National Defence Défense nationale

Canadian Forces College

Collège des Forces Canadiennes

ENHANCING MALIAN AIR FORCE ENGINEERING MAINTENANCE PRACTICES TO MEET CONTEMPORARY FLIGHT OPERATIONAL NEEDS

MAJOR BAKARY KONE

JCSP 46

Service Paper

Disclaimer

Opinions expressed remain those of the author and do not represent Department of National Defence or Canadian Forces policy. This paper may not be used without written permission.

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.

PCEMI 46

Étude militaire

Avertissement

Les opinons exprimées n'engagent que leurs auteurs et ne reflètent aucunement des politiques du Ministère de la Défense nationale ou des Forces canadiennes. Ce papier ne peut être reproduit sans autorisation écrite.

© 2020 Sa Majesté la Reine du Chef du Canada, représentée par le ministre de la Défense nationale.

Canada

CANADIAN FORCES COLLEGE – COLLÈGE DES FORCES CANADIENNES

JCSP 46 – PCEMI 46
2019 – 2020

SERVICE PAPER - ÉTUDE MILITAIRE

ENHANCING MALIAN AIR FORCE ENGINEERING MAINTENANCE PRACTICES TO MEET CONTEMPORARY FLIGHT OPERATIONAL NEEDS

By Major Bakary Kone

"This paper was written by a candidate attending the Canadian Forces College in fulfillment of one of the requirements of the Course of Studies. The paper is a scholastic document, and thus contains facts and opinions which the author alone considered appropriate and correct for the subject. It does not necessarily reflect the policy or the opinion of any agency, including the Government of Canada and the Canadian Department of National Defence. This paper may not be released, quoted or copied, except with the express permission of the Canadian Department of National Defence."

« La présente étude a été rédigée par un stagiaire du Collège des Forces canadiennes pour satisfaire à l'une des exigences du cours. L'étude est un document qui se rapporte au cours et contient donc des faits et des opinions que seul l'auteur considère appropriés et convenables au sujet. Elle ne reflète pas nécessairement la politique ou l'opinion d'un organisme quelconque, y compris le gouvernement du Canada et le ministère de la Défense nationale du Canada. Il est défendu de diffuser, de citer ou de reproduire cette étude sans la permission expresse du ministère de la Défense nationale. »

Word Count : 2,615

Nombre de mots : 2.615

ENHANCING MALIAN AIR FORCE ENGINEERING MAINTENANCE PRACTICES TO MEET CONTEMPORARY FLIGHT OPERATIONAL NEEDS

AIM

1. The aim of this paper is to propose a reorganization of the Malian Air Force (MAF) engineering branch with a view to enhancing efficiency. The paper will highlight an overview of the MAF. Thereafter, it will discuss the challenges and propose a way forward. It is assumed that the reader knows the link between aircraft maintenance and the fight against terrorism.

INTRODUCTION

2. The primary role of an air force is to safeguard the territorial integrity of a nation[1]. The change in role from conventional military operations to internal security and paramilitary duties requires intense and time consuming periods of training.[2] The role of the MAF has changed from the conventional military operations to fight terrorism since 2012. Terrorism is the unlawful use of violence or threat of violence, often motivated by religious, political, or other ideological beliefs, to instill fear and coerce governments or societies in pursuit of goals that are usually political.[3]. Air power is commonly seen to perform 2 broad counter-terrorism functions, namely prevention and response.[4]

According to Keith B. McCutcheon, ‘‘Aviation is a dynamic profession. The rate of obsolescence of equipment is high and new aircraft have to be placed in inventory periodically in order to stay abreast of the requirements of modern war’’. To achieve these functions, an air force must possess an adequate equipment, a well-trained personnel and a good engineering organisation.

[1] www.worldatlas.com/articles/the-united-states-air-force-usaf.html.
[2] James Salt and M. L. R. Smith. "Reassessing Military Assistance to the Civil Powers: Are Traditional British Anti-Terrorist Responses Still Effective?" Low Intensity Conflict & Law Enforcement 13, no. 3 (Winter 2005). 246.
[3] US Joint Counterterrorism Publication 3-26, 24 October 2014.
[4] Sam Gray-Murphy, Air Power and Trans-national Terrorism: The Possibilities, Advantages and Limits to Using Australian Air Power in the ‘War on Terror’’, 2008.

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

3. The MAF has already an existing engineering branch organisation but this structure has several challenges. The first is the difficulty to face the high demand of air operations as well as to manage the number and type of air assets effectively. Indeed, the MAF is involving in combating terrorism since 2012. Because of this situation, the MAF has redeployed fighters and helicopters in the center and the north of Mali. These places do not have facilities as well as equipment. Thus, only the pre-flight checks and some small maintenance tasks are performed in these places, the rest is done in Bamako at the Main Operating Base (MOB). The time allocated to some maintenance tasks is too high and this affects the serviceability of aircraft as well as the conduct of air operations. The second is the lack of personnel and specialists for specific or intermediate maintenance tasks. This is due to the methods of recruiting and training. The third is the aging of the maintenance facilities and the equipment as well as the materiel for maintenance.

DISCUSSION

OVERVIEW OF THE MALIAN AIR FORCE

4. The Malian Air Force, was created in 1976. The MAF received the training equipment, primarily from the 'Soviet Union.[5] In the 1970s and early 1980s, 2 AN-26s as well as 14 MIG-21 fighters aircraft were acquired.[6] All these aircraft were grounded at the end because of either their potential hours or their age. In order to bring the act of creation of the MAF into conformity with the legal provisions, a new ordinance was drawn up in December 1999, providing the MAF with the legal framework for its existence.[7] The MAF has several missions such as preserving the integrity of the national airspace, the operational defense of the territory as well as Search and Rescue

[5] www.glaobalsecurity.org, archives Armée de l'Air du Mali
[6] Ibid.
[7] www.globalsecurity.org..

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

(SAR)[8]. Others missions are the assurance of people and property as well as the participation in the economic, social and cultural development effort. The lack and the age of platforms affect a lot the effectiveness of the different missions assigned to the MAF. New acquisition of some platforms as well as the overhaul of the others could overcome these challenges. Therefore, there is a need for MAF to acquire new and overhauled platforms to achieve effectively its missions.

5. In January 2015, the President of the Defence Council and Supreme Chief of the Malian Armed Forces or Forces Armées du Mali (FAMa), Ibrahim Boubacar Keita announced the implementation of measures for a military investment plan of 1,230 billion CFA.[9] This plan was part of the "Military Orientation and Programming Law (LOPM)", which was approved in February 2015[10]. This law provides for a modernization of the FAMa, and the MAF acquired a number of new and modern aircrafts.

6. Despite the application of the LOPM, the MAF has challenges due to the geographical and environmental situations. Indeed, the republic of Mali has 7 neighboring countries and a landscape of 1,241,328 km² with a line border of 7240 km.[11]The two third of the Malian territory are desert and a very little part is controlled. The roads towards the main cities of the North namely Gao, Tombouctou and Kidal are mined. This situation increases the air transport operations because of the impracticability of the roads. In addition, the MAF is involved in the center and the north of Mali in fighting terrorism. These situations forced the MAF to redeploy its aircrafts. The high rate of air operations coupled with the sandy operational area as well

[8] www.fama.ml
[9] www.Globalsecurity.org , Mali Air Force.
[10] Ibid. archives Armée de l'Air du Mali
[11] Dr Zeïni MOULAYE / IGP Mahamadou NIAKATÉ, Gouvernance Partagée de la Sécurité et de la Paix: L'expérience Malienne, 2011.

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

as the difficult climatic conditions (more than 45° C) increase a lot the frequency of maintenance tasks.

CHALLENGES FACING THE MALIAN AIR FORCE ENGINEERING BRANCH

7. The MAF Engineering Branch is facing mainly three types of challenges. The first has to do with the serviceability of aircraft. The second concerns the dearth of personnel and/or the lack of specialists. The third is the overage of the maintenance facilities and the equipment for maintenance.

UNSERVICEABILITY OF AIRCRAFT

8. In the MAF, combat helicopters such as MI-24 and MI-35 are involved in operations against terrorism. Due to the maintenance exigencies of these 2 types of aircraft, which required lubrication and short time planned maintenance, the serviceability is a challenge.

9. The lack of effective planning for maintenance tasks affect a lot the serviceability of helicopters. There is a need for the MAF to review the maintenance planning in order to have at least one helicopter of each type in the Area of Operations (AO). This would contribute to decrease the unserviceability.

DEARTH OF PERSONNEL AND LACK OF SPECIALISTS

10. Dearth of Personnel. The republic of Mali does not have an Air Force Training School (AFTS) to train pilots and mechanics. The MAF depends mainly on bilateral and multilateral cooperations of some countries providing training for the MAF personnel. Because of the absence of training school for technicians, it is impossible for the MAF to select the number and the final skills of its technical personnel. The lack of an AFTS and the dependence on foreign air forces training institutions affect the number as well as the

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

final skills of the MAF technical personnel. To overcome these problems, the MAF should propose the creation of an AFTS to the higher command. This would allow the MAF to determine the number of technical personnel to be trained and their skills as well.

11. Lack of Specialists. Aircraft systems are becoming increasingly sophisticated and complex.[12] Unfortunately, as sophistication increased, both reliability and the ability of the MAF personnel to maintain systems decreased. This is due to the difficulty to specialize technicians according to the technological advancement or the improvement in some systems or components. The difficulty to train specialists affect the specialization of the MAF technicians. There is a need to specialize technicians according to the technological advancement.

OVERAGED MAINTENANCE FACILITIES AND EQUIPMENT

12. Overaged Maintenance Facilities. The hangars in the MAF MOB were established in 1976. These hangars were built for aircraft that are no longer in service. New generation Aircraft have replaced them. There is an inadequacy between the aircraft and the hangars because some of the aircraft cannot fit in any of the hangars. Because of this situation, some maintenance tasks, which required hangars, could not be performed. The inadequacy of hangars affects the effectiveness of the maintenance. There is a need for MAF to readapt its facilities according to the fleet. This could contribute to avoiding unnecessary waste of time and prevent against incident.

13. Overaged Equipment for Maintenance. The performance of any engineering installation will be directly related to the equipment that regulates and controls its operation.[13] In the MAF MOB the available equipment is most of the time unreliable

[12] Ibid.
[13] John Armstrong, Maintenance engineering and management, CIBSE, 2008.

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

because of their ages. This situation affects the accuracy during maintenance tasks. In addition, many of these equipment is incompatible with the type of aircraft. The unreliability coupled with the incompatibility of these equipment affects a lot the effectiveness of the maintenance tasks and thus the operations. There is a need for the MAF to sufficiently upgrade equipment in order to improve the quality of maintenance. This will increase the efficiency of the maintenance and will contribute to support operations effectively.

WAY FORWARD

14. A maintenance organization is subjected to frequent changes due to uncertainty and desire for excellence in maintenance.[14] Because of the involvement of the MAF in fighting terrorism, it is important to maintain the sustainability of air operations. This is done through well-trained personnel, adequate facilities and equipment as well as a high rate of aircraft serviceability. In order to reorganise the MAF engineering branch efficiently it will be necessary to apply the LEAN process. The concept of lean maintenance, which originated in the manufacturing industry, is known as a systematic approach to identify, analyze and eliminate waste through proper management and continuous improvement.[15] Waste is defined as any activity that absorbs resources and creates no value.[16] Lean from an operational perspective involves implementing a set of shop floor tools and techniques aimed at reducing waste within the plant.[17] Such tools and techniques include, for example, setup time reduction, work standardisation, and preventative maintenance.[18] By using these tools in the MAF, the definition and the identification of the value are the assurance of a high rate of aircraft serviceability. The

[14] Ahmed E. Haroun and Salih O. Duffuaa, Maintenance Organization, 2009.
[15] Malgorzata Jasiulewicz-Kaczmarek1 and Anna Saniuk, How to Make Maintenance Processes More Efficient Using Lean Tools?
[16] Professor Deborah Nightingale, Fundamentals of Lean, September 12, 2005.
[17] Malgorzata Jasiulewicz-Kaczmarek1 and Anna Saniuk, How to Make Maintenance Processes More Efficient Using Lean Tools?
[18] Malgorzata Jasiulewicz-Kaczmarek1 and Anna Saniuk, How to Make Maintenance Processes More Efficient Using Lean Tools?

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

waste in this case is the recruiting method of technician, the inadequacy of facilities and equipment, the qualification of personnel and the duration of maintenance tasks.

RECRUITING AIRCRAFT MAINTENANCE TECHNICIANS DIRECTLY FROM CIVIL

15. Aircraft maintenance is a specialised field that necessitates training.[19] The lack of training school affects a lot the number of technicians in the MAF. The MAF recruits its technicians among young soldiers with scientific background from the Army Non Commission Officers School, it takes a minimum of 4 years for the MAF to train an Aircraft Maintenance Technician (AMT). To reduce the duration of the AMT training it is important for the MAF to recruit young after the baccalaureate and to send them directly abroad to the aviation school. This will reduce the availability of AMT from 4 to 2 years.

16. The AMT method of recruitment increase the duration of AMT availability. By adopting the direct recruitment from civil of young with science diploma and by sending directly these young to countries which use the same platform as the MAF, the dearth of personnel as well as the duration of the training could be solved. Therefore, the MAF will have enough and well-trained AMT to perform maintenance tasks efficiently and to support effectively air operations.

17. Maintaining aircraft requires a lot of "stuff," including tools, fixtures, test equipment, raw materials, parts, portable work platforms, procedures, technical documentation, expendable supplies, etc.[20] Maintenance is no exception in being under

[19] **Century Avionics, the Importance of Regular Aircraft Maintenance, September, 2016.**
[20] Michael E. Maddox, Facility Design.

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

the influence of rapid technological changes. [21] Indeed, the technological advancement affects aircraft design and by extension facilities as well as equipment. The facilities and equipment in the MAF did not follow the technological advancement. For instance, available hangars cannot fit most of the aircraft. This situation affects the execution of some maintenance tasks such as jacking the aircraft, removing engines or helicopters main transmission gearbox. The issue of execution of such tasks affect the flight safety thus air operations. the construction of new and modernise facilities with high capacities will make possible the execution of some major maintenance tasks. This will increase the serviceability of aircraft and will contribute to sustaining air operations as well.

18. In aviation, the rate of obsolescence of equipment is high and new aircraft have to be placed in inventory periodically in order to stay abreast of the requirements of modern war.[22] In the MAF, the lack of updating maintenance equipment affects a lot of maintenance tasks. There is a need for the MAF to update equipment in order to carry out all the maintenance tasks.

The implementation of such equipment will increase the performance of maintenance tasks and aircraft can be release quickly for air operations.

INCREASING THE SERVICEABILITY OF AIRCRAFT

19. The goal of lean maintenance is to minimize waste in terms of non-value-added activities, such as waiting time, motion time, set-up time and WIP (Work In Process) inventory.[23] As the AO of the MAF is mainly the centre and the north, it is important to establish a good maintenance engineering in that zone by using the Lean concept. This

[21] Albert H.C. Tsang, Maintenance Performance Management in Capital Intensive Organizations, 2000.
[22] Keith B. McCutcheon.
[23] S.Kolanjiappan, Lean philosophy in aircraft maintenance.

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

will reduce considerably the duration of the immobilization of an aircraft and will help to achieve the objective of a better serviceability of aircraft.

CONCLUSION

20. The high rate of air operations coupled with the sandy operational area as well as the rude climatic conditions (more than 45° C) increase a lot the frequency of maintenance tasks. These maintenances tasks are compressor and turbine washes, Hot Part Inspection, lubricating, greasing, and some scheduled maintenances.

21. The lack of effective planning for maintenance tasks affect a lot the serviceability of helicopters. There is a need for the MAF to review the maintenance planning in order to have at least one helicopter of each type in the Area of Operations (AO). This would contribute to decrease the unserviceability.

22. The lack of an AFTS and the dependence on foreign air forces training institutions affect the number as well as the final skills of the MAF technical personnel. To overcome these problems, the MAF should propose the creation of an AFTS to the higher command. This would allow the MAF to determine the number of technical personnel to be trained and their skills as well.

23. The inadequacy of hangars coupled with the problems of stores and workshops affect the effectiveness of the maintenance. There is a need for MAF to readapt its facilities according to the fleet. This could contribute to avoid unnecessary waste of time and prevent against incident. In addition, the unreliability coupled with the incompatibility of some equipment affects a lot the effectiveness of the maintenance tasks and thus the operations. There is a need for the MAF to upgrade equipment to maintainable condition in order to improve the quality of the maintenance. This will

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

increase the efficiency of the maintenance and will contribute to support operations effectively.

24. The AMT method of recruitment increase the duration of AMT availability. By adopting the direct recruitment from civil of young with science diploma and by sending directly these young to countries which use the same platform as the MAF, the dearth of personnel as well as the duration of the training could be solved. Therefore, the MAF will have enough and well-trained AMT to perform maintenance tasks efficiently and to support effectively air operations.

25. The renovation of existing hangars coupled with the construction of new one will help to reduce the immobilization time of aircraft in one hand. On the other hand, it will make possible the execution of some major maintenance tasks. This will increase the serviceability of aircraft and will contribute to sustain air operations as well.

RECOMMENDATION

26. Recommend MAF consider the following instructions:

a. To Review the maintenance planning.

b. To Propose the creation of an AFTS to the higher command.

d. To readapt its facilities according to the fleet.

e. To upgrade equipment to maintainable condition.

f. To adopt the direct recruitment from civil of young with science diploma.

g. To renovate existing hangars, and build a new one.

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.

BIBLIOGRAPHY

Ahmed E. Haroun and Salih O. Duffuaa, Maintenance Organization, 2009.

Albert H.C.Tsang, Maintenance Performance Management in Capital Intensive Organizations, 2000.

Christopher N. Winston, The importance of Administration and Training in your CMMS Implementation.

Civil Aviation Regulations- Part VI - Approved Maintenance Organisation.

Dr Zeïni MOULAYE / IGP Mahamadou NIAKATÉ, Gouvernance Partagée de la Sécurité et de la Paix: L'expérience Malienne, 2011.

James Salt and M. L. R. Smith. "Reassessing Military Assistance to the Civil Powers: Are Traditional British Anti-Terrorist Responses Still Effective?" Low Intensity Conflict & Law Enforcement 13, no. 3 (Winter 2005). 246.

John Armstrong, Maintenance engineering and management, CISSE, 2008.

Kinnison and Siddiqui, aviation maintenance management 2013.

Malgorzata Jasiulewicz-Kaczmarek1 and Anna Saniuk, How to Make Maintenance Processes More Efficient Using Lean Tools?

Michael E Maddox, Facility Design, 2005.

Polly Carpenter-Huffman and Bernard Rostker, The relevance of training for the maintenance, 1976.

Sam Gray-Murphy, Air Power and Trans-national Terrorism: The Possibilities, Advantages and Limits to Using Australian Air Power in the 'War on Terror", 2008.

US Joint Counterterrorism Publication 3-26, 24 October 2014.

www.fama.ml

www.Globalsecurity.org, Mali Air Force.

www.usni.org/author/lieutenant-general-keith-b-mccutcheon

www.worldatlas.com/articles/the-united-states-air-force-usaf.html.

© 2020 Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence.
All rights reserved.