

Proposed Physical Exercises Framework for Aircraft Maintenance Students involved in Territorial Army

Mohd Harridon, Sazly Anuar, Fadzil Adly Ishak, Afiq Faizal Azman,
Muhammad Syazwan Mat Ghani, Mohd Razi Saad, Mohd Nor Azmin Md Hashim

Abstract: Maintenance works upon aircraft is complicated and involve the use of myriad body parts of the personnel that actuate maintenance. It's imperative for workers to be physically fit as this affects the output of the work and safety. This paper proposed a physical exercises framework that could be used by Aircraft Maintenance Students where this framework could be used by the Territorial Army to train the students that are involved in the Territorial Army.

Keywords: Myriad Body Parts, Aircraft Maintenance, Territorial Army.

I. INTRODUCTION

Maintenance of aircraft requires an individual to be physically fit since there is a lot of processes which use a large part of the human anatomy such as the hands, back, abs, and legs. For example, opening up an aircraft engine requires the technician to use tools that are to be handled by the hands. Hoisting equipment and aircraft components also requires strong back, abs, and thighs. Students that go through the Aircraft Maintenance Training should also be physically fit to prepare them for employment in the Aircraft Maintenance Industry. At Universiti Kuala Lumpur Malaysian Institute of Aviation Technology (UniKL MIAT), the students go through Aircraft Maintenance Training and the students also have an option to be involved in extra curriculum activities such as martial arts, Territorial Army, and others.

The Territorial Army of Malaysia has instill physical exercises as part of their training syllabus. Most of the physical exercises are calisthenics in nature which uses body weights as resistances for strength and muscle building.

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Mohd Harridon, Aviation Fitness Cluster Universiti Kuala Lumpur Malaysian Institute of Aviation Technology, European Paratroopers

Sazly Anuar, Universiti Kuala Lumpur Malaysian France Institute, Territorial Army of Malaysia

Fadzil Adly Ishak, Aviation Fitness Cluster Universiti Kuala Lumpur Malaysian Institute of Aviation Technology, Territorial Army of Malaysia

Afiq Faizal Azman, Aviation Fitness Cluster Universiti Kuala Lumpur Malaysian Institute of Aviation Technology.

Muhammad Syazwan Mat Ghani, Aviation Fitness Cluster Universiti Kuala Lumpur Malaysian Institute of Aviation Technology, Territorial Army of Malaysia

Mohd Razi Saad, Aviation Fitness Cluster Universiti Kuala Lumpur Malaysian Institute of Aviation Technology, Territorial Army of Malaysia

Mohd Nor Azmin Md Hashim, Aviation Fitness Cluster Universiti Kuala Lumpur Malaysian Institute of Aviation Technology

In this paper we proposed a set of calisthenics exercises that could be used by the Territorial Army to physically train students of UniKL MIAT within the context of Aircraft Maintenance. This is called Functional Training which is to train individuals to be physically fit in their specific job (in this case the job is maintaining aircraft) [1].

II. LITERATURE REVIEW

There are numerous physical needs in aircraft maintenance. According to Yazgan, its imperative for the body to perform at its optimum in order to gain outputs of work which are acceptable to the Aircraft Maintenance Industry [2]. Yazgan further stated that one of the primary concerns is the fact that unfit personnel are more prone to pain and aches which can contribute to poor workmanship and thus create maladies and untoward incidents during flights [2].

Hobbs concurred and stated that the job of maintaining aircraft is physically strenuous and those who are physically fit can withstand these conditions [3]. The work place, according to Hobbs, is usually constricted where the workers needed the physical ability or strength to crawl within these confined spaces and also the workers usually work outdoors in cold conditions and thus require the necessary muscles to produce heat in their bodies [3].

A paper by Saadah suggested that the training of the Territorial Army of Malaysia is almost similar to the training of the Regular Army of Malaysia [4]. This is concurred by the Royal Army of Malaysia which stated that the individuals of Territorial Army of Malaysia have similar skill sets of their regular counterpart [5]. This entails, any physical exercises actuated by the Territorial Army are deemed almost similar to those of the Regular Army. The Territorial Army implements calisthenics as their primary mode of physical exercises with concentration in strength and conditioning, endurance, anaerobic and aerobic exercises, and others. It is a norm, every morning, before breakfast, an hour or more of physical training is actuated to increase or maintain the fitness of the personnel of the Territorial Army of Malaysia.

In Functional Training, according to Shaikh, the components of the body, such as hands, leg, abs, and others are trained in order to increase their strength or muscle mass where the increase is to aid individuals in performing their daily chores [6]. Shaikh also added that Functional Training



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had increased the physical fitness of the individuals that subscribed to the training.

Hostager indicated that Functional Training had shown to be effective in gaining fitness for individuals. She stressed that if the outcome is to train certain parts of the body to

perform certain functions, then Functional Training should be chosen [7].

III. Methodology

Our methodology is shown in Figure 1.

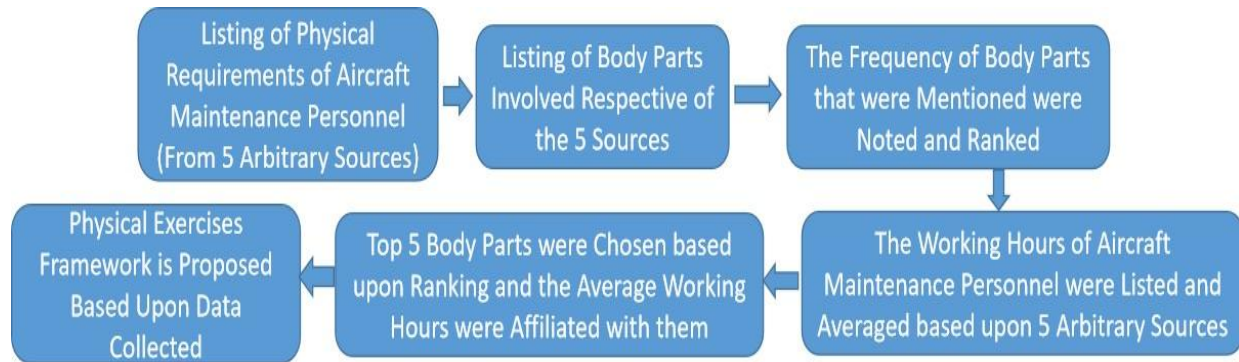


Fig. 1 The Methodology to Gain the Physical Exercises Framework

We had gone through 5 aviation sources (5 is a number that we had arbitrary chosen) and extracted the list of physical requirements of Aircraft Maintenance Personnel as stated in these sources. From there we made interpretations, via heuristics, on the body parts that are involved in relations to the statements or phrases we had extracted from the 5 sources. We then tabulated these body parts and counted their frequencies (eg. how many times the body part had been mentioned). These frequencies were then ranked where the highest value of frequency is ranked first while the lowest value of frequency is ranked last. We also had gone through 5 aviation sources (this is also an arbitrary value) to gain the daily working hours of Aircraft Maintenance Personnel and these hours were then averaged. The top 5 ranked body parts were then chosen and the average daily working hours were affiliated with these top 5 body parts. Our physical exercises framework was then developed based upon these top 5 ranked body parts and

their average daily working hours. Heuristics also played a role in developing the exercises framework where the authors have sufficient knowledge in fitness via their experiences in sports and military.

It has to be noted that the ranks of thighs, calf, and ankles are the same which is 4 but calf was chosen over others since there were numerous literature that showed calf is uttermost importance than thighs and ankles. One such literature is a paper by Dixon which stated that calf has a high propensity to injury due to it's ingrained nature [8]. He furthermore explained that the injuries at the calf are common among individuals, thus leaving them precarious.

IV. RESULTS

Tables 1 till 6 show the data and also the evolution in producing the exercises framework.

Table. 1 Physical Requirements of Aircraft Maintenance Personnel

Physical Requirements of Aircraft Maintenance Personnel
FROM SOURCE ONE: 1. Use hands where the usage is to Control, Handle, or Feel 2. Standing within a prolong period 3. Observe objects 4. Usage of fingers 5. Movement of arms 6. Holding of arms at a position 7. Able to grasp using the hand 8. Focus 9. Support the body using abs and back 10. Stretch of body 11. Bend of body 12. Twist of body 13. Swift reaction 14. Carry heavy object 15. Lift heavy object 16. Push heavy object 17. Pull heavy object 18. Alter body movement 19. Prolong period of activity 20. Coordination of body parts 21. Balancing of body 22. Iteration of movement of parts of hands
FROM SOURCE TWO: 1. A majority of time is used for standing 2. Actuate lifting of heavy object 3. Confined / Tight Spaces - it's a norm to work in this condition 4. Able to hammer metal (sheet metal works) 5. Able to concentrate
FROM SOURCE THREE: 1. Ladders - standing on them 2. Able to work at myriad heights 3. Mechanical ability that is strong 4. Constant movement from one place to another
FROM SOURCE FOUR: 1. Use hand 2. Use power tools 3. Use test equipment 4. Able to concentrate 5. Work outdoor in cold and wet weather 6. Usage of scaffolds 7. Heavy physical demand 8. Lift / pull frequently 9. Movement of weight (on average 50 pounds weight) 10. Crouching 11. Reaching 12. Kneeling 13. Crawling 14. Fingering 15. Handling
FROM SOURCE FIVE: 1. Usage of hand tools 2. Usage of power tools 3. Has the ability to move heavy tools 4. Has the ability to move heavy equipment



Table. 2 Mapping of Body Parts Involved

List of Body Parts Involved (Respective of Numbers in Table 1)
SOURCE ONE: 1. Triceps, Biceps, Wrists, Fingers 2. Thighs, Calf, Ankles 3. Eyes, Brain 4. Fingers 5. Biceps, Triceps 6. Biceps, Triceps 7. Fingers, Biceps, Triceps 8. Brain 9. Abs, Back 10. Biceps, Triceps, Abs, Back, Thighs, Calf, Ankles 11. Back, Abs 12. Back, Abs 13. Thighs, Calf, Ankles, Abs, Back, Biceps, Triceps, Wrists, Fingers 14. Thighs, Calf, Ankles, Abs, Back, Biceps, Triceps, Wrists, Fingers 15. Thighs, Calf, Ankles, Abs, Back, Biceps, Triceps, Wrists, Fingers 16. Thighs, Calf, Ankles, Abs, Back, Biceps, Triceps, Wrists, Fingers 17. Thighs, Calf, Ankles, Abs, Back, Biceps, Triceps, Wrists, Fingers 18. Abs, Back 19. Abs, Back, Thighs, Calf, Ankles 20. Brain 21. Brain 22. Biceps, Triceps, Wrists, Fingers
SOURCE TWO: 1. Thighs, Calf, Ankles 2. Thighs, Calf, Ankles, Abs, Back, Biceps, Triceps, Wrists, Fingers 3. Thighs, Calf, Ankles, Back, Abs 4. Triceps, Biceps, Wrists, Fingers, Back, Abs 5. Brain
SOURCE THREE: 1. Thighs, Calf, Ankles, Biceps, Triceps, Wrists, Fingers 2. Thighs, Calf, Ankles, Biceps, Triceps, Wrists, Fingers 3. Biceps, Triceps, Wrists, Fingers 4. Thighs, Calf, Ankles
SOURCE FOUR: 1. Biceps, Triceps, Wrists, Fingers 2. Triceps, Biceps, Wrists, Fingers 3. Triceps, Biceps, Wrists, Fingers 4. Brain 5. Muscles keep body warn - Thighs, Calf, Ankles, Back, Abs, Chests, Neck, Biceps, Triceps, Wrists, Fingers 6. Thighs, Calf, Ankles, Biceps, Triceps, Wrists, Fingers 7. Biceps, Triceps, Wrists, Fingers, Abs, Back, Thighs, Calf, Ankles 8. Biceps, Triceps, Wrists, Fingers, Abs, Back, Thighs, Calf, Ankles 9. Biceps, Triceps, Wrists, Fingers, Abs, Back, Thighs, Calf, Ankles 10. Back, Abs, Thighs, Calf, Ankles 11. Biceps, Triceps, Wrists, Fingers 12. Thighs, Calf, Ankles 13. Thighs, Calf, Ankles, Back, Abs, Biceps, Triceps, Wrists, Fingers 14. Fingers, Wrists 15. Biceps, Triceps, Wrists, Fingers
SOURCE FIVE: 1. Biceps, Triceps, Wrists, Fingers 2. Biceps, Triceps, Wrists, Fingers 3. Biceps, Triceps, Wrists, Fingers, Back, Abs, Thighs, Calf, Ankles 4. Biceps, Triceps, Wrists, Fingers, Back, Abs, Thighs, Calf, Ankles

Table. 3 Frequency and Ranking of Body Parts

Body Parts Involved	Frequency of Mentioned	Ranking
Triceps	31	1
Biceps	31	1
Wrists	28	3
Fingers	30	2
Abs	22	5
Back	22	5
Thighs	24	4
Calf	24	4
Ankles	24	4
Brain	6	6
Chests	1	7
Neck	1	7

Table. 4 Working Hours Per Day and Average Value

Source	Working Hours Per Day	Average
SOURCE 1	12 hours	8.57 hours
SOURCE 2	7.4 hours, 8 hours	
SOURCE 3	8 hours	
SOURCE 4	8 hours	
SOURCE 5	8	

Table. 5 Top 5 Ranking of Body Parts

Body Parts Involved	Ranking	Average Working Hours Per Day
Triceps	1	8.57 hours
Biceps	1	
Fingers	2	
Wrists	3	
Calf	4	

Table. 6 Proposed Physical Exercises Framework

Body Parts Involved	Exercises Framework - Daily Calisthenics
Triceps	Diamond Push Up - 10 repetitions (slow pace) - 7 sets - 15 seconds rest in between sets
Biceps	Regular Width Push Up - 10 repetitions (slow pace) - 7 sets - 15 seconds rest in between sets
Fingers	Hand Finger Tendon Glide - 10 repetitions (slow pace) - 7 sets - 15 seconds rest in between sets



Wrists	Push Up with Back of Palm on the Ground - 10 repetitions (slow pace) - 7 sets - 15 seconds rest in between sets Knuckles Push Up - 10 repetitions (slow pace) - 7 sets - 15 seconds rest in between sets
Calf	Jumping Jack - 20 repetitions - 7 sets - 15 seconds rest in between sets

V. DISCUSSION

We had already explained the steps in gaining Tables 5 and 6 in the Methodology Section. In this section, we dwell more upon it. Table 6, which is the proposed physical exercises framework, was produced in relations to the information in Table 5. A majority is based upon heuristics as mentioned earlier. For triceps, we are concerned upon its strength. In order to gain strength in triceps, Diamond Push Up is appropriate as mentioned by Ethier [9].

He furthermore compared Diamond Push Up with regular and wide push ups and results indicated that Diamond Push Up increased the strength in triceps more. We advised individuals to actuate 7 sets of the Diamond Push Up where each set contains 10 repetitions. Between each set there is a resting period of 15 seconds. The pace of the push up we set at slow pace. Several literature had indicated that a slow pace would give an individual more strain and pain and thus the individual would gain more strength and muscle mass and this is concurred by Hsu in his paper [10]. With this in mind, our calisthenic exercises involving all body parts were set at slow pace. The number of repetitions, sets, and time of rest for all body parts is based upon heuristics and the framework would be future tested to gain feedback and inputs on the sufficiency and adequacy of the number of repetitions, set, and time of rest. Our test bed would be the Territorial Army where the physical exercises, based upon experiences, are perhaps more. Thus we can also seek to denote our framework as the minimum basis for physical exercises. But this depends upon the intensity of the current Territorial Army exercises, whether it is more than our framework or perhaps less.

VI. CONCLUSION

The Physical Exercises Framework that we had proposed is based upon calisthenics. This is appropriate as most physical exercises of the Territorial or Regular Army are calisthenics in nature. Our framework takes into account the participation of students of Aircraft Maintenance in the Territorial Army and hence the framework is customized in accordance to the job scope of Aircraft Maintenance Personnel which requires a lot of physical activities. Our framework is thus deemed as a Functional Training and the Territorial Army is the best place to implement any physical workout programme since the army forte is “fitness for troops”.

REFERENCES

1. Schoenfeld, B., “Do Single-Joint Exercises Enhance Functional Fitness?”, *Strength and Conditioning Journal*, February 2012, Volume 34, Issue 1, pg 63-65, doi 10.1519/SSC.0b013e31823e82d7.
2. Yazgan, E., “Evaluation of Stress Affecting Aircraft Maintenance Technician’s Performance”, *International Journal of Computing, Communications & Instrumentation Engineering (IJCCIE)*, Volume 4, Issue 1 (2017), ISSN 2349-1469 EISSN 2349-1477.
3. Hobbs, A., “An Overview of Human Factors in Aviation Maintenance”, *ATSB Transport Safety Report, Aviation Research and Analysis Report, AR-2008-055 Final*, Australian Government, Canberra City, December 2008.
4. Saadah, N., “The Implementation of Military Leadership Training Programme; Reserve Officer Training Unit (ROTU) in Shaping Islamic Moral Among Cadets : A Study in Universiti Sains Islam Malaysia (USIM)”, *Journal of Global Business and Social Entrepreneurship*, Volume 1, No. 3, (2017), pg 24-36, eISSN 24621714.
5. Malaysian Army, “Malaysian Army Corps / Regiment Roles”, Ministry of Defence of Malaysia, Jalan Padang Tembak, Kuala Lumpur, 2019.
6. Shaikh, A., “Effect of Functional Training on Physical Fitness Components on College Male Students - A Pilot Study”, *IOSR Journal of Humanities and Social Science*, ISSN2279 - 0845, Volume 1, Issue 2 (September - October 2012), PP 01-05.
7. Hostager, K., “Functional Training as Compared to Resistive Strength Training in Older Adults with Functional Deficits”, *Pacific University Common Knowledge, PT Critically Appraised Topics*, Paper 17, School of Physical Therapy, 2011.
8. Dixon, J., “Gastrocnemius vs. Soleus Strain : How to Differentiate and Deal with Calf Muscle Injuries”, *Journal Curr Rev Musculoskelet Med*, v.2(2), 2009 May 23rd, PMC 2697334.
9. Ethier, J., “Push-Ups : How to Best Use Them For Growth (4 Science Based Tips)”, *Built With Science*, Vancouver Canada, 2019.
10. Hsu, H., “Effect of Push-Up Speed on Upper Extremity Training until Fatigue”, *Journal of Medical and Biological Engineering*, 31(4), January 2011, DOI : 10.5405/jmbe.844

