

## A320 Wing Training Kit

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**Abstract** : Primarily, our idea of the project is an educational tool that provides visual and physical interaction with students in the aviation course. Manufactured with state-of-the-art hardware gives more exposure, discovery and the experience of moving mechanisms. This project can also be implemented in various educational centers to expand the idea of aviation among students and people in general. Our project emphasizes the structure of a whole wing and how it operates. The main target of this training kit is aviation students. This training kit can help Maintenance Training Organizations (MTO) to educate their students more efficiently. As for students that is new to discover about the aircraft wing fundamental, it is a good learning tool which gives them more knowledge regarding the wing system. This training kit is able to quicken aviation students understanding of the aircraft wings and functional parts which are the control surfaces. This gives the students a wide glance of the parts and wing functionality in a miniature size. It is because the wing on this training kit works exactly like the real wing but on a smaller scale. In other words, our project is aimed to design a wing training kit for students in aviation career as an a tool for education purposes. In addition, this training kit also can reduce costs for (MTO)'s by not spending extra for arranging a study tour on visiting the real aircraft. Compare to other training kit manufacturers, this training kit is the cheapest educational tool that requires minimal cost and maintenance. Purpose for this project is to develop the wing training kit so that the aviation students using this tool could get a better depth in understanding the concept of all sorts of aircraft wings. Next is to demonstrate the the real-life operation on how the wing works which makes the teaching and learning process much easier. An add to that, the scope of our project is subjected to the students taking aircraft maintenance course in Polytechnic Banting and also to students studying aviation courses in other Maintenance Training Organizations (MTO)'s which has a similar exposure. Also, our project is limited to the design of an Airbus A320 aircraft wing only . The last scope of our product is to emphasize the working control surfaces which are flaps, slats, spoilers and aileron.

**Keywords:** Taining Kit, Maintenance Training, Visual And Physical Interaction

## 1. Introduction

Our A320 Wing Training Kit (Figure 1 and Figure 2) was introduced in the market purposely for educational purposes as our main objective is to develop a training kit for technology in education. Firstly, our wing is a replica of an Airbus 320 aircraft wing with its size scale reduced to a ratio of more or less 1:17. As stated before, the only moving control surfaces highlighted are the aileron, spoilers, flaps and slats controlled by programmed servos. To programme the servos, we have used the micro-controller, Arduino. To connect the servos to the Arduino, we have used a set of extensions and most of our components are inspired by the Remote Controlled (RC) aircraft due to its simplicity and their compatibility with our ratio. In addition to that, the components are available at reasonable prices so the capital for our project would not be that expensive. Since the aviation industry has experienced a very rough patch since the inception of the Covid 19 Pandemic, making it very difficult for students to go for educational trips to aviation industries to expand their knowledge and perception of aircraft maintenance organizations. These types of trips are very significant for students as they will need to visualize what that they will be working with one day and with that visualizations, comes with an understanding. Our training kit has been designed to improve the understanding of aviation students towards the movement of control surfaces during three operations which are taking-off, cruising, rolling and landing. As a wing training kit has never been made before, we are positive that our project will be an advancement to the future of aviation's technology in education.



Figure 1: A320 Wing Training Kit control panel.



Figure 2: A320 Wing Training Kit top view.

## 2. Materials and Methods

### 2.1 Materials

First and foremost, our wing is made from a high-quality material which is Depron. Depron is a type of high-quality foam that is mostly used in the manufacture of high-grade RC aircraft. To make it robust and sturdy, we decided to layer it with a composite that is light and strong. We selected carbon fibre as our composite. The layering of the carbon fibre is done on every control surface and the whole wing structure with the use of epoxy resin and a hardener. Furthermore, for the movement of the control surfaces, we have used a set of MG90s servos. The micro-controller used by us to programme the servos is Arduino UNO. We managed to determine the type of command we want to use in Arduino software. Our connections to our working buttons on the interface and most of our connections from the circuit board to servo extensions, we only use single wires as they are much easier to handle and solder. There are four push buttons and also two flip switches featured on the control panel. The four buttons are used for the operations of control surfaces. One of the flip switches is used for the turbine motor which simulates a real-life turbine engine and the other one acts as an on/off button. Also, the metal structure for the casing for the wing was built to fit the whole structure of our wing and also to fit in the interface controlling the wing. We covered the metal casing using clear perspex which is attached to the casing

by using a clear silicone seal. For the finishing, on the control panel, we attached a tablet that is used for the interaction between the kit and students. This tablet will explain each operation of the wing in depth.

## 2.2 Methods

Firstly, figure 3 illustrate the Training Kit's power adapter is connected to any power socket to supply A/C current to the Kit. Like any other Training Kit produced by well known companies such as Avotek, this training kit is mainly used for educational purposes. This A320 Wing Training Kit is equipped with four main buttons, and two flip switches. The first four buttons will be used to illustrate the wing movement during Taking-Off, Cruising, Landing, and Rolling of an A320 aircraft. One flip switch is used to switch on the whole system while the other switch is used to switch on a separate circuit which is connected to the miniature turbine engine installed.



**Figure 3: A320 Wing Training Kit with its wiring and being mounted on the metal casing**

## 3. Results and Discussion

In the beginning, all of our group members decided to conduct a survey to random aircraft maintenance students in our campus. The objective of this particular survey is to test the students knowledge on the aircraft wing when it operates. The outcome of the survey will surely help us in identifying the problems which will be solved by the production of our A320 Wing Training Kit. After doing the necessary research including the correct programming codes and types of materials we are going to use, in the end, all components for the A320 Wing Training Kit was successfully assembled, tested and demonstrated. Users can push any of the push buttons on the control panel to simulate each operation which is rolling, taking-off, cruising and landing. At the same time, a video and explanation related to that particular operation will pop out on the tablet to further enhance the experience using the training kit and also give some more insight into the operation. With all of the components moving and functioning, in conclusion, this A320 Wing Training Kit is able to demonstrate the operation of the real-life working wing to aviation students hence educating them more efficiently (Figure 4 – Figure 8).

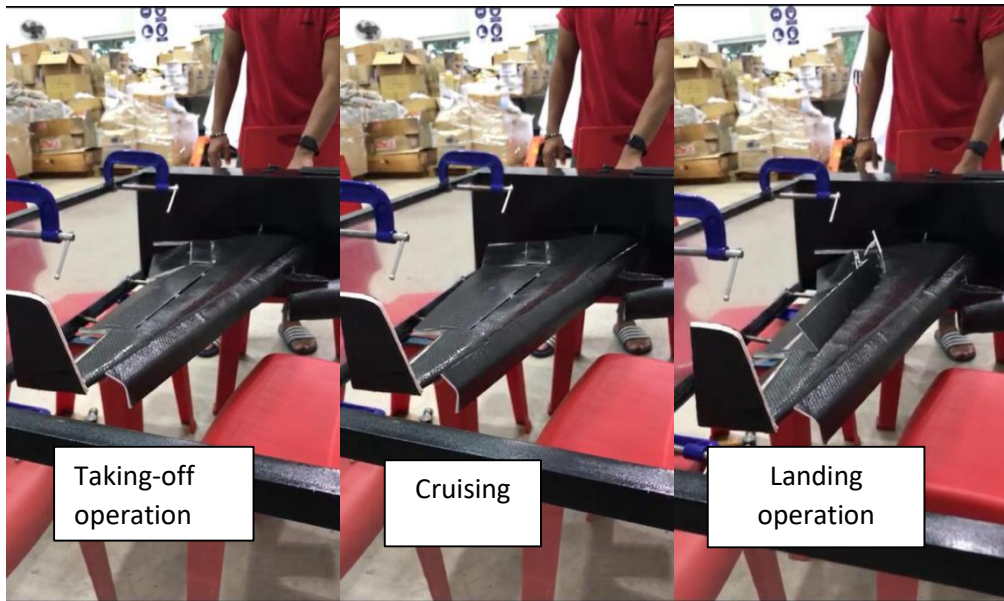


Figure 4: Taking-off operation

Figure 5: Cruising Operation

Figure 6: Landing Operation



Figure 7: Rolling to the left operation



Figure 8: Rolling to the right operation

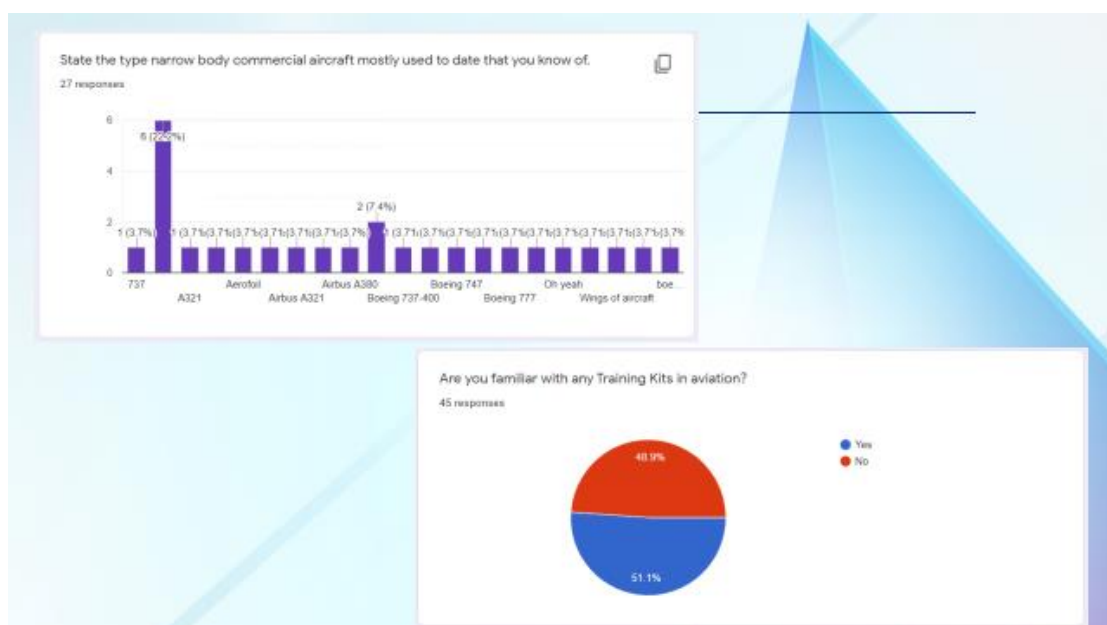
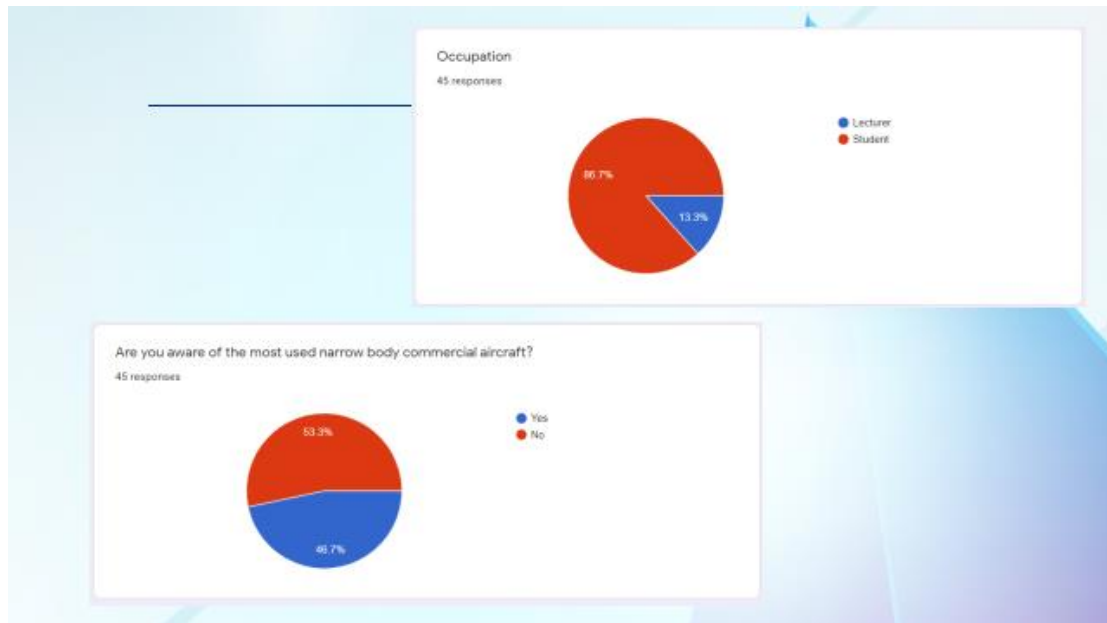
#### 4. Conclusion

Based on our research regarding the aviation education system, our training kit was developed to overcome the problem faced by students and lecturers which is related to efficiency in learning. Our project is designed to improve the visual knowledge of students understanding regarding the wings operation. We hope in the future, we are able to add more features to this wing training kit that may simulate a more advanced miniature wing of an Airbus 320 or even different varieties of aircraft such as Boeing 737, Airbus 350, and many more.

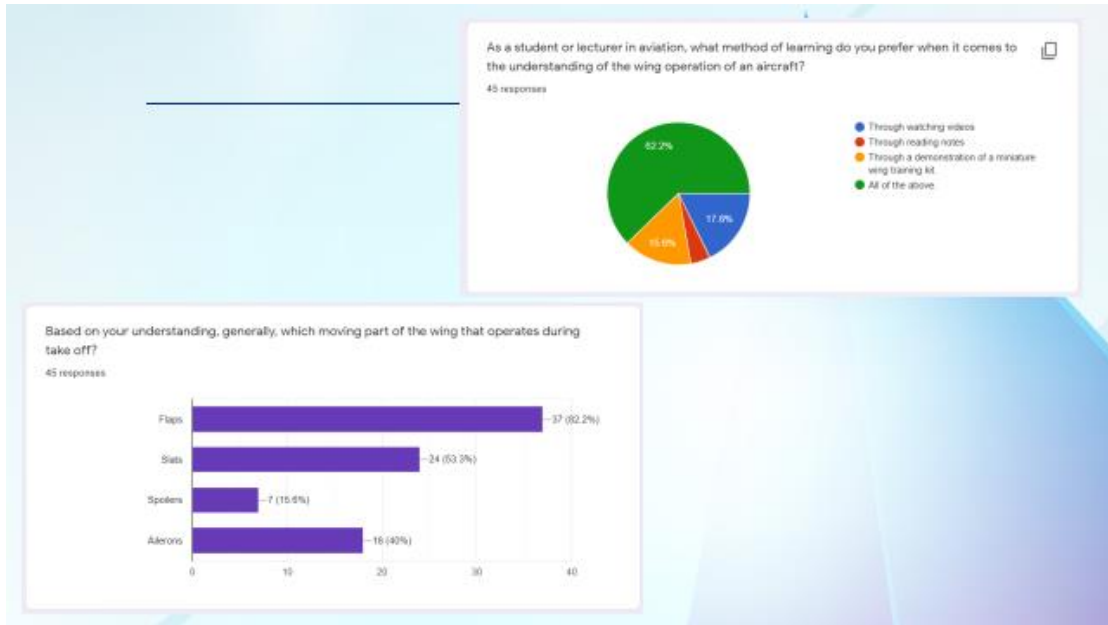
## Acknowledgement

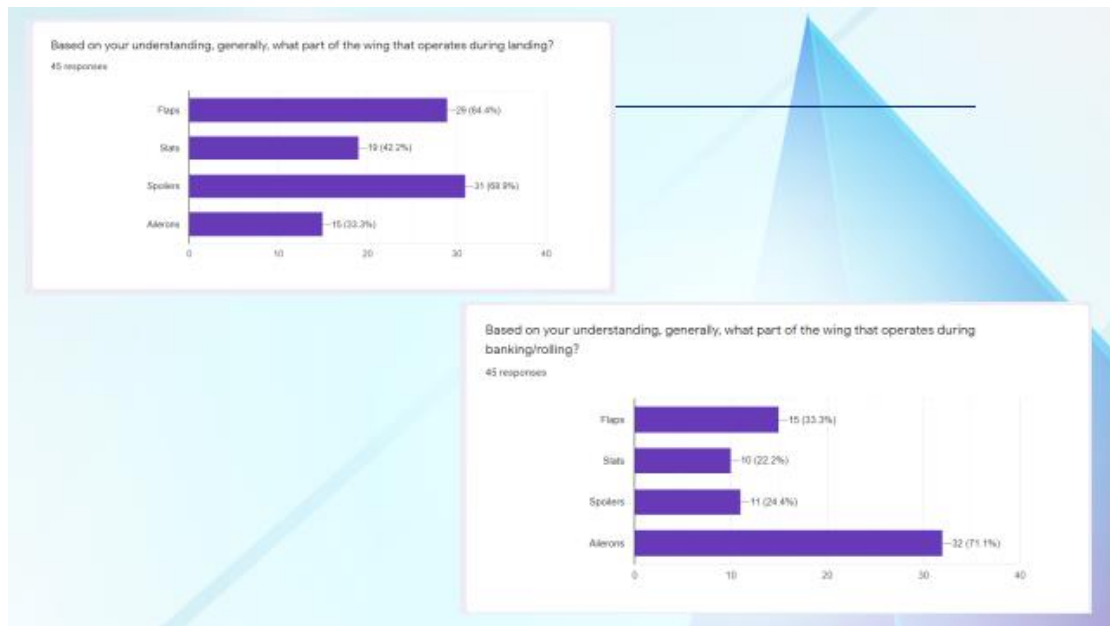
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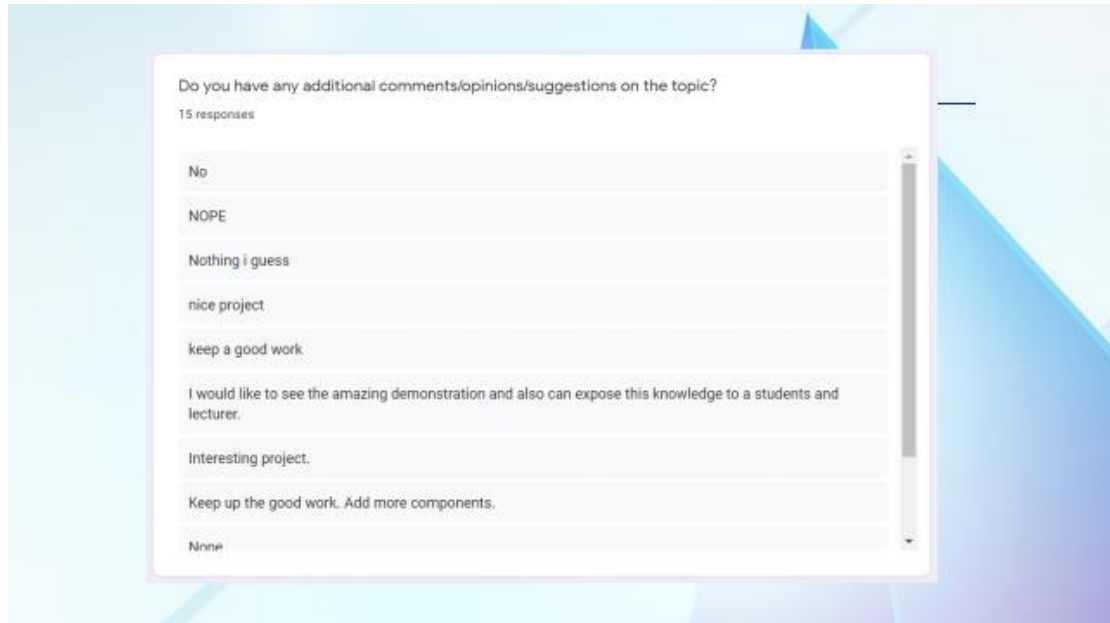
## Appendix A (Questions regarding survey conducted by our group during semester 4 for our Final Year Project)











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