International Journal of Current Research in Multidisciplinary (IJCRM) *ISSN: 2456-0979*
Vol. 7, No. 6, (June'22), pp. 01-08

Simulator Based Flight Training in BAF: It's Effectiveness on Operational Readiness

"Let's take flight simulation as an example. If you're trying to train a pilot, you can simulate almost the whole course. You don't have to get in an airplane until late in the process." Roy Romer

[1]Sabrina Rahman, [2]Md. Majidul Haque Bhuiyan
Department of Microbiology,
Department of Electrical and Computer Science Engineering, North South University
North South University, Bashundhara, Dhaka 1229, Bangladesh

ABSTRACT: *The advancement of computer and electronic technology in the present century has also made remarkable improvement in the field of aviation simulation training. The capabilities offered by simulation have created unlimited opportunities for aviation training. In fact, aviation training is now more realistic, safe, cost-effective, and flexible than ever before and can generate training environments very close to the actual situation in which aircrews can acquire and practice most of the normal, emergency and combat maneuvers.*
Military aviation dealing with the combat aircrafts need more efficiency in aircraft handling as it is complex task oriented and highly demanding. Sound and effective training is the foremost requirement for achieving the operational readiness in military flying. Air Forces throughout the world are focused on ensuring high levels of operational preparedness through peace time exhaustive training. With the advancement in the flight simulation technology, military aviators also found simulator as a pragmatic and realistic solution to reduce their training cost and increase the operational readiness through rehearsal with much safety.
KEYWORDS: *Operation, Effect, Bangladesh Air Force.*

INTRODUCTION

Recently BAF has upgraded its fleet in all three streams and acquired more sophisticated and digitized platform. But the full potential of those newly inducted system cannot be exploited without appropriate training.BAF being constraint by its budget, need to limit itself while generating the actual flying hours due to the high fuel, maintenance and other depreciating costs of aircraft. To that end,simulator based flight training may offset her portion of training requirement while maintaining the cost effectiveness vis a vis operational readiness of the pilots. As such, recently BAF has inducted the latest and upgraded simulation system in its inventory. But, merely inducting the system is not going to be effective unless proper utilization, appropriate policy and recognition is in effect. In that backdrop, the present BAF simulator based flight training need to be evaluated so as to ascertain its effectiveness in operational readiness as well as cost effective training. This research may result in specific to broad findings of simulator based trainingtowards the operational preparedness of BAF. The evaluation will ultimately guide BAF for determining the future options too.

AIM

To determine the effectiveness of Simulator based flight training of BAF for maximizing the operational readiness while reducing training costs in today's fiscally constrained environment of BAF.

EVOLUTION OF FLIGHT SIMULATOR AND ITS NECESSITY

Evolution of Flight Simulator

The first flight simulator was used in 1910 for training which consisted of two barrel halves, one placed on a pedestal and the other which represented a swinging cockpit. (The history of flight simulators, 2018)

Figure 1: The first simulator in 1910

Gradually during the First World War, practices of spatial orientation were given to the pilots through flight training machines (The history of flight simulators, 2018). The best-known early flight simulation device was the Link Trainer, produced by Edwin Link in Binghamton, New York, USA, which he started building in 1927 (Flight simulator, 2018). At the start of the Second World War, the need arose for the training of very large numbers of pilots and almost 10,000 Link Trainers were produced to train 500,000 new pilots from allied nations. (Link Trainer, 2015).

Figure2 : Link Trainer in the World War II Gallery at the National Museum of the USAF

After the end of World War II, advances in electronics made flight simulators possible to simulate instruments and control systems and thus simulators were also introduced in civil aviation. (The history of flight simulators, 2018). With the progress of computer technology at the end of the 70s, three-dimensional landscapes were developed and the development continues to this day. Now, the simulator landscapes are almost indistinguishable from the real world.

Necessity of Flight Simulator

Flight simulators offer unique training advantages not available in real aircraft.Aircraft are primarily for flying, and simulators are primarily for teaching. Flight simulator training is now an integral part of the processes of pilot training and professional development due to many reasons. Some of them are depicted below:

Building Situational Awareness

Despite the high level of automation of modern combat aircraft, military flying still possess heavy psychophysical load to the pilots. The growing complexity of technical systems also increases the burden on

the operators. So, mastering the operator's action, a long and costly process, can be done on ground with appropriate flight simulation in a cost effective way (Vincent WONG, 1996)..

Emergency and Procedure Training
There are many emergencies like engine failure; spin in jet aircraft, tail rotor failure in helicopters etc. which are not feasible to practice in real aircraft. All those emergencies are possible to practice in realistic scenario in the simulator and thereby pilots become familiar with the emergency situation and its corrective action (Mahbub, 2018).

Advance Maneuver's and Weapon Delivery Training
Practicing weapon delivery in real situation demands lot of effort and planning for many agencies. Here, flight simulator remains as a viable option to meet such demands. Again, before having considerable experience, young pilots can master their combat manuevres in flight simulator which will ensure better safety in an actual mission(Hawladar, 2018).

Safety
The first and obvious benefit of using a flight simulator for training is the safety of the training operation itself. In this safe environment a trainee can make mistakes and errors and learn from them, perform and repeat normal and abnormal procedures which may not be considered appropriate or safe when flying with a real aircraft(Mahbub, 2018).

Cost Effective Training
Although a flight simulator is also expensive for initial set up, but it has been proven to be the most cost-effective method for training pilots in the long run. More so, it can beoperated without damaging the real aircraft and can also enjoy a long life with lesser maintenance cost(Vincent WONG, 1996).

Limitations of Flight Simulator
Flight Simulators though shows many positive sides in present day aviation training however it has also some limitation which also need to be kept in mind. Some of those limitations are described below:

Simulator Sickness
Most simulators cannot accurately produce the correct amount of movement to correspond to the movement that the screen is showing to our eyes, this might causemotion sickness. The small space inside an enclosed simulator mixed with lack of full motion can also cause simulator sickness (Simulator Sickness, 2018).

Maintenance Problem
Simulators operation are mostly software based which are normally not available other than the manufacturing company. As the simulators get old and the software's become backdated and corrupted, it becomes difficult to maintain. At times the manufacturing company also becomes unable to troubleshoot the software (Shaukat, 2018).

High System Cost
The initial cost of a Full Flight Simulator with its total system is higher or almost similar to the latest combat aircraft/helicopters. But the simulator cost goes quite high comparing to the price of the basic trainer aircraft. As the benefits of the simulators are also intangible, so it becomes difficult for the Air Forces with budgetary constraints to prioritize this over other equipment.

PRESENT STATE OF SIMULATOR BASED FLIGHT TRAININGIN BAF
BAF first inducted simulator back in 1983. Since then, BAF had operated some simulators like PT-6 simulator, L-39 simulator, FT-5 simulator and a helicopter simulator. However, all those simulators are phased out after their useful utilization and at present BAF is having only two serviceable simulators. One is for Yak-130 and another for Mi-171 helicopter (Shaukat Ali, 2018). Both the simulators are inducted recently and state of the art simulator. If we consider the Flight Simulator Training for BAF it may be divided in following categories:

a. Basic Flying Training
b. Jet/Fighter Flying Training
c. Transport Flying Training
d. Helicopter Flying Training

Basic Flying Training
BAF had an on Type simulator for the basic students of PT-6 ac which has been phased out on Dec 2017 (Mustaque, 2018). Instructors and senior leadership also realizes the necessity of replacing the phased out simulator with a more realistic one (Choudhury,2018). BAF is actively processing to have a new advanced on type Full Flight simulator for Basic students (Shaukat Ali, 2018).

Jet/Fighter Flying Training
Recently BAF inducted the simulator for Yak-130 aircraft with the same contract while procuring the aircraft. This is the only jet/Fighter simulator presently available in BAF (Shohag, 2018). BAF may think of inducting simulator for F-7 series fighter as BAF has a considerable number of F-7 series fighters with sufficient life.

Transport Flying Training
So, far BAF did not have any transport simulator. The reason behind not to have the simulator are likely to be the cost effectiveness and relatively smaller transport fleet (Santanu, 2018). However. The importance of simulator in transport aircraft is as equal to the other stream.Abroad training may be one of the temporary solutions till fighter or transport platform receive any simulator.

Helicopter Flying Training
BAF has recently inducted a Level-D Full Flight Simulator in BAF Base Bashar, Tejgaon for Mi-series helicopter on Sep 2017 (Ahmed, 2018). This simulator meets all the highest level of FFS qualification currently available in the world.

EVALUATION OF SIMULATOR BASED FLIGHT TRAINING IN BAF ON OPERATIONAL READINESS

For the first time in BAF history a level-D Full Flight Simulator (Mi-17 Series) is inducted which is already functional from Sep 2017. Recently inducted Yak-130 simulator though does not have full motion but yet a very good platform to achieve proficiency on the aircraft. Following are its few training benefits of the Yak-130 and Mi-17 Series Simulator which helps inenhancing the pilot efficiency:

Cockpit Procedure Training
The full scale cockpit replica of the Mi-171 sh helicopter and Yak-130 makes the simulators more realistic for cockpit procedure training. In these simulators, pilots can practice right from the start up. Instructors also opined that the performance on the cockpit checks and procedure of the students has improved after simulator flying (Mahbub, 2018).

Different Phases of Flying Training
Both the simulators are also capable of training the pilots in all the phases of flying like General Flying, Instrument Flying, Night Flying, Formation Flying, Armament Flying and Navigation Flying. In Yak-130 simulator, pilots can also practice air to air interception. All this flying training provisions have created a versatile training scope for the air crews of BAF which they did not have previously.

Emergency Handling Training
Pilots can practice all types of emergencies in these simulators. The level of the emergency can also be controlled from IWS, which enables a pilot to be acquainted with different types of emergency with actual reading. (Samad, 2018). Air crews can practice any emergency situation as many times necessary to gain confidence of successful handling.

Different Types of Weather

These simulators also allows the pilot to practice takeoff, flying, landing in rain, snow, haze, gusty wind, restricted visibility, wet runway and even strong wind can be added with direction and knots control. This creates a very realistic situation for a pilot to train and gain proficiency in bad weather flying (Samad, 2018).

Reduction of Training Period

Training of aircrews are conducted in following a planned timeline. Simulator is placed indoor and there is no effect of weather on it. It is also capable to fly 24/7 without any limitations. It can generate bad weather conditions or change in night condition for the training of aircrews any time when necessary. Thus, aircrew training can be completed within planned time in simulator (Atiquzzaman,2018).

Mission Specific Training

Presently, BAF helicopter crews are operating beyond the national boundary in United Missions. The terrain, weather characteristics and the operational environment in those countries are different than Bangladesh. In these simulators, similar conditions can be generated and aircrews can get training before deployment. (Atiquzzaman,2018).

Training Mode and Target through IWS

Pilots can even practice air to air missions in the Yak-130 simulator. It can produce other types of synthetic aircraft on the projector screen for the pilots to practice tracking and even firing. An instructor can choose all the weather, synthetic aircrafts, emergencies from the IWS with full authority for maximum and effective training (Shohag, 2018)

Reduction of Training Cost or Cost Effectiveness

Preparing an operational crew by training in real helicopter takes long time and involves huge cost. This cost includes the fuel cost, the cost of the aircraft and its maintenance. Moreover, manpower from different agencies like flight line personnel, air traffic services, meteorology department, medical squadron etc get involve for flying a sortie in the real helicopter. Considering all this, developed countries and civil aviation pilots gets a reasonable portion of training in the simulator, which incurs training cost (Atiquzzaman, 2018). Civil Aviation Authority of Bangladesh (CAAB) has already made the ZFTT policy for level 'C' and 'D' simulator (Circular-03/2011, CAAB, 2014). Similarly, as the Mi-series simulator is level 'D' type, so training of the aircrews in the helicopter simulator is going to reduce the actual flying in a significant amount which is already visible in the provisionally approved syllabus of Mi-171 Sh (Mi-171 Sh Syllabus, 2018). Per hour cost of the Mi-17/171 helicopter is determined BDT 2,19,778/- and Mi-171 Sh is BDT 1,96,261/- (MOD letter, 2013) whereas, per hour simulator cost is approximately BDT 55,000/- only (assumed by calculating it's all aspect broadly).The study in Yak-130 will also provide closely similar statistics. This shows that simulator based flight training is going to be cost effective besides its effectiveness in operational readiness.

CHALLENGES OF SIMULATOR BASED FLIGHT TRAINING IN BAF AND WAYS FORWARD

Recently BAF has procured upgraded simulator for Yak-130 simulatorand first Full Flight Simulator (FFS) of Mi-17 series helicopter. As these are the new inclusion in BAF inventory, following challenges are identified by the user so far and most of which might be mitigated by proper planning and appropriate pro-active actions:

Sensitivity of the Simulator

The simulator is too much sensitive to weather like dust, humidity, moisture, etc. To protect the device from effects of those weather components, it is placed in a specialized air tight complex with 24 hours air conditioning system. Maintaining such weather condition through-out may become a challenge and costly affairs for BAF in future (Atiquzzaman, 2018).

Maintenance of the Simulator

For proper maintenance of hi-tech, sophisticated soft and hard wares of the simulator devices, expert manpower is required. Currently, BAF having only few expert manpower on this simulator who are trained

from abroad on the operation and maintenance of this simulator. BAF needs to plan training of more manpower on this simulator for overcoming the maintenance challenge in future (Sultana, 2018).

Availability of Spare Parts

It will be time consuming to make a part available in case of requirement. The HUD of the Yak-130 simulator is unserviceable for last few months which cannot be repairedalso (Kalam, 2018).To overcome this challenge, BAF needs to plan in advance and prepare a healthy stock of spare parts to keep the simulator serviceable (Sultana, 2018).

Physiological Feeling

The simulator is static in a place and the motion of the aircraft is created by visual devices. Thus, discomfort body feelings may develop for some of the aircrews which results in vertigo, headache, vomiting tendency, etc. (Ahmed, 2018).Due to this,for Yak-130 pilot,it is prohibited to fly the actual aircraft after flying the simulator on the same day (Samad, 2018).

Shortage of Simulator Instructor

Simulator instructors need additional expertise to teach the emergencies to the other crews (Mahbub, 2018). Currently, only four simulator instructors for this helicopter simulator are available in BAF. Some of them are also deployed in other duties. Due to the shortage of simulator instructors, the simulator is underutilized also. BAF needs to plan immediately for training more simulator instructors to overcome the challenge and utilize the simulator at its optimum capability (Atiquzzaman, 2018).

Integration of the Simulator in the Existing Training System

The recognition of simulator hours and integration of this simulator in the existing training system is a challenge for BAF as the system is new. So far, no concrete policies were developed on the simulator training in BAF. A draft plan on the integration and utilization of this simulator in the training of helicopter aircrews are thought about and accordingly a training syllabus is already provisionally approved by Air HQ. Hopefully, with the passage of time, a comprehensive policy will be developed and the challenge of integration of the simulator in the BAF training system will be overcome (Ahmed, 2018).

CONCLUSIONS

The evolution of simulator from its beginning till today shows a positive increase of the requirement of flight simulator. With the growing complexity of aircraft technology and its operating cost simulator is likely to be used even dominantly in future. Though it has got few limitations but its positive sides are many. Specially cost effective training with enhanced safety and situational awareness makes the simulator unique tool to enhance the professional competency of the pilots.

BAF first inducted simulator back in 1983. Most of those early simulators are phased out after their useful utilization and at present BAF is having only two serviceable simulators. One is for Yak-130 and another for Mi-17 series helicopter. BAF does not have any flight simulator presently for basic training. Senior leadership of BAF also feel the necessity of it and the induction of new simulator is on process to fulfil the requirement. For whole fighter stream, only available Yak-130 simulator cannot be sufficient though it seems very effective for the specific platform. BAF may think of inducting flight simulator for F-7 series fighter which has a sizable fleet in BAF with considerable life. On the other hand, transport flying are lacking in simulator platform due to its' meagre aircrew strength vis a vis higher cost of simulators. Abroad training may be one of the temporary solutions till fighter or transport platform receive any simulator. Recent induction of FFS for helicopter is a step forward for BAF in this domain.

Yak-130 simulator and BAF helicopter simulator of HSI provides scope for positive training to the aircrews. It is enhancing the pilot proficiency in Cockpit Procedure Training as well as in different phases of flying training. Most importantly it provides the unique emergency handling training and adverse weather flying which is not possible through real flying.It can also make a pilot proficient in different operational environment like desert or hill. Even combat missions like air to air interception mission can be practiced for the fighter pilots. In general, from the study it was found that professional competency of the pilots are

enhancing through simulator based flight training which in turn contributes to the operational readiness of BAF. If effectively utilized and simulator training is maintained as per the provisionally approved syllabus of Mi-171 Sh, then each phase of training would be more cost effective besides its effectiveness in operational readiness.

Simulators are sophisticated device and maintaining those in our weather condition may become a challenge and costly affairs for BAF. For proper maintenance of these devices, expert manpower is also required. Non-availability of spare parts also makes maintenance questionable sometimes. Maintaining appropriate no of instructor, recognising and integrating the simulator in the training system would help it to be utilized in a more cost effective manner. The entire process revealed that the "Simulator based flight training" has a positive effect on aircrew flying training which ultimately contribute towards the operational readiness of BAF and minimizes the training cost as well.

RECOMMENDATIONS

Upon the findings of this research following recommendations are placed for enhancing the operational readiness of BAF through simulator based flight training:

a. BAF may expedite procurement of flight simulator for basic flying training.
b. BAF may include flight simulator for F-7 series fighter in its procurement plan.
c. BAF may send her pilots abroad for maintaining simulator currency till simulator is established on the specific type of aircraft.
d. BAF may develop a comprehensive policy for appropriate integration and utilization of the simulator in the BAF training system.

BIBLIOGRAPHY

[1] *AFM 60-27, (2010, Jun 09) Standard Operating Procedure Mi-17/171/171 Sh Helicopter Ref: Air HQ/7089/Air*

[2] *Ahmed, Wing Commander Md Shahariar, Chief Instructor, HSI. (Personal Communication, 2018, August 29) (Wing Commander Haroon, Interviewer)*

[3] *Atiquzzaman, Group Captain Abul Fazal Md, Commandant Helicopter Simulator Institute. (Personal Communication, 2018, September 04) (Wing Commander Haroon, Interviewer)*

[4] *BAF Aircraft and Helicopters Per Hour Flying Cost, (2013) MOD ltr No- 1B-5/08/D-7/547/43A dated 20 November 2013*

[5] *Bhuiyan, M. M. H., & Faisal, M. (2020). An Agenda of Advancing Health Monitoring System with a Contemporary Arrangement of Digitalized Operable Medical Kits. Southeast University Journal of Science and Engineering (SEUJSE). Volume 15, Issue 1, pp. 21-30*

[6] *Bhuiyan, M. M. H., (March-April 2022). Challenges Military Couples Face in Raising Their Children, International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 8 Issue 2, pp. 276-299, doi: https://doi.org/10.32628/CSEIT228252 Journal URL : https://ijsrcseit.com/CSEIT228252*

[7] *Bhuiyan, M. M. H., (May, 2022). Integration of UAV with manned aircraft: prospects and future options. LAP LAMBERT Academic Publishing.Copyright © Majidul Haque Bhuiyan. Copyright © 2022 Dodo Books Indian Ocean Ltd., member of the OmniScriptum S.R.L Publishing group. ISBN: 978-620-0-32694-2.*

[8] *Bhuiyan, M. M. H., Imam, S. T., & Rakhi, K. (2021). The Use of Modern Technology in English Language Teaching-ELT.*

[9] *Bhuiyan, M. M. H., Sabrina Rahman, Sahib, S. M., (2022, April). Overparenting's Consequences in Bangladeshi Society Child's Intelligence, Growth, and Creativity. In 2022 International Journal of Scientific & Engineering Research Volume 13, Issue 4, pp.1301-1312. ISSN: 2229-5518. https://doi.org/10.14299/ijser.2022.04.01*

[10] *Bhuiyan, Md Majidul Haque (2021). Case Study on Sri Lankan REM- "How Product Quality can Enhance the Purchasing Behavior of Real Estate Industry". Available on PhilArchive copy v1:https://philarchive.org/archive/BHUTAOv1*

[11] *Bhuiyan, Md Majidul Haque,(2022). Lecture note on Pakistan Colonial Administration. Available on https://philpapers.org/rec/BHULNO*

[12] *Bodeen, C. (2011, November 12). Chucks Overview. Retrieved September 07, 2018, from X Plane.org:https://forums.x-plane.org/index.php?/forums/topic/54831-a-short-history-of-flight-simulation/*

[13] *Choudhury, Air Vice Marshal Ehsanul Gani, Assistantant Chief of Air Staff (Plans) (Personal Communication, 2018, September 03) (Wing Commander Haroon, Interviewer)*

[14] *Circular-03/2011, (2014), ZFTT policy for Aircraft Endorsement for pilots using Level 'C' and 'D' Simulator, Flight Safety and Regulations Division Headquarters, CAAB, Kurmitola, Dhaka, Ref Letter-CAAB/52/85/97/FI/(Vol-2)/1015 dt 27 July 2014.*

[15] *Faisal, M. A., & Bhuiyan, M. M. H. (2020), Contemporary Framework of Technical Challenges in Enactment of Smart Grid. Southeast University Journal of Science and Engineering (SEUJSE). Voume 14. Issue 1. pp.54-61.*

[16] *Flight simulator. (2018, September 2). Flight simulator. Retrieved September 7, 2018, from Wikipedia-The free encyclopedia: https://en.wikipedia.org/wiki/Flight_simulator*

[17] *Howlader, Wing Commander Md Moniruzzaman, Officer Commanding 5 Squadron, BAF (Personal Communication, 2018, September 03) (Wing Commander Haroon, Interviewer)*

[18] *Imam, Syeda Tasfia ; Bhuiyan, Md Majidul Haque & Rakhi, Kamrunnahar (2021), An Existing Sculps Human Modelling- The Deviations in Dialect of Indian Standard English from the British Colonial Period to Present Times. Available on PhilArchive: https://philarchive.org/archive/IMAAE*

[19] *Kalam, Squadron Leader Shahriaz Ebne, Officer-in-Charge Yak-130 Sim and CBT, (Telephone Communication, 2018, September 05) (Wing Commander Haroon, Interviewer)*

[20] *Mahbub, Wing Commander Rahman, Instructor, 31 squadron and HSI. (Personal Communication, 2018, August 29) (Wing Commander Haroon, Interviewer)*

[21] *Plateau, T. P., & Bhuiyan, M. M. H. (2017, February). A heuristic proposition of efficient copper-electrodeposited p-type thin film for CZTS solar cell. In 2017 International Conference on Electrical, Computer and Communication Engineering (ECCE) (pp. 95-99). IEEE.*

[22] *Plateau, T. P., Islam, M. T., & Islam, N. (2019). Potentiostat Electro-Deposited Cuprous Oxide and Cupric Oxide Thin Films for Photovoltaic Use. International Journal of Automotive and Mechanical Engineering, 16(2), 6624-6633.*

[23] *Ray L. Page. (n.d.). http://citeseerx.ist.psu.edu. Retrieved August 25, 2018, from Brief History of Flight Simulation: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.132.5428&rep=rep1&type=pdf*

[24] *Samad, Wing Commander S M Ragib, Officer Commanding, Attack Squadron, 105 AJTU,BAF. (Personal Communication, 2018, October 29) (Wing Commander Haroon, Interviewer)*

[25] *Santanu, Wing Commander Chowdhury, Officer Commanding 103 Squadron, BAF (Personal Communication, 2018, September 04) (Wing Commander Haroon, Interviewer)*

[26] *Shaukat Ali, Air Commodore Md, Director, Directorate of Communication & Engineering. (Personal Communication, 2018, August 12) (Wing Commander Haroon, Interviewer)*

[27] *Shawon, S. I., Bhuiyan, M. M. H., & Plateau, T. P. (2018). An Innovative Construction of Wheelchair for Handicapped Persons. International Journal of Science and Qualitative Analysis, 4(1),13.*

[28] *Shohag, Squadron Leader Md Moniruzzaman, Flight Commander, 105 AJTU, BAF (Personal Communication, 2018, August 20) (Wing Commander Haroon, Interviewer)*

[29] *Simulator Sickness, C. v. (2018). Cybersickness vs Motion Sickness vs Simulator Sickness. Retrieved August 29, 2018, from cybersickness.info: http://cybersickness.info/cybersickness-vs-motion-sickness-vs-simulator-sickness/*

[30] *Sultana, Squadron Leader Fatema, Engineering Officer, HSI, (Personal Communication, 2018, September 03) (Wing Commander Haroon, Interviewer)*

[31] *The history of flight simulators, P. a. (2018). Pro Flight. Retrieved August 25, 2018, from www.proflight.com: https://www.proflight.com/en/full-flight-simulatoren/historie.php*

[32] *Training Syllabus Mi-17 Series helicopter (Provisionally Approved, 2018), Helicopter Simulator Institute.*

[33] *Vincent WONG. (1996). Flight Simulation an application of Virtual Reality. Retrieved August 21, 2018, from https://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol1/kwc2/article1.html*

[34] *Zaman, H. U., Bhuiyan, M. M. H., Ahmed, M., & Aziz, S. T. (2016, January). A novel design of line following robot with multifarious function ability. In 2016 International Conference on Microelectronics, Computing and Communications (MicroCom) (pp. 1-5). IEEE.*

