CAD/CAM

DIGITAL METHODS

GENERATIVE DESIGN

FUSION 360

KASHISH PATEL

SEM-5, 3rd YEAR

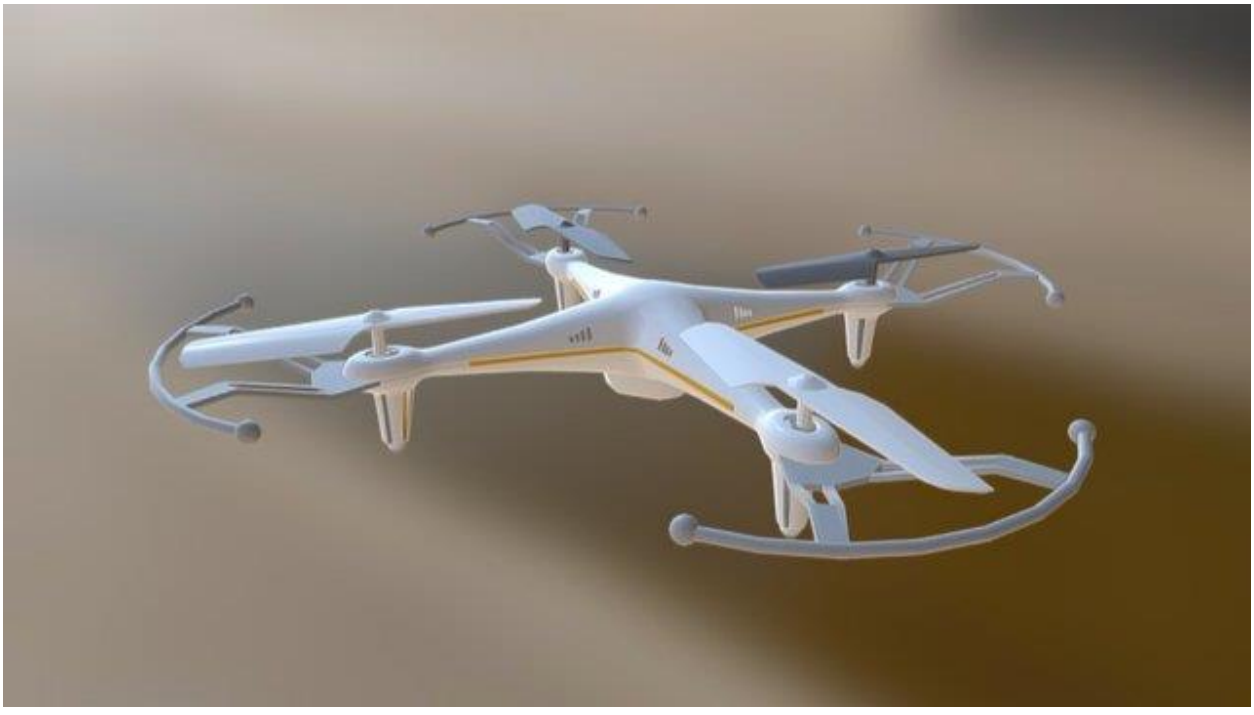
Acknowledgement

I would like to thank Prof.Chaitanya Kachare for imparting
us to the vitalities of generative design and Fusion
360 and guiding me through this project. It was under his visual guidance I was successfully able to do this project.

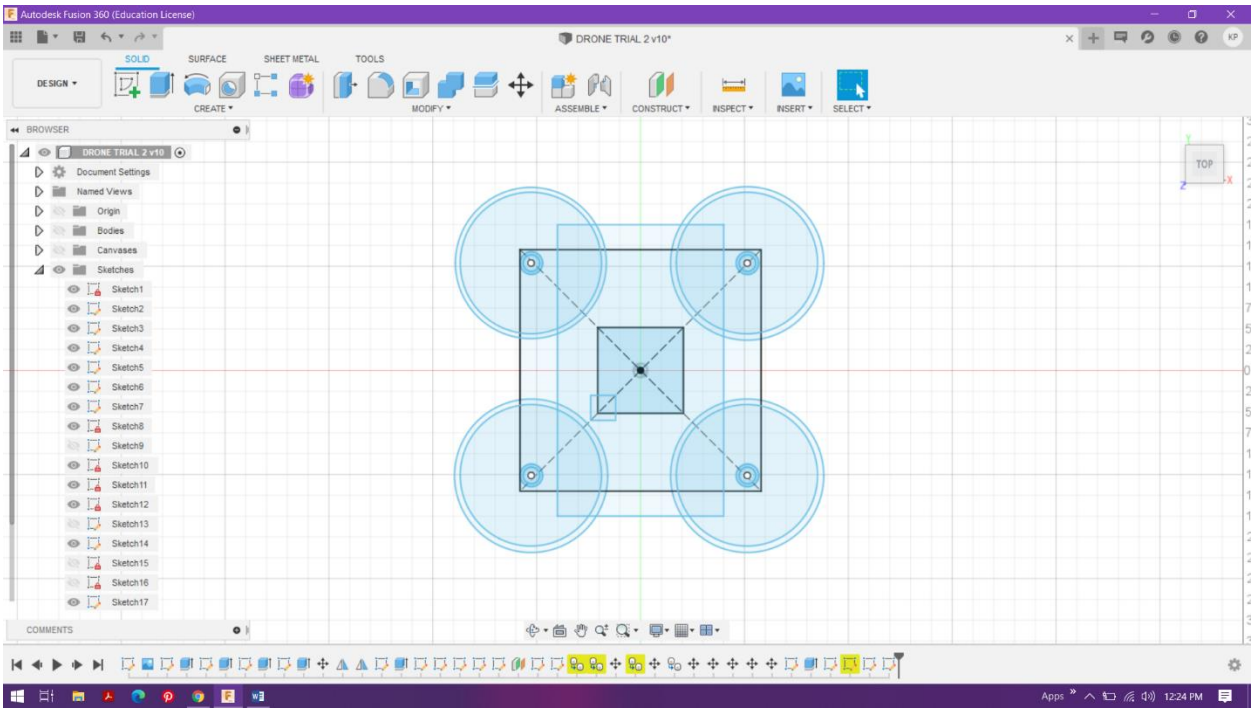
I would also like to thank AutoDesk India , for helping me out with getting this software and teaching it.

Introduction

The product I chose for techno aesthetic detailing is the frame for a Sky Rider drone. Quadcopter frame modeling is useful to analyze the reliability of body frame part and to help determine the type of rotor and propeller in order to assure the necessary flight acceleration. Quadcopter flight stability is influenced by the resulting thrust, by the distance between each rotor propeller and also by the frame rigidity; the frame has been designed to be as light as possible, meanwhile maintaining the strength to carry the load. Fusion 360 software has been used to design and analyze the quadcopter frame - having propeller and rotor's angular velocity and air flow produced around the propeller. This showed that the presence of rotational velocities in each propeller flow field will significantly affect the thrust efficiency which can cause flight instability or body frame vibration. The frame has to be accurate to generate just the right amount of weight to be carried by the Drone for aerial and projectile momentum and thus cannot cross the weight limit.

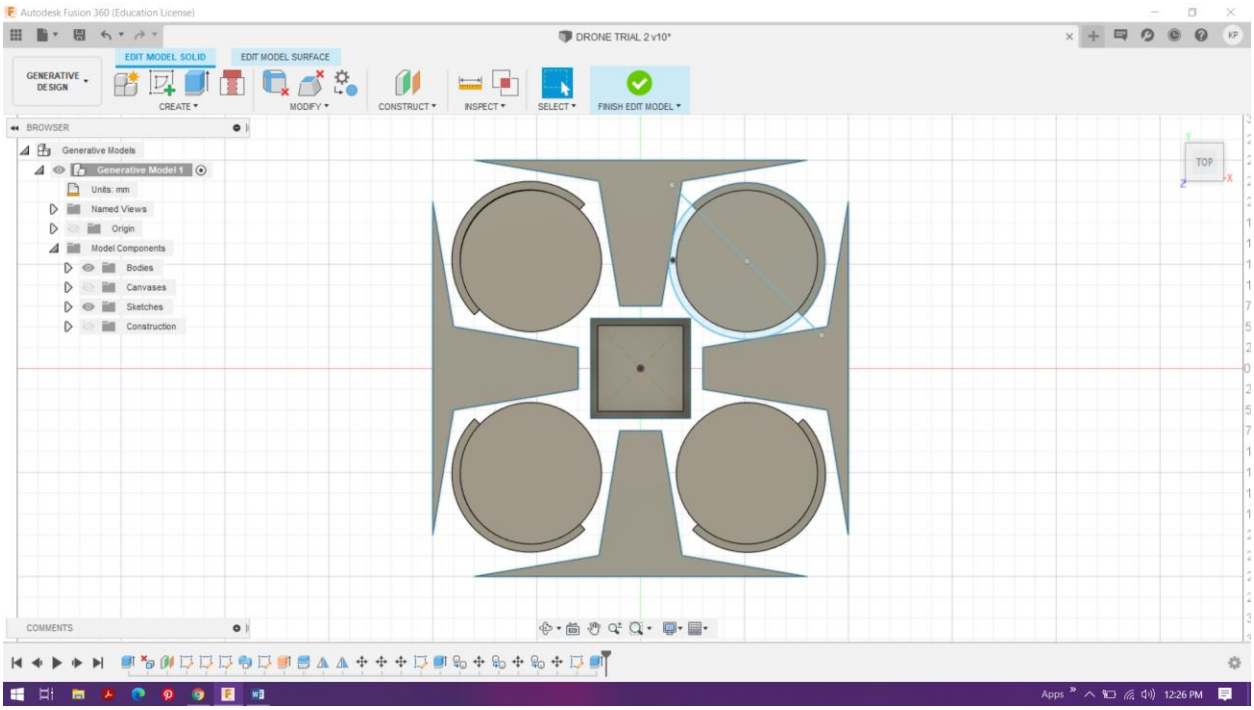


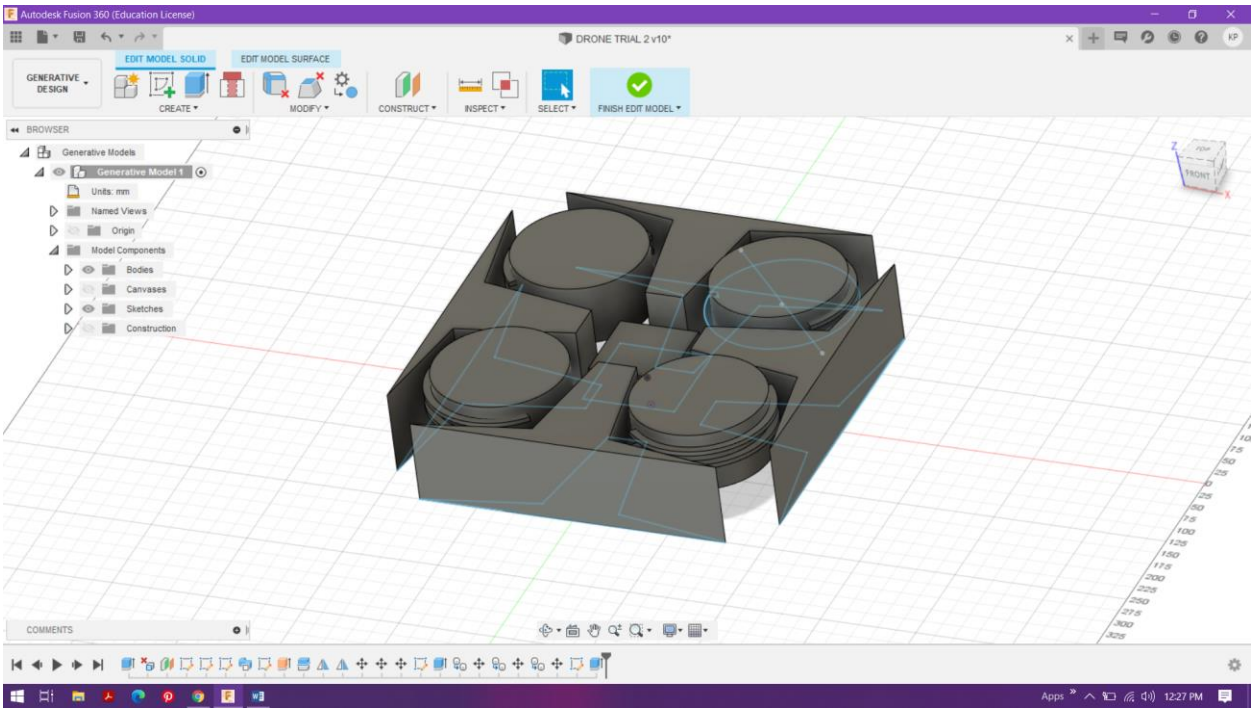
Drone Framework Template



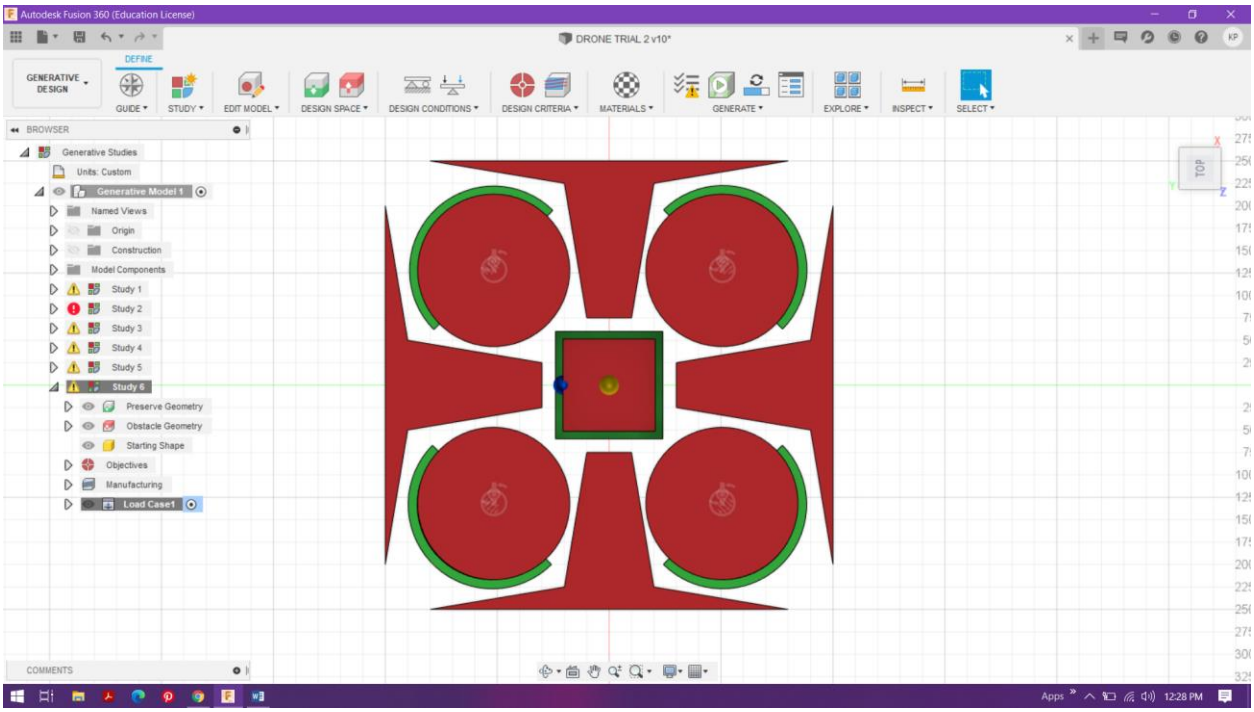
The frame of a quadcopter is the main structure, or the skeleton upon which the rest of components will be attached. The 2D sketch of the frame for mandatory product parts includes the mounting grubs for the motors, the propellers , RC receiver , Flight controller and battery.

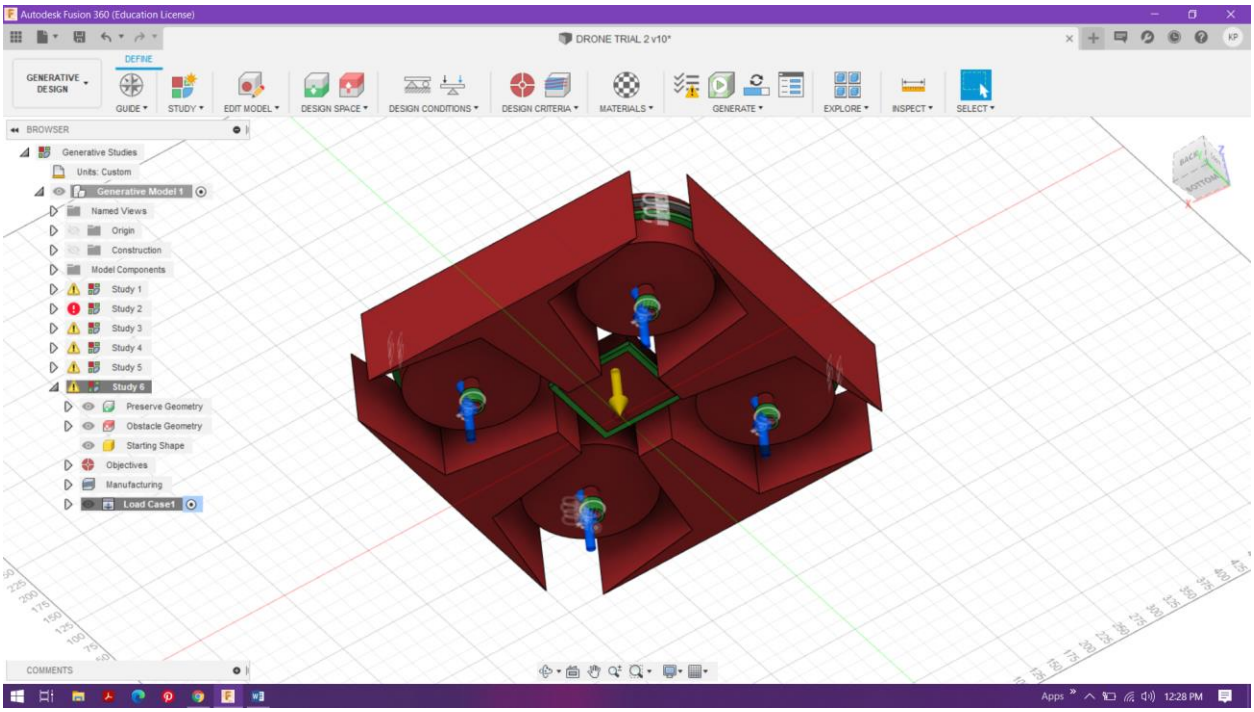
Modelling the Parts

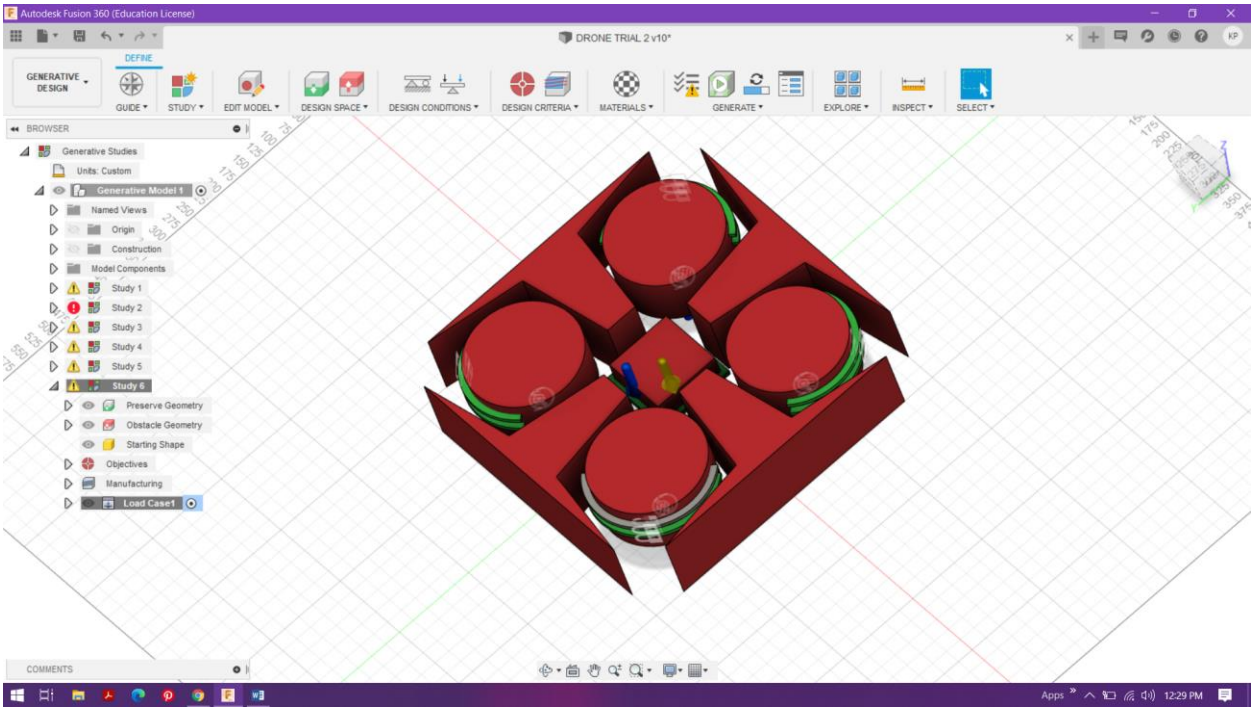


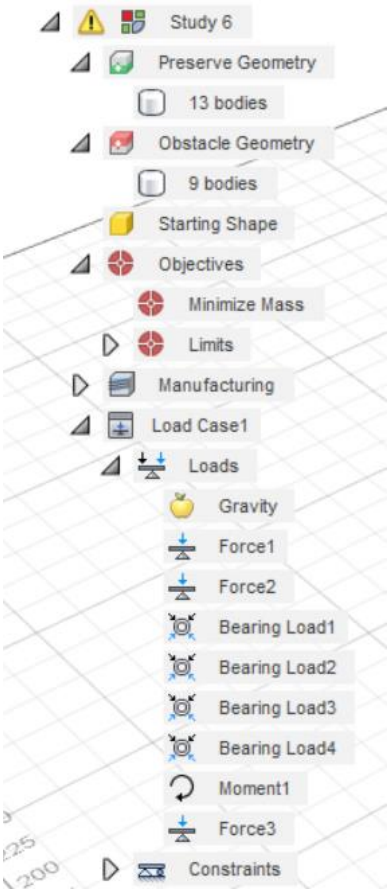


Putting obstacles and preserved geometry and constraints and loads









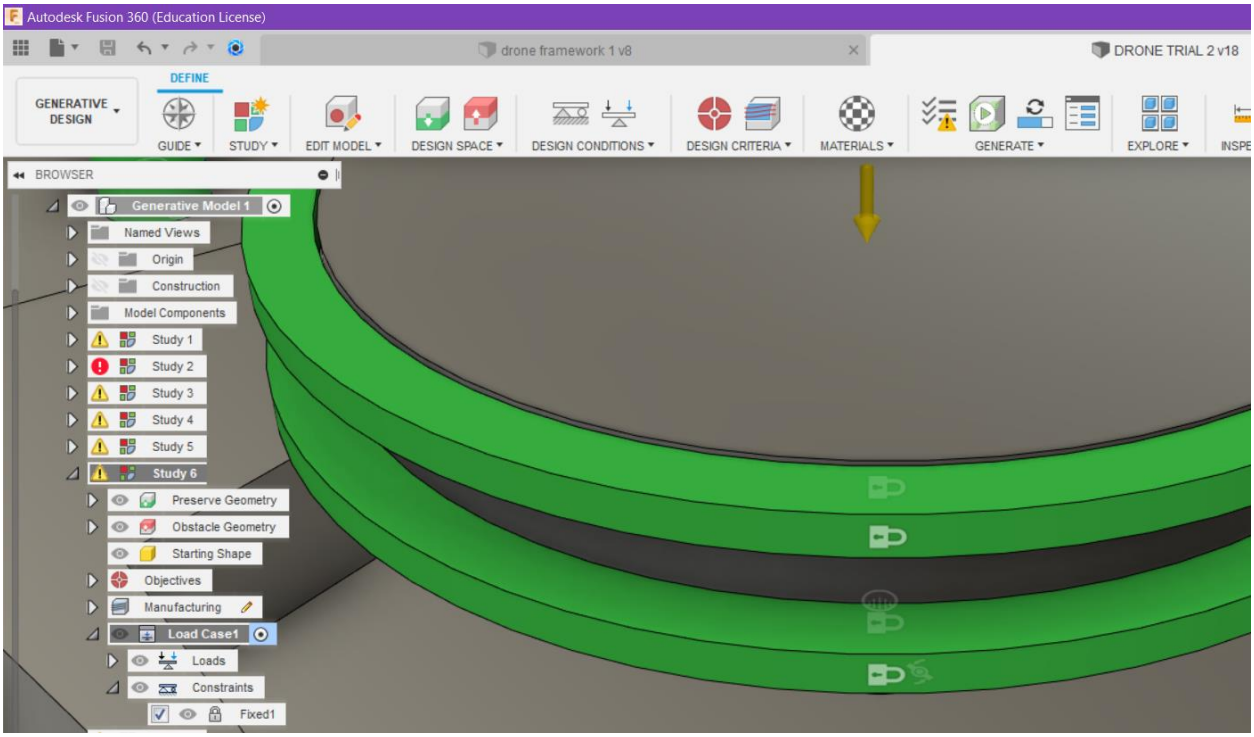
The red bodies are the obstacle geometry and green bodies are the preserved geometry

The load is put in newton meter for the weight of the drone.

1.3 kg = 13.72 Nm (Battery and RC)
840g = 8.2 Nm (Motors)
Bearing load for motors

Moment Load – 21.92 Nm

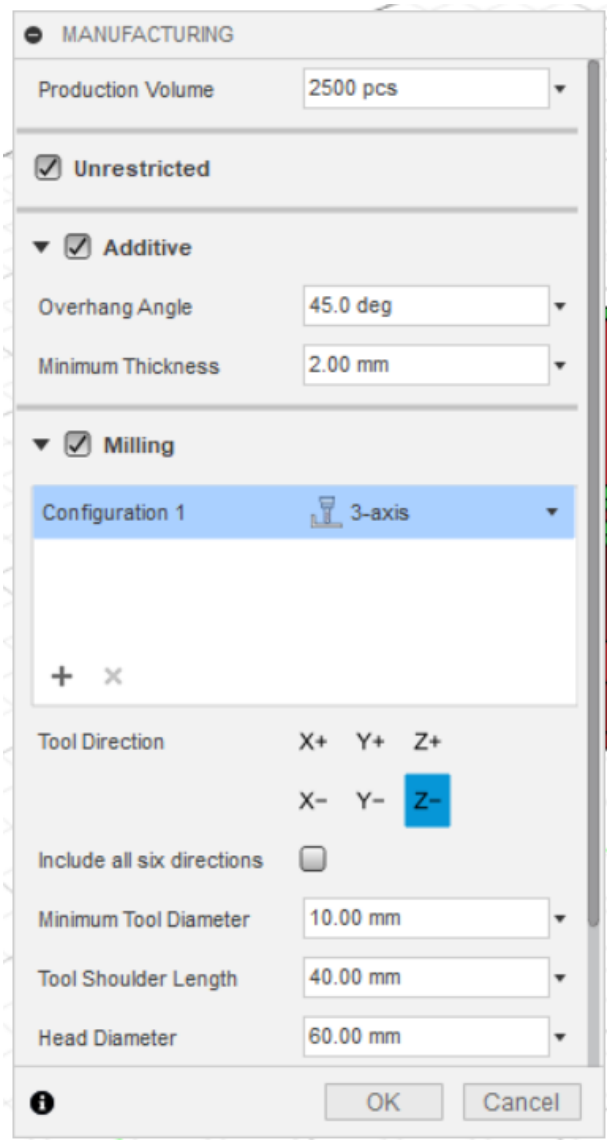
The Constraints put are fixed constraints on the drone propeller frame.

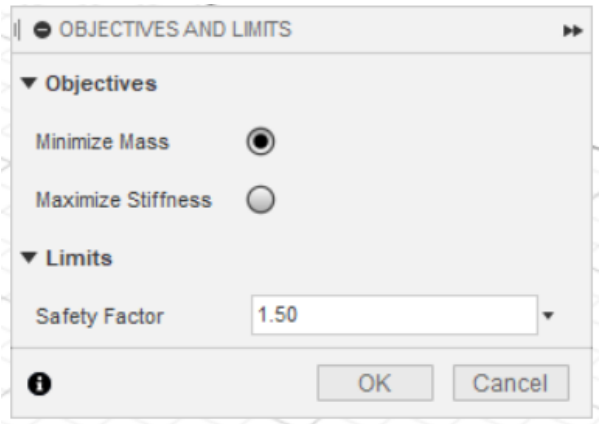


Objectives and Manufacturing

For Objectives, I changed the safety factor to 1.50.

For manufacturing, the Additive Minimum Thickness changed the value to 2.00





Outcomes

Converged

Study 6 - Outcome 2
Converged

Completed

Study 6 - Outcome 1
Completed

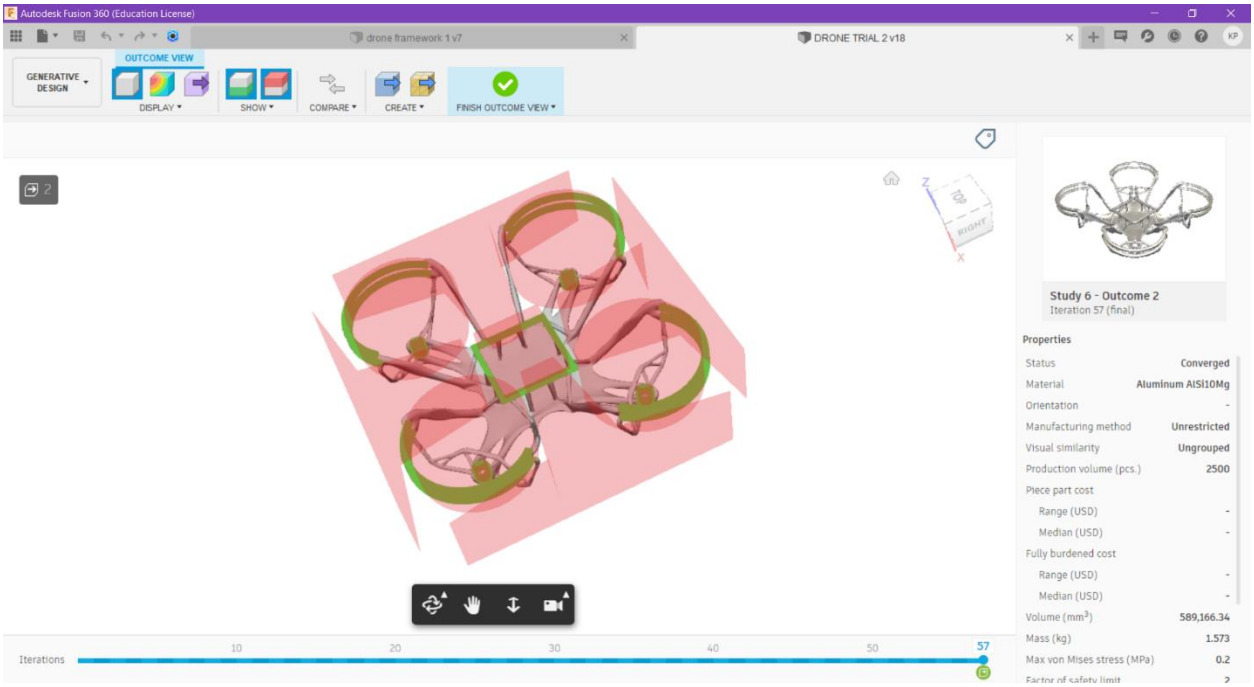
Study 6 - Outcome 3
Completed

Study 6 - Outcome 4
Completed

Study 6 - Outcome 5
Completed

Final Iteration and Report

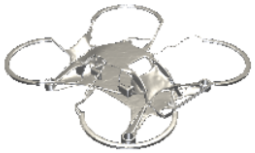
Properties	
Manufacturing method	Unrestricted
Visual similarity	Ungrouped
Production volume (pcs.)	2500
Piece part cost	
Range (USD)	-
Median (USD)	-
Fully burdened cost	
Range (USD)	-
Median (USD)	-
Volume (mm^3)	589,166.34
Mass (kg)	1.573
Max von Mises stress (MPa)	0.2
Factor of safety limit	2
Min factor of safety	1,006.5
Max displacement global (mm)	2.185e-4



Comparison of Outcomes

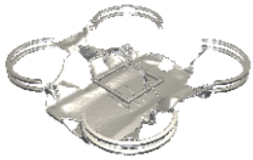
Converged

Study 4 - Outcome 2
Converged



Study 4 - Outcome 3
Converged

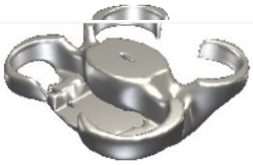
Study 4 - Outcome 5
Converged



Study 5 - Outcome 3
Converged

Study 6 - Outcome 2
Converged

Completed



Study 4 - Outcome 1
Completed

Study 4 - Outcome 4
Completed

Study 5 - Outcome 1
Completed

Study 5 - Outcome 2
Completed

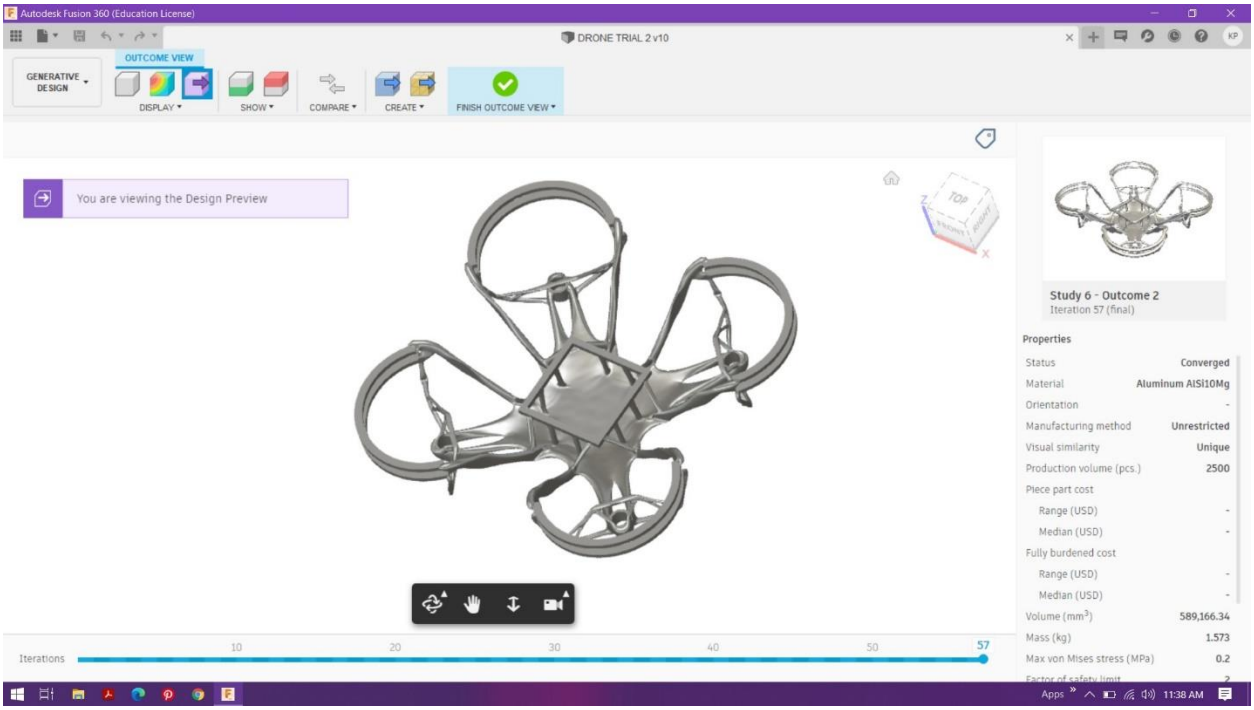
Study 5 - Outcome 4
Completed

Study 5 - Outcome 5
Completed

Study 6 - Outcome 1
Completed

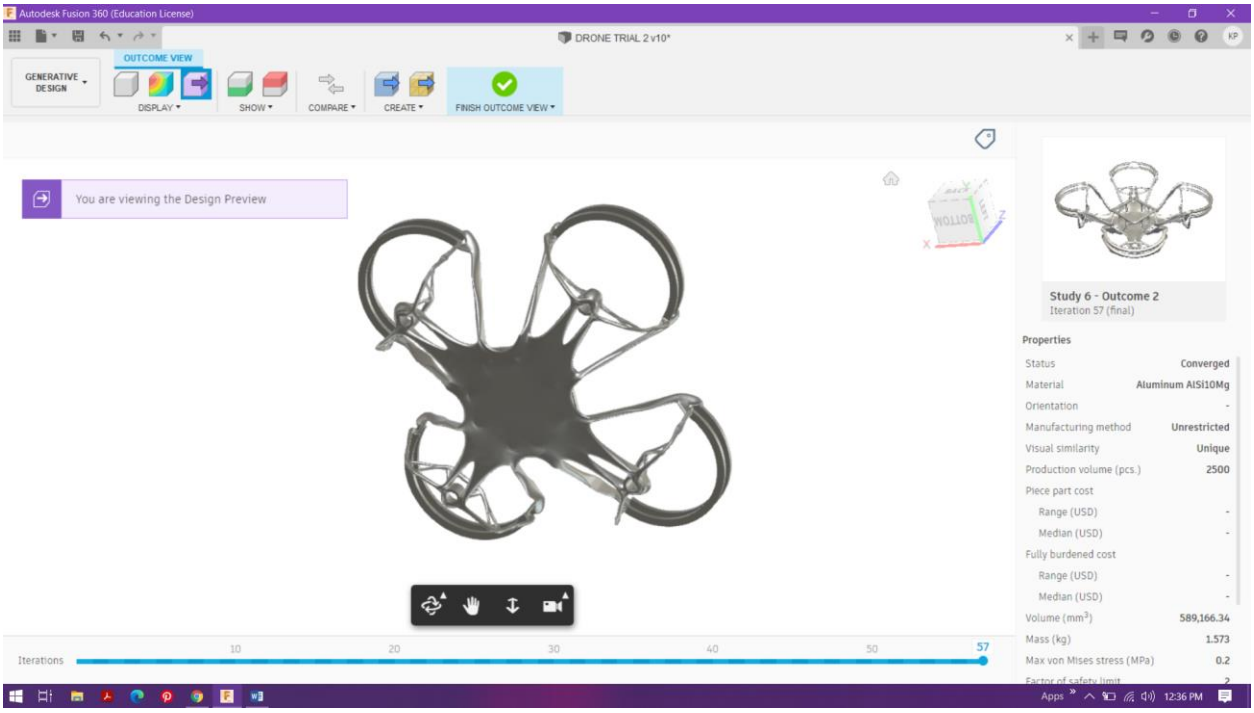
Study 6 - Outcome 3
Completed

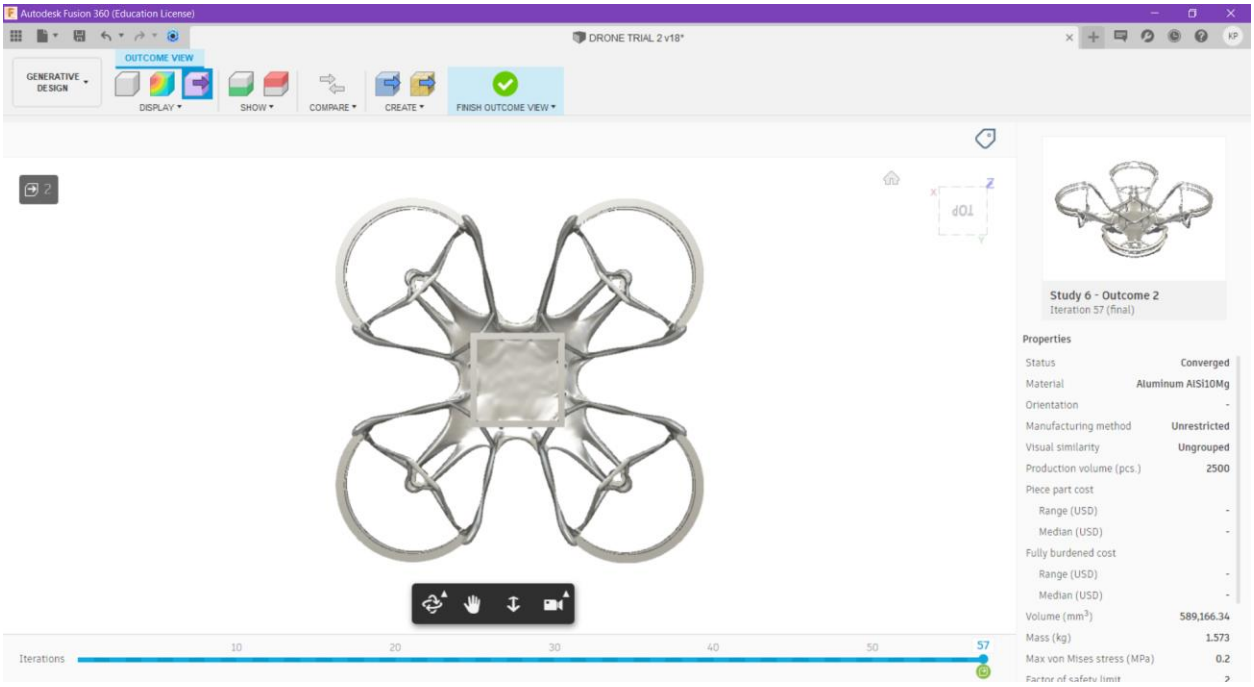
Reason for choosing the outcome



The above outcome was chosen at it satisfies both , the aesthetics and the function for the drone frame. The whole purpose of the drone frame is for the body to be light for aerial motion, for propellers to carry the body in upward movement.

It satisfies aesthetic purpose too as the frame is in symmetry quadratic pattern.


Autodesk Fusion 360 (Education License)
DRONE TRIAL 2 v10*
GENERATIVE DESIGN
OUTCOME VIEW
DISPLAY
SHOW
COMPARE
CREATE
FINISH OUTCOME VIEW
You are viewing the Design Preview
Study 6 - Outcome 2
Iteration 57 (final)
Properties
Status Converged
Material Aluminum AlSi10Mg
Orientation -
Manufacturing method Unrestricted
Visual similarity Unique
Production volume (pcs.) 2500
Piece part cost
Range (USD) -
Median (USD) -
Fully burdened cost
Range (USD) -
Median (USD) -
Volume (mm³) 589,166.34
Mass (kg) 1.573
Max von Mises stress (MPa) 0.2
Iterations 10 20 30 40 50 57
Apps 12:36 PM


Autodesk Fusion 360 (Education License)
DRONE TRIAL 2 v18*
GENERATIVE DESIGN
OUTCOME VIEW
DISPLAY
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COMPARE
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FINISH OUTCOME VIEW
Study 6 - Outcome 2
Iteration 57 (final)
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Volume (mm³) 589,166.34
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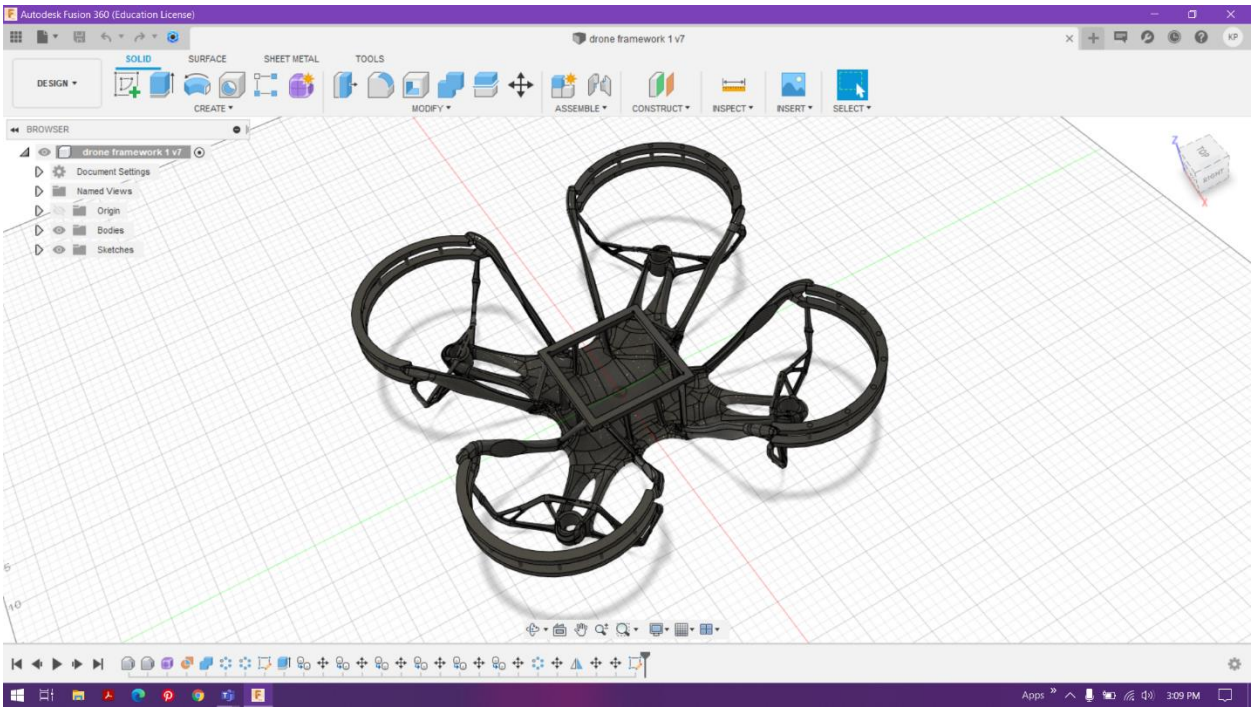
Model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drone framework 1 v7
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TOOLS
CREATE
MODIFY
ASSEMBLE
CONSTRUCT
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SELECT
BROWSER
drone framework 1 v7
Document Settings
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Bodies
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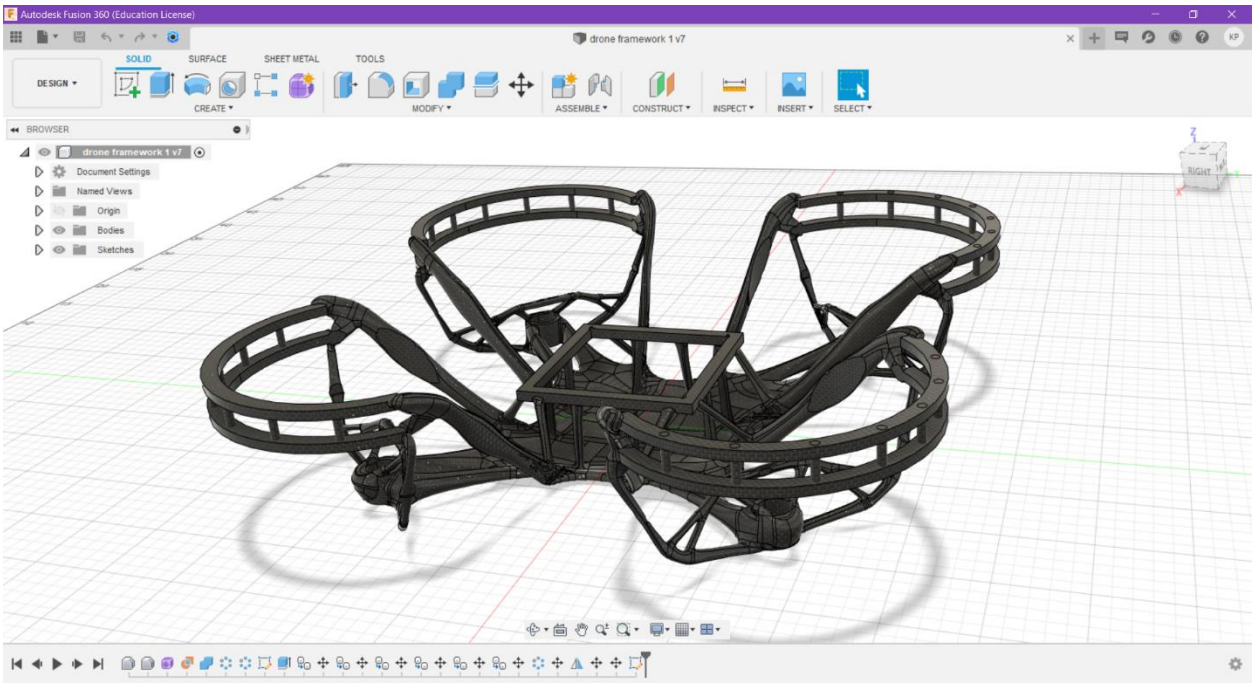
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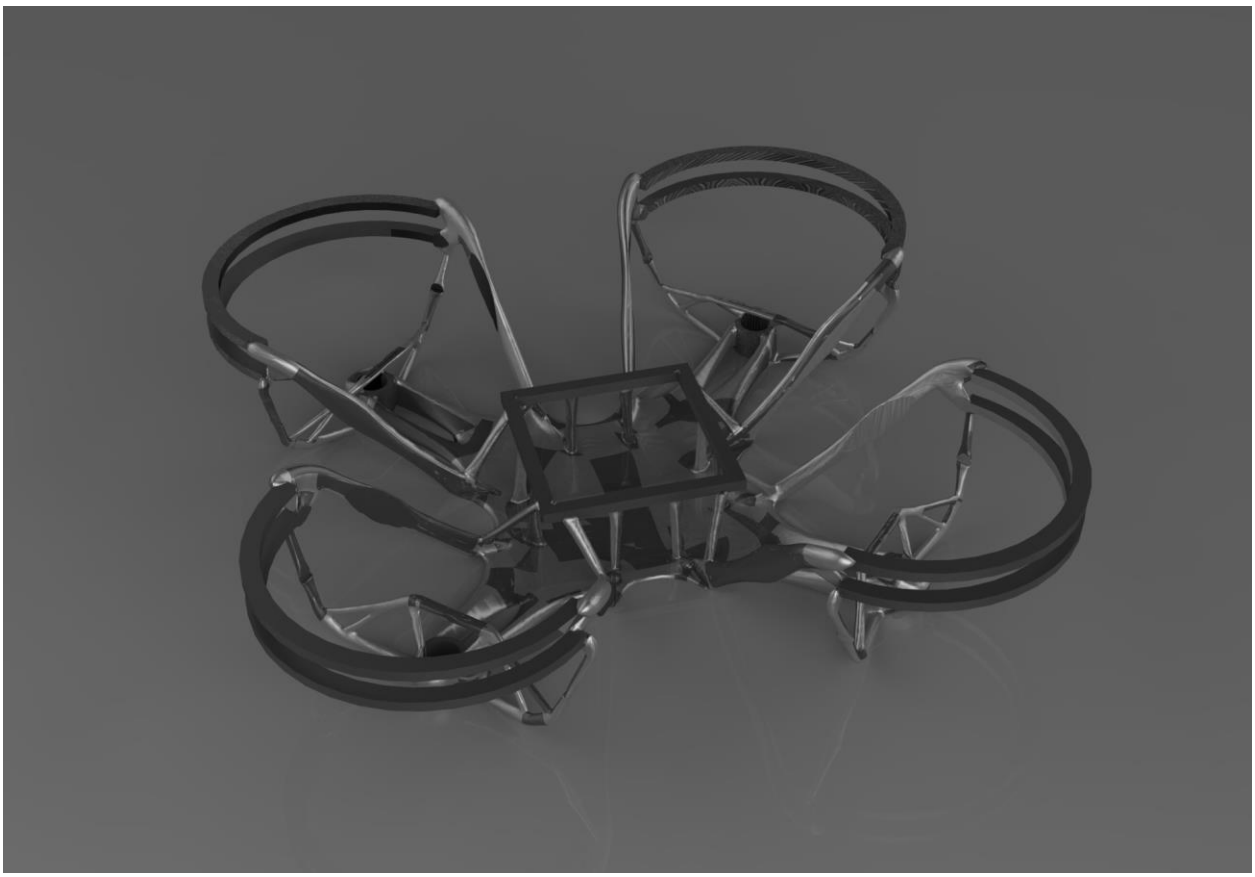
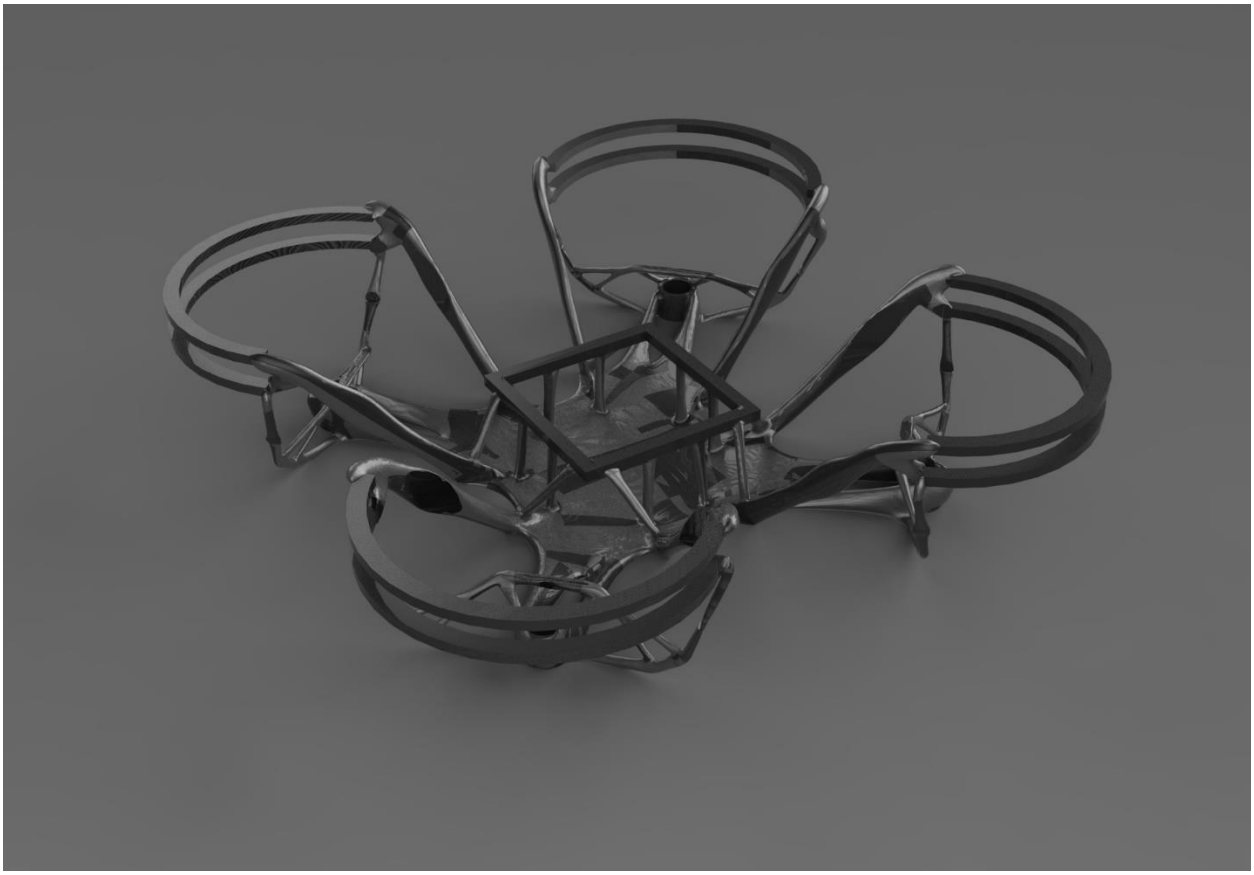
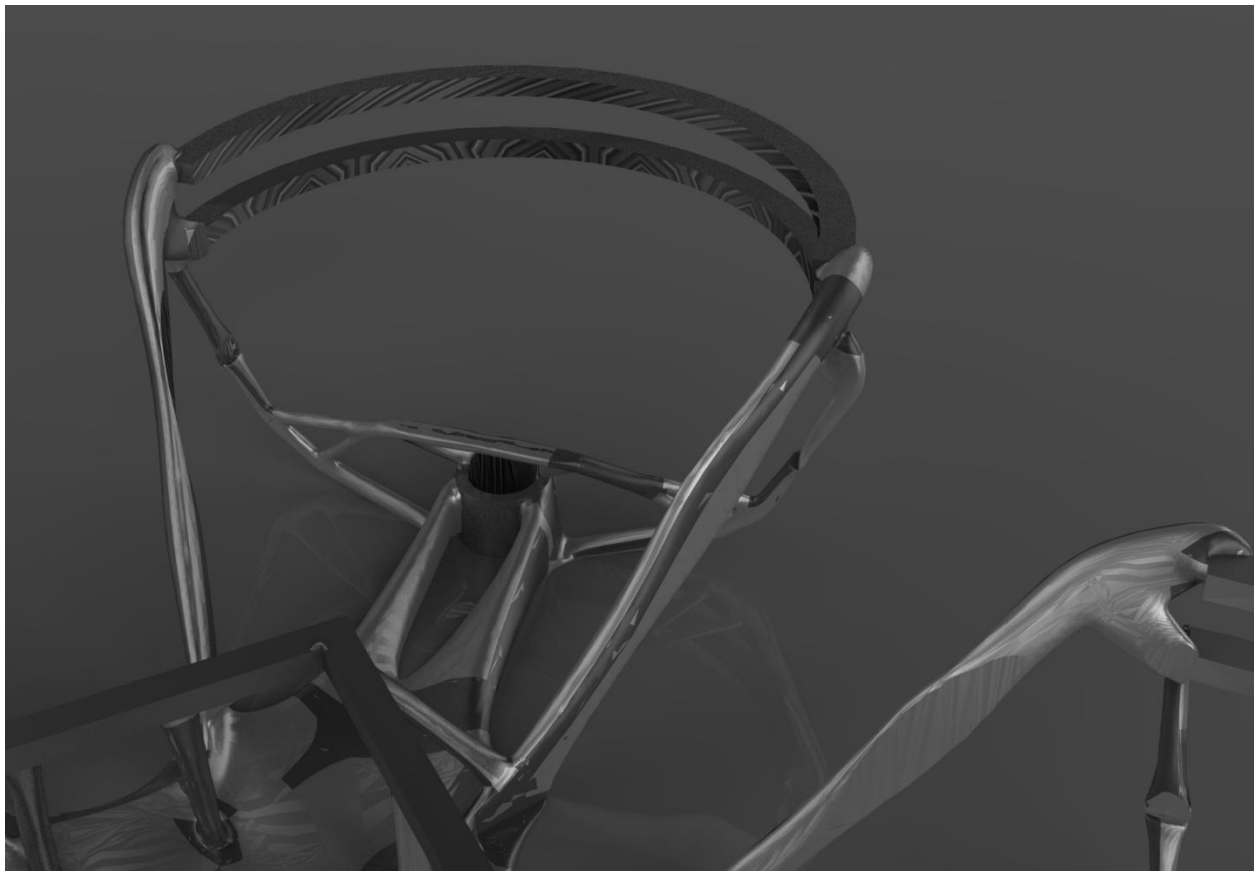
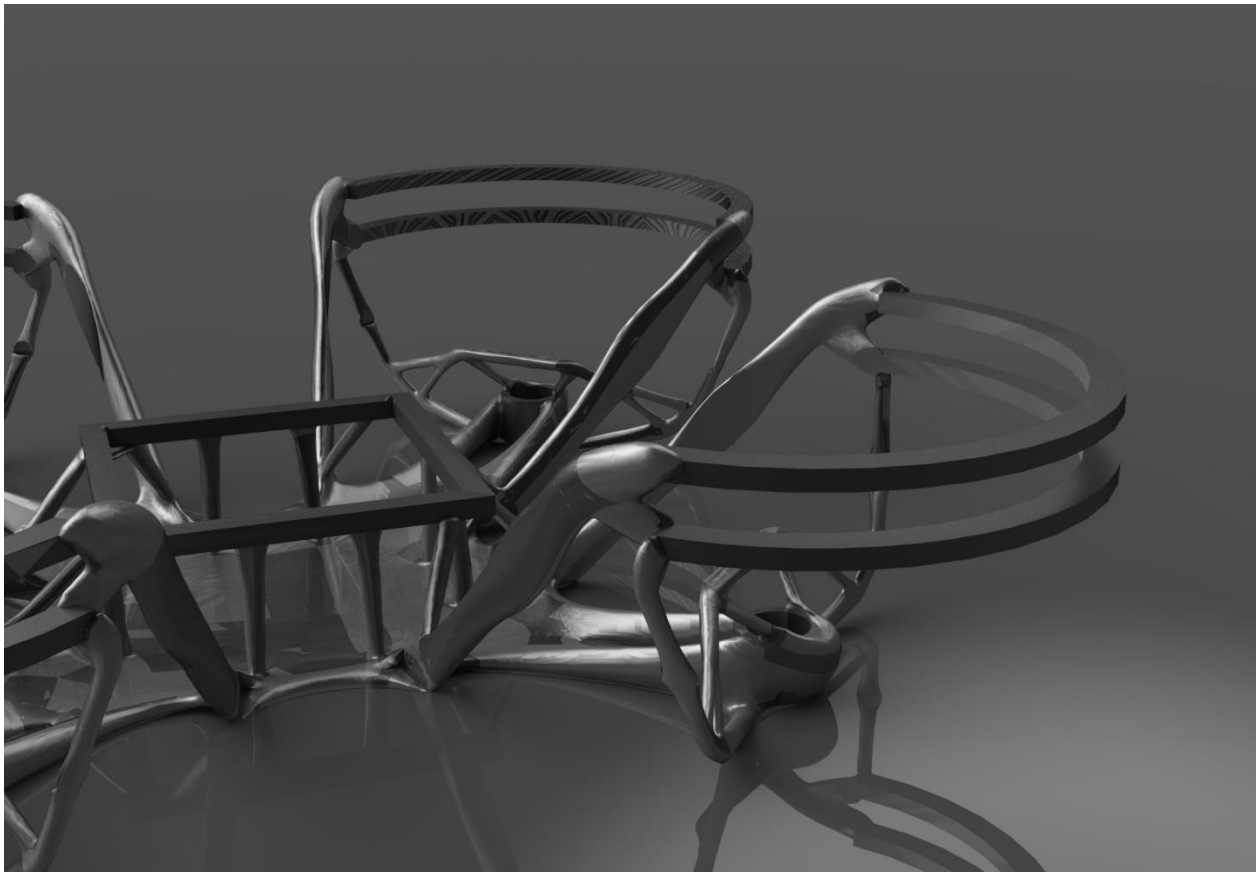
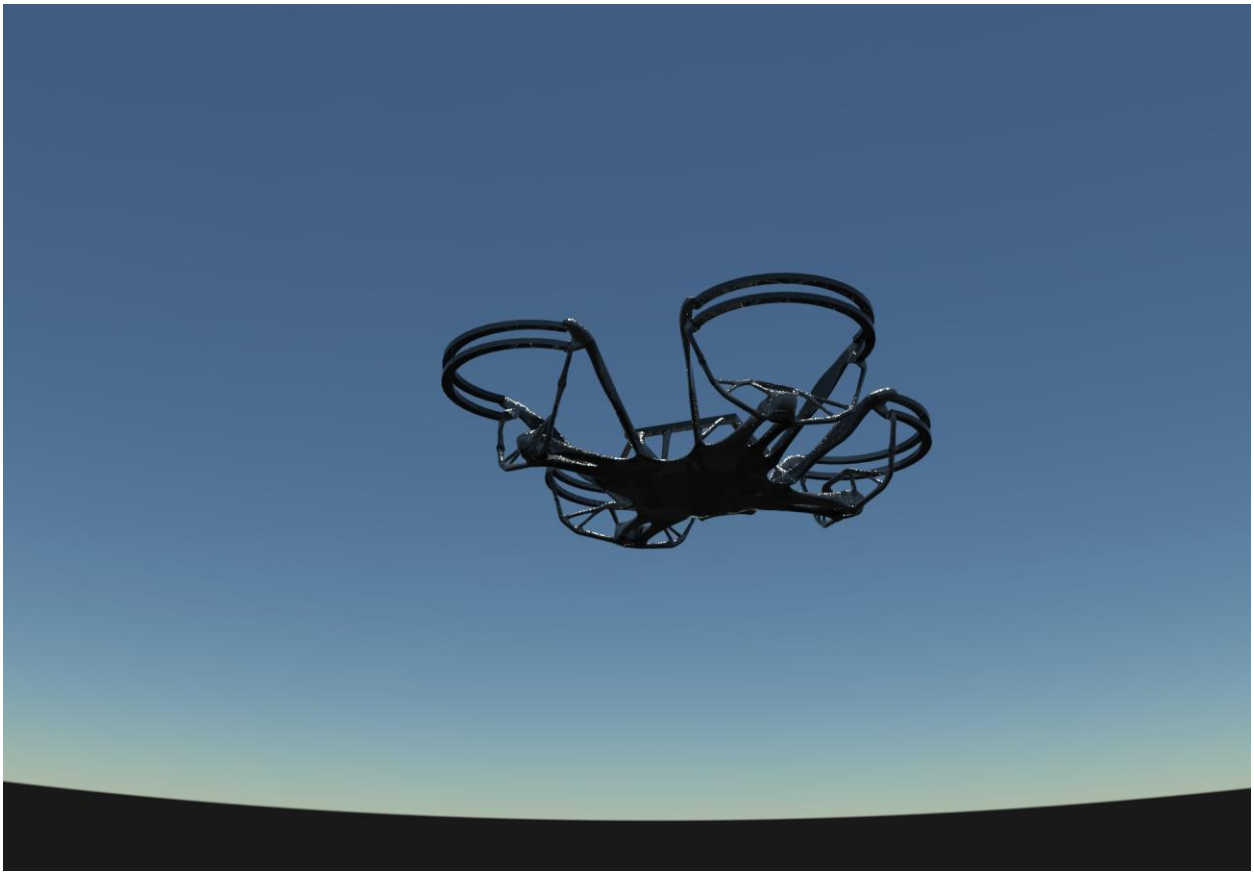
Renders











References :

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https://www.researchgate.net/figure/Hydrostick-Pro-metal-hydride-fuel-stick-specifications_tbl2_325614021
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Thankyou