



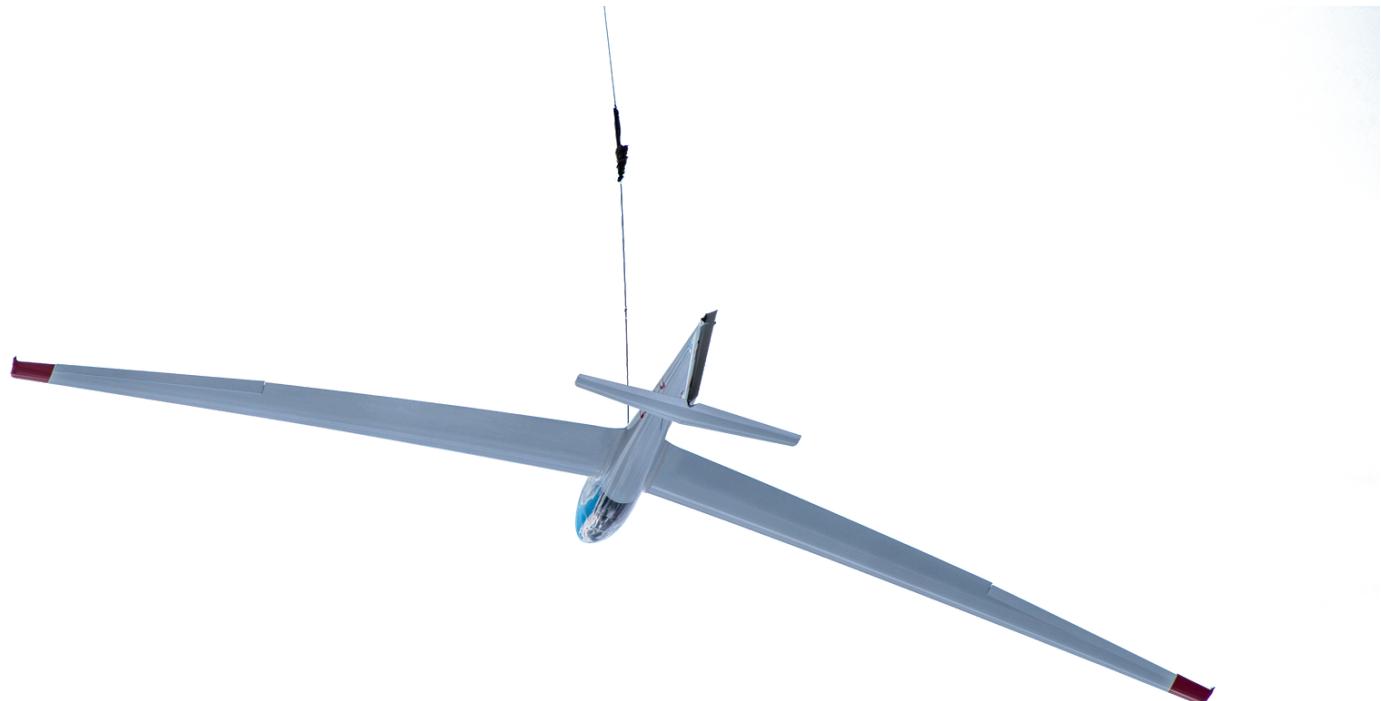
ES115: Design, Innovation and Prototyping

TECHNO AESTHETIC

PROJECT BRIEF



Glider project

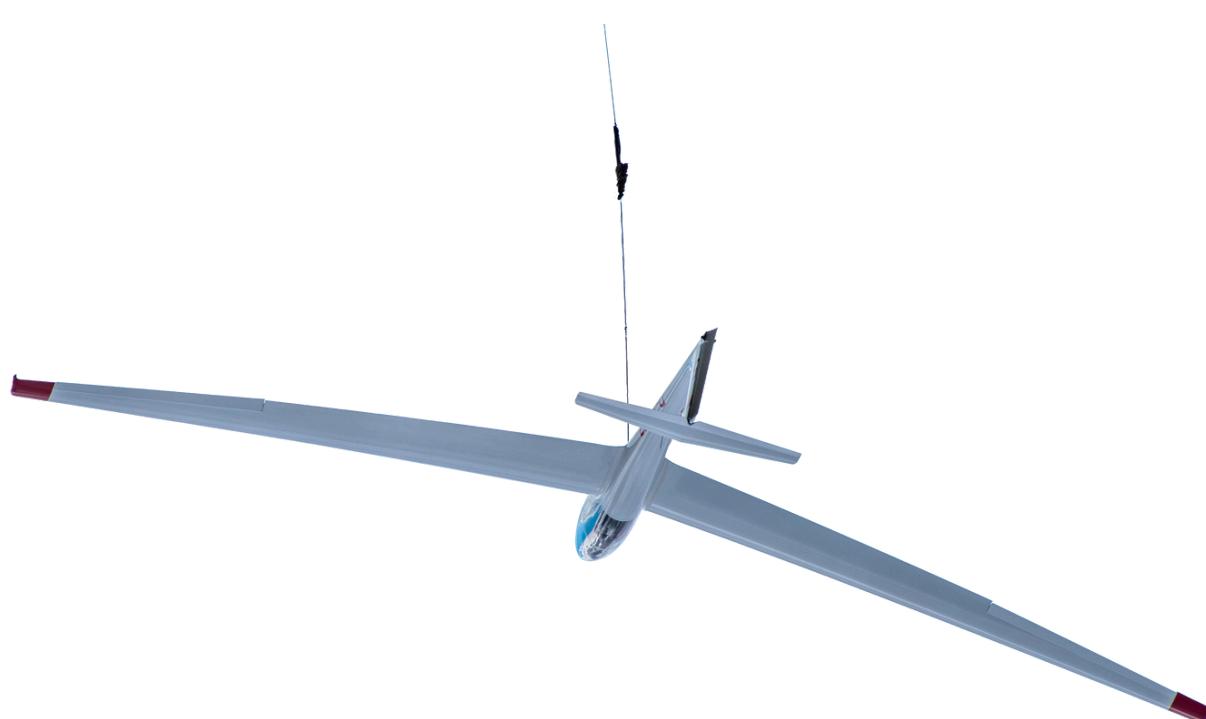


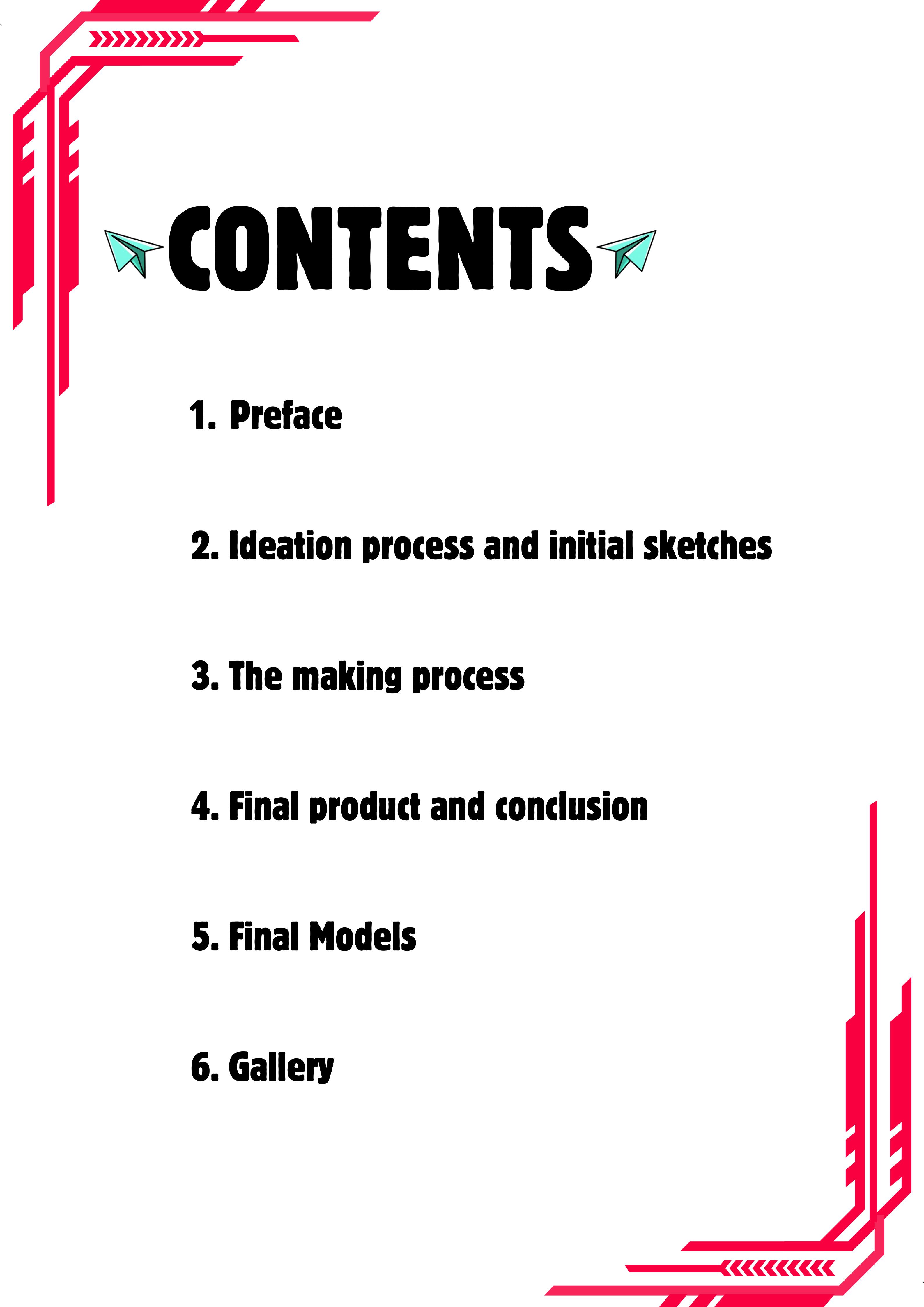
Presented by:

Group 1



Game Changers





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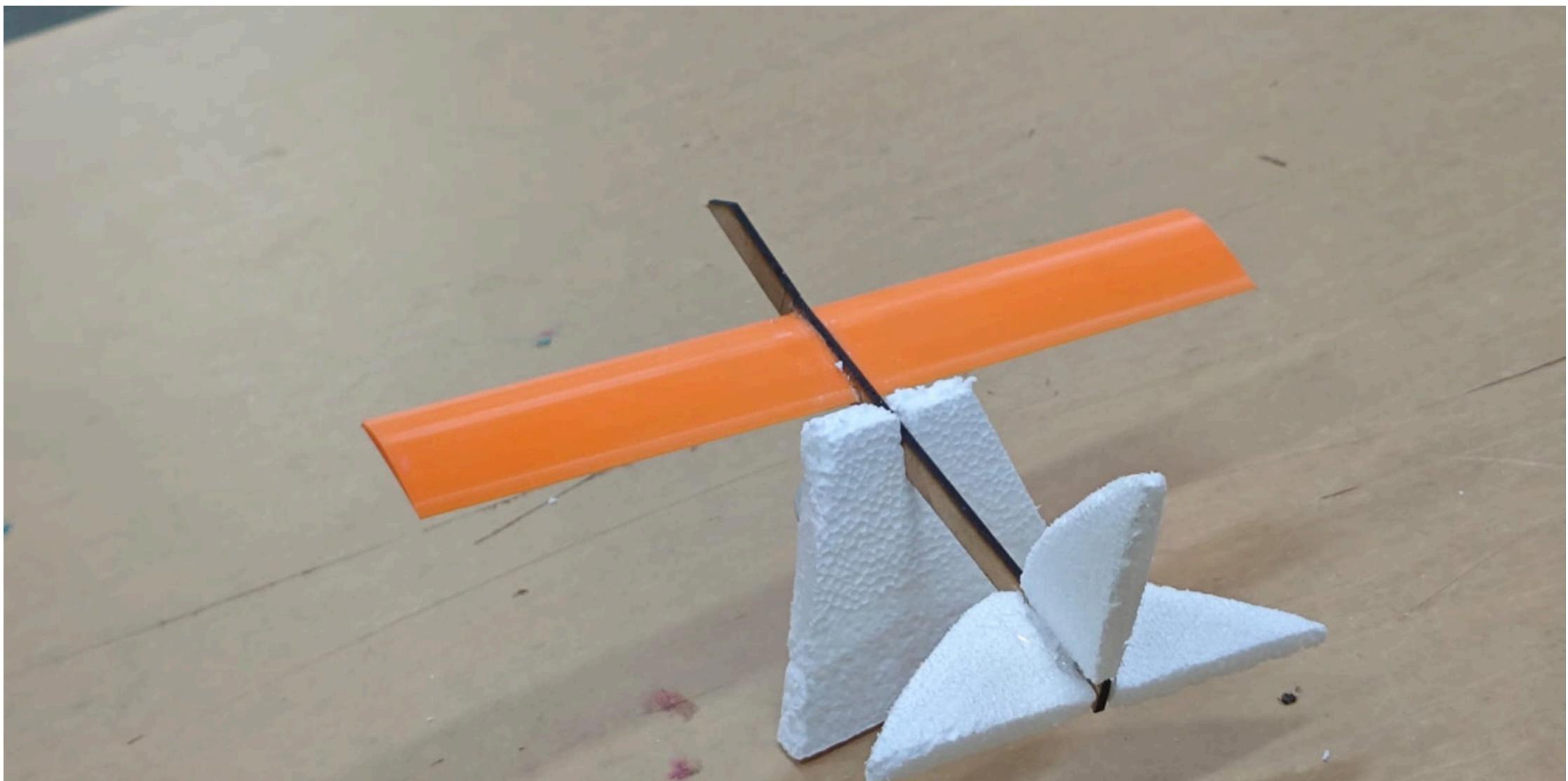
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Preface

The glider is an innovation that has fascinated everyone who has laid their eyes on it since its inception. The glider is one of the most elegant displays of aerodynamics, which smoothly soars through the skies. The fascination of watching a glider fly never goes away, no matter how many times a person witnesses it. Gliders are also one of the simplest working models of an aircraft as they barely contain any form of electronics, and their working is based solely on the lift generated by the specific shape of the wings. The glider paved the way for more modern aerial vehicles like the airplane, which is basically a glider with external power provided to keep it in the air for longer periods. With this project, our vision was to create a visually pleasing but functional glider to recreate the mesmerizing sight of watching one soar through the skies. We worked hard on designing and prototyping the glider model to finally arrive at a model that we are pleased with. We pushed our knowledge and skills to the limit in the designing process and also learnt a lot throughout the making of this project. With this, we proudly present our concept of the model of a glider.



Ideation process and initial sketches

The ideation process started with some initial sketches and initial designs of the wings and the glider's body in AutoDesk Inventor. We knew that we were mainly going to use 3-D printing, CNC Wood Milling, and Laser cutting as those trades deal with the lightest materials. We wanted to make a lightweight but sturdy glider that could fly well but also endure any unforeseen impacts during flight. We first, created some sketches of the parts (The wings and the main body) shown below, and tried to finalize the designs in AutoDesk inventor.

Recommendations By Rakesh Sir:

After completing our wing and body design, we showed our sketch and model to Rakesh Sir. He was greatly helpful with his suggestions and pieces of advice. Some of the modifications he suggested were:

Aerofoil shape of the wing & attaching method

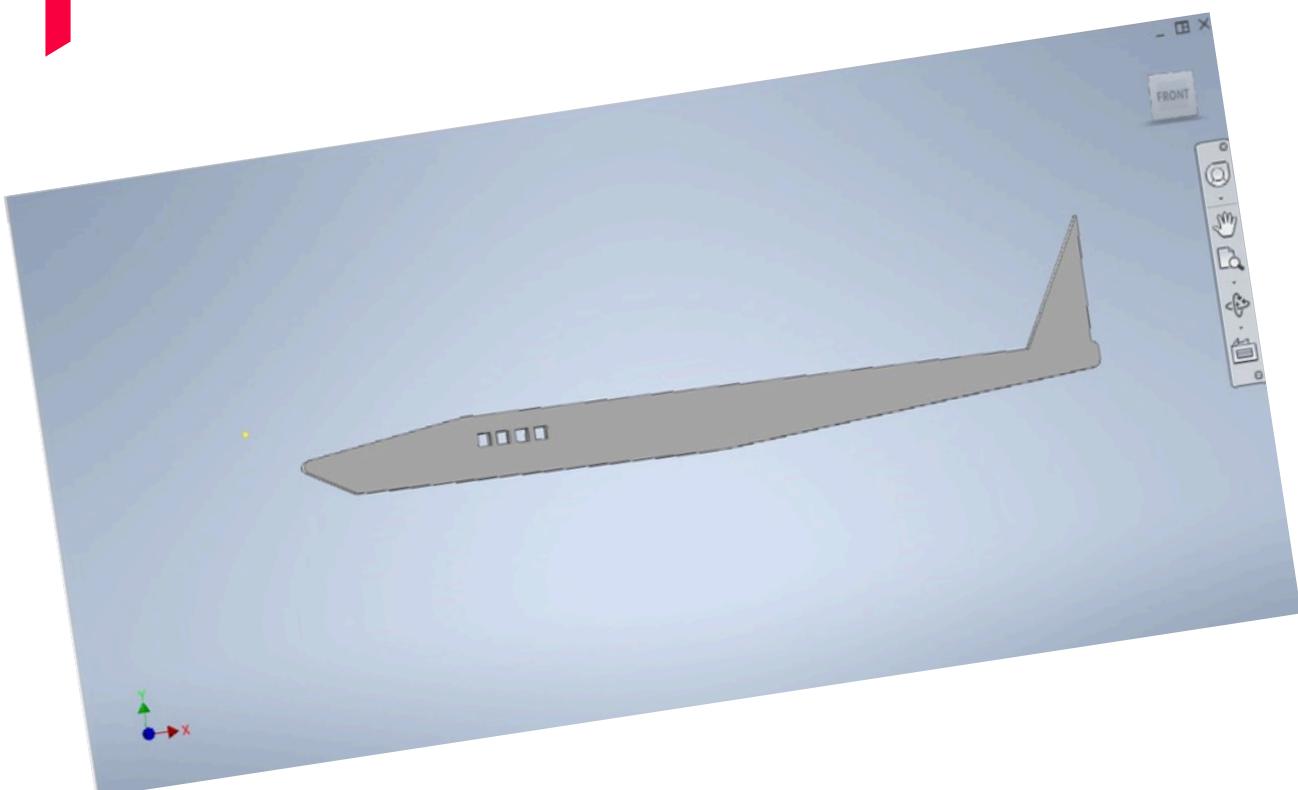
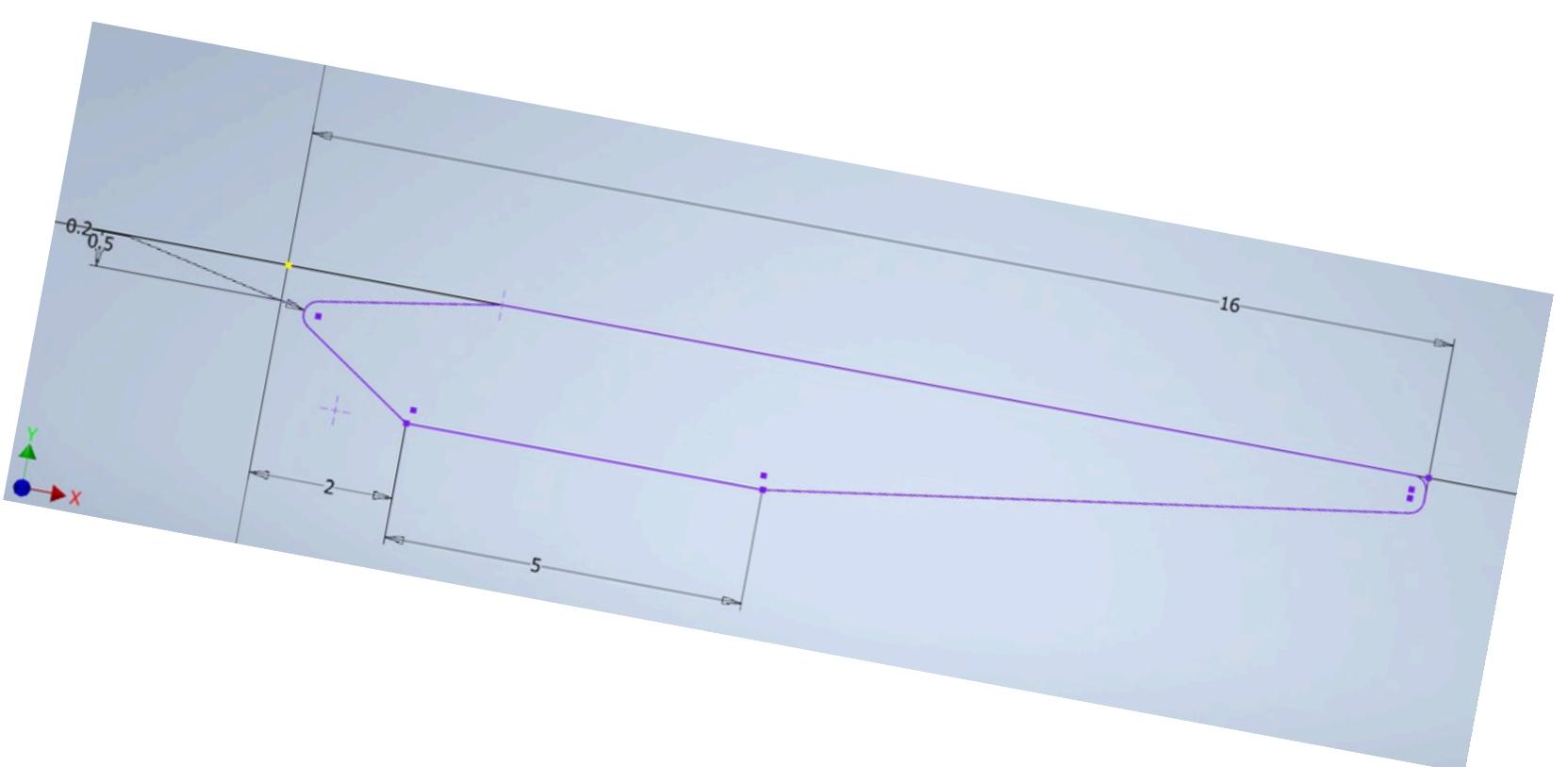
He recommended that the design and shape of the wing should be made keeping in mind the aerodynamic structure; therefore, he recommended the wings' aerofoil shape. He had also recommended that we have grooves to attach the parts, which would be a safer option than glueing them.

Material of the body:

At first, we would make the glider's body out of wood. Realising that it would probably be too heavy for use, he recommended that we use MDF (Medium Density Fibre) to decrease the overall weight of the glider.

Reducing the number of materials to 2 only:

It was the project requirement that we use a minimum of 3 materials. Still, he showed us that using and attaching more materials would make the glider highly unstable in real-life conditions. Therefore, we used only two materials for the sake of it working.





The making process

The making process of the glider had a lot of highs and lows. We faced a lot of problems while building the model of the glider which we had to face head-on. But, we never gave up. We persevered through and were able to finally create a model that we were happy with.

Prototyping

After the raw model design and taking the advice of faculty and supervisors, it was time to prototype the said parts. At first, we had to 3D print the wings, for which we had used PLA material. After trying to use different machines and many settings, we could print them and were more or less satisfied with the results. Please note that 3D printing is a time-consuming and expensive process, so we have to be extra sure before printing anything. Next comes the part where we created the main fuselage (and tail part) using laser cutting. Here, one of our team members took the design in Autodesk format and laser cut the required shape on a 3 mm MDF sheet with all the grooves on it. Now, our first run of manufacturing was over.

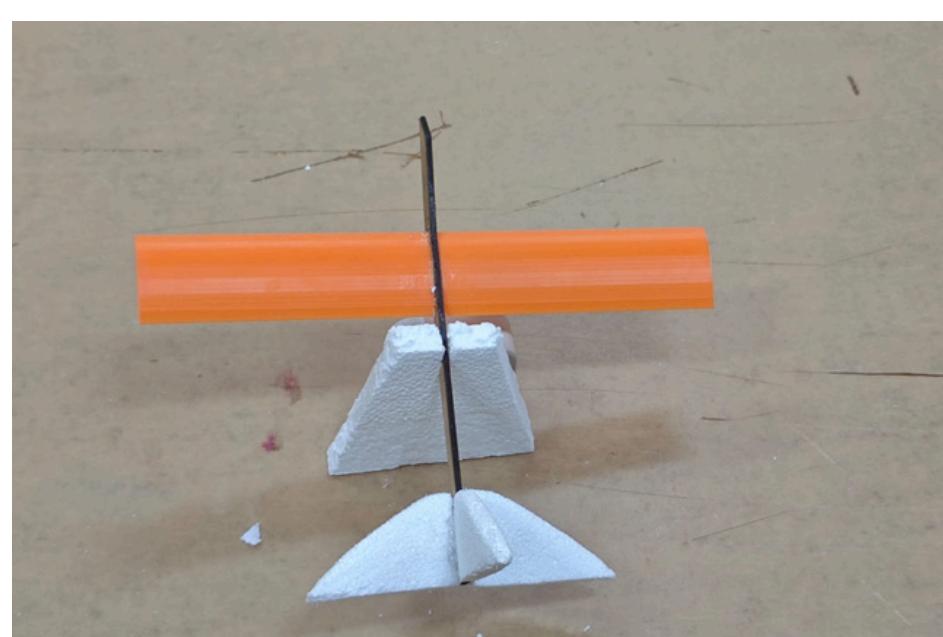
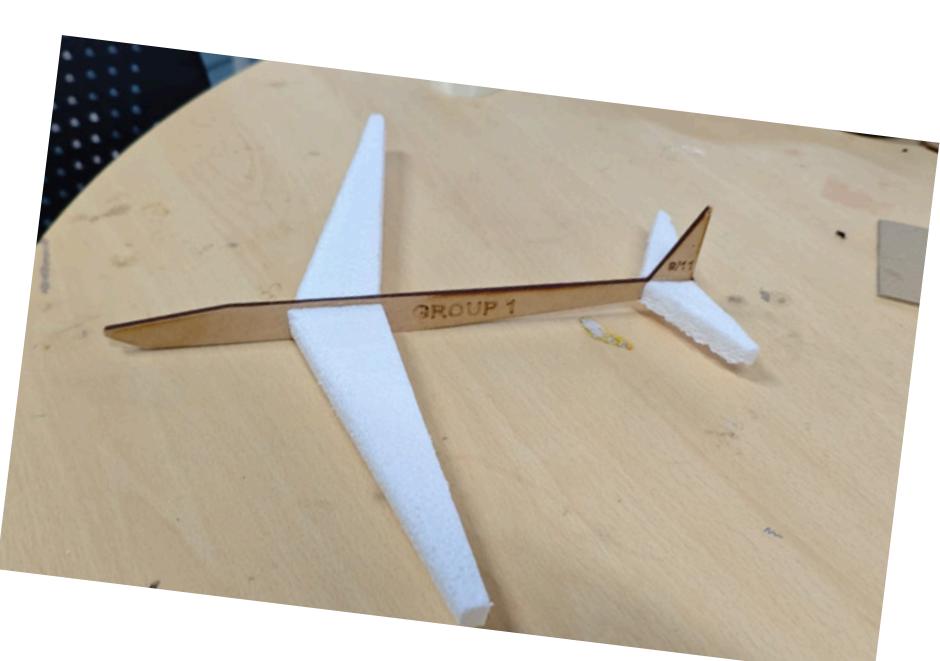


Problems Faced

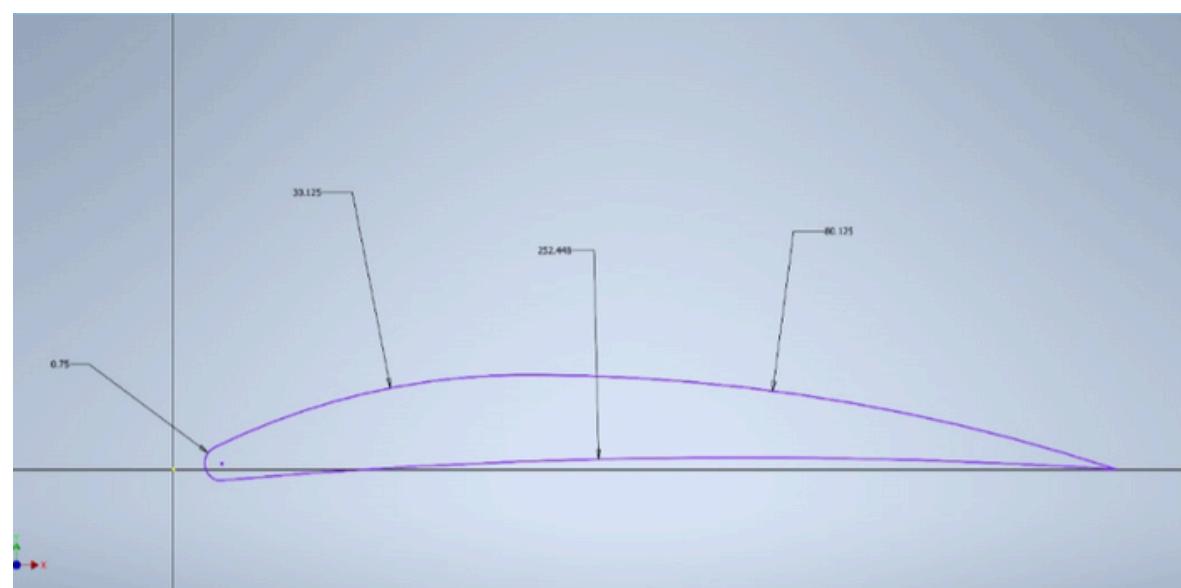
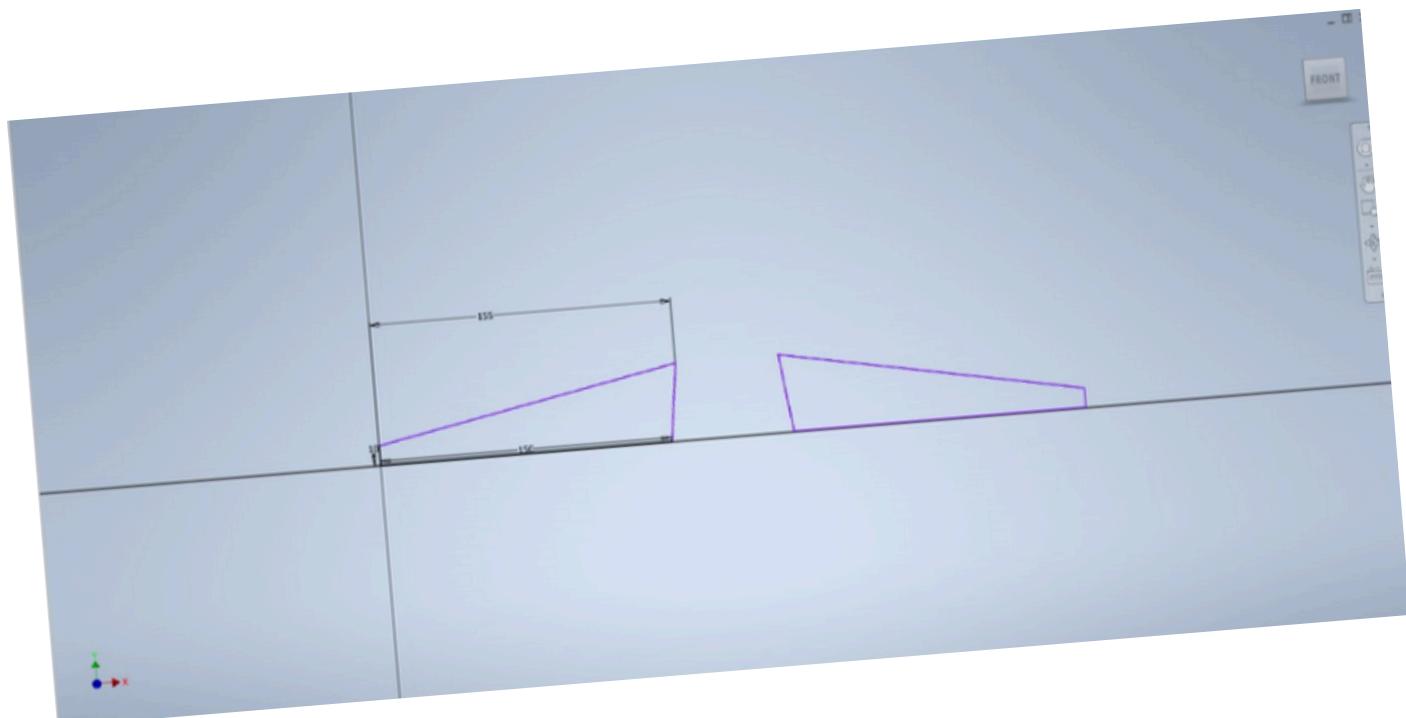
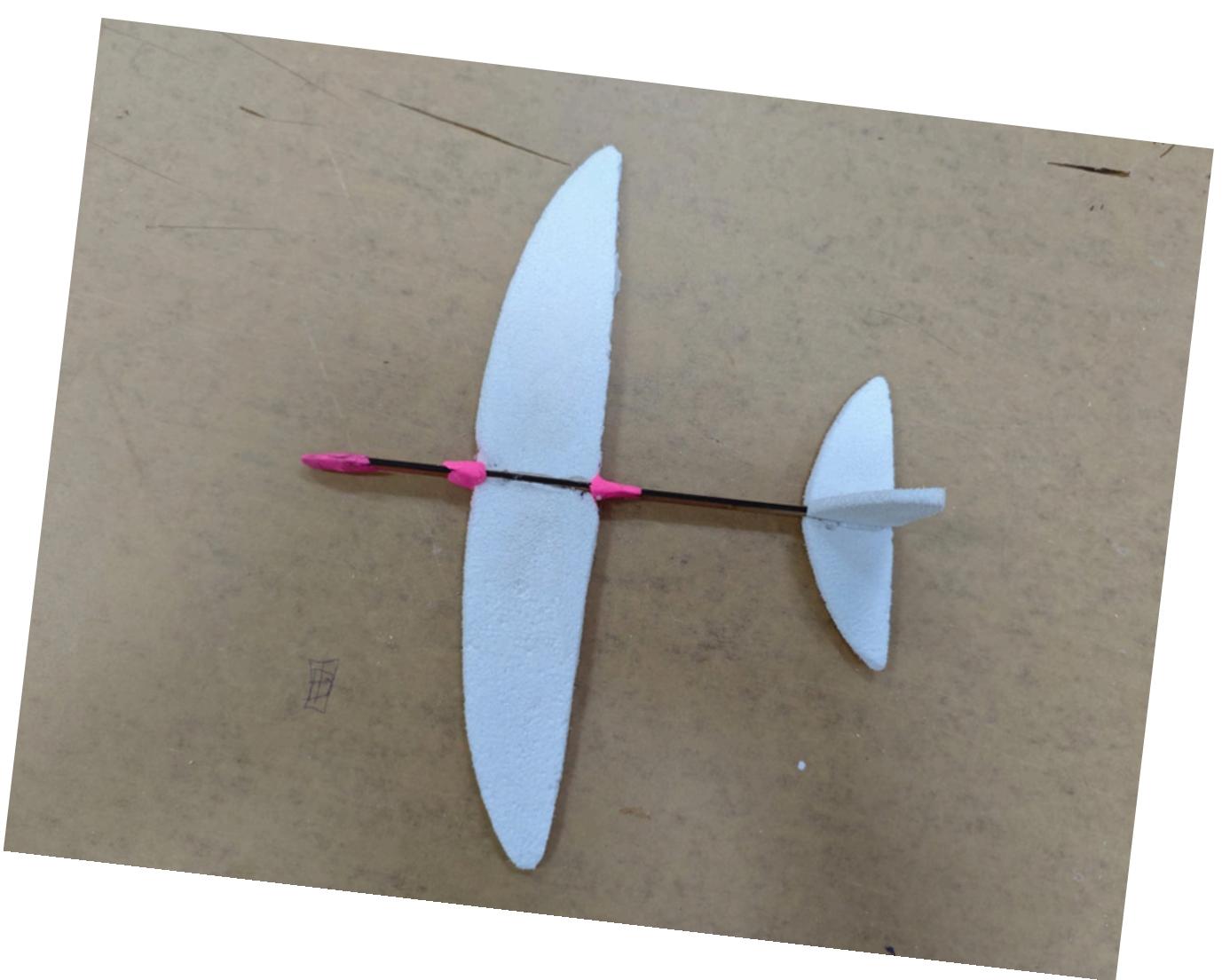
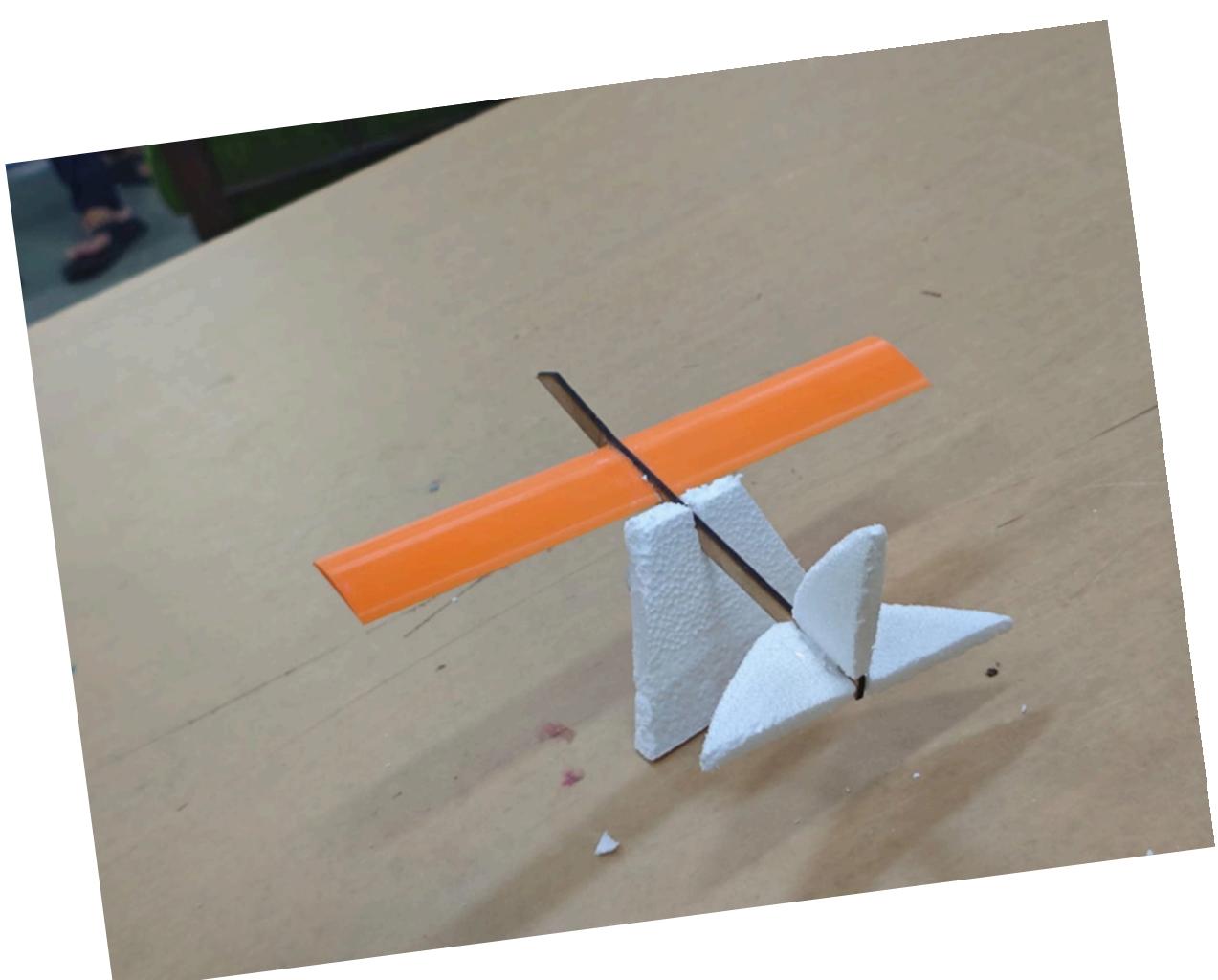
After manufacturing the individual parts, it was finally time to attach everything. This was the point where we ran into a lot of problems:

- 1. Parts could not attach due to grooves of different sizes.**
- 2. Even with 0 infill density, the wings were still quite heavy, significantly increasing the glider's weight. This was a huge problem, and we had to set aside 3D printing for this model.**
- 3. The wing span was too small to generate lift, so we had to break the maximum allowed dimension ceiling for it to work.**

For the second round of manufacturing, we decided to change the shape of the wings and reduce the curvature. We also changed the wings' length and made the glider's body thinner. This was done to reduce the plane's weight and improve the aerodynamics of the glider. Along with this, we also tested with wings made from a foam board. We re-designed the wings in Autodesk and had them 3D printed and cut out the new, thinner body of the glider using the laser cutting machine. The foam wings were hand-cut and sanded to the required shape and aerodynamics. To balance out the weight of the glider, we used clay and stuck it to specific places on the body of the glider. This helped us change the center of mass of the plane to the right place. We worked with in the CCL labs of the campus during the assembly process and also during the test flights.



When completed, we were extremely confident with both models. After some tests and adjusting, both the gliders flew really well. We were really happy with the result and we relived the awe that one always has when they see a glider fly graciously through the sky. Thus, we concluded the second manufacturing process with a successful glider made of MDF wood, FDM plastic and foam-board.



Final product and conclusion

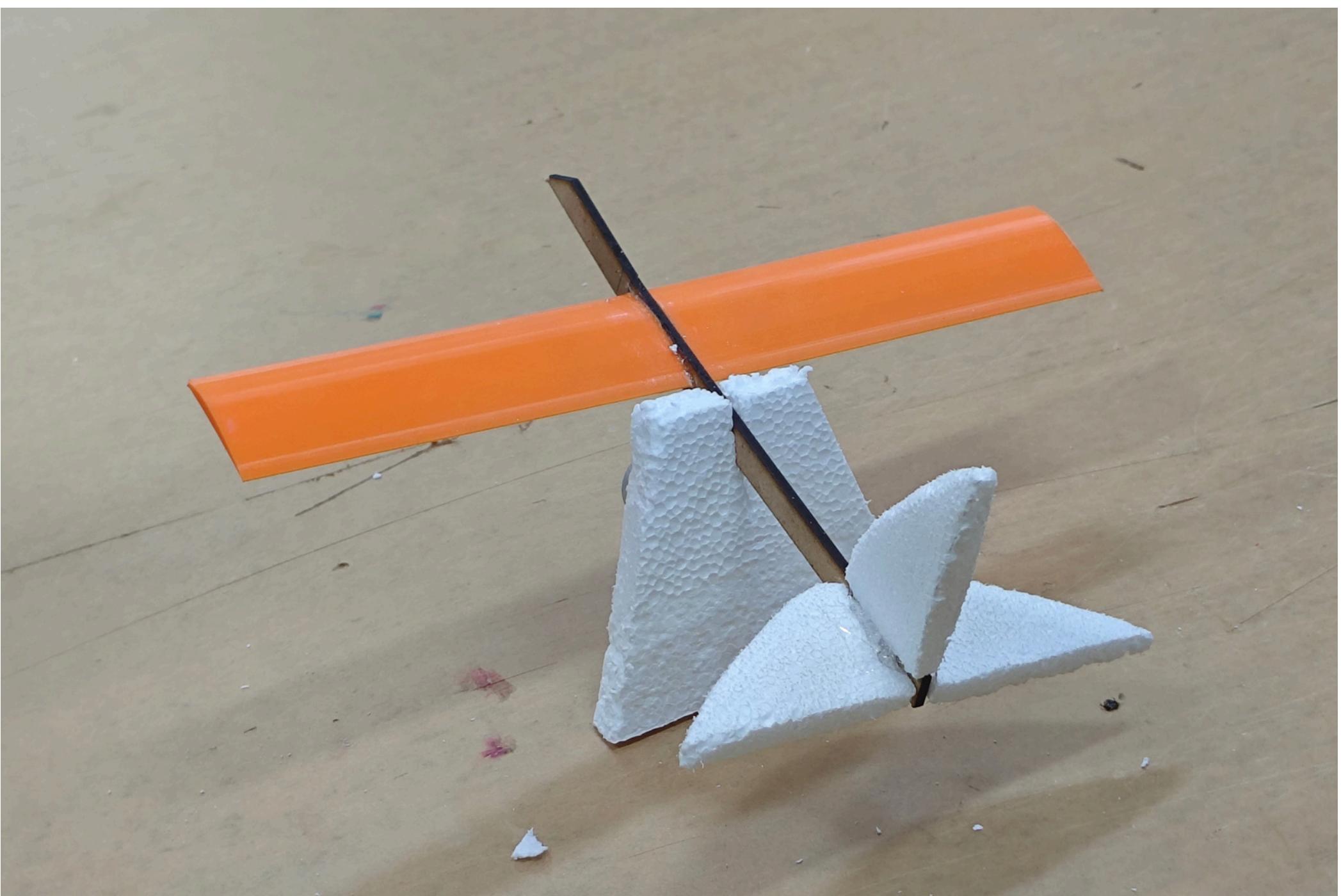


In conclusion, we were successfully able to design and prototype two engineering pieces, each having its own pros and cons. As our final product, we are submitting two models, one of which is preliminary (foam), and other one is our primary model (FDM). Please consider the 3D printed model as our Project submission. We are attaching both products because we have worked hard on both of them, and both deserve to be demonstrated. It was a beautiful but tiring journey for all the team members directly or indirectly involved in this process. Lastly, we would like to extend a special thanks to the MakerBhavan staff, CCL staff and the faculties for guiding us when completing this project before the deadline seemed impossible.

A note from the creators

Certain things deserve a special mention. We have made two models, one from the foam board and the other from PLA material; we have attached both as our final model because we have worked hard on both, and both ended up being amazing models. The point might be raised regarding the extra usage of materials in making of the two models, which might end up as an expensive affair for the management. But you can be assured that all the materials have been used judiciously. We might make some final tweaks to our model before Amalthea's submission.

The final models



Gallery

