to establish the value of maintenance. The focus of these models is to enhance the operations of the industry and improve its performance to exponential abilities. (Rashid, Place, & Braithwaite, 2014) segments the objectives of these maintenance models into five categories which are to ensure that the system functions well, enhance the lifespan of the system, enhancing the safety standards of the system, enhancing the human well-being and enhancing the optimal capital alternative decisions.

1.3 Aviation

Aviation entails the operations that are involved in the design, servicing and the operations of aircrafts. Aviation and the related industry have been very instrumental in the development of various sectors of the global economy. As discussed by Panagiotidou & Tagaras (2007), aviation has revolutionized the transport sector thus making very tremendous contribution to businesses. Moreover, the development of the aviation industry has greatly enhanced the operations of the military as well (Chen et al, 2016).

The history of aviation can be traced back to the 10th Century when the concept of hot air balloon was conceptualized. In the 17th Century, further developments followed which led to the flying of the first flight of airships developed through the concept of hot air balloon (Dalamagkidis, 2015). While developing the history of airplanes, Shafiee & Chukova (2013) note that the inventions and conceptualization of ideas from the 12th Century was so rapid that it was hard to keep tabs on the step by step developments in the industry (Dalamagkidis, 2015). However, he notes that the 19th Century invention of the first controlled and powered flight by the Wright

brothers marked a major milestone in the development of airplanes. It essentially revolutionized the sector and provided a platform for an avalanche of inventions that have led to the current technological advancements (Bejan et al, 2016).

The 19th and 20th Centuries witnessed massive inventions in the development of aircrafts. Passenger airplanes began commercial flights, military aircrafts were developed in the early 19th Century to help in the conventional warfare and the discipline of aviation advanced immensely. Currently, airplanes operate on advanced technology that has even witnessed the establishment of unmanned aircrafts (Chen et al, 2016). In the military, there have been a lot of technological advancements in the field of aeronautical engineering that has led to the development of advanced airplanes in the globe.

1.3.1 Types of Aviation

There are several types of aviation (Robertson, 2014). These are clustered based on the functions or the responsibilities of the industry. Civil aviation for instance, entails the commercial aircrafts that are not engaged in any military activity. Civil aviation is a representation of both commercial and private flying which does not involve any military activity. Civil aviation includes all scheduled air transportation and private or commercial flights which have no specific flying times. Other types of aviation entail military aviation which entails military activities (Hopp, & Kuo, 2010). In addition, other types of aviation include private aviation, ballooning and soaring aviation.

1.3.2 Safety as an Issue of Aviation

One of the major areas of focus for research in the aviation industry is safety. Many operators in the sector are seeking for modalities of ensuring that all who are engaged in the sector are safe. According to Panagiotidou & Tagaras (2007), many scholars in the sector admit that the biggest challenge in the sector is having a robust system where the safety of the operations in the sector is guaranteed. Errors in the aviation industry have led to catastrophic ends where massive losses have been reported either in terms of life or resources. In this regard, it is accurate to disclose that the massive challenge in the sector is safety and the numerous research publications on aviation safety management (Hopp, & Kuo, 2010).

1.4 The Problem of Study

The complexity in the military aviation has been explored by Shafiee & Chukova (2013). They note that the operational strategies of the military, unlike other types of aviation, make it a very complicated industry that needs a fairly rational approach. Studies have been developed to suggest that the operations of military aviation are fundamentally different from those of other type of aviation. Being radically different, the management of the maintenance approach used in the industry is very different. It lays emphasis on a lot of variables that are considered at the centre of the operations of the military in the globe (Hopp, & Kuo, 2010).

Maintaining military equipment requires specialized training other than the conventional technical skills required for the normal aircrafts. This is based on the fact that the military equipment are adapted for special purposes. Wohl (2015) corroborates this by noting that the fact that military aircrafts are differentiated into specialized equipment for special tasks makes them very complex in terms of their technical abilities. In this regard, there is considerable challenge for the engineers or the technicians engaged in the maintenance of these aircrafts.

There are many challenges that come from the technical complexities of the military equipment, Jeong et al (2016) admits that military aviation comes with a relatively stringent code of ethics that bind the technicians engaged in the maintenance of its equipment. The operational manual of the normal technicians in the civil sector are quite different from those of the military. For instance, there is a lot of confidentiality involved in the military maintenance practice (Nicolai and Dekker, 2008). The technicians are bound to undertake their activities in privacy without revealing to unauthorized personnel their activities. Therefore, this study is meant to fill in the gaps by examination of human error in military aviation maintenance management programs. It explores how the use of technology in military aviation maintenance where technicians share their experiences and challenges, the military operational model thus seems a little bit complex to navigate.

1.5 Objectives of the Study

This study was guided by the following objectives:

1. To establish the types of human errors that can occur and the complexities that arises while working in the aviation industry

2. To identify factors influencing human error in military aviation maintenance management programs

3. To explore challenges associated with military aviation management

Hypothesis

1- Human errors occurs alongside the complexities that arises while working in the aviation industry. This hypothesis was designed to explore how human errors that are influenced with other technicalities may contribute to fatalities in the aviation industry. It looked into erroneous circumstances that emanates along the line of aviation management.

2- There are varied factors influencing human error in military aviation maintenance management programs This hypothesis explored issues that enhance the occurrence of errors in the military aviation maintenance programs. It utilized previous publications to compare and contrasts previous while an insight concerning the significance of knowing the factors influencing human error in military aviation maintenance program.

3- There are challenges associated with military aviation management. This hypothesis looked into issues surrounding military aviation management programs with lots of focus on prevention mechanisms.

1.6 Maintenance and Maintenance Management in Aviation

As earlier noted, the essence of developing intermittent maintenance programs in military aviation is to eliminate any chance of error in the operations of the aviation military assets. According to Hopp, & Kuo (2010), these maintenance operations are to ensure that these assets are at very high operational standards. Human error, unfortunately, tends to lower in a significant capacity, the operational effectiveness of military assets. Thus a proper maintenance system must effectively handle the problem or the risks of these errors that may lower the operational capacity of the military assets.

Human errors in military aviation, just like in the conventional aviation discourse, refer to the errors that arise out of human acts of omission or commission. Anil, Yadava, & Deshmukh, (2011) note that errors are those actions that do not generate the purpose for which they are intended. When errors are attributed to humans, it essentially means that they are generated out of the faults of the humans themselves. Usually, human errors, just like other errors lead to several undesired effect like accidents. Anil, Yadava, & Deshmukh, (2011). Succinctly puts it that the outcome of

these acts of error lead to immense loss that can be so devastating to a great extent. The accompanying loss thus makes the need to generate strategies of overcoming human error a very urgent objective in the aviation industry.

Many programs have been instituted by various stakeholders in the military aviation sector to develop critical strategies of finding remedies to the debilitating effect of these errors on the operations of the military (Rashid, Place, & Braithwaite, 2014). Hopp, & Kuo (2010), offer an exhaustive discourse on the progression of various programs initiated to remedy human errors in aviation military (Anil, Yadava, & Deshmukh, 2011). They do note that there have been several concerted efforts by the military to develop effective programs to ensure that various antecedents to human errors in the aviation sector are assessed and various strategies developed to ensure that these errors are reduced significantly.

While human errors cannot be entirely eliminated in its entirety within the realms of military aviation, Shafiee & Chukova (2013) assert that tremendous steps have been made to understand some of the very pertinent issues regarding these errors. Studies suggest that research is taking a very fundamental in developing these programs as to mitigate the effects of human errors in military aviation (Anil, Yadava, & Deshmukh, 2011). Based on the fact that it is the desire of any organization, commercial or otherwise, to eliminate human error, there have been several efforts to establish effective management programs to deal with he expected errors based on several antecedents. A wide number and models have been rolled out to aid in the management of human errors within aviation military. The focus of these programs is to review the errors and establish what is called “a model of debugging” the error which is essentially a strategy of developing solutions to these errors so as to improve on maintenance management.

1.7 Military Aviation Maintenance Management

Anil, Yadava, & Deshmukh (2011) give a very elaborate discourse on the need to conceptualize an effective maintenance management for military aviation. He begins this discussion by making an admission that maintenance is a critical aspect of operations in military aviation whole relevance cannot be overemphasized. His studies assert that there is no way in which aviation military operations can be undertaken without an effective maintenance management template. Hopp, & Kuo (2010), mentions that to improve the manner in which management is undertaken, a proper management plan has to be developed to aid in this.

Many scholars, including Robertson (2014) and have proposed several models for managing aviation maintenance in the military. He admits that there is not any single maintenance rubric that is fool proof or effective in entirety. He discloses that there is need to constantly review the existing operations and incorporate newer and effective management modules based on the dynamics of the industry. Jeong et al (2016) supports this assertion by noting that the management rubric used a decade ago may not be able to offer the same efficiency as the rubric used today in the industry. Essentially, this means that constant reviews of the established strategies and device modalities through which improvements can be mad. The aviation operations in the US military, according to Hopp & Kuo (2010), constantly review their management framework for safety as a way of solving emerging issues in the operations of military aviation.

The development of any aviation military management maintenance plan, argues Jeong et al (2016), should be based on a very extensive research of various factors. This is affirmed by Hopp, & Kuo (2010). He mentions that developing a management strategy for maintaining the assets of the military should be after a consideration of the facts "as they come." This essentially means that any operation of aviation military is a chance to undertake a comprehensive research so that proper mechanisms are instituted in a bid to operationalized effective management modules relevant to address the emerging errors or risks in the industry (Govindan et al, 2015). Research therefore plays a very pertinent role in the management of these safety management practices.

1.8 Managing Complexity in Military Aviation Maintenance

The complexity in the military aviation has been explored by Shafiee & Chukova (2013). They note that the operational strategies of the military, unlike other types of aviation, make it a very complicated industry that needs a fairly rational approach. Studies have been developed to suggest that the operations of military aviation are fundamentally different from those of other type of aviation. Being radically different, the management of the maintenance approach used in the industry is very different. It lays emphasis on a lot of variables that are considered at the centre of the operations of the military in the globe (Hopp, & Kuo, 2010).

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1.8.1 How is Military Aviation Managed?

Management in military aviation in the globe over follows a strict code of ethics established by the military (Jeong et al, 2016). While these codes of ethics vary immensely, it is also agreeable that there are specks of similarities in the globe. Operations of military aircrafts are, to a large extent, very private (Govindan et al, 2015). They operate independently within their set of statues apart from those that are reserved for the civilians.

Not many research publications explicitly detail the manner in which military aviation is undertaken (Wohl, 2015). Majority of academic publications have very little information into how they undertake their maintenance activities based on the fact that their activities are closely guarded. However, many scholars agree that the maintenance of aircrafts in the military aviation is as consistent as can be. As earlier noted in the introductory sections of the study, the military is engaged in a lot of research to identify newer models of operating their aviation. In this regard, military aviation has a routine maintenance model of its products (Govindan et al, 2015). With a robust set of skilled human resource capital, there is very robust maintenance program for managing its military aviation hardware.

1.8.2 Who Manages Military Aviation

As earlier indicated, military in the globe has its own professionals who are engaged in the daily maintenance of its hardware. The army hardly relies on private contractors to undertake their maintenance activities since majority of their operations are considered very private. There is an

established institutional operation rubric established by the military aviation to facilitate its maintenance services in the industry (Wohl, 2015). The military has segmented its operational management template to cater for different operators in the industry. The operators entail a team of engineers and technicians who are able to undertake any form of maintenance for the military aviation assets. Based on the standards set by strategic aircraft capability, the management of military assets are conferred through the process of validation of due regard to military aircraft. In that respects, there is a secured approach to demonstrate the management of military aviation programs.

1.8.3 Essence of Military Aviation Maintenance Management

There are a lot of merits in having an inviolable maintenance operations whether in the military or in the civil aviation sector. As examined by Wohl (2015), the aviation industry faces near similar challenges whether it is in the civil or the military aspect of aviation. In this regard, it is admissible that the rationale behind the establishment of a proper management strategy in the aviation industry.

Efficiency

Operational efficiency is a very critical aspect of operations in the military. The military requires their equipment to be operating at their best and most importantly, they - the equipment, should be able to perform the purpose that they are designed for without any hitch. Perhaps this is the primary focus of any maintenance program instituted in the military aviation industry (Jeong et al, 2016). Operations efficiencies enhances the performance of the military in executing their mandates and thus if this is achievable through a well-documented program of maintenance, then there is a lot of sense in establishing an effective management framework to facilitate maintenance of its equipment.

Safety

Safety is a very core issue in the management of aircraft operations (Rashid, Place, & Braithwaite, 2014). Whether in military aviation or civil, the concept of safety is emphasized. Maintenance, in its broader sense has a very important role to play in the enhancement of the safety of the operators. Whether in terms of the servicemen or the operators of the machines, developing clear program for servicing its products play a very crucial role in enhancing safety for military

operations. Jeong et al (2016) lay a lot of emphasis on this in his discourse on safety as an issue in aviation. He notes that safety is the basic fabric onto which the maintenance programs in the aviation industry is woven. Essentially, it means that the philosophy of any maintenance procedure, whether in the military or the civil aviation should be to protect the users.

Cutting cost

Maintaining products is essential in cutting down the costs of operations. Predictive and protective costs are all geared towards solving a problem that would otherwise damage the entire equipment. Thus it is admissible that through maintenance of equipment in the aviation industry, an unforeseeable loss is avoided by fixing the risks that may lead to the loss (Rashid, Place, & Braithwaite, 2014). Simões, Gomes, & Yasin (2011) develop this concept further by noting that the military hardware come with very huge price tags and losing a single unit of an aircraft for instance, is a huge burden, financially, for the public. In this regard, constant maintenance provides a better alternative other than risking the life of the whole equipment or the users.

Thesis Map

This thesis is meant to examine human error in military aviation maintenance management programs. The thesis is divided into 7 chapters. Chapter one talks about introduction, background of the study, problem statement and the objectives of the study. Chapter two explains about the literature review, chapter three Theoretical and Conceptual Framework and chapter four methodologies. Chapter five is meant for data analysis, chapter six findings discussions and a conclusion is addressed in chapter seven.

Chapter 2: Literature Review

2.1 Introduction

The aviation trade is an unbelievable world that counts sure not solely advanced machinery and instrumentation however additionally the correct folks to coordinate and manage those advanced machines. Such complexities additionally account for issues of safety that don't seem to be simply necessary to the pilot however to every single person related to the trade. Advancements can also be seen on the part of Aviation industries and such rapid advancements can be seen. Things that seemed to be impossible once are now an industry in itself and a major source of communication and transport connecting the whole world. The future of Aviation industry seems to keep growing until once what was science fiction is now a reality. Aviation Industry not only includes private, commercial aeroplanes and military aeroplanes but also space research organisations such as NASA. This industry crossed the limits and took the human civilisation to the next level, hats off to advanced aerospace technology that is evolving every single day. Maintenance is another aspect of the aviation industry and it holds the topmost priority. Improper maintenance will lead to accidents and casualties and will account for a huge loss in revenue also. Since the industry deals with physical assets which require continuous care and supervision and every bit of problem is to be scientifically addressed and resolved. Technological advancement has also led to simulation training methods which have revolutionised the aviation industry by ensuring a very much safe and something that could virtually create any terrain and situation. Simulations are present everywhere and have basically two main components which are, the hardware that comprises of the whole cabin environment and the software that controls the different processes and basically coordinates along with the pilot’s responses. Of course, dealing with such advanced technology often results in exposure to chances of errors and it doesn’t take a moment for those errors to turn to the critical anomaly. Errors on the part of humans seem to be the most common type of error haunting the aviation industry. Since every process requires proper team co-ordination where every single member on any side of the team is accountable to thousands of lives or a million dollar misfortune. Same goes for military aviation industry where there is an additional thing which needs an even extra level of maintenance and supervision and that thing is ammunition and armory. The main analysis aim is basically to critically investigate probable human error inside military aviation maintenance management programs. The key analysis

objectives to be self-addressed square measures in order to explore the construct of aviation maintenance management initiatives. Specific human errors associated with such maintenance programs can also be determined. In order to understand the doubtless consequences of such human error analysis of human error in aviation maintenance is necessary. The research is basically to identify the real reasons behind such human errors in military aviation maintenance management programs.

2.2 Aviation Operations and Management

As per Panagiotidou and Tagaras (2007, pp. 335–338), the operations of equipment have two basic phases of operation which is the in-control phase and the out of control phase. The equipment at the beginning processes at the in-control phase and may or may not shift to the out of control phase prior to maintenance (Panagiotidou and Tagaras, 2007). These phases comprise of the overall working phase of aircraft management and control. As referred by Rashid, Place and Braithwaite (2014, pp. 78-81) alongside with equipment errors which arise due to operational reasons but furthermore it is seen that the operations are handled by both machines and humans, as humans are behind the supervision and maintenance of the equipment so there can be chances of human errors in the process. But he also stated that there are approaches to tackle those errors in the process by choosing a proactive approach which is analysed from the data obtained by the findings of previous work and introducing an approach which is called Aviation Maintenance Monitoring process (Rashid, Place and Braithwaite, 2014). This process is actually undertaken for monitoring the occurrence of human errors. As stated by Dekker (2014, pp. 45-46), emphasis should be laid upon two basic approaches of Human error which are categorised as Old View and New View. The New View approach seems to be a more detailed and in-depth study of the causes of human errors (Dekker, 2014). The former approach tends to focus light on the basic human error occurrence and suggests direct measures to resolve those irrespective of the overall working conditions of the human workers, but this has been addressed in a much convenient manner in the New View approach by ensuring a proper study of the human behavioural analysis as a part of the study for error resolving. According to Doyle (2004, pp. 678–682) maintenance as a part of aviation programmes tends to look upon another important factor, that is the air pressure. Coordination of humans, as well as specialised tools and machinery, is essential that monitor and control the amount of air pressure for the air locking system (Doyle, 2004). Preparation of stress reports to monitor the running pressure capacity of the aircraft vessel is also a part of the process.

According to Wohl (2015, pp. 690-692), it all goes back to the history of Aviation. Through the course of time, humans have evolved from primitive ways to explore the skies which included Kites, Tower jumping, hot-air balloons and such (Wohl, 2015). Currently, this is the digital era which has revolutionised the concepts of aviation which include hi-tech modernised equipment, specialists in the field of aviation and such. As claimed by Chen, Wen, Lorente and Bejan (2016, p.014901) Evolution of aircrafts also gave birth to helicopters which are quite different in mechanism and flight statistics and have also evolved in the years, pertaining to different methods of maintenance and operational processes and techniques (Chen, Wen, Lorente, and Bejan, 2016). As per Block, Ahmadi, Tyrberg and Söderholm (2014, pp. 78-89) the importance of decision making in aircraft management has been addressed. Aviation includes lots of processes as a part of pre-flight and post-flight arrangements and they need to be addressed effectively for that the importance of management as a part of the process is addressed to prevent risks and most importantly to manage the costs so that the least amount of expenses are incurred along with a smooth flow of fleet arrangements by minimising traffic (Block, Ahmadi, Tyrberg and Söderholm, 2014). To ensure a smooth flow of air transportation system there exists the maintenance workforce who looks after the operations and is responsible for the overall process. As stated by Halford (2016, pp. 38-39) because casualties occur mostly due to the human error causing fatalities all around the globe and so proper training and guidance must be assured to all the working personnel (Halford, 2016). According to Wiegmann and Shappell (2017, pp. 52-53) there are also military aircrafts which are comparatively more complex in operations and containment (Wiegmann and Shappell, 2017). Since military aircrafts also carry weapons and ammunition so their operations tend to be much more sophisticated.

2.2.1 Challenges Associated with Aviation Management

As per Aditya, Kumar, Galar and Stenström (2015, pp. 2-33) different concept, issues and approaches are being considered for the maintenance performance measurement by the developing management. Advantages and limitations of many different frameworks help the mangers of having insights of the framework for implementation. Considering many issues and challenges, maintenance performance measurement is presented for frameworks and different approaches (Aditya, Kumar, Galar and Stenström, 2015). As stated by Robertson (2014, pp. 220-224), aviation is growing fast and there are different economics benefits and environmental consequences caused by aviation. Consumption of huge amount of fuel for power and pollution,

results in greenhouse effect which led to massive impact in terms of global climatic changes. For manufacturing of aircraft, aluminium and metals are needed, such as cobalt, tungsten and nickel which are mined and can cause heavy impact in loss of future resources. Cutting down of trees and using the land for building large airports also is a part of environmental consequences (Robertson, 2014). A large amount of noise pollution from aircrafts also has an adverse impact globally.

As considered by Dalamagkidis (2015, pp. 57-81), the UAV techniques are been considered as the recent inventions, but in the past two-three decades, many unmanned flights were designed. In the modern world UAV system is developed for making many unmanned flights like drones. Today UAV systems are designed and developed into different designs and engineering like helicopter approaches are implemented, ducted fan small infrastructure for the flight. This type of UAV invention is been adopted for different purposes like weather monitoring, the spy camera and also helps in infrastructure inspections. According to (Bejan, Charles, Lorente and Dowell, 2016, pp. 1120-1123), the construction theory of flight not only depends on the speed, body size of the flight and the density but also depends upon physical parameters which also form an integral part of the designing and manufacturing process of an aircraft. As stated by Hopp and Kuo (2010, pp. 435-458), the maintenance of aircraft engine is important as well as also very difficult due to a variety of reasons. Engines are very complex and involved in many components also that are subjected to failure and wear of aircraft. There are some components that are difficult to access like in engine removal and in disassembly of the parts in order to repair, servicing and maintenance.

Different studies have been carried out on the common effects human error in aviation industry whereby major airline companies have recorded a significant number of maintenance errors. A bigger percentage comes from omissions related errors while incorrect installations follow. Also, it can be noted that wrong parts and equipment is another challenge in the aviation industry. Further, incorrect setting up of aviation equipment together with fitting maintenance parts on the wrong areas adds up to human errors which can be controlled and managed to a state of not occurring again (Aditya, Kumar, Galar and Stenström, 2015).

2.2.2 Managing Human Error in Aviation Maintenance

Some critical components are also been involved in safety issues which mean a failure in any parts or machine leads to engine failure. Aircrafts are generally very costly and thus times which are lost in inspection and also in maintenance may be very costly to bear. Thus aircrafts

engines are very challenging in order to do maintenance. According to Anil, Yadava and Deshmukh (2011, pp. 5-25) the maintenance and optimisation of different models and techniques are the trends of emerging in future research in the field of optimisation and maintenance (Anil, Yadava and Deshmukh, 2011). As stated by Shafiee and Chukova (2013, pp. 561-572), in present competitive market there are many products available in the market which are sold with warranty. It is basically a type of contract between the manufacturer of the product and the buyer. With the increase in the period of warranty in the complex type of systems, by reducing the cost servicing of warranty has built a great issue for the manufacturers (Shafiee and Chukova, 2013). According to the present market scenario, the technologies are developing in a large extent and with this development, customers are demanding more coverage period of products to the manufacturer like the warranty period of airplanes has increased as compared to the recent market scenario and thus manufacturers are under pressure.

Incidents of human error in military aviation maintenance and aviation transport industry in general have been on the increase for the past few years with majority being connected to human factors. Based on this, Halford (2016) suggested that the industry required developing strategies and ways to manage and control human error from happening at any given time. With the help of Flight Aviation Association (FAA) a data base concerning aviation human factors was established in line with developing an effective system for aviation maintenance. However, managing human error requires detecting the errors and the accompanying performance characteristics. Past scholars have identified two essential error detection methods in aviation maintenance. One retroactively detects human error on the bases of performance deviations and error reporting responses while the other is for identifying human error pro-actively in both commercial and non-commercial aircrafts. Effects brought about by human errors in aviation maintenance are of greater magnitude and therefore lack or minimal address to them determines where the future of the aviation industry lies. Dekker (2014) argues that human error reporting system is normally used to present the varying scales on the major cause of error led incident by identifying the various human error contributions as presented.

2.3 Government Involvement in the Maintenance of Aviation Error

The Federal Aviation Administration (FAA) along with the Office of Aviation medicine has developed a programme based on the involvement of Human factors impacting the operations

of aircraft management and have formulated an inspection and maintenance research programme. As per Hopp and Kuo (2010, pp.435–458), this research programme is a government and private collaborative partnership that involved numerous parties such as universities, government bodies and research organisations. According to their research which is deliberately based on worldwide aviation phenomenon, it could be seen that 80% of the aircraft accidents and incidents took effect due to human error whereas 20% of the accidents were related to mechanical and other technical failures. In May 2009, an incident took place due to improper maintenance which resulted in a horrific accident as Air France 447 that had taken off was bound for Paris on its way from Rio de Janeiro with a total of 228 passengers who were on board. The reason being the freezing piton tubes which resulted in disconnection of the autopilot and causing the aircraft to switch from standard law to substitute law ending up without any stall protection in the process.

According to Hooper and O'Hare (2013 pp.803-813), another incident that had taken place in Russia was a Boeing 737 Crash Flight no. U9 363 in 2013 where Boeing 737, a Tatarstan Airlines crashed in Kazan where all its passengers on board were dead, the number reported being a total of 52 deaths. Further investigation into the tragic accident and was found out that the accident had taken place due to technical fault along with a loss of awareness and technical uncertainty were the factors behind it. Also, the pilot was an amateur and had a very low amount of experience and resulted in a crash on its third try of landing.

2.4 Types of Errors in Military Aviation Maintenance

Maintenance and safety are an important part of the aviation industry whether it is military or civil aviation. As stated by Rashid, Place and Braithwaite (2014, pp. 71-90), bad maintenance and improper supervision are responsible for lots of military accidents and incidents. Some people are not very serious about their work and do not perform their tasks or duties nicely. There is also a lack of maintenance while installing and repairing many parts of a plane. This happens because the environment in which the labours work is very tough. People are not careful and even ignore the rules and regulations while doing a regular check-up of the planes. This leads to many future problems while flying higher up in the air. Another reason for lack of maintenance of the military aviation is due to the influence of the powerful organisations. It means organisations which prepare aviation products do not use good products for making them.

Different new technologically skills and programmes are used for making the aviation systems. According to Robertson (2014, pp. 220-224) most of the people or technicians are not so good and specialised and so are unable to solve different problems of the aviation. It is also difficult not only to maintain the technological tools and systems used in preparing the aviation but also to inspect and diagnose them easily. As the technicians and labours are unable to analyse and solve the problems such as repairing defective components of the plane, cannot configure the instrument sequences properly etc. Labours and technicians working in high pressure most of the time cannot handle it positively and result in negligence. After analysing all the factors mentioned above basically, there could be found two major aspects of aircraft casualties being technical or mechanical issues and human error seems to be the major cause of such incidents. Notably, the majority of the air-crashes both on air and on land happen to be the reasons behind improper coordination among the all the people who are associated with aircraft operations. Though many measures are being developed to put a check to resolving such casualties such as properly regulated training programmes and also simulation-based training designed to tackle all sort of situations and this method turns out to be very effective. As stated by Simões, Gomes and Yasin (2011, pp. 116-137), commercial aircrafts have to operate taking in hands the burden of its passengers who literally carry their lives on the line as one simple mistake can end the life of everyone in just a split second. Using UAVs as a part of training and development phase for aeroplanes and also for proper assessment of flight control services can really make the scenario better. Also, training and awareness programmes need to be much more realistic so as to provide a wider outlook towards safety measures.

It can be understood that both the maintenance and the inspection are important for creating as well as improving the condition of the maintenance. It is also clear that if the working environments where the employees are employed to repair and check the plane and its parts are sent or kept are good then it is possible to lessen both the accidents and incidents. It is also clear that the technicians or the labours should be given proper training and knowledge so that they are able to solve both the simple and the complex problems very easily. According to Wohl (2015, pp. 687-696), it is also mandatory to maintain a good relationship among each other as well as with the ground staffs so that any kind of problem while flying high up in the sky can be solved within less time. Employees should be given little flexibility so that they can perform their work nicely and without any mistakes. They should be given good opportunities to learn and should be

motivated to perform their work well and solve the errors or the mistakes nicely. Simple technological skills should be used while developing the instruments within the aviation industry so that the problems can be identified at any point in time. By the rapid advancements in technology in aviation not only meant to be the replacement of control of the human by computers and advanced machines but also brought improvements in the maintenance and reliability of the equipment. As per Jeong, Moon, Hyun, Lee, Kim and Kang (2016, pp- 1-6.) by the availability of different upgraded techniques manufacturing process and upgrading equipment has become much more efficient and more reliable.

There can be different reasons behind which the flight engine can shut down like incomplete installation of any parts of the aircrafts, any equipment is not activated or may be deactivated, due to improper installation etc. Aircrafts safety basically depends on minimising error in the aircraft system. In the recent trend, aircrafts engineers give more attention to reducing human errors in the aircraft's maintenance and also in the inspection. Basically, aviation maintenance and aircraft inspection is a part of complex organisations which are performed in an environment where there are various complexities like time pressures, unwanted ambience conditions and also sparse feedback. This type of situational characteristics results in a different human error and thus in the result of the failure of engines in aircrafts or aircrafts accidents also. At present human error has been reduced to a wide extent of all type of civil as well as military aviation accidents. There are different human factors related to civil and military accidents like different organisation influences, unsafe supervision, preconditions for unsafe acts, unsafe acts. As stated by Rashid, Place and Braithwaite (2014, pp.71-90) Organisational influences can include different things like organisation climate, operational process, and also resources management.

Due to rapid growth in the technology, humans are very much responsible for the success of safety in the aviation industry. Human must gain knowledge, good judgment and information regarding the maintenance of the aviation. The aviation industry must look after in certain conditions like investment in training, more upgrade technology and experts to supervise the maintenance and inspections of aviation. Thus in improving human performance and information can reduce aircrafts accident rate to a great extent. In the past year with the invention of more upgraded technologies safer and more reliable designs of aircrafts are been very much responsible in the reduction of aircraft accidents. Controlling the human error within the maintenance environment

is basically the most significant challenge that we really face in the aviation industry. According to Robertson (2014, pp. 220-224) There should be adequate results available in order to reduce human error in the aviation industry. With the help of different training, technical knowledge and aircraft safety related issues are providing in the aviation industry. Now a day's aircraft industries have hired experts to investigate related to the situation of awareness in aircraft maintenance. The major goal of the aircrafts industries is to reduce maintenance-related accidents and incidents which can occur from human error.

The following are additional factors that causes that emanates from maintenance-related accidents and incidents due human error.

Lack of Communication

Communication challenge has also been identified as another problem affecting military aviation management program (Bock, 2011). Poor communication may contribute to suboptimal, incorrect and fault during the maintenance thereby holding potential danger to the entire craft. While communication between the maintenance team and the management is very important, Padilla-Díaz (2015) posits that poor communication between technicians may lead to error and further aircraft accidents. Varied accidents have been reported where miscommunication between technicians and the management. Under circumstances where communication is critical and any slightest chances of miscommunication are detrimental is during the shift exchange or fixed base operators (Bock, 2011). When a job that is not fully completed is transferred from one technician to the other without adequate communication, the entire execution process becomes detrimental. Therefore, appropriate measures must be taken to ensure that all the procedures are verified before it can be handed over to the next personnel.

Self- Satisfaction

Self-satisfaction is also another negative bearing in the military aviation maintenance management programs. As pointed out by Simões, Gomes and Yasin (2011), most aircraft technicians utilize the knowledge gained and experiences as part of self-satisfaction. It is critical to note that self-satisfaction may lead to false confidence and precedence for error. Where repetitive tasks such as inspection are involved, one may overlook of skip due to self-confidence, this has contributed to fatal incidences in the aviation industry. In his sentiments, Wohl (2015)

clarifies that false assumption is a common theme in the aviation industry. However, the consequences of the fault may be detected and timely corrected if all the routine tasks are performed and without giving false assumption on the required tasks (Bock, 2011).

Lack of Awareness

Lack of awareness has also contributed too much human error in military aviation maintenance management programs. According to Rashid, Place and Braithwaite (2014), lack of awareness is considered as failure to identify the consequences of actions or simply failure to foresee an occurrence. In military aviation maintenance program, some task is performed one in a while a projection of future occurrence or performance (Bock, 2011). Therefore, lack of awareness of what is expected of a current task in an aviation industry often makes it difficult for technicians to mitigate some incidence that could have otherwise been avoided. For that reason, it is advisable that each time a task is completed; it should be handled as a new one to prevent unprecedented fatal situations.

Human Fatigue

As more human errors happen, people are exposed to dangers and effects resulting from accidental and error related activities like health complications, loss and damage to property among others. In this regard, human fatigue degrades ones performance in work and is said to develop gradually from slight effects to catastrophic ones. It is a personal experience which involves ones aspirations, self-evaluations, and achievements and associated to the present and previous circumstances (Guy, 2011). According to investigations and researches done, it has been claimed as the source and primary cause of accidents in the transportation industry especially in aviation industry. It becomes costly and unbearable to handle accidents and other impacts resulting from fatigue complications. In addition it affects individual's ability to perform and actively participate in day to day activities. Human fatigue cannot always be avoided due to human error but can be managed in different ways.

According to U.S Department of Transportation (2010), human fatigue results into slower reactions, while in the military aviation sector alertness is a major concern in connection to human reactivity to certain incidents or occurrences. Lower levels of reactivity result to reduced ability towards processing information, absent mindedness and memory lapses. Moreover, when one losses attention and focus chances of errors occurring are very high. Problems associated with

overtime and shift swapping lead to less working hours and inadequate resource allocation. Sleep disturbances as a result of fatigue can lead to conditions and environments for all modes of transportation (SOW, 2010). Mental sharpness function in an individual is also affected through fatigue whereby the risk of human error presents itself.

The most common symptom of fatigue in military aviation maintenance personnel is depression whereby depression disorders have been exhibited by personnel working in the aviation industry. Majority of them tend to have sad moods always hence affecting the performance at working stations. According to Krieger, Altenstein, Baettig, Doerig and Holtforth (2013) individuals with this kind of symptom have negative thoughts, they feel helplessness and hopeless in their working life. These individuals may indulge in very strange behaviors including excessive or less eating habits; sometimes they may have sleepless nights or oversleep which in most cases presents human errors . According to Wiegmann and Shappell (2017), depression could result from long periods of stress. In military aviation, personnel in the maintenance departments who have stress and fail to seek medical and psychological attention may develop signs of depression. However, environmental conditions are also considered to have contribution into depression and human error related actions. Some major depressions seem to be recurring in some individual's generation after generation. In many instances, genetic, psychological and the environmental factors contribute in one way or the other in the occurrence of human errors not only in the aviation industry but in all sectors. People affected by depression react differently to possible human errors depending with the stressors that contribute to depression from time to time (Figley, 2002a).

2.5 Political Interests & Lobbying Towards Human Factors

Current issues affecting safety in the aviation and transportation industry has led to the emergence of lobbyists from all sectors of the society in relation to the impacts experienced as result of human fatigue and related factors. The lobbying is aimed at addressing all the concerns by setting new rules and regulations that are connected to and advances the existing ones through the government. Special interest groups from national to local levels have come together covering all sectors of social, economic, security and safety, private as well as regional and local authority's representatives (U.). Moreover, various organizations have created interest on the issue of human fatigue, creating more lobbies, pressure groups and promotion ones. All parties concerned with this issue have engaged in direct advocacy on fatigue as a public matter. They have undertaken

numerous campaigns with the help of other political affiliations to ensure the matter is addressed to the latter. Additionally, political interests have played part in making the government to undertake research and awareness with the aim of people to understand well the issue of human error in military aviation maintenance management programs and its effects (U.S Department of Transportation, 2010).

However, the phenomenon of more and more accidents occurring as a result of human error has drawn attention across all stakeholders not leaving out social and political interests. The issue having been addressed for long period of time has made the political class to come in the aspect of regulation and enforcement of laws (SOW, 2010). There is need for the formulation of laws and rules to govern the transport industry in order to save loss of lives from accidents and fatalities. Through legislation many laws have been made available with concern to working times and resting periods to employees which has not been followed in the past years. Political good will is attributed to the establishment of the aviation boards in reference to investigations, recommendations and advises on critical issues regarding safety in the transport sector (National Transportation Safety Board, 2009).

Human factors aviation industry has evolved over the past decades which have been experienced by changes in the maintenance sector as a result of the frequent happening of accidents across the globe. According to Dekker (2014) from the early days of aviation to the present time, majority of aircraft accidents have been associated to mechanical failures resulting from human errors which in most cases are not accounted for. However, as air transport becomes more efficient and reliable compared to other means of transport, accidents as well as mechanical failures to military and traveler's aircrafts are mainly caused by human errors which can be averted. In order to combat engineers or pilots errors, the aviation industry has considered adoption of formal training programs to enhance coordination and effective communication between all departments. Crew resource management has become a standard requirement for all aviation operators. However, it has only been in the last few years that increased rates on occurrence of human errors which has raised concerns to the maintenance crew on ways to eliminate them. Due to this movement, several air carriers have implemented training classes to improve individuals' understanding of their impact on safety. Hooper and O'Hare (2013) noted that aircraft accidents often occur as a result of a procession of activities. Therefore, interfering with one of these actions by one of the

maintenance personalities can prevent any accident from ever happening or reduce its magnitude (Hooper & O'Hare, 2013).

According to Wiegmann and Shappell (2017), human errors in military aviation maintenance management programs require additional safety management based systems to reduce the rate of their occurrences. This entails having an effective and systematic management of possible aviation operations risks with regard to maintenance of aircrafts. In addition, these programs help in facilitating the achievement of overall safety performance to the whole industry through supporting operational excellence, managing risk, preventing accidents and other maintenance incidents. Marx and Graeber (2014) identified four main pillars of success within aviation industry by applying Safety Management System (SMS) towards promoting safety at large. Whereas flight Safety together with a series of digest to human factors defines aviation safety culture as the combination of individual norms, roles, beliefs and attitudes, maintenance on other end prescribes on technical practices with major goal of minimizing employees' exposure, public, management and customers to conditions considered life threatening (Marx & Graeber, 2014).

Another scholar Dekker (2014) in his study clarified that the so called maintenance resource management and human factors are similar basic concepts in the aviation industry. They involve programs which address management and mechanics working together to utilize all available resources to reduce human errors or promote safety. In order to reach these goals, the courses emphasize the significance of effective communications, types of human errors, environmental factors and the importance of the aviation culture. Nevertheless, accidents and other aviation incidents together with the variety of activities involved are analyzed so as to identify their main causes and what could be done to avoid same occurrence. These exercises help participants highlight potential situations that currently exist in their work stations. All in all, the success of the training rests on the individuals. Both mechanics and managers can use the tools to identify and mitigate areas that can lead to potential aviation accidents. The concerned or affected personalities should always be willing to re-examine the working environment together with specific job practices that are questionable (Wiegmann & Shappell, 2017).

2.5.1 Human Factors Training

While addressing how to control human error in the military aviation maintenance, there is always need to understand the concept of human factors in terms of training and maintenance

practices. According to Hooper and O'Hare (2013) the concept of maintenance of human factors through trainings was introduced in the aviation industry in the year 1989. Aviation industry players and other stake holders have embraced on this and have been improving from time to time. Case in point is the Continental Airlines who have adapted Cockpit Resource Management training (CRM) to cater for its training program on maintenance of Human Factors. It further developed to Crew Resource Management (CRM) training program as a result of ever changing global aspects. Rashid, Place and Braithwaite (2014) noted that the main concern of CRM training on communication between aviation workers as whole. In this case, maintenance personnel require effective communication with others such as pilots, cabin crew members and security people. Moreover, it involves communication between aviation companies with present governments, and the management department to labor section among others (Halford, 2016).

Human Factors (HF) Trainings are considered vital in military aviation maintenance management programs concerning human errors experienced within aviation industry. HF training importance can vary from one department to another and among variety of personnel but all aim to achieving quality, safety and commitment by all to investing in an effective communication. However, these programs should incorporate all the stake holders from engineers to an organization's leadership. Human Factors training in the military aviation is instrumental in the sense that it fosters positive culture on safety in aviation industry. Also, it reinforces coordination on different concepts associated to voluntary reporting, internal investigation as well as risk assessment with an aim of ensuring good maintenance and safety practices. As per International Civil Aviation Organization (ICAO) global requirements, all organizations should invest more on HF training including military aviation sector. ICAO indicates that this kind of training tend to improve individual performance while promoting health and safety of workers in their respective working areas (Dekker, 2014).

2.6 Human Error Management

Guy (2011) pointed out that there exist two components when dealing with error management not only in the military aviation industry but across all sectors. These are; error reduction and error containment whereby reduction aspect focuses on developing measures tailor made towards limiting the occurrence of errors. Error containment on the other hand entails putting in place measures targeted to restraining adverse error occurrences at any given time. Nevertheless,

either of the two can be useful to stake holders and industry players. In addition, error management tools can be utilized across organizational and structural levels including individual employees, workplaces, teams and the organization itself.

National Transportation Safety Board (2009b) identifies two main error management techniques that have worked very well in the recent times. These are; error reduction kit (ERK) and managing engineering safety health (MESH) which focuses on factors which are proactively within work stations and the organizations. According to SOW (2010) ERK aims at core understanding to the available maintenance omissions through two approaches. One works to determine different features presented as omission prone while the other seeks to identify the available cognitive mechanisms. Moreover, in order to avoid omission problem from reoccurring use of reminders have been recommended too, for many organizations including the military. Reminders are regarded as the first aid strategies and measures in coping with problems and difficulties witnessed within the aviation industry as whole (Guy, 2011).

Human error control in aviation maintenance and inspection is very important in the growth and development of aviation industry as whole. Dekker (2014) suggests that once people in the air transport recognizes that human errors are the main contributors and play significant role in aircraft's accidents and other safety related incidents, then there is have no alternative other than addressing mechanisms to control as well as manage possible errors. This should apply to the present generations and also the future ones by identification of a variety of interventions for implementation. Furthermore, effective implementation of interventions most of the times reduce error occurrences. Rashid, Place and Braithwaite (2014), in their study identified different interventions that can be used for error reduction by employees in aviation sector. They include programs on selection, aiding, equipment design, training together with job designation to mention a few. In the aviation maintenance together with inspection, these interventions can be short term as well as long-term depending on the issue to be addressed. According to Hooper and O'Hare (2013), various techniques as well as strategies have been developed and applied in the aviation maintenance processes towards reducing human error occurrences and re occurrences. They are considered in accordance with organizational considerations, environment, training, equipment and the availability of information on inspection and aviation maintenance programs (Marx & Graeber, 2014).

2.7 Conclusion

The human factors analysis and the classification system framework help in investing different components responsible for aircraft accidents due to human error. The human factor is one of the most common factors that can cause the major error in the accidents in the aviation industry. In order to reduce the risk of aircrafts accidents different new safety tips are being developed to reduce this accident problem. The aviation company must develop new improvement strategy to reduce human error accidents. Thus the drone is the newest invention in the present world. The aviation company must use the drone to analyse everything and educe from human error accidents. The growth of aircraft industry is the best strategy for future growth of the economy. Aviation industries must have concentrated on the minimisation of the aircraft in the mishaps and all the accidents. The aviation industries must concentrate and should develop different techniques in the result protects the environment from aircraft accidents by human error. The aviation industry must focus on many areas in order to reduce human error accidents like Leadership and organisational culture, process management, learning and growth and measurement, analysis and of knowledge management. Basically, a type of major change is required like reduce time pressure in order to decrease human error accidents. We get that human factor analysis the four level of failure we must reduce different aspects of unsafe acts, the organisational influences and the preconditions for unsafe acts and unsafe supervisions. The major aim of the project is to examine the accidents occur in aviation accidents to include many points of organisational factors, specific reviews, and environmental also. Thus the investigation demonstrates us that basically the HFACS. Thus the military has the ability to maintain different effective battlefield mobility is also defined by different factors. In the military aviation for the different military research that should be the best aviation assets. The aviation basically experiences a lot of changes that are used in the maintenance of the aviation system. The assessment of the job in the market for the post of aeronautical engineers is being established in the market. Generally, the development of the aviation industry has basically used for the operation of the military as well. Thus the research is to develop new technologies as well design also and also to develop and implement and to test and also to produces in order to enhance human performance.

Chapter 3: Theoretical and Conceptual Framework

3.1 Introduction

This section explores models and theories based on the topic of evaluation. In this regard, the researcher evaluates the existing theories, models and framework that influence human error in military aviation maintenance management programs especially in aviation engineering. A conceptual framework is also employed to support the theories in an attempt to fill the existing gaps in the civil aviation industry. The following theories were used in this study.

Theoretical perspective on research methodology

According to Hooper and O'Hare (2013), theoretical perspective on research method should be able to explain and describe action very easily and in a way it is incorporated in our social world. The social world consists of powerful economic, political, social, gendered, racial, linguistic and moral structures. Theories in research give account and explain why things happen and they give room for further critical thinking on various actions. In the case of the present study, Human Error in Military Aviation Maintenance Management Programs can be as a result of one of the said factors or a combination of a number of this (Hooper & O'Hare, 2013). According to theoretical model of Positivism, it can be argued that reality can only be generated from what can be available to the sense, what can be seen, smelt, touched and any function of the sense organ. It further emphasis that inquiry should be based on scientific observation. Therefore, an empirical inquiry and finally it asserts that natural as well as human based sciences do share general logical together with methodological ideals which deals with facts but not values. All these are well connected to occurrences of human errors not only in the military field but across the board (Halford, 2016).

On the other hand, the model of Interpretivism perspective interprets the social life in the world, not from the scientific point of view but from interpretation derived from historical and cultural phenomena. The perspective believes that natural reality is different from social reality hence a better approach to explain social reality should be constructed. Whereas the Phenomenology perspective argues that to understand social reality one has to base his ground and understanding on people's experience, people construct reality after they revisit their immediate experience on a phenomenon in order for new meaning and reality to emerge. This includes human actions

performed on daily bases with some resulting to the so called human errors (Halford, 2016). Critical inquiry focuses on changing and challenging conventional social structures. It carries out investigation on current values and raise question about them. On the basis of naturalistic inquiry, realities should be studied in a holistic manner. It draws from a wide pool of arenas and develops knowledge that comprehensively describes a social reality and it explains a phenomenon in totality. Theoretical perspective on research methodology put emphasis on how social things, actions and the world are looked at. It gives a perspective that will shape the methodology to be observed and to be taken by a researcher. It also reflects the epistemology of the researcher (Eisenhardt, Graebner & Sonenshein, 2016).

3.2 Theories and Models

The two theories that were adopted to support this study were “Domino Theory" and “Organization culture Theory”

"Domino Theory"

This theory was established by Grenier Richards in 1967. As pointed out by the Domino Theory, the most important contribution of errors is poor emphases of less important programs. In his sentiments, Grenier (2010) acknowledges that human factors, environmental factors or job factors can cause a tremendous accident in the aviation industry. Therefore, it is the responsibility of aviation personnel’s to embrace programs that mitigate possible chances of human error. The theory was employed in addressing the role of management policies and procedures alongside actions of individuals.

Organization culture Theory

Organization culture is an asset of shared symbols, norms, values together with beliefs that include events as well as personalities representing a unique organizational character. This theory identifies a specific company together with the people who work for the company (Dekker, 2014). This culture affects the beliefs, psychology, attitudes, and values of both the people and the organization and controls the interaction of people and groups within the organization together with outside world. With all these activities the possibility of occurrences of errors is high. Under the symbolic interpretive approach, organization cultures arise out the social processes of the employees (Eisenhardt, Graebner & Sonenshein, 2016). The meaning given to a certain object is

subject to change over time and from place to place. Symbolic interpretive includes also the experiences that lie beyond the five senses. The theory asserts that organizations culture is created and maintained through symbolic behavior, giving the managers the opportunity to articulate and sustain the organizations values as individuals focus on shared values. Symbolic interpretive reduces ambiguity and tension within the organization. The process involves three parts, initial gesture from one person, a response to that gesture from another and then the result which may be positive or negative f or this matter being human error (Dekker, 2014).

Conceptual model

Independent variable **Dependent variable**

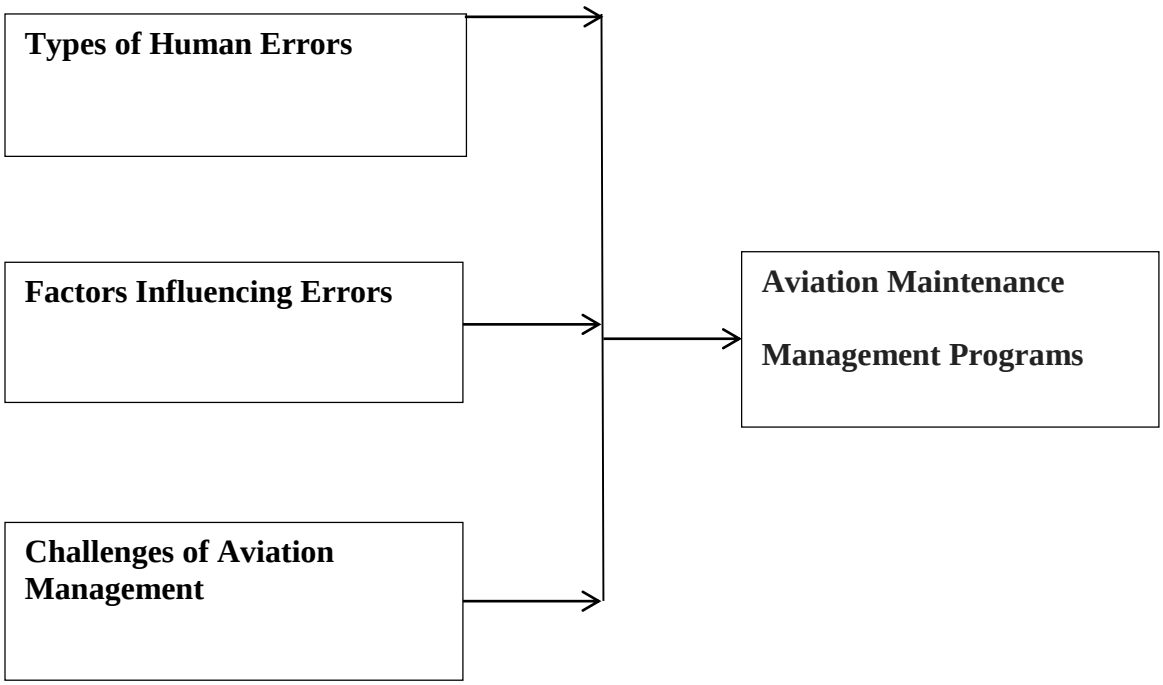

Figure 3.1: Conceptual model

Military aviation maintenance has drawn a lot of attention from scholars. However, it is obvious that human errors associated with military aviation maintenance have since been ignored. From the early studies by McCorklebn and Trillin (2015), it is clear that more effort needs to be embraced so as to impact knowledge with regard to aviation failures that emanates from human errors. It is under this premise that aviation traffic controllers have always enjoyed support of the human thereby ignoring the focus on errors caused by aviation maintenance personnel.

As pointed out by Van der Linden (2015), aviation maintenance has led to unscrupulous cost in the military aviation industry. In the United Arab Emirates for instance, the cost of military aviation emanating from human errors amounted to the 11% of the aggregated maintenance cost in 2012 some of which can be avoided. Similar evidence was observed in 2014 with an increase amounting to $500 billion. On a routine basis, the maintenance team should contend with the environmental conditions including frosty, high temperature, downpour, obscurity, noise, heights, accessibility and chemical substances that come with aviation maintenance. In most situations, human errors in the aviation industry have emanated from healthcare and environmental related challenges.

Other common human errors associated with the military aviation maintenance include latent failures, active failures and accidents among others. In his sentiments, technological failures have been given more weight as the leading cause of aviation mishaps; the reality is that most failures are instigated by human errors at some point (Reason and Hobbs, 2017). Other than immediate failures that are evidenced on a daily basis, the maintenance teams have a long standing systemic cause of failures in the military aviation industry. Therefore, it is important to look into the immediate circumstances of the human practices leading to the anomalies.

In the understanding of human errors associated with the military aviation management program, it is important to understand factors that influence human errors (Jeong et al., 2016). It is under this premise that reliability assessment becomes vital in exploring the extent at which some of the factors that are influencing these errors. There are varied factors perceived to influence errors in the military aviation maintenance. One of the critical factors influencing chances of errors in the military aviation maintenance is the individual personality of the human factor. According to Patankar and Taylor (2017), individual factors such as observing behavior may contribute to intentional errors during the maintenance process.

Another factor that is found to influence errors in the military aviation maintenance is haste in work or pressure thereby leading to fatigue among the maintenance personnel's. In order to mitigate this kind of error, good planning regarding the volume of work is recommended. This is also considered as a sure way of managing complexity that comes with strict timeframe considered as warning towards possible chances of human errors.

According to Wiegmann and Shappell (2016) communication is considered as another contributing factor of error occurrence in the military aviation maintenance. In his sentiments, Wiegmann and Shappell (2016) agree to the notion that unintentional human errors are mainly caused by miscommunication or poor communication structure. Therefore, a failure in the communication between the mechanics undertaking different shifts is most likely to cause a detrimental effect on the entire maintenance system (Jeong et al., 2016). In order to solve this challenge, there is a need to establish appropriate schedule that would see proper assignment of duties to avoid conflicts of schedules. In case the maintenance schedule is meant to happen in a more sophisticated department then communication is instituted in a way that there is no conflict of interest in the line of duties.

Another problem often arises in the line of equipment and tools. Errors regarding equipment and tools have become common in the military aviation maintenance. In essence, misrepresentation or improper usage of tools e for wrong purposes has proven to be futile in the long run. In circumstances where tools have been wrongly used then there is precedence for irregularities. Varied research indicates that a balance score-card can only exist where organizational culture is embraced as part of the technical system maintenance.

One of the common challenges associated with the military aviation maintenance is the environment. The success of any business requires sustainability, so does the military aviation maintenance (Wensveen, 2018). Nonetheless, the military aviation maintenance is not putting this into practice. First, the institution is not committed in fostering environmental suitability initiatives. The institution has non ambitious goals that are limited to fuel economy. The management does not take part in the control of emissions toxic gases into the atmosphere, Instead they look into issues of speed and stealth and confidentiality that has nothing to do with the environment (Jeong et al., 2016).

Another detrimental challenge in the aviation industry is safety. Just like in commercial aircrafts, military aviation maintenance program is characterized with a high risk factor emanating from repairs. According to Wensveen (2018), technicians working in the mechanical departments in charge of engine maintenance are exposed to high risks as compared to those working in the technological al department. the level of risk can be even be much higher with the breakdown in employee corporation or red tape that requires approval by the command in power to grant permission before an activity can be initiated.

Finally, there is the challenge of service obligation. Military operates on stringiest policies requiring subjects to adhere to information from the highest hierarchy (Jeong et al., 2016). This has made it difficult for the maintenance personnel to execute some of the maintenance practices even in terms of urgency. In that respect, it has led a counter back in some areas thereby eroding the quality of service.

Chapter 4: Research Methodology

4.1 Introduction

This section of the paper constitutes descriptive analysis of techniques that were utilized to execute the process of data collection. This chapter focuses on the relevance, reliability, and validity including approaches for collecting data. Some of the key sections that form part of this section include; research philosophy, research approach, data collection procedures, sampling technique and data collection tools.

4.2 Research Philosophy

Research philosophy entails the guiding perception and view forming part of the research study. According to Padilla-Díaz (2015), there are different classes of research philosophy that can be utilized in this study. Major types of the research philosophies include; the positivist, interpretive and mixed research philosophies. However, interpretive philosophy dictates that social constructs of a research event determines the type of data analysis that should be employed during the process of data analysis. Finally, the philosophy proponents explains that phenomenon under investigation must be addressed in accordance to the objectives. According to Padilla-Díaz (2015), constructed elements like time, therefore, helps in the analysis of the phenomenon. For this study, qualitative and quantitative philosophy formed the major part of the study.

Qualitative research is used to gather information on non-statistical sources or non-numerical sources. It not only helps to understand the feelings, views and thoughts about a particular topic from a specific group but also helps to analyse their views without any partiality. There are different methods which are used to conduct the qualitative research. They are a survey, observation, interview, focus group, both ethnographic as well as participant observation etc. The qualitative research method is very useful as it also helps to understand the reasons which in the future help the research to discover the problems as well as its solutions (Silverman, 2016). Data is collected in two ways based on the above research. They are primary as well as secondary data collection. While conducting this study both the secondary as well as the qualitative research techniques are used. They are used to understand and analyze the reasons and the problems which may arise. It also helps to find the necessary solutions to the problems so that in the future any kind of difficulties can be solved easily (Williams, 2011). Interview method is used as it helps to

understand deeply and clearly the reasons responsible for the problems and the solutions aroused in the study.

4.3 Research Approach

There are varied types of research approaches, but this has been summarizing in two broad categories. These include either quantitative vs qualitative, or the inductive vs deductive approaches. As such, this part of the study justifies approaches that were employed to collect process and analyze data. The main aim of this study was to examine human error in military aviation maintenance management programs. Therefore, the research approach was guided by the following objectives: to establish the types of human errors that can occur and the complexities that arises while working in the aviation industry, to identify factors influencing human error in military aviation maintenance management programs and explore challenges associated with military aviation management.

4.3.1 Inductive vs Deductive Approaches

While deductive approach is aimed at testing the theory, inductive approach is targeted at generating new theories emerging from data. One specific inductive approach is that it grounded to necessitate a complete open mind without preconceived ideas. The main differences between inductive and deductive research approaches are that deductive research is defined by the objectives or the hypotheses. As pointed out by Eisenhardt, Graebner, Sonenshein (2016), inductive approach requires the establishment of new hypotheses. Therefore, inductive approach requires conceptualization data to come up with a new model. On the other hand, deductive research approach is targeted at evaluating an already existing theory. In that respect, it is suited at exploring cultural, phenomenon associated with a study within a specified duration.

This study would be supported by Domino Theory. As addressed in the previous chapters, the theory was applied in addressing how human error in military aviation maintenance management programs has contributed detrimental effect to the industry. The entire concept is based on the notion that earlier identification of the human Error in military aviation maintenance management programs has contributed a significant impact in saving lives while reducing unprecedented catastrophic errors. As such, a deductive research approach was adopted to facilitate the examination of the already existing theories that are associated with project management in the aviation industry.

4.3.2 Quantitative vs Qualitative Approaches

Qualitative and quantitative approaches are defined by the type of data that used for analysis. According to Hussein (2015), quantitative approach involves the use of primary data sourced from the first hand respondents to substantiate about a given topic. The approach is characterized by collection of primary data, compilation, processing and reinterpretation. For that reason, quantified data must be statistically assessed. Of critical concern to note is that quantitative data can be evaluated statistically based on the constructs of participants. From a different perspective, qualitative data cannot be quantified. As such, this approach only involves the use of the previous publications of other scholars. For that reason, the researchers do not have to collect for data from the respondents. Therefore, the use of statistical measures may not be applicable in this case. According to Hussein (2015), advocated for the need to harmonize the existing gaps between quantitative and the qualitative research approaches leading to development of mixed/triangulation approach that simply entails the use of both approaches.

This study adopted the use of triangulation method where both qualitative and quantitative techniques were used to examine human error in military aviation maintenance management programs. While quantitative data provided physical results in accordance to the understanding of the respondents, the qualitative approach supported the results based on the findings through research obtained from the previous scholars.

4.4 Study Population

In his article "Research methods and statistics", Jackson (2015) explains that targeted population as actual or conjectural class of persons, events or things that makes up special characteristics needed by for the study. For this study, the targeted population constituted military aviation technicians at MRO (Maintenance Repair and Overhaul) headquarters in Abu Dhabi, United Arab Emirates. While the institution may have varied classes of personnel's, aviation technicians were chosen because they are mainly engaged with the maintenance are highly susceptible to causing of human errors. The above population was considered appropriate for the study because, it falls within the military strata and they are in charge of the aviation management programs. Therefore, it was deemed best for extortion of data.

4.5 Data Collection Procedures

Due the vast population of the respondents, the study concentrated on the survey and the focus groups. Therefore, survey was mainly used the gathering of quantitative data from the respondents from military personnel's stationed at MRO (Maintenance Repair and Overhaul) headquarters in Abu Dhabi, United Arab Emirates. However, special consideration was put in place to ensure that only quality data were obtained. This process was supported by distribution of questionnaires among 65 personnel's who had been selected prior to the study. Of mutual importance to note is that all the questionnaires were distributed alongside official letters explaining the relevance of the study and the level of confidentiality that would be taken by the researcher. For that reason, all the respondents were invited to take part in the filling in of the questionnaires and the notification was further sent reminding them to take part in the study.

4.6 Research and Data Collection Tools and Sampling

4.6.1 Sampling Technique

Survey which is an element of descriptive technique was used chosen to support this study. The respondents comprised employees from MRO (Maintenance Repair and Overhaul), United Arab Emirates who were also attached to the aviation maintenance department. Approximate populations of 650 employees who are attached to the aviation maintenance department at the MRO (Maintenance Repair and Overhaul) headquarters in Abu Dhabi, United Arab Emirates were embraced as the sampled size. Based on descriptive technique, only 10% of the populations were defied as fit for the actual study, this makes 65 respondents. According to Mugenda & Mugenda (2013), descriptive study should only take 10% of the entire proposed population a figure that is simpler for calculation. The population size was considered appropriate because it comprised of 90 percent of the population who are engaged in the MRO (Maintenance Repair and Overhaul) department. According to McNabb (2015) descriptive design only assume 10% of the actual figure during the study. Moreover, the survey also utilized simple random technique to capture first-hand information thereby promoting the credibility of the data.

4.6.2 Data Collection Tool

The main data collection tool that was used for this study is questionnaire. Therefore, the questionnaires were designed by the researcher and before being submitted to the respondents. The questionnaires were subdivided into two sections. The first section constituted demographics of

the respondents while the second part was designed to cover the objectives. Some of the demographic aspects covered in the first section of the study included; age, gender, department of the work among others. However, the second parts constituted; consequences of the cutting costs in the aviation, types of human errors in the aviation industry and complexities arising in the aviation industry.

The questionnaires contained only closed questions that coincided with the hypothesis. The idea behind establishing closed questions was to make it easier for the respondents to handle. Besides, they contain choice that help respondents to comprehend what is needed within a study. Therefore, the questions were designed on the basis of the objectives, research question and the hypothesis.

Chapter 5: Data Findings and Analysis

5.1 Introduction

This chapter analyses the findings obtained from this study. Tables' charts and figures have been utilized to clarify the results. For further enhancement of clarity, the researcher categorized into varied sections including the respondents' gender, ages, the consequences of the cutting costs in the aviation, type of human errors can occur and complexity can arise while working in the aviation industry. The discussion structure of the paper has influenced the level of attainment of the objectives as supported by the findings of the investigations concerning the factors influencing human error in military aviation maintenance management programs.

5.1.1 Response Rate

A total of 65 questionnaires were dispatched to the respondents obtained at MRO (Maintenance Repair and Overhaul), Abu Dhabi, United Arab Emirates. An observation of the findings indicated that 61 of the questionnaires were successfully filled and returned. This was approximated to be an average of 95.91% as shown in the Table 5.1

How arrived at 65 is explained above, it was10% of the 650

Table 5.1: Response Rate

	Frequency	Percentage
Responded	**61**	**95.91**
Non response	**4**	**4.08**
Total	**65**	**100**

The response rate was deemed successful, as indicated in table 5.1e. This figure coincides to Mugenda and Mugenda (2003) idea who argues that 50% response rate is adequate, 60% good and above 70% rated very well.

5.1.2 Percentage Gender of the Respondents

The issue of gender played a significant role in this study because it formed the basis upon which the researcher could test the reliability of the respondents and the validity of the data obtained. Based on the above information, respondents were requested to fill in the checklist for

their gender. The results obtained were meant to help the researcher in establishing any link between the respondents and their gender as shown in table 5.2

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	8	12.0	12.0	12.0
	Male	57	88.0	88.0	100.0
	Total	65	100.0	100.0	

Table 5.2: Gender Percentages of the respondents

Table 5.2 Gender Percentages of the respondents

Based on the results in table 5.2, it is observed that gender component had a significant value in this study. With 88% percent forming part of the male gender and 12% female, it was concluded that more men are conversant to factors influencing human error in military aviation maintenance management programs as compared to female.

Table 5.3: Representation of ages of respondents involved in the study

The researcher sought to find out the ages of the respondents who were engaged in the study, the results were compiled in the table 5.3 below.

Age				
		Frequency	Percent	Valid Percent
Valid	20-30	10	11.4	11.4
	30-35	18	29.5	29.5
	36-39	28	43.2	43.2
	40 and Above	9	15.9	15.9
	Total	65	100.0	100.0

Table 5.3 Representation of ages of respondents

As observed in table 5.3 above, 15.9% were found to be the ages 40 and above years. 43.2% of the total respondents indicated that they were of age variance 36-39 years. 29.5% ranges between age 30-35 years, 11.4% was of ages 20-30 years. From the above results, it was noted that the greatest age variance to have been recorded in this study were between age 36-39. The statistics for the ages of the respondents were of vital concern to the study because they were used to assess the relevance of age and factors influencing human error in military aviation maintenance management programs.

Table 5.4: Respondents area of specialization

Department	**sample size**	**Percentage**
Aircraft technician	32	44
Mechanical engineer	11	21
System Engineer	7	9
Safety audit	5	7
General service	10	19
Total	65	100

An overall analysis indicated that majority of the persons interviewed were working as Aircraft technician with the military aviation department. The sample experienced enough exclusion the general service technicians. This indicated that they do not form major part if the human error associated with the military aviation maintenance management programs. Sufficient human errors in the military aviation maintenance management programs were also confirmed to be emanating from the mechanical personnel's.

5.2 Human Errors in the Military Aviation Maintenance Management Programs

Table 5.5 Consequences of the Cutting Costs in the Aviation

Statements posed	1	2	3	4	5		
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Total Respondents**	**Weighted Mean**
Human error causes high fuel levy in military aviation	0	0	0	45	52	65	5
Human errors reduces the cost of fuel	0	2	0	25	38	65	5
Cost cutting errors affects the cost of labor	0	0	0	16	49	65	5
Human error attributes to high cost of labor	0	0	24	10	31	65	4
When I think of human error labor cost comes into your mind	0	0	6	15	44	65	5
When I think of human error cost of fuel comes into your mind	0	0	25	30	10	65	4
Mean of the weighted means							**4**

According to the respondents, there are many consequences or after effects of the cutting costs in the aviation industry. With a weighted mean of 4, the most important aspect confirmed to affect the industry faces are the fuel and the labour costs. Though labour expenses are fixed and cannot be changed for a long time so it does not affect much. The fuel costs can change at any point in time based on the change in the oil price. It is also said that since the change of oil price is responsible for both the profit and loss of the aviation industry.

Table 5.6 Types of Human Errors Can Occur

	N	Minimum	Maximum	Mean	Mean	Std. Deviation	Skewness
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	std error
Proper maintenance	100	2	6	2.24	0.733872	-0.1096	0.1928
Operation system	98	4	6	3.43672	0.401384	0.3192	0.1952
Neglect	100	3	6	2.864	0.5818	-0.88704	0.1928
Machine safety	100	4	6	3.39392	0.36304	0.7056	0.1944
Fuel cost	100	5	6	3.832	0.327488	-1.1568	0.1928
Predictive cost	100	5	5	3.2000	-	-	-
Overhead cost	100	5	5	3.2000	-	-	-
Poor attention	100	4	4	3.2000	-	-	-

As stated by the respondents, different kinds of human errors can occur. The failure to use the proper maintenance of operations system may lead to higher risks as the people are not attentive while working. It is also possible that people neglect or did not focus much on the product as well as machine safety. This may lead to severe accidents as well as problems while flying higher up in the sky. It is also difficult to maintain operation as well as fuel costs. Finally, it was established that both the protective as well as the predictive costs are sometimes ignored for lowering the costs.

Table 5.7 Complexity Arising In the Aviation Industry

Statements posed	1	2	3	4	5		
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Total Respondents**	**Weighted Mean**
There are lots of complexities in the military aviation maintenance	0	0	0	12	53	65	5
Solution challenges are common phenomena in the military aviation maintenance	0	2	0	27	36	65	5
Technological challenge is rampant in the military aviation maintenance	0	0	0	48	17	65	5
There are more of the technological challenges that mechanical	0	0	24	20	21	65	4
When I think of military aviation maintenance challenges stream into your mind	0	0	28	25	12	65	5
Poor training techniques is attributes to changes the military aviation maintenance	0	0	17	20	28	65	4
Mean of the weighted means							**4**

According to the respondents, it is sometimes difficult to understand and solve the complex problems which may arise due to the use of difficult technologies. With a weighted mean of 4, it is also possible that the employees that are not fully trained to handle or solve those problems contribute to highest number of errors in the military aviation maintenance programs. This means that majority of the respondents population had a view that poor training of the personnel's may have led to an upsurge in the number of human errors in the military aviation maintenance programs. Therefore, different precautionary measures taken by the Aviation management measures such as the employees and the labour are trained in modern technological skills and tools.

They are also trained and taught properly to solve the critical as well as the operational problems so that the accidents can be lessened.

Correlations

The researcher sought to find out the relationship between the numerous human errors that exists in the aviation industry and the Consequences of the cutting costs in the aviation. The results were recorded in the table below.

Correlations				
Consequences of the cutting costs in the aviation		Consequences of the cutting costs in the aviation	Types of human errors can occur	Complexity arising in the aviation industry
Consequences of the cutting costs in the aviation	Pearson Correlation	1	-.319*	-.728**
	Sig. (2-tailed)		.035	.000
	N	44	44	44
Types of human errors can occur	Pearson Correlation	-.319*	1	-.418**
	Sig. (2-tailed)	.035		.005
	N	65	65	65
*. Correlation is significant at the 0.05 level (2-tailed).				
**. Correlation is significant at the 0.01 level (2-tailed).				

Table 5.8: Correlations

Interpretation

As observed in the correlations table, there was a significant relationship between Consequences of the cutting costs in the aviation and Types of human errors can occur. Besides, there was a significant relationship between consequences of the cutting costs in the aviation Complexity arising in the aviation industry. Therefore, it was reported that there are broad number of human error in military aviation that are caused by maintenance management programs.

Chapter 6: Findings Discussion

6.1 Overall Aims Background

Generally the main aim of the current research paper was to examine human error in military aviation maintenance management programs based on the existing literature and collected field information by the researcher. There were other guidance objectives used by the researcher into carrying out an in-depth information study which included the identification of different types of human errors that occurs and their complexity while working in the aviation industry. The study also sought to examine the factors influencing human error in military aviation maintenance management programs.

For the researcher to deliver the set out objectives and aim of the study towards end results, use of research questions gave an added advantage to the researcher. The research questions included;

1. What type of human errors can occur and what complexity arises while working in the aviation industry?
2. What are the factors influencing human error in military aviation maintenance management programs?
3. What are the challenges associated with military aviation management?

6.2 Human Errors Can Occur and What Complexity Arise While Working in the Aviation Industry

The research question on various human errors and the resulting complexities was used to help in examining the exact human errors and their complexities with regard to military aviation maintenance management programs. In order to get a clear picture of the overall industry, the researcher utilized his wisdom by identifying and classifying the industry into various departments. This was to enable a better understanding of data while analyzing it and for easy interpretation of data. According to the findings the researcher identified different departments according to professions given that there exist diversity of professionals within the aviation industry. Different professionals including aircraft technicians, mechanical engineers, system engineers, safety auditors and general service departments were identified. More emphases were put on the aircraft

technicians who in turn indicated as forming the major part of human errors associated with the military aviation maintenance management programs. On the other hand mechanical engineers were the second sources of human errors as per the research findings recorded during the study. This result compares to comments by Anil, Yadava, & Deshmukh, (2011). Three authors publicized that errors are those actions that do not generate the purpose for which they are intended. When errors are attributed to humans, it essentially means that they are generated out of the faults of the humans themselves. In such a case, human errors, just like other errors lead to several undesired effect like accidents in the military aviation.

However, human errors in the military aviation maintenance management programs are associated with consequences of cutting costs in the aviation industry as whole as per research findings. Nevertheless, research findings established that different kinds of human errors can occur within work places not only in the aviation industry but also across other industries. While making comments on the same line Shafiee and Chukova (2013) explain that human errors cannot be entirely eliminated in its entirety within the realms of military aviation. Therefore, appropriate measures must be put in place to appreciate some of the very pertinent issues regarding these errors. In support of the same opinion as indicated in the results, Bock, (2011) acknowledges that poor communication may contribute to suboptimal, incorrect and fault during the maintenance thereby holding potential danger to the entire organization such as military aviation maintenance program.

Researcher's understanding is that failure to use the proper maintenance of operations system contributes to higher risks as individual workers are not attentive while working. Human errors included negligence, ignorance and lack of interest towards proper maintenance, operation system, machine safety, and costs (fuel, predictive and overhead costs.

6.3 Factors Influencing Human Error in Military Aviation Maintenance Management Programs

For the study to enlighten more on the significance of human error with regard to maintenance management programs the researcher sought to find out the driving force behind all these. Therefore, researcher arriving to the identification of different factors influencing occurrences of human error. In order to assess the relevance of age as one of factors influencing human error in military aviation maintenance management programs, respondents' gender and age

played a vital role. The study went further to establishing any link between the respondents and their gender as findings have indicated in figure 5.2. It was established that more percentage of respondents in this study was males as opposed to their counter parts who presented a minimal percentage. With a bigger number of males being involved then it was clear that the female gander is not conversant to factors attributed to human error in military aviation maintenance management programs. In a retaliatory effect, Bock (2011) believes that lack of awareness of what is expected of a current task in an aviation industry often makes it difficult for technicians to mitigate some incidence that could have otherwise been avoided retaliatory effect,

Despite the gender factor being highlighted by the researcher, age is another factor of great importance to this study. According to the past researches, there is a bigger age variance in both genders when it comes to the issue of human error as supported in the literature review section. Human errors inhibited by the older generations are totally different to that of the young personalities. This may vary from one individual to another.

6.4 Challenges Associated with Military Aviation Management

Military aviation management from time to time has undertaken different approaches and concepts into ensuring improvement in overall maintenance performance within an institution framework. However, presence of different challenges has forced military aviation managers to develop maintenance performance measurement programs as the researcher indicates in the literature. It is clear that modernization through technological advancements have resulted to diverse challenges to the aviation industry from huge consumption of fuel to pollution. Global climatic changes have most of times interfered with military aviation operations hence putting countries into crossroads in this error of terrorism. Past studies have indicated that large amount of noise pollution from aircrafts also has an adverse impact globally. The ides is much similar to what Simões, Gomes, & Yasin (2011) concluded military hardware come with very huge price tags and losing a single unit of an aircraft for instance, is a huge burden, financially, for the public.

Military aviation management entails the often maintenance of aircraft engine which is an important component in the aviation industry. Engines are very complex and involved in many mechanisms also that are subjected to failure and wear of aircraft. There are some components that are difficult to access like in engine removal and in disassembly of the parts in order to repair,

servicing and maintenance. Though human error is not emphasized by many, in the field of aviation majority of challenges are as a result of human error. To sum up the idea, it is clear that maintenance of aircraft engine is important as well as also very difficult due to a variety of reasons. Engines are very complex and involved in many components also that are subjected to failure and wear of aircraft as pointed out by.

Chapter 7: Conclusions

7.1 Relevance of the Topic

Over the years military have played an important role in the growth and development of nations in the perspective of social, economic, political and environmental aspects. Whereas in ensuring smooth running to military operations, it requires a nation to put in place a competent group of personnel to oversee proper management and operation to its machineries. Therefore, safety becoming a significant issue in the aviation industry with regard to military maintenance management programs in general. However, this involves human's activities from one sector to another with human errors being witnessed here and there hence giving relevance of the current study's topic.

There is need for one to have a good understanding on maintenance and maintenance management in aviation industry specifically on military departments given that all machinery to be used ought to be at standby throughout the year. Other than having all the military equipment in good condition, there is human error factor to be checked to enhance performance within the industry. It is understood that human errors have in the past and present times caused loss of people's live, property and damages in general. With little research having been done, this elicited the researcher to carrying out the current study due to the magnitude it weighs.

7.2 Overall Study Findings

The study was guided by descriptive analysis of techniques that were utilized to execute the process. The researcher also utilized the interpretive philosophy where by social constructs of a research event determines the type of data analysis that should be employed during the process of data analysis. Qualitative research is used to gather information on non-statistical sources or non-numerical sources. It not only helps to understand the feelings, views and thoughts about a particular topic from a specific group but also helps to analyse their views without any partiality. The targeted population constituted military aviation technicians at MRO (Maintenance Repair and Overhaul) headquarters in Abu Dhabi, United Arab Emirates. Data were collected by distribution of questionnaires among 65 personnel's who had been selected prior to the study.

Pertaining to the gender of the respondents, the study observed that 88% percent were of male gender and 12% female, it was concluded that more men are conversant to factors influencing human error in military aviation maintenance management programs as compared to female. With

regard to representation of ages of respondents involved in the study, it was observed that observed 15.9% were of ages 40 and above years. 43.2% of the total respondents indicated that they were of age variance 36-39 years. 29.5% ranges between ages 30-35 years, 11.4% was of ages 20-30 years. From the above results, it was noted that the greatest age variance to have been recorded in this study were between age 36-39. The statistics for the ages of the respondents were of vital concern to the study because they were used to assess the relevance of age and factors influencing human error in military aviation maintenance management programs. The areas of the specialization returned a rate of 44 percent indicating that sufficient human errors in the military aviation maintenance management programs mainly emanates from the mechanical personnel's.

As per the researcher set out objectives and study's main goal, through analyzing the data collected from the field, the researcher came up with findings. Findings of the investigations concerning the factors influencing human error in military aviation maintenance management programs were clearly supported by data collected and also from existing information. It was established that human errors are directly connected to individual personalities and therefore human day to day operations contributed the biggest portion to the occurrences of errors. Thus, the only available solution remains to human error is human themselves.

The study also did indicate that relevance of age into factors influencing human error in military aviation maintenance management programs. According to the individual responses from different military departments, it was evident that aircraft technicians and mechanical engineers topped the rank as major contributors of human error in the aviation industry. Moreover, on the issue of cutting costs within the aviation industry research findings did indicate that there are many consequences associated to this. It is said to affect fuel and labor costs consequently. Also, changes on oil prices impacts both industry's profits and losses significantly. On the other hand, the researcher found that failure to use of proper maintenance operations systems in one way or other may cause higher risks to the industry with some individual employees being inattentive in their work stations.

The unique researcher's contribution of the current study is the broader view of involving other stake holders in the aviation industry towards reduction of human error accidents including leadership, learning, organizations' culture and process management. In the current case, one

would expect to come up with a single solution but it is not the case to the researcher. This paper takes a different approach into solving and handling of human error within military aviation.

The current research findings do poses wide academic as well as managerial implications especially in the aviation industry. With regard to academics, the bridge between existing literature on the same and the present study varies a lot. The fact that challenges faced by the aviation industry in reference to maintenance and management programs have far reaching effects to different sectors differently as it is evidenced in the literature review. Secondly, current study's findings as well as conclusions touches on managerial approaches used across industries aviation industry included.

7.3 Future Research Opportunities

My study topic was literature based examination of human error in military aviation maintenance management Programs main focus being human errors in general. However, regarding human error there is a lot which is needed to be further investigated by future researchers. Although human are dynamic, the aviation industry together with the stake holders have to keep on changing tactics given how delicate military operates. Future studies should aim more on establishing different mechanisms towards eradication of human errors with the help of technology. Though the researcher limited himself to military aviation technicians and mechanical engineers at MRO (Maintenance Repair and Overhaul) headquarters Abu Dhabi, United Arab Emirates, it does not put limitations to other researchers present or future into studying other personnel in the same industry.

7.4 Limitation of the Current Work

Maintenance being a central component of military aviation entails all those activities that are engaged on enhancing the performance of all the operations in the industry. Current study focused on military aviation technicians at MRO (Maintenance Repair and Overhaul), Abu Dhabi, United Arab Emirates. While the study area may have different kinds of personnel's, the researcher limited himself to aviation technicians. The main reason of choosing them was because they are mainly engaged with the maintenance and they are highly susceptible to making human errors.

That study confirmed that sufficient human errors in the military aviation maintenance management programs were also confirmed to be emanating from the mechanical personnel's. This compares to Wohl (2015) who agrees to this idea it is also mandatory to maintain a good

relationship among each other as well as with the ground staffs so that any kind of problem while flying high up in the sky can be solved within less time. The study further identified that the change of oil price is responsible for both the profit and loss of the aviation industry. Such an idea was supported by Dekker (2014) who believed that new approaches of aviation maintenance seems to be a more detailed and in-depth study of the causes of human errors (Dekker, 2014).

Though credible measures including advanced technology often results in exposure to chances of errors, it does not take long for the errors to turn to the critical anomaly. Besides, the study has confirmed that that poor training of the personnel's may have led to an upsurge in the number of human errors in the military aviation maintenance programs. The idea has also been supported by Robertson (2014) sentiments who acknowledge that there should be adequate results available in order to reduce human error in the aviation industry. The research has also confirmed that the major goal of the aircrafts industries is to reduce maintenance-related accidents and incidents which can occur from human error. In conclusion, the research has confirmed that varied human error in military aviation maintenance management programs.

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Appendices

Appendix 1 Questionnaire:

Dear Respondent,

Regarding the continued debate concerning the extent of Human Error in Military Aviation Maintenance Management Programs, you are kindly requested to take part in the study by filling in the questionnaire below.

SECTION A: GENERAL DATA

Gender

Male ☐

Female ☐

Age

Less than 23 Years ☐

23-28 Years ☐

28-33 Years ☐

33-38 Years ☐

Above 38 Years ☐

3. Highest Level of Education

Secondary Level ☐

College Level ☐

University Level ☐

Others (Specify)……..……

How Many Years have you been Working?

Less than 3 Years ☐

3-6 Years ☐

6-9 Years ☐

9 Years and Above ☐

SECTION B:

Please tick the most appropriate number of each statement which corresponds most closely to your desired answers. Use a scale where; strongly Agree = SA, Agree = A, Neutral = N, Disagree= D and Strongly Disagree = SD

Consequences of the Cutting Costs in the Aviation

Statements posed	1	2	3	4	5		
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Total Respondents**	**Weighted Mean**
Human error causes high fuel levy in military aviation							
Human errors reduces the cost of fuel							
Cost cutting errors affects the cost of labor							
Human error attributes to high cost of labor							
When I think of human error labor cost comes into your mind							
When I think of human error cost of fuel comes into your mind							

Complexity Arising In the Aviation Industry

Statements posed	1	2	3	4	5		
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Total Respondents**	**Weighted Mean**
There are lots of complexities in the military aviation maintenance							

Solution challenges are common phenomena in the military aviation maintenance							
Technological challenge is rampant in the military aviation maintenance							
There are more of the technological challenges that mechanical							
When I think of military aviation maintenance challenges stream into your mind							
Poor training techniques is attributes to changes the military aviation maintenance							

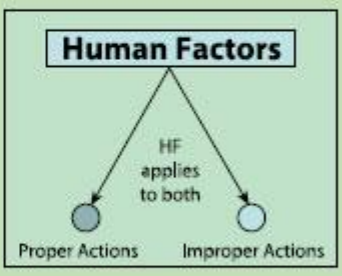
…..End …..

Appendix 2: Military Aviation Safety Guideline

Appendix 3: Human Factors In Aviation Management Programs

Human Factors

Active Failure
Assertiveness
Asynchronous Communication
Authoritarian Leader
Communication
Complacency
Crew Resource Management
Dirty Dozen*
Egalitarian
Ergonomics
Human Factors
Inter-team
Intra-team
Instructional Systems Design
Latent Failure
Leadership
Maintenance Resource Management
Mental Model
Norms
Participatory Leader
Safety Culture
Situational Awareness
Stressor
Synchronous Communication
Team
Team Situational Awareness
Teamwork



* 1. Lack of Communication 2. Complacency 3. Lack of Knowledge 4. Distraction
5. Lack of Teamwork 6. Fatigue 7. Lack of Resources 8. Pressure 9. Lack of Assertiveness
10. Stress 11. Lack of Awareness 12. Norms