# BlueSky Simulator for Air Traffic Control Training Platform

*Muhammad Amin Syahmi bin Qadim Affridi, S.M.B. Abdul Rahman\**
*Fakulti Kejuruteraan Mekanikal, Universiti Teknologi MARA, 40450 Shah Alam, Selangor*
*\*mariam4528@uitm.edu.my*

## ABSTRACT

*Aviation and air travel have established itself as a crucial key economic and social resource in modern times. As the world population increases and becomes ever more interconnected, the demand for air travel will only increases. Air Traffic Control (ATC) serves as a medium or service provided by ground to control movement of all aircraft within a controlled airspace. The goals of ATC are maximizing safety, and capacity without compromising the life of passengers or disrupting traffic efficiency. The increasing number of air operations led to navigable airspaces becomes more congested, this situation becomes a challenge for Air Traffic Controllers (ATCO). To overcome the limitations of air traffic controllers, new visualization, analysis tools, training method and platforms had to be developed to maintain and further improve the safety level of air traffic operations. This study is looking at the possibility of using an open source ATC simulator, namely BlueSky for ATCO training purposes. Feedback on the features, look and feel of the simulator as an ATC training tool, were gathered from Civil Aviation Authority Malaysia (CAAM) ATCO. Based on the feedback, the controller feels that the simulator has the potential to be a training platform but requires more hands-on testing and customization to suit the requirement for a simple training simulator.*

**Keywords:** *Air Traffic Controller, Training Platform, Air Traffic Simulator, BlueSky Simulator*

## Introduction

Aviation and air travel play a crucial role in today's world. The air travel sector has expanded to the point that it plays a major role in economic growth in Malaysia. In 2019, IATA reported that air transport sector has provided a total of 450,000 jobs and contribute to 3.5% of the country's Gross domestic product (GDP) [1]. With the increase in air traffic [2] and industry are showing interest in developing Unmanned Aerial Vehicle (UAV) for various purposes [3], the navigable airspaces that are already crowded will only grow in volume. Thus, the air traffic also will increase significantly.

### Kuala Lumpur Flight Information Region (KLFIR)

ATCO works within their assigned airspace by radar and communicates with pilots through radio communication. Within the assigned airspace, ATCO will provide information and instruction for pilots to organize and maintain the flow of air traffic within the region. The controlled airspaces are managed by giving clearances and advices to the aircraft according to the parameters such as altitude, airspeed and heading from ATCO [4]. The airspace is divided into smaller sections called sectors, each one of which has a radar controller responsible for the safety of aircrafts. For instance, Malaysia Flight Information Region (FIR) are divided into two FIR regions, namely Kuala Lumpur, and Kota Kinabalu FIR. For this research, the simulator was customized according to KLFIR and respondents were also active ATCO from the respective FIR. The KLFIR covers the area of peninsular Malaysia, northern border with Thailand, southern border with Singapore and western border with Indonesia and India [5].

Figure 1 shows snapshot from BlueSky with KLFIR sectorisation. The sectorisation characteristics can be customized according to the user requirements. Details of the KLFIR sectorisation were referred from Aeronautical Information Products (eAIP) Malaysia [6] and flight data simulated were gathered from Automatic dependent surveillance–broadcast (ADS–B) data from Flightradar24.
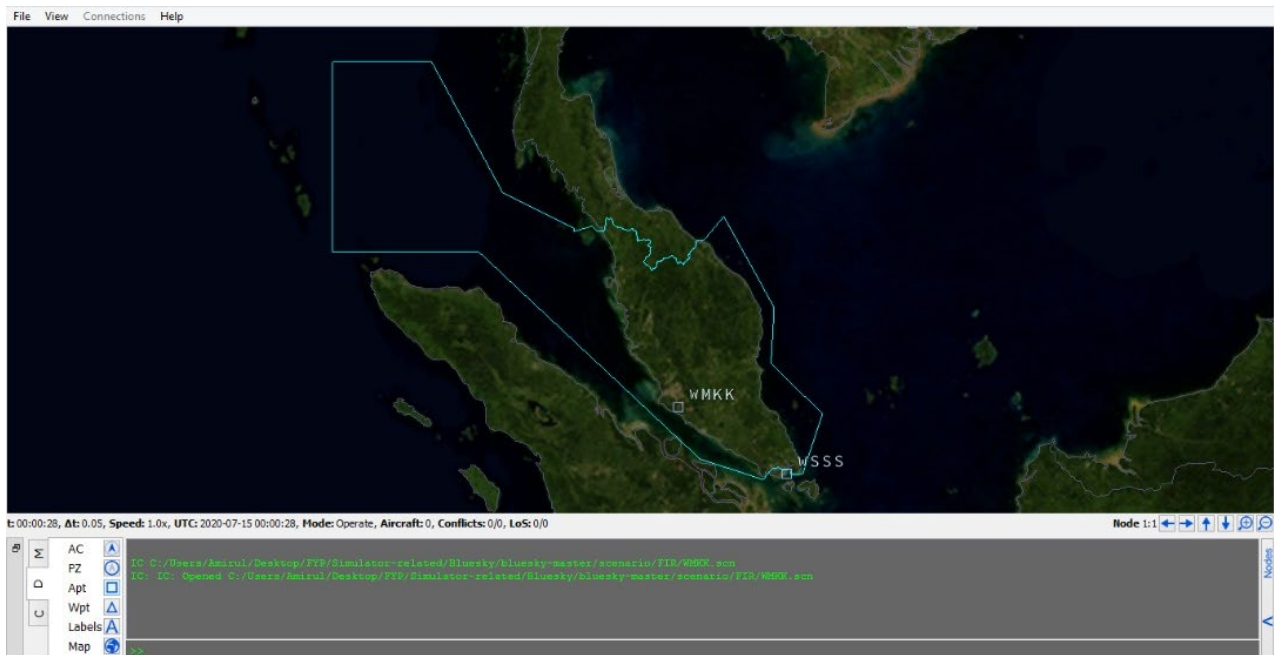
Figure 1: Sectorisation in BlueSky Simulator

## Air Traffic Control

Air Traffic Control (ATC) is a service provided by ground-based air traffic controllers which direct aircraft and provide information on the ground through controlled airspace [7]. The service also aids and support pilots that is under the supervision of the Air Traffic Controller (ATCO) in the controlled airspace [8]. A smooth Air Traffic Management (ATM) is paramount to ensure air traffic service is safe and efficient. This can be ensured by using reliable and efficient tool to aid the ATCO during the operation of an air traffic control.

### Air Traffic Control Training

Air traffic controller handles hundreds of flights per day. They also oversee and control the assigned airspace by using radiotelephony communication as means of communication between pilots and them. Successful completion of ATCO training will provide them with ATC license which gives them privileges to work individually in live traffic and provide air traffic control service within specific area of responsibility [9]. To achieve the license, they must complete training consisting of initial training, unit training, continuation training, and development training. This strict regulation will ensure ATCO that are produced has high level of competency and knowledge.

Furthermore, Various ATC system is used in order to aid the controllers in performing their tasks as a controller [10]. To smoothen the operation and minimizing threat and errors, various software or technology are developed to aid air traffic controller in ATC operation. In Malaysia, there is only one place for training centre of ATCO. Therefore, by allowing the concept which simple training can be done through simplified open source platform, it will help overcome the crisis of having less facility for ATCO to train.

In addition, due to COVID-19 pandemic, ATCO have lesser work shifts, thus leading to reduced workhour which is not ideal for them. ATCO work best with optimum traffic [9]. Reduced workload will affect ATCO performance and training. Hence, by having simplified simulator such as BlueSky simulator as a training tool it will allow ATCO to maintain their skill and overcome the possible threats of not having optimum workload.

## Data Gathering

Real time flight data that are gathered and acquired from Flightradar24. It was extracted and used to create scenarios of air traffic that would be run with the BlueSky simulator. In addition, the sectorization data for KLFIR were gathered from eAIP and detailed using skyvector.com, a web-based application that is used to create or chart a flight plan. The gathered coordinates were then saved for the customization of the simulator.

To customize the simulator, a video of operational guide and snapshots of how to use the BlueSky Air Traffic simulator is provided to the ATCO personnel that are actively working with the Civil Aviation Authority Malaysia (CAAM). In addition, a series of questions on the BlueSky simulator were asked in a feedback form along with the guide. Their feedback on the current version of the BlueSky Simulator was taken into consideration in customizing the

simulator to be a simplified ATCO training tool. The feedback can then be used to customize BlueSky Air Traffic Simulator to make it viable to be used as a simplified training tool for ATCO.

## Results and Discussion

A total of 10 respondents among active ATCO with CAAM submit their feedback regarding the look and feel and features available at BlueSky simulator. The respondents are between the age of 31 to 50. 50% of respondent have work as a controller for more than 10 years and the remaining have 5 to 10 years of experience as a controller. The respondent represents three different types of controllers, namely Area Controller, Aerodrome Controller and Approach Controller. The diversity in age, years of experience, and type of controller is important to capture a bigger picture of ATCO insight to air traffic with less experienced controller might have a different view with a more experienced controller and different control position might have different insight regarding the available features.

Conveying flight information is important in the air traffic simulator. A simple but concise information from the simulator will help smoothen the ATC operations. From Figure 2, 30% of the respondents agreed that the current flight information tag feature presented to them can be used as the means of conveying flight info. Meanwhile, another 40% of them believed that current flight information tag feature is not enough in conveying the needed flight information. They feel that the flight information feature should add more attribute in the label such as heading and speed of the aircraft to better convey the flight information. This was highlighted mostly by Approach Controller as their task requires them to monitor traffic during its decent and climb manoeuvre phase. In addition, 90% of the respondents agree that flight level change feature is important and should be available as means of conveying flight information in the simulator.
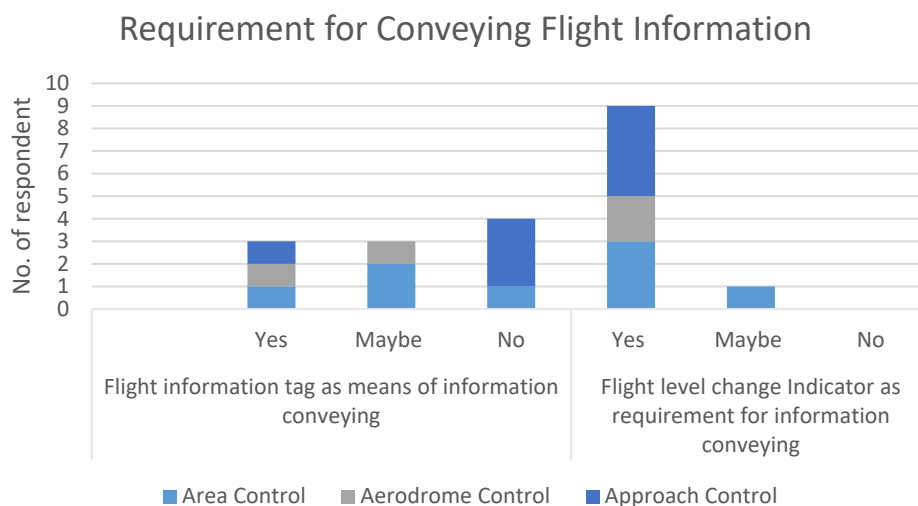


Figure 2: Conveying Flight Information Requirements

Next, in improving the training of ATCO, specific training features in ATC simulator are important to ensure that the simulator was able to replicate real life situation. In Figure 3, 80% of the controllers believed that adding and removing an aircraft feature is important in specific training feed of the simulator. They also specifically stated that the simulator should be able to add or delete an aircraft without resetting the whole scenario. While the other 20% are unsure on the feature as a specific training feature. In addition, 50% of the respondent agreed that adding a stop or fly to a waypoint is a necessary component in a specific traffic feed requirement for the simulator. Only 20% of them disagreed while another 30% are unsure of the importance of the feature. Majority of respondents that agreed on the feature are approach and area controller, this might be due to the feature that suits the operation of those controllers. The ATCO also commented that it is important to have the features of aircraft trajectory movement based on the flight plan in ATCO training. Moreover, 70% of controllers agreed that preloading a scenario suits the requirement of traffic feed for a training simulator. Meanwhile 20% of them are unsure and only 10% disagree with the feature to be used as training specific features
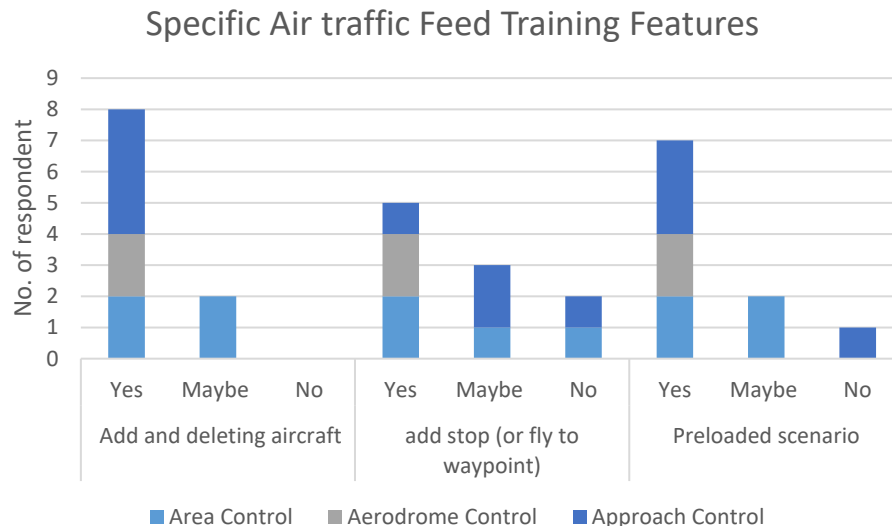
## Specific Air traffic Feed Training Features



Figure 3: Specific Air Traffic Feed Training Features

## Current Scenario

In 2019, it was forecasted that the air transport market in Malaysia would grow by 127% in the next 20 years, resulting in an additional 66.7 million passenger journeys by 2037 [1]. However, due to COVID-19 pandemic, it was reported that Malaysia's has seen a contraction in passenger traffic movement of 97.8% in May 2020 compared to the same period in 2019 [11]. If the traffic were to increase eventually after the pandemic, we need to ensure that the ATCO cognitive capability did not deteriorate due to a smaller number of traffic handled and lesser working hours during the pandemic.

## Conclusion

The open-source BlueSky Simulator can be an alternative for ATCO training platform. Different features can be customised to suit the needs of ATCO depending on the type of control task that they were involved. However, the simulator requires more hands-on test runs to gather more inputs regarding necessary customization that is needed to suit the need of the ATCO during training session. By customising and enhancing the user experience of the simulator, it can really help with ATCO training.

Furthermore, the proposed idea of having an open source simulator as an alternative for training platform are well received. Citing that due to time constraints, manpower constraints and the new norm after COVID-19 pandemic is the reason such simulator are a great option for supplementary ATCO training.

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