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B. V. Bhoomaraddi Engineering & Technology College Campus, Hubballi - India

V SEMESTER

2020-2021

A Mini Project Report on

Reverse Engineering of RC HOVERCRAFT

Staff in-charge:
Prof Shridhar Mondal and Prof Shivanandgouda Patil

Submitted by:
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Yashovardhan Patil

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KLE Technological University, Hubballi - 580031

KLE TECHNOLOGICAL UNIVERSITY

SCHOOL OF MECHANICAL ENGINEERING

CERTIFICATE

This is to certify that this mini project report entitled **"Reverse Engineering of RC Hovercraft"** submitted by Prasanna Honkalse (01FE18BME091), Raghunandam Patil (01FE18BME094), Sanganagouda K K (01FE18BME116), Samrudh Deshmukh (01FE18BME114), Yashovardhan Patil (01FE18BME085) in partial fulfilment of the requirements for the degree of Bachelor of Engineering in Mechanical Engineering of the KLE Technological University, Hubballi, during the academic year 2020-21, is a bonafide record of work carried out under my guidance and supervision.

Guide **HOD**

Prof Shridhar Mondal B.B Kottursheta
Prof Shivanandgouda Patil

Name of the Examiner **Signature with date**

1.

2.

CONTENT

- **ABSTRACT**

A Hovercraft is relatively new means of transportation .The concept of the hovercraft was born when engineers developed an experimental design to reduce the drag force of a vessel. The revolutionary idea was to use a cushion of air between the boat and the water to reduce the drag force. The aim of this project is to dismantle the selected product (existing) by applying reverse engineering and take the dimensions of the parts with help of measuring instruments. Then creating 2d and 3d design of the various parts using CATIA 3D Experience (dassault systems) under sketcher work bench exercise and assembling the part drawing by applying innovative idea. The expected outcome for this project is to study reversing engineering on existing product and design methodology in CATIA.

• Introduction

A hovercraft is a vehicle that can float like a boat, can drive like a car but will traverse ditches and gullies. A hovercraft is also sometimes called an air cushion vehicle because it can hover, over or move across, land or water surfaces while being held off from the surfaces by cushion of air. It can travel over all types of surfaces including grass, mud, sand, quick sand, water and ice. Hovercrafts prefer a gentle terrain although they are capable of climbing slopes of up to 20%, depending on the surface characteristics.

Modern hovercrafts are used for many applications where people and equipment need to travel at high speeds over water and be able load and unload on land. For example, they are used as passenger or freight carriers, as recreational machines and even as warships.

• Process of Construction:

a. First Stage

At first the hull (Upper and Lower) and skirt were prepared because they are the major part of the hovercraft model. To produce the hull and skirt according to the design, a polystyrene cutter has been used to shape the polyurethane.

b. Second stage

In the second stage, the servo control the rudder was prepared, and the motor to produce the lift and thrust force was installed. For the part to produce lifting force lift duct is attached on the hull according to design dimension. For the motor, which produces thrust, it requires a cover to cover motor holder to trap the air produce, and force it on single hole.

Working Principle: Hovercraft use blowers to produce a large volume of air below the hull, or air cushion that is slightly above atmospheric pressure. The pressure difference between the higher pressure air below the hull and lower pressure ambient air above it produces lift, which causes the hull to float above the running surface. The hovercraft will ride on a cushion of air, reducing friction. Depending on the air supply, it is possible to lift several hundred pounds.

• Mechanical parts :

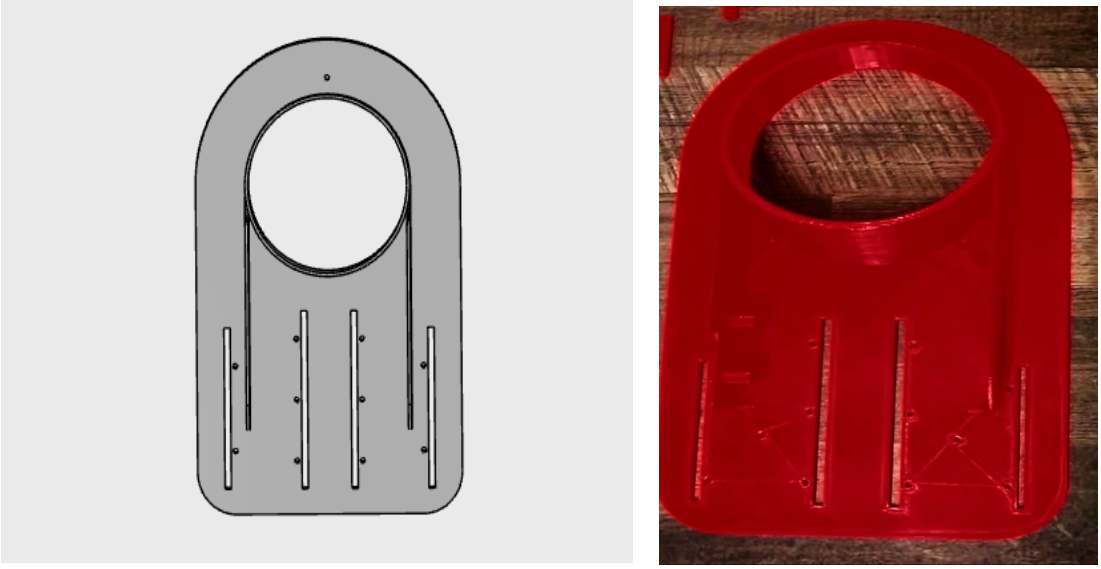
1) Brushless DC motors
2) 3s Lipo Battery
3) Propellers (BLADES)
4) Small screws
5) Spring steel for rudder
6) Heavy duty trash bag for skirt
7) Copper or brass tube for rudder screws
8) Upper Hull and Lower hull
9) Servo motor

• Material Specifications:

1) Hull and Skirt : Polyurethane
2) Propeller: Nylon

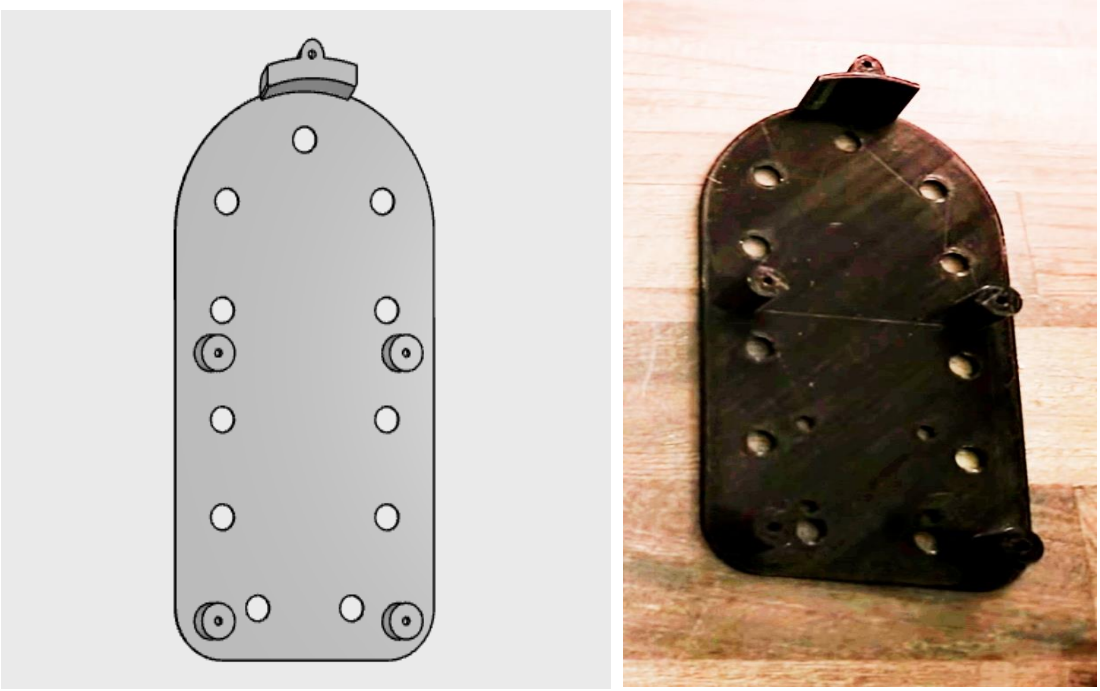
- # 3D Part Modelling:

1) UPPER HULL



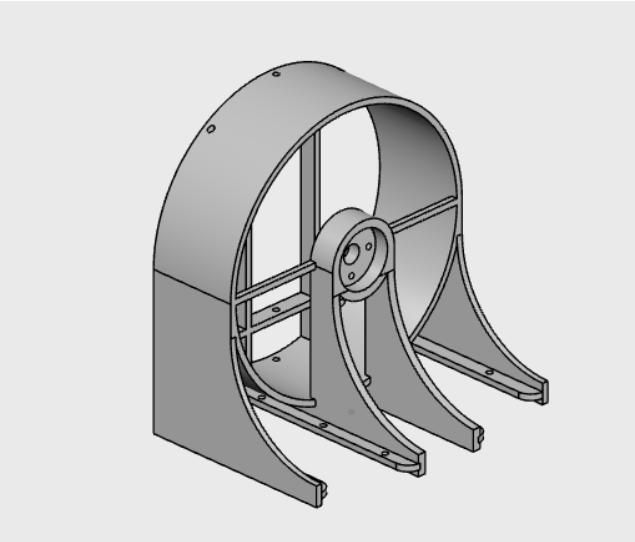
Modelled part versus Real image

2) LOWER HULL



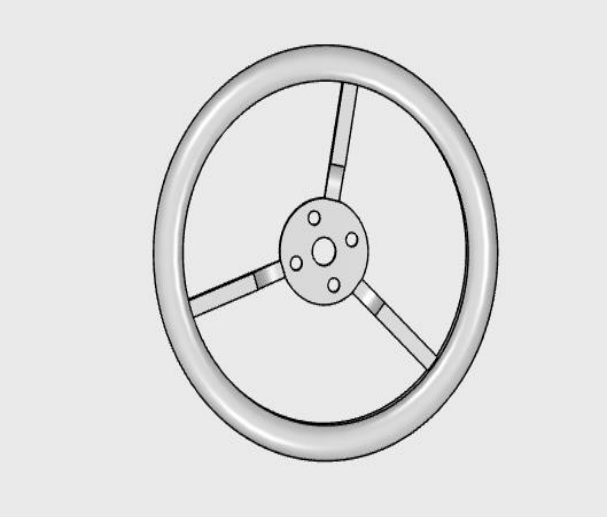
Modelled part versus Real image

3) THRUST DUCT



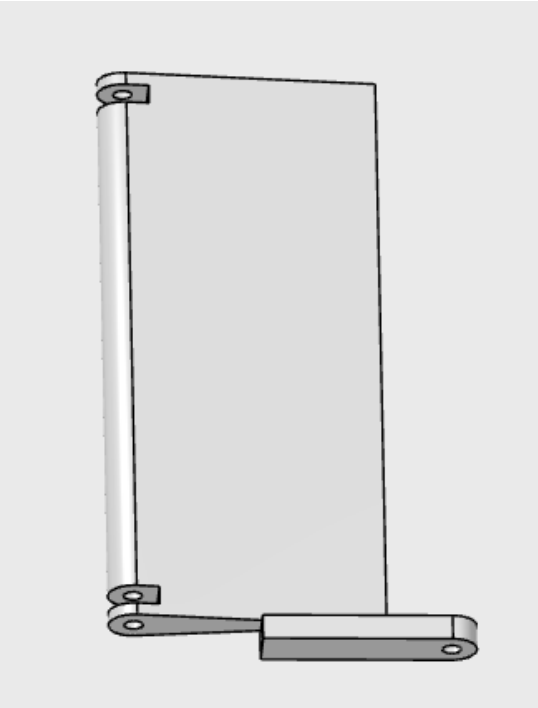
Modelled part versus Real image

4) LIFT DUCT



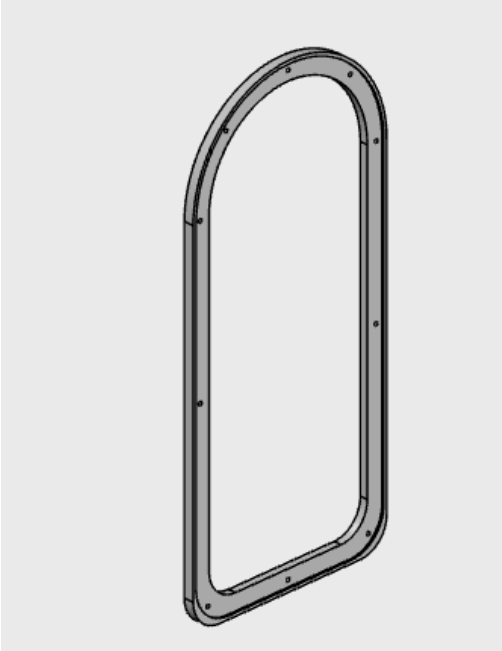
Modelled part versus Real image

5) RUDDER & PUSH ROD



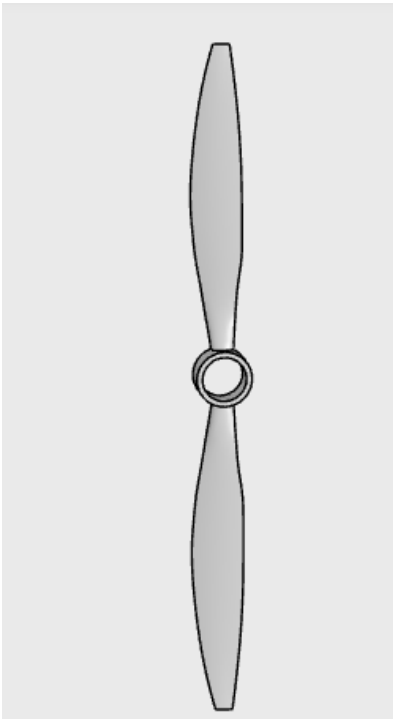
Modelled part versus Real image

6) SKIRT RING



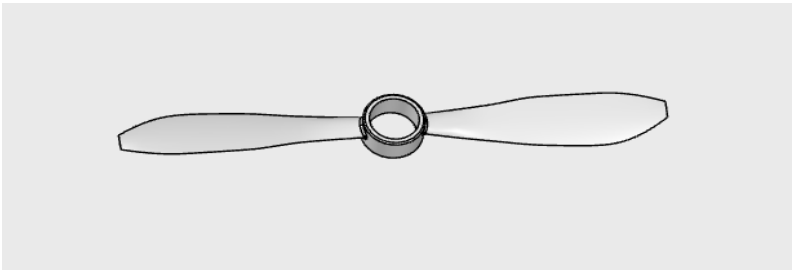
Modelled part versus Real image

7) BLADE (Used in thrust duct)



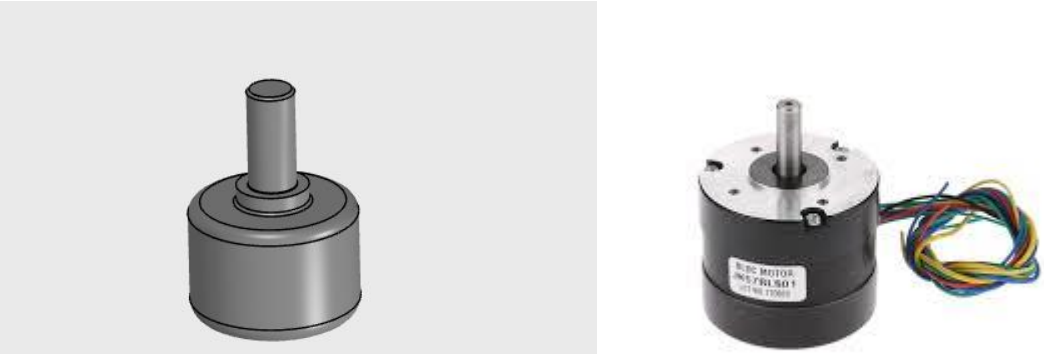
Modelled part versus Real image

8) BLADE (used in lift duct)



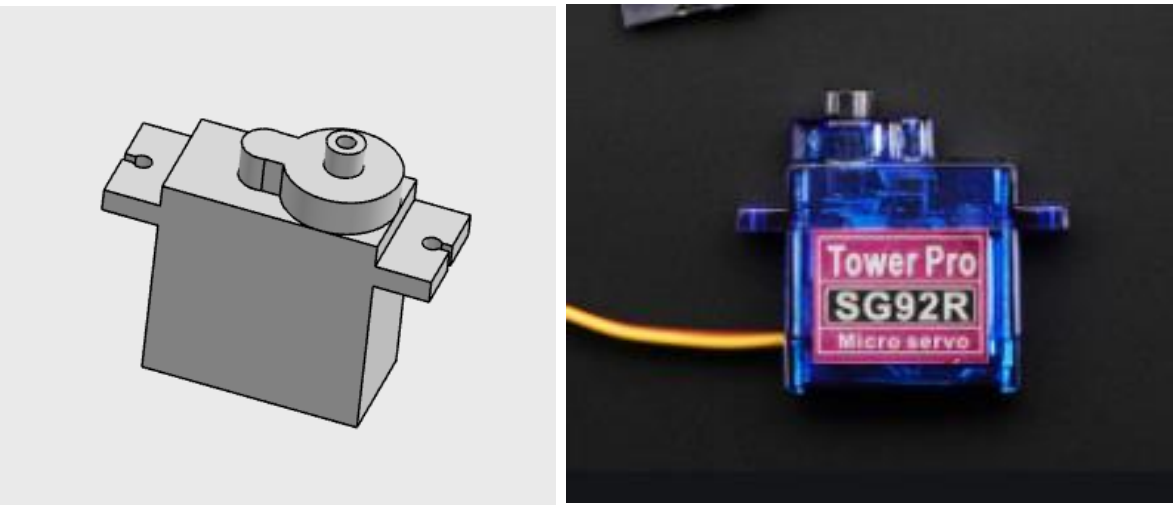
Modelled part versus Real image

9) BLDC MOTOR



Modelled part versus Real image

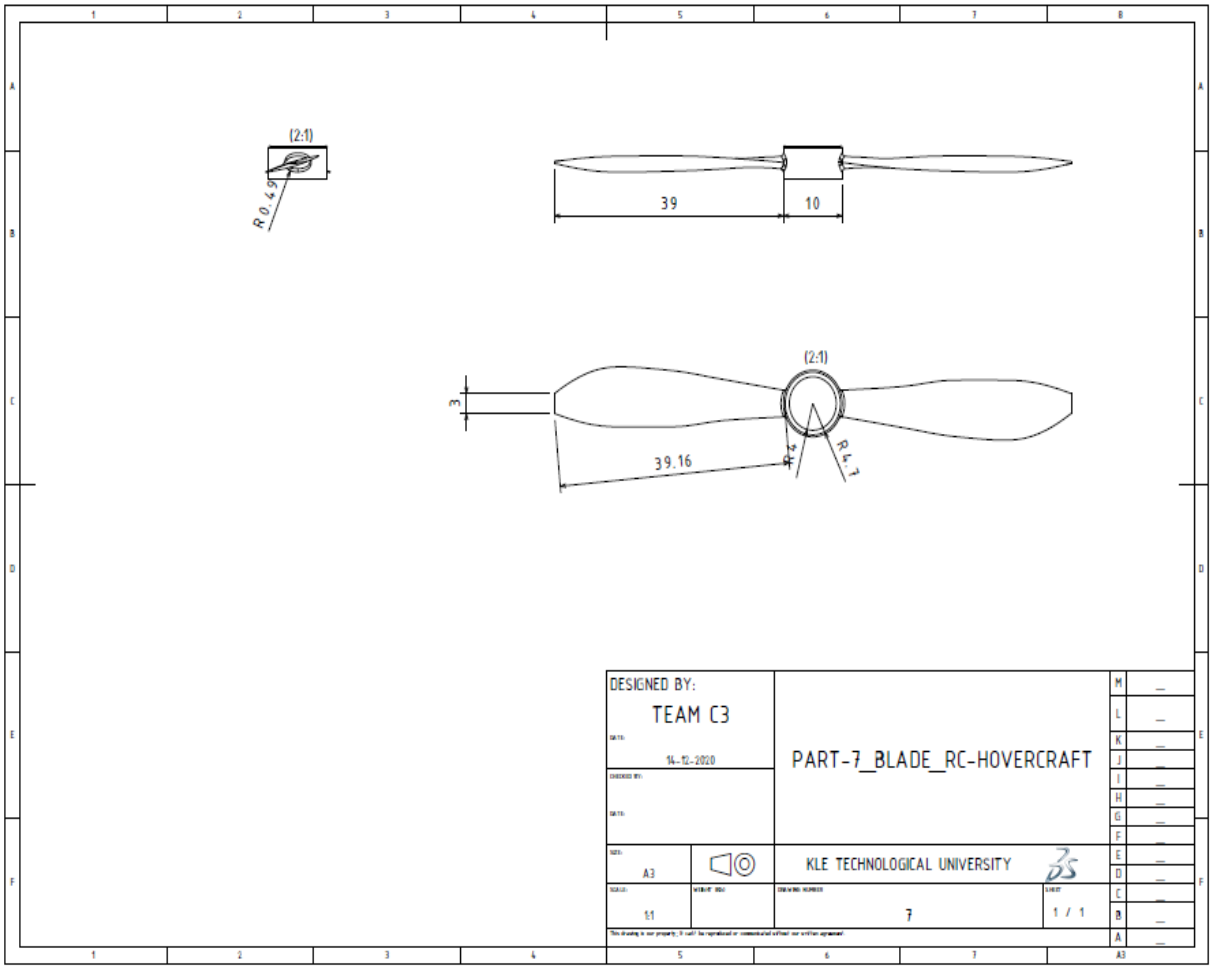
10) SERVO MOTOR



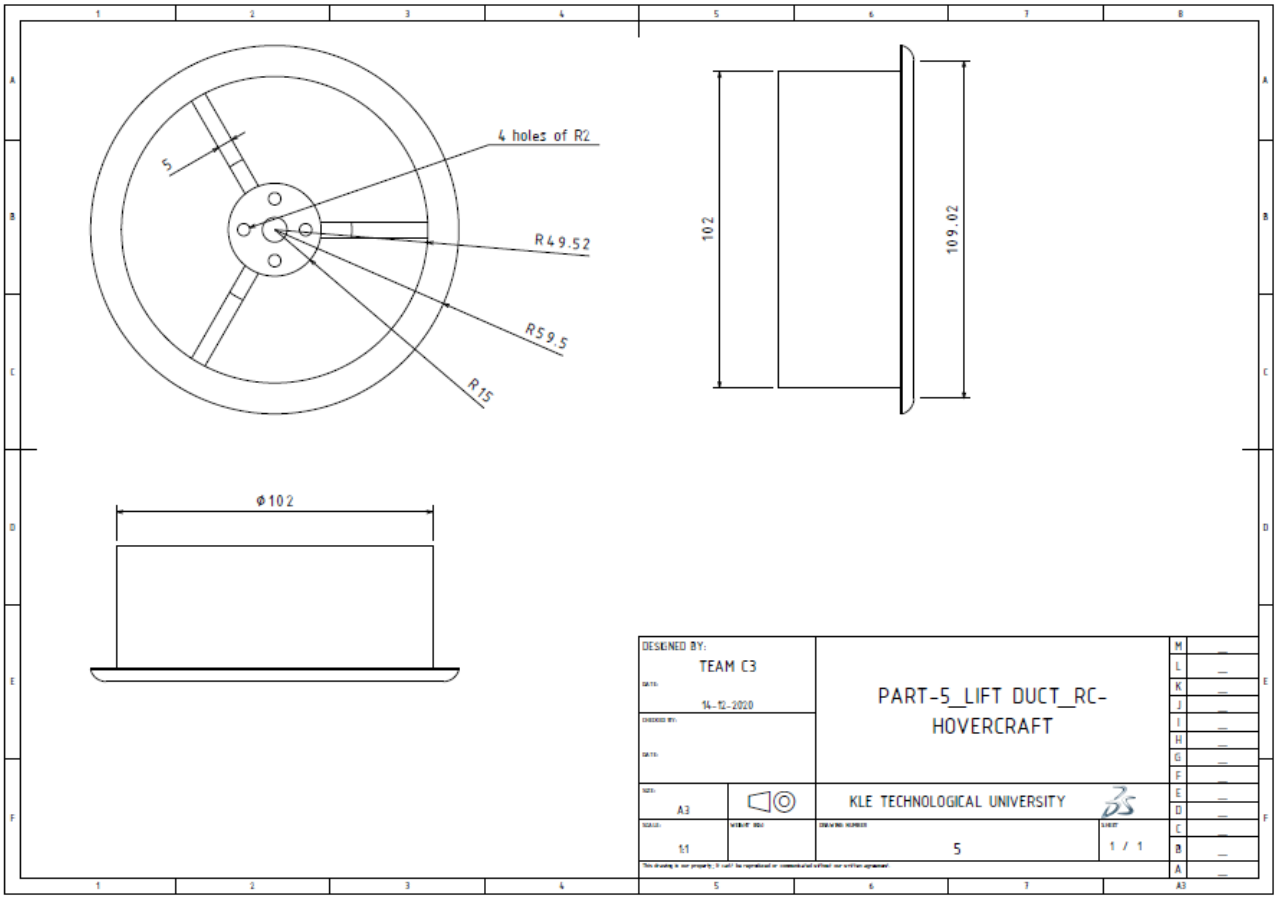
Modelled part versus Real image

- **2D Drafted Part Drawings :**

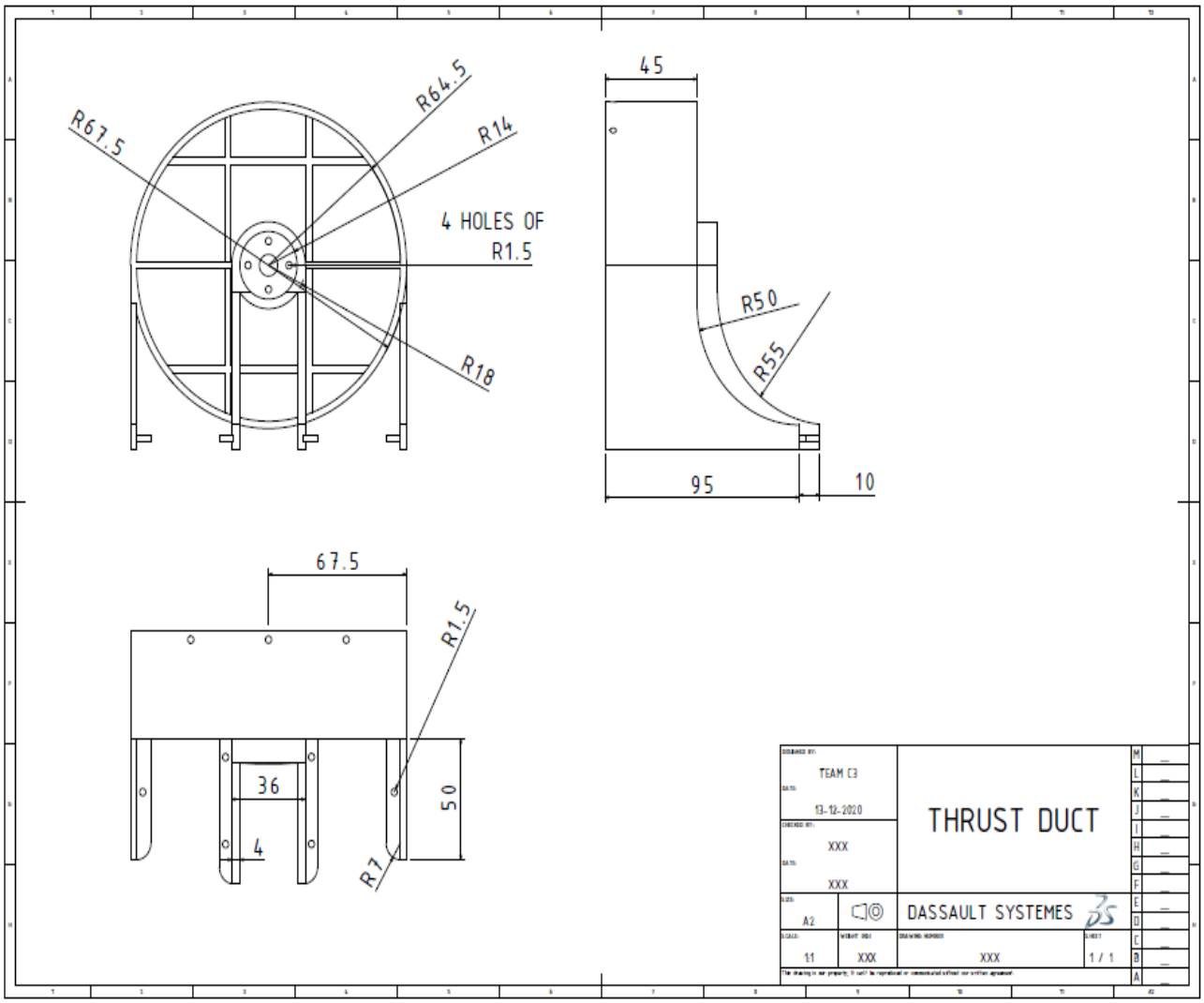
1) BLADE or Propeller (Thrust Duct)



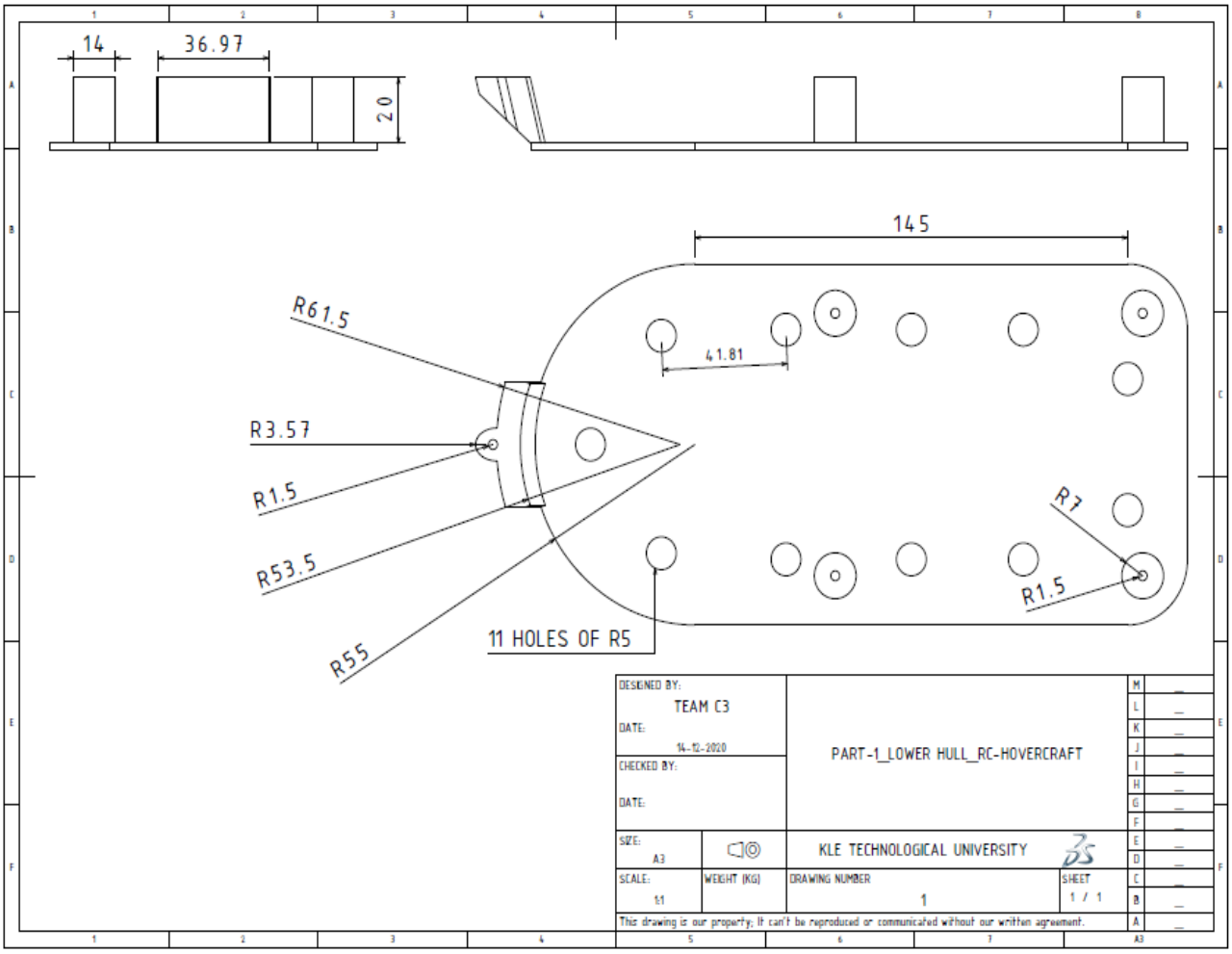
2) LIFT DUCT


4 holes of R2
5
R49.52
R59.5
R15
102
109.02
ϕ102
DESIGNED BY:
TEAM C3
14-12-2020
PART-5_LIFT DUCT_RC-HOVERCRAFT
KLE TECHNOLOGICAL UNIVERSITY
A3
1:1
5
1 / 1

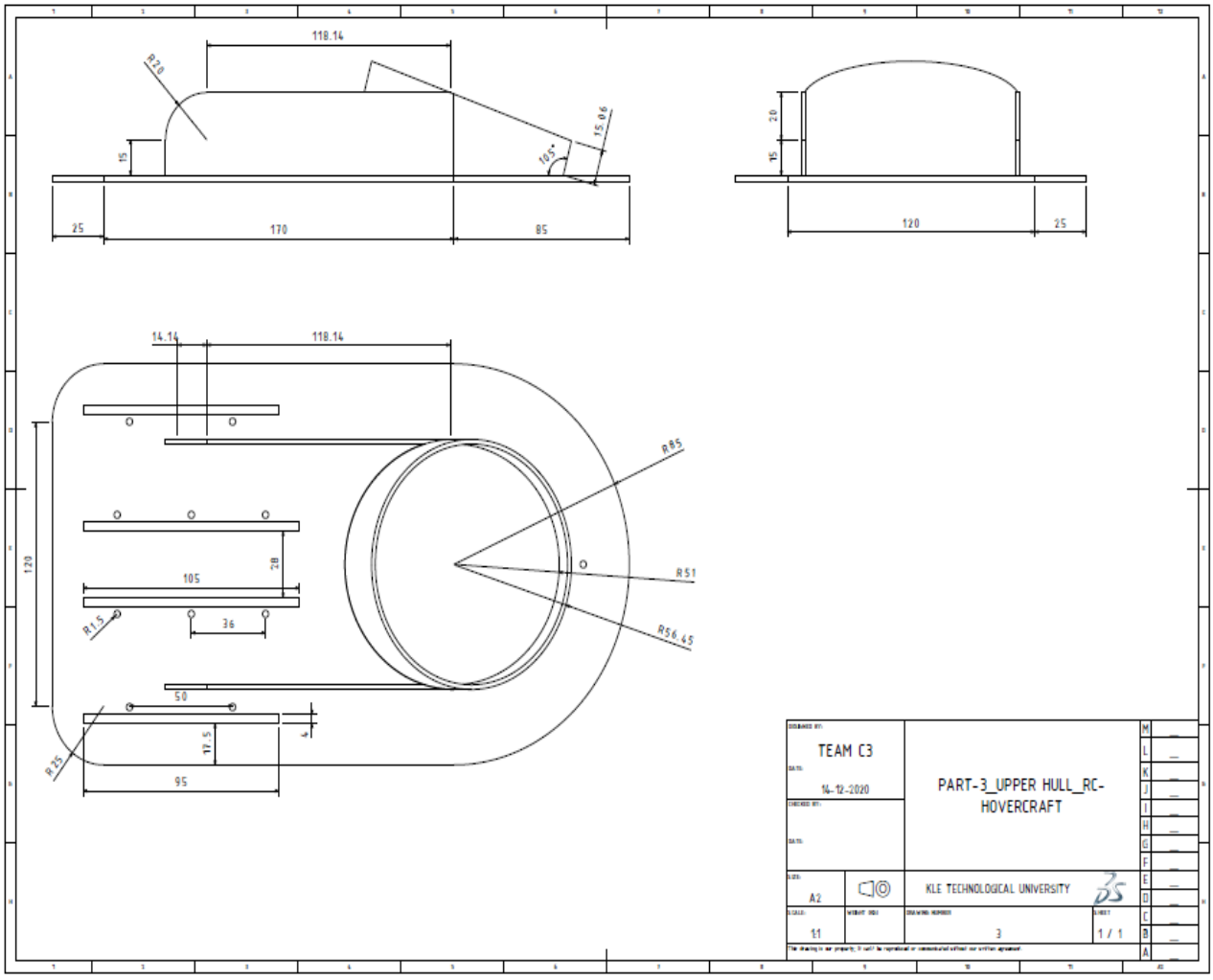
3) THRUST DUCT



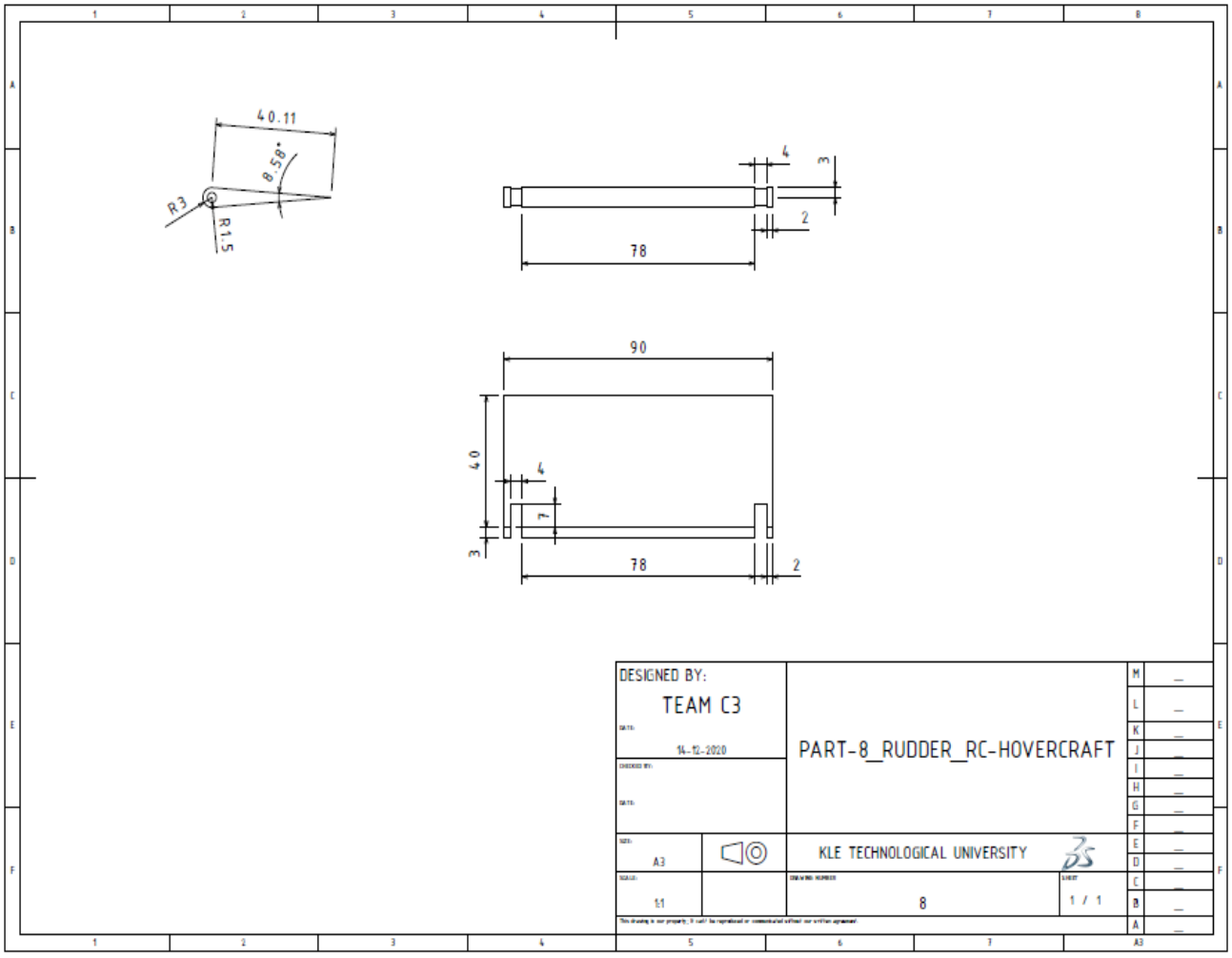
4) LOWER HULL


14
36.97
20
145
41.81
R61.5
R3.57
R1.5
R53.5
R55
R7
R1.5
11 HOLES OF R5
DESIGNED BY:
TEAM C3
DATE:
14-12-2020
CHECKED BY:
DATE:
PART-1_LOWER HULL_RC-HOVERCRAFT
SIZE:
A3
KLE TECHNOLOGICAL UNIVERSITY
SCALE:
1:1
WEIGHT (KG)
DRAWING NUMBER
1
SHEET
1 / 1
This drawing is our property. It can't be reproduced or communicated without our written agreement.

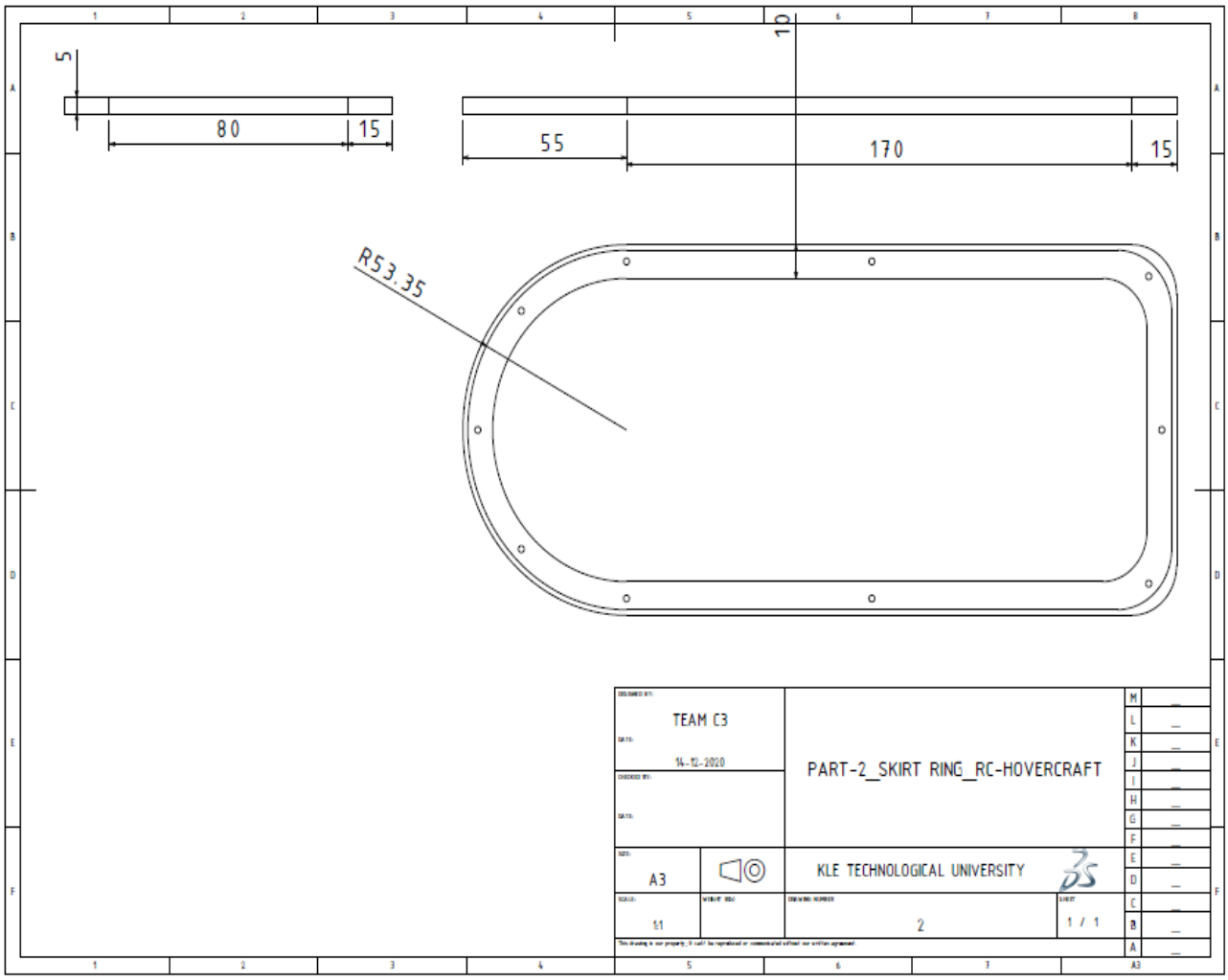
5) UPPER HULL


118.14
R20
15
15.06
10.5°
25
170
85
20
15
120
25
14.14
118.14
R85
R51
R56.45
120
105
28
R15
36
50
17.5
4
R25
95
TEAM C3
14-12-2020
PART-3_UPPER HULL_RC-HOVERCRAFT
A2
KLE TECHNOLOGICAL UNIVERSITY
11
3
1 / 1

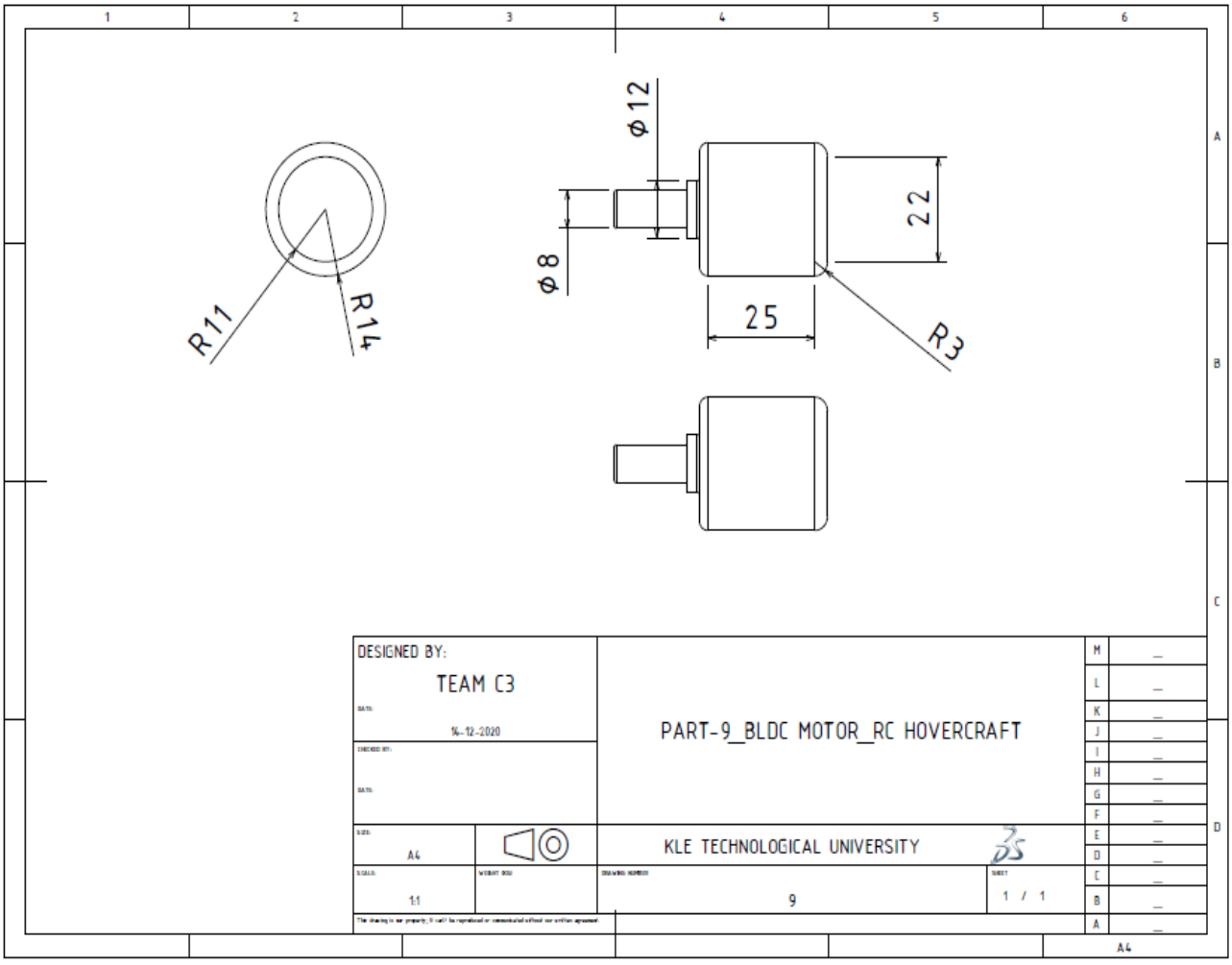
6) RUDDERS & PUSH ROD



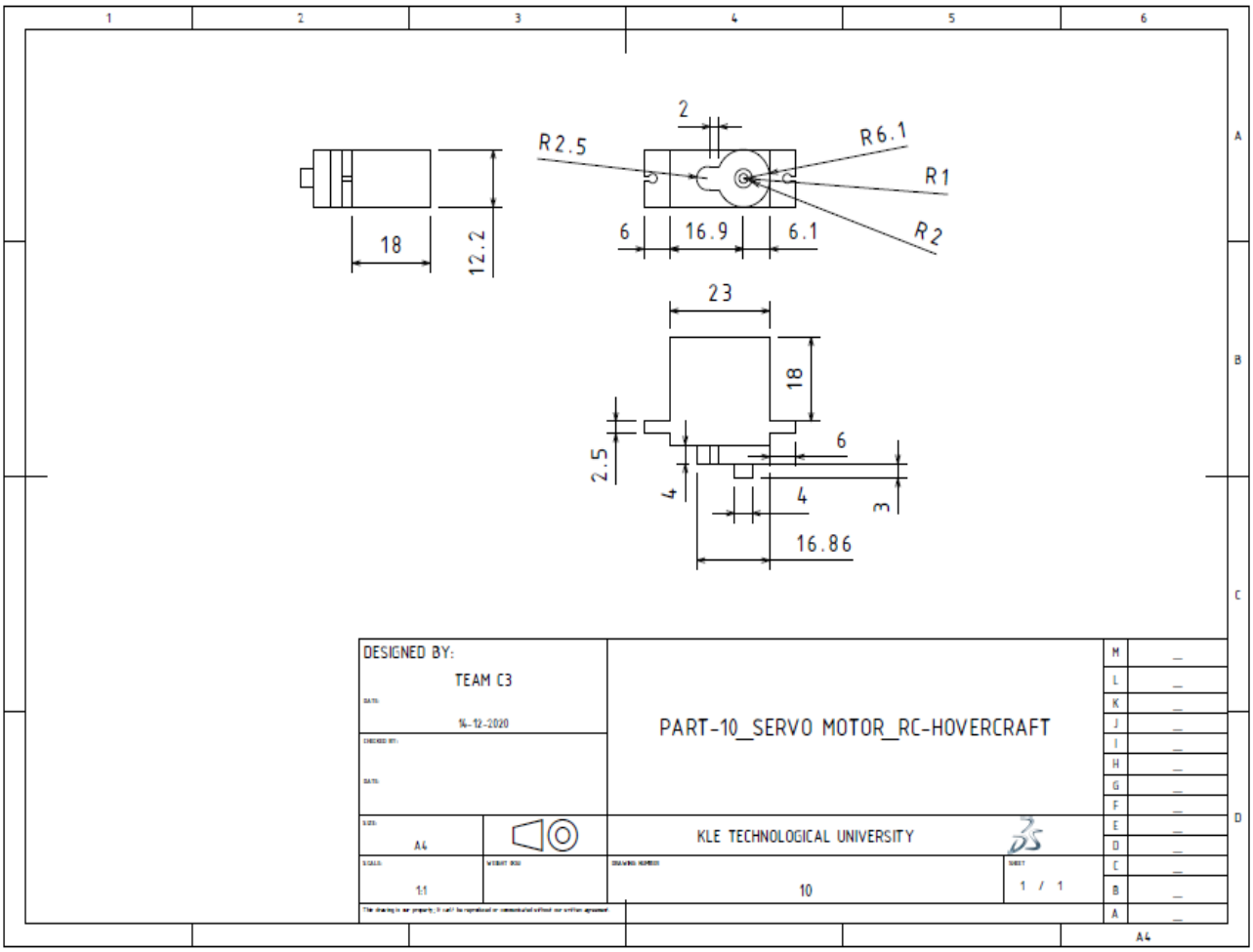
7) SKIRT RING


5
80
15
10
55
170
15
R53.35
TEAM C3
14-12-2020
PART-2_SKIRT RING_RC-HOVERCRAFT
A3
KLE TECHNOLOGICAL UNIVERSITY
1:1
2
1 / 1

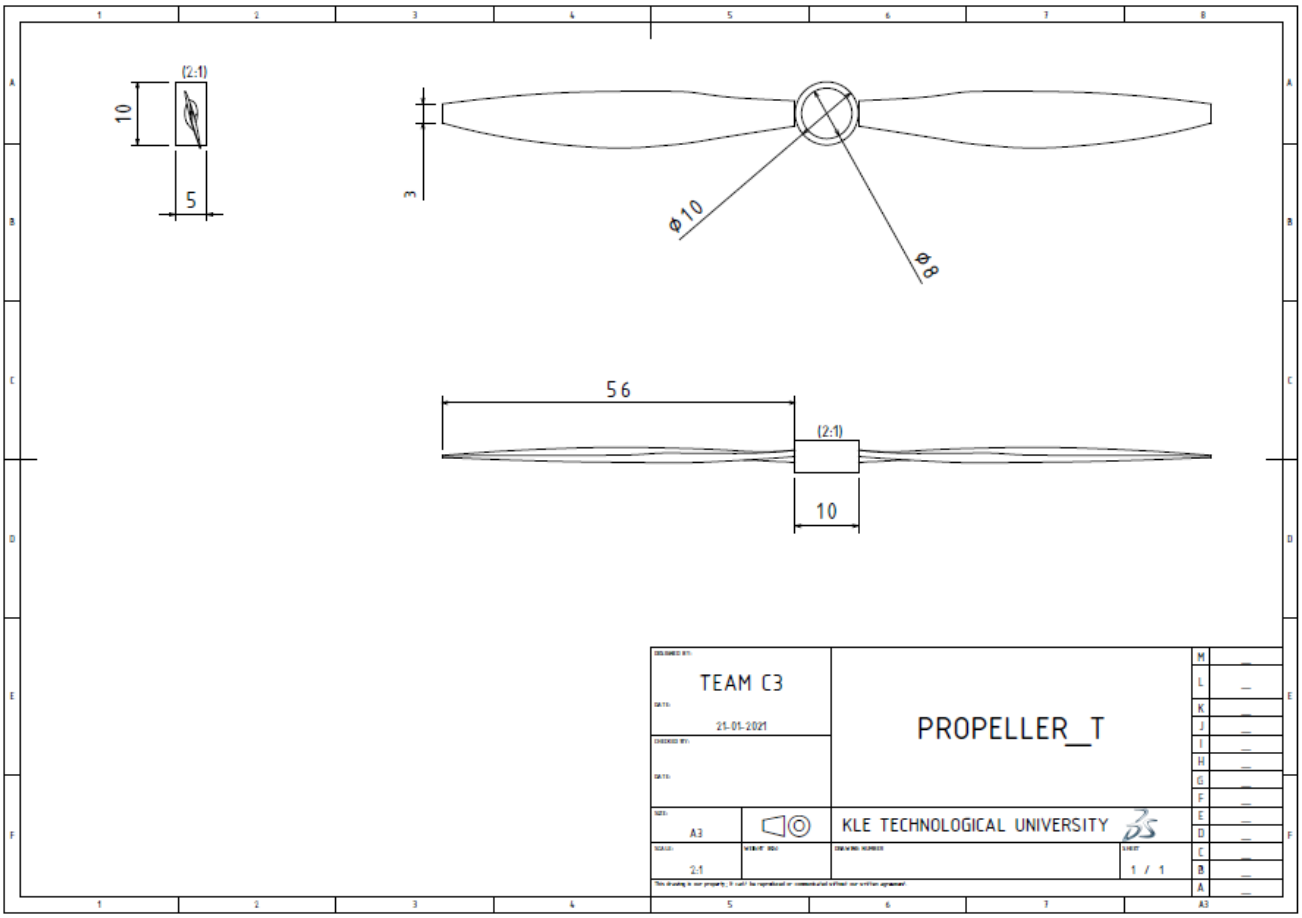
8) BLDC MOTOR


ϕ12
22
ϕ8
25
R3
R11
R14
DESIGNED BY:
TEAM C3
14-12-2020
PART-9_BLDC MOTOR_RC HOVERCRAFT
A4
KLE TECHNOLOGICAL UNIVERSITY
1:1
9
1 / 1

9) SERVO MOTOR

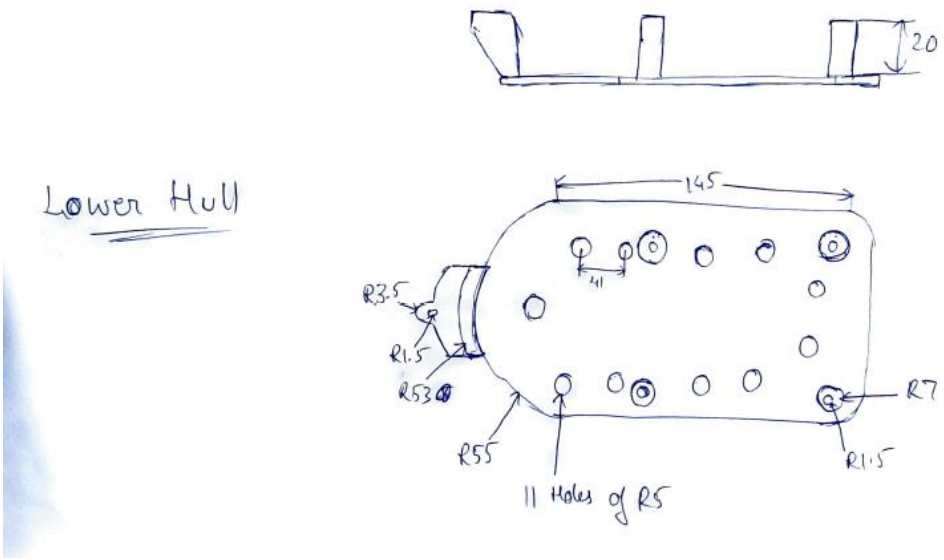


10) PROPELLER (used in Thrust Duct)

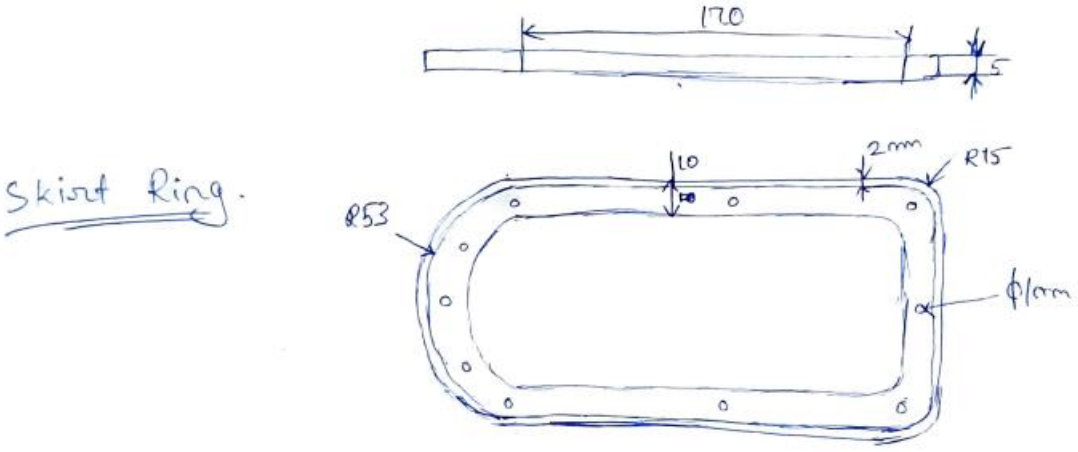


- # 2D HAND DRAWING:

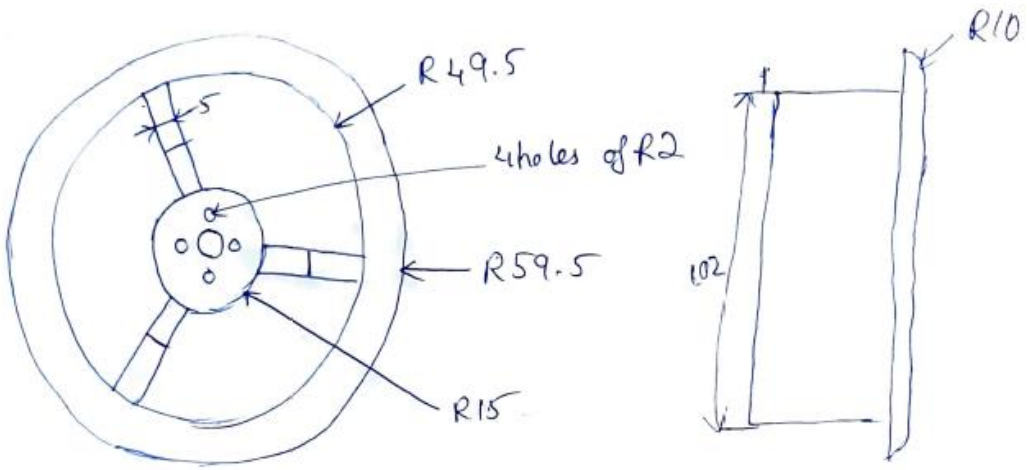
1) LOWER HULL



2) SKIRT RING

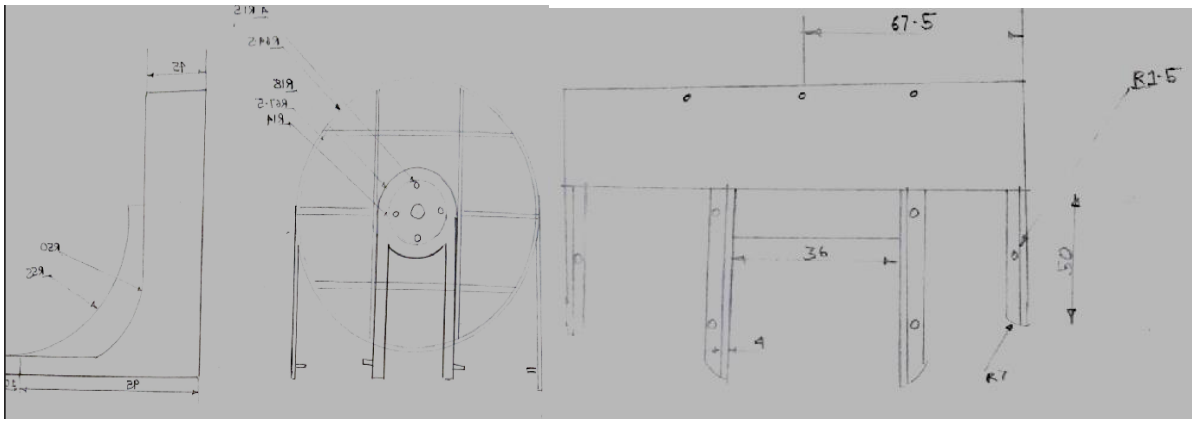


3) LIFT DUCT

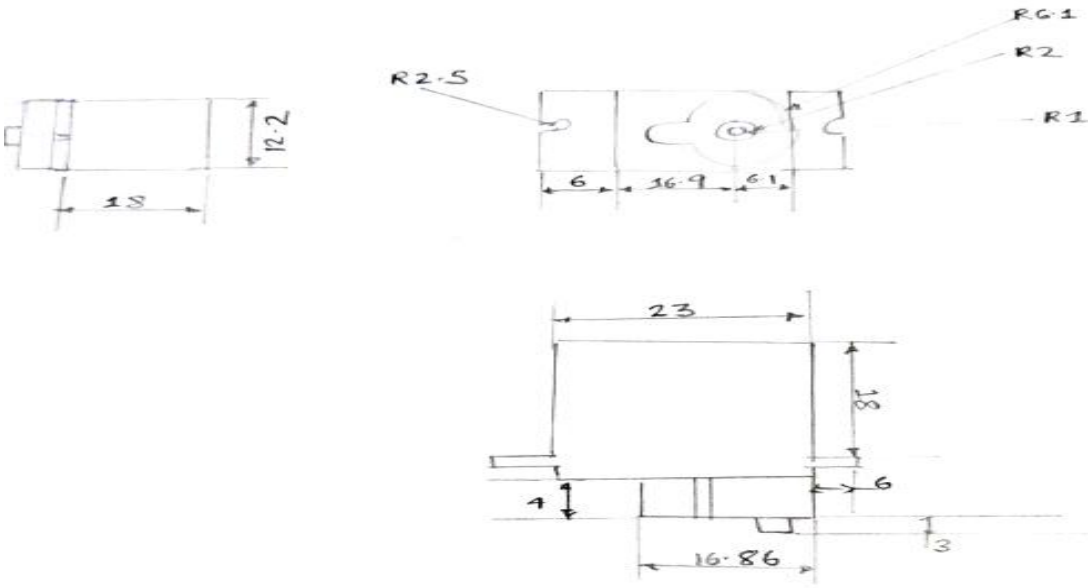


Lift Duct

4) THRUST DUCT

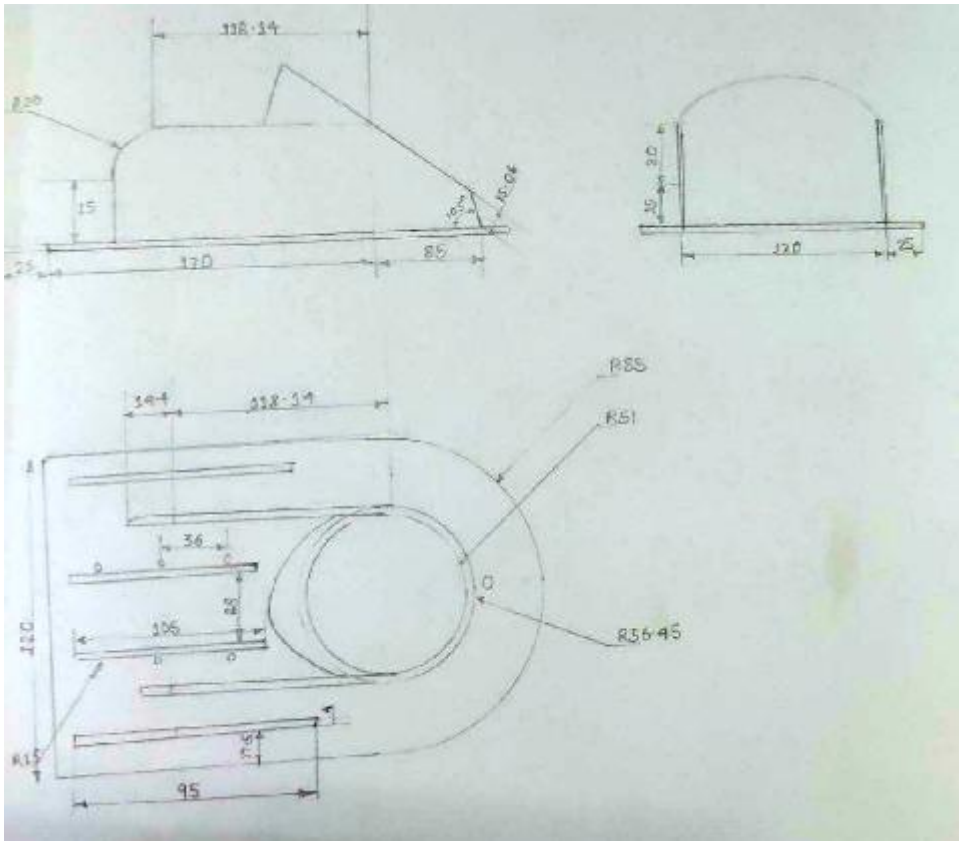


5) SERVO MOTOR

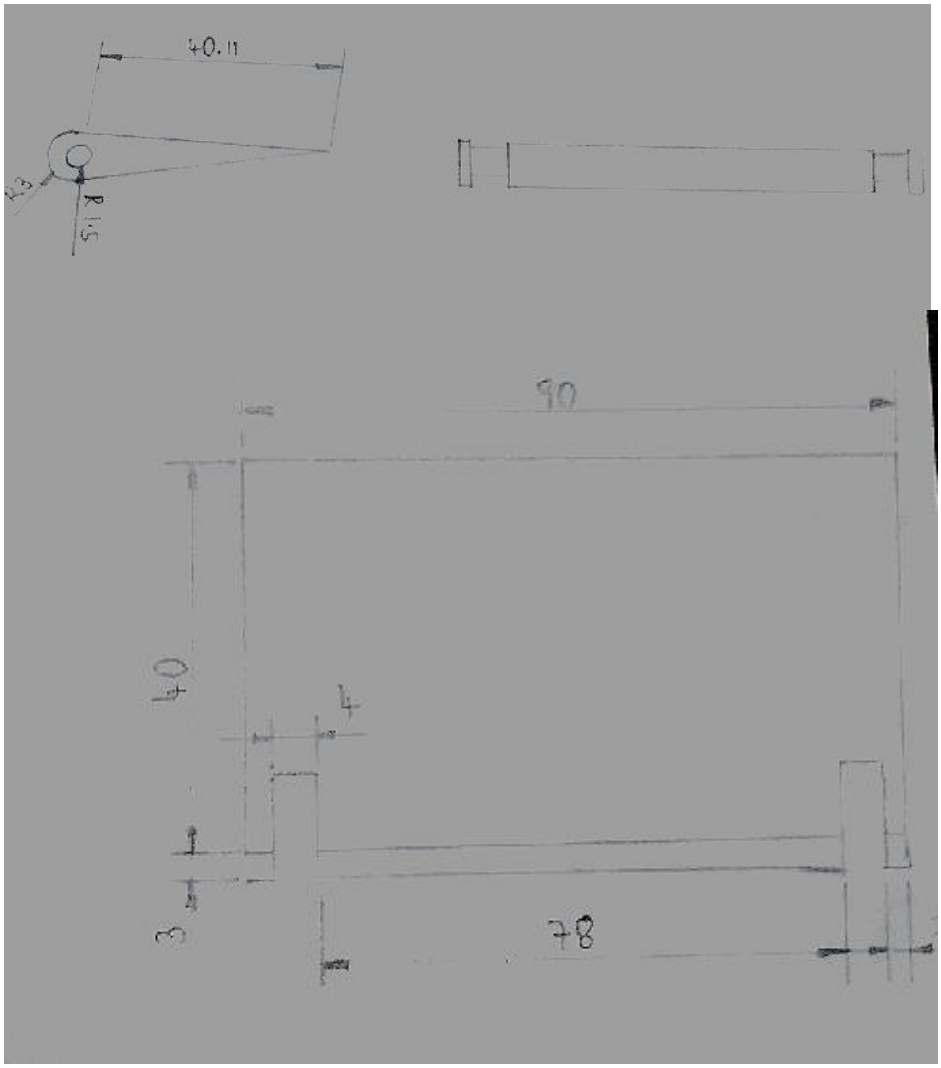


SERVO MOTOR

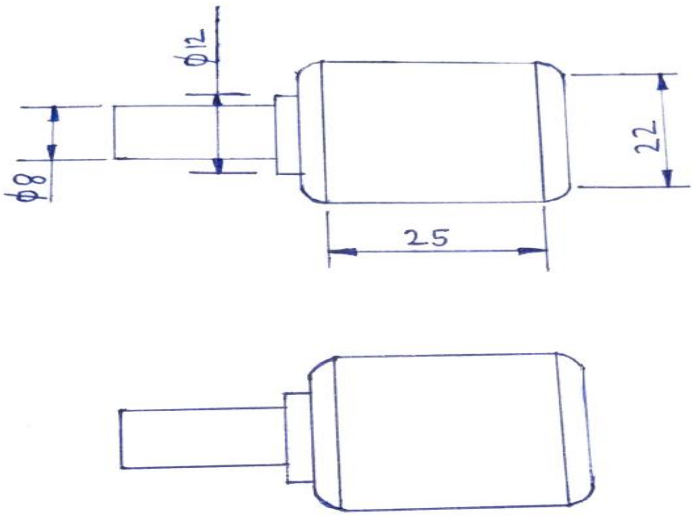
6) UPPER HULL



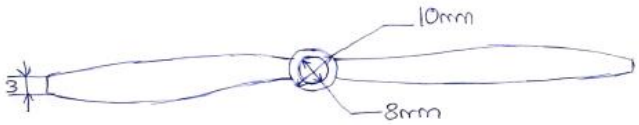
7) RUDDER & PUSH ROD



8) BLDC MOTOR

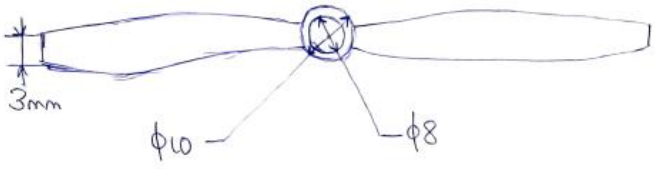


9) PROPELLER (Used in lift duct)

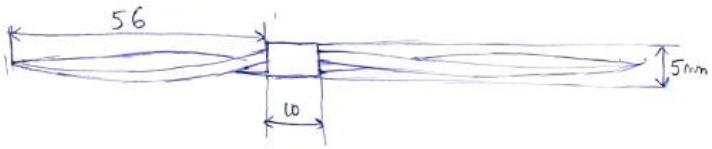


⇨ Lift duct's Propeller

10) PROPELLER(Used in Thrust duct)



⇨ Thrust Propeller

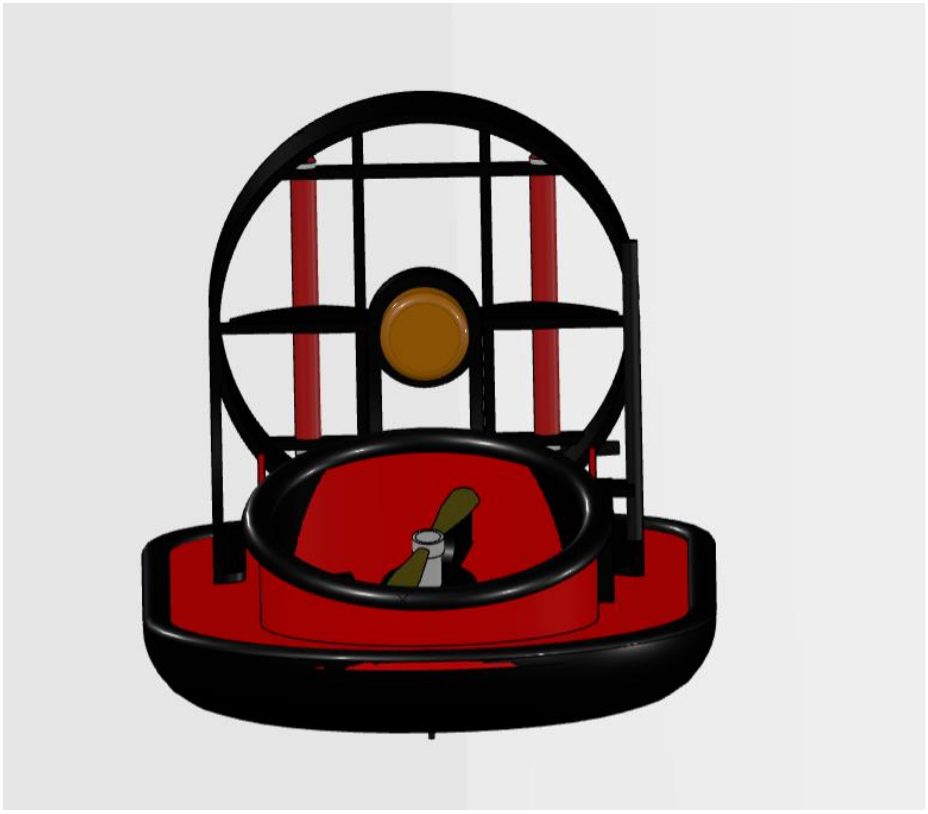


- **Bill of Materials**

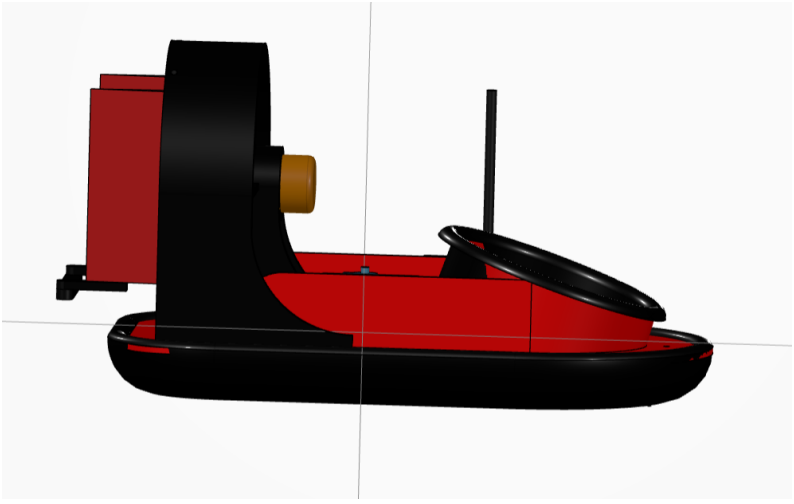
SL No	Quantity	Title	Material / Power Capacity (kv)/
1	1	Lower Hull	Polyurethane
2	1	Upper Hull	Polyurethane
3	1	Thrust Duct	Polyurethane
4	1	Lift Duct	Polyurethane
5	1	Skirt ring	Polyurethane
6	1	Skirt	Nylon
7	2	Propellers	Nylon
8	8	Motor mounting Screws	Carbon steel
9	4	Rudder mounting Screws	Carbon steel
10	2	Rudders	Polyurethane
11	2	Push rods	Polyurethane
12	2	BLDC motor	2205-2300
13	1	Servo motor	3-6
14	1	Lipo battery	1500mAh
15	1	Spring steel wire	Steel

- **Assembly of the RC Hovercraft Model**

  - **Front View**



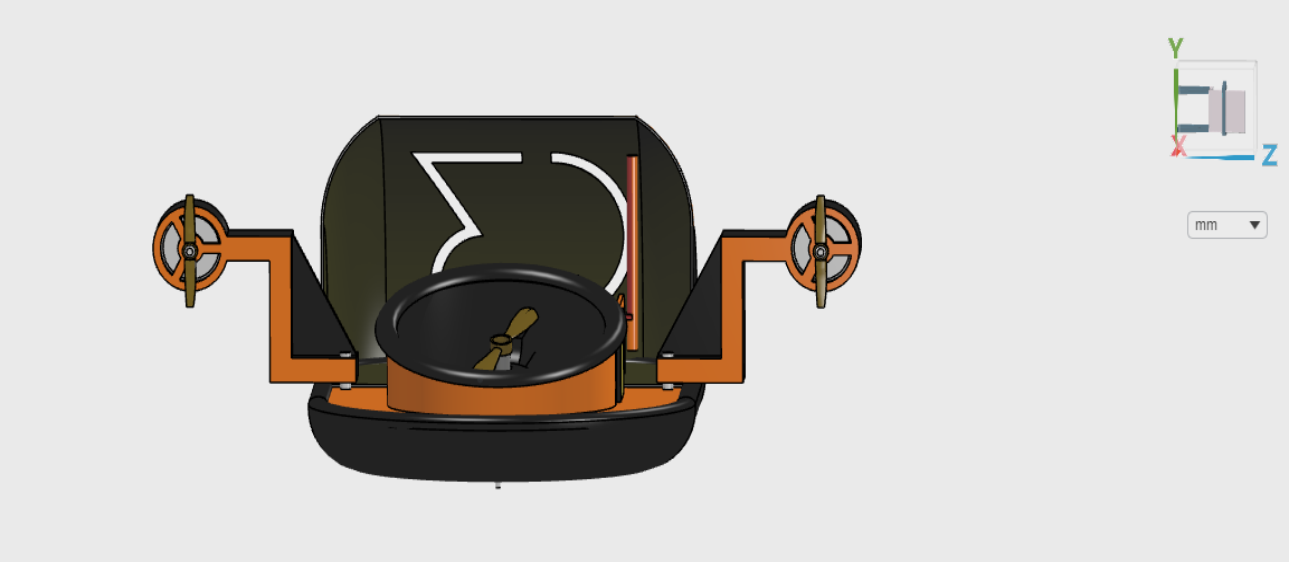
  - **Side View**



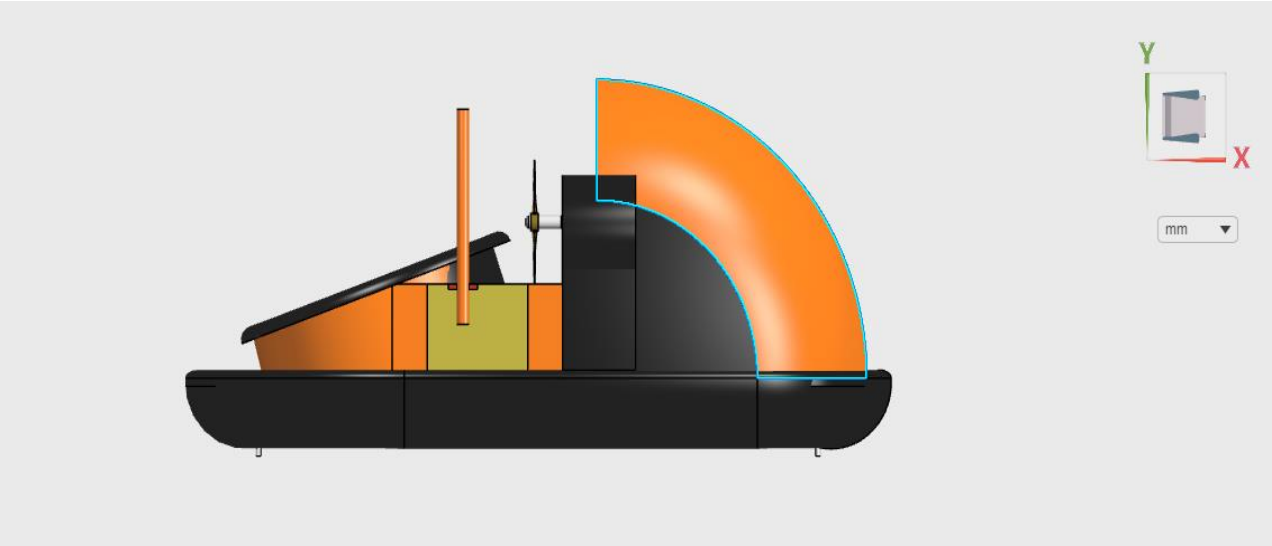
Model of RC Hovercraft

- **Assembly of Modified RC Hovercraft Model**

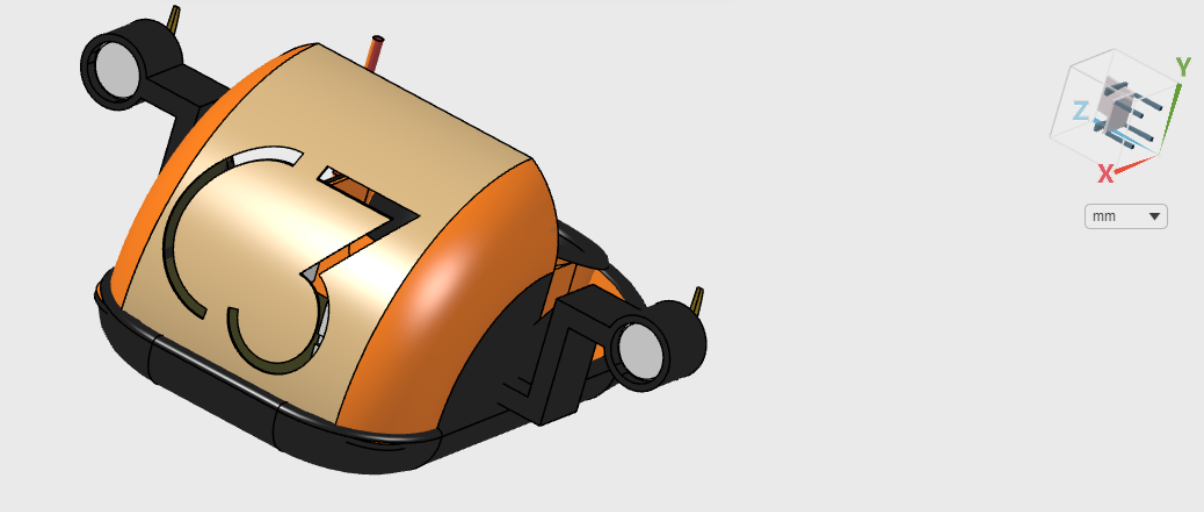
In the original RC hover craft which we have taken up as our project, it basically uses propeller in Lift duct to hover on the surface of the terrain. A propeller in the thrust duct is used to push the hovercraft forward and changes its direction with the help of rudders. These rudders are controlled with the help of servo motor. The drawbacks we mainly get is by the placement of thrust duct in the original version. The main drawback will be its manuverity in the terrain.
However, we came up with a better improved version in which the thrust duct is replaced with 2 propellers (as in image) on the either side of the hovercraft, placed at centre position. The advantages include improved manuverity, space available to place higher capacity batteries and other equipment (like camera),lesser moving parts (which means reduced wear and tear) and reduction in manufacturing cost (because complex thrust duct replaced with simple motor holders) which can increase the profit margin when mass manufactured. In addition to the above advantages, we can get the hovercraft to rotate 360 degrees in its resting position by various combination of the rotation of propellers which adds up be the key feature in our RC hovercraft.



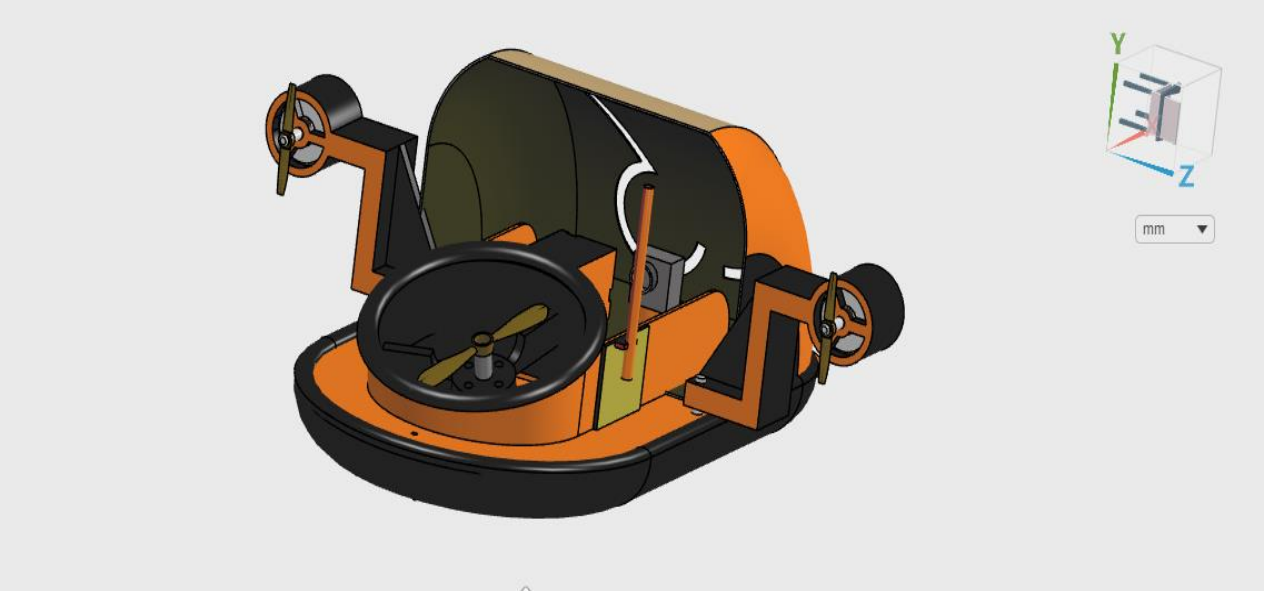
Front view of Modified of RC Hovercraft



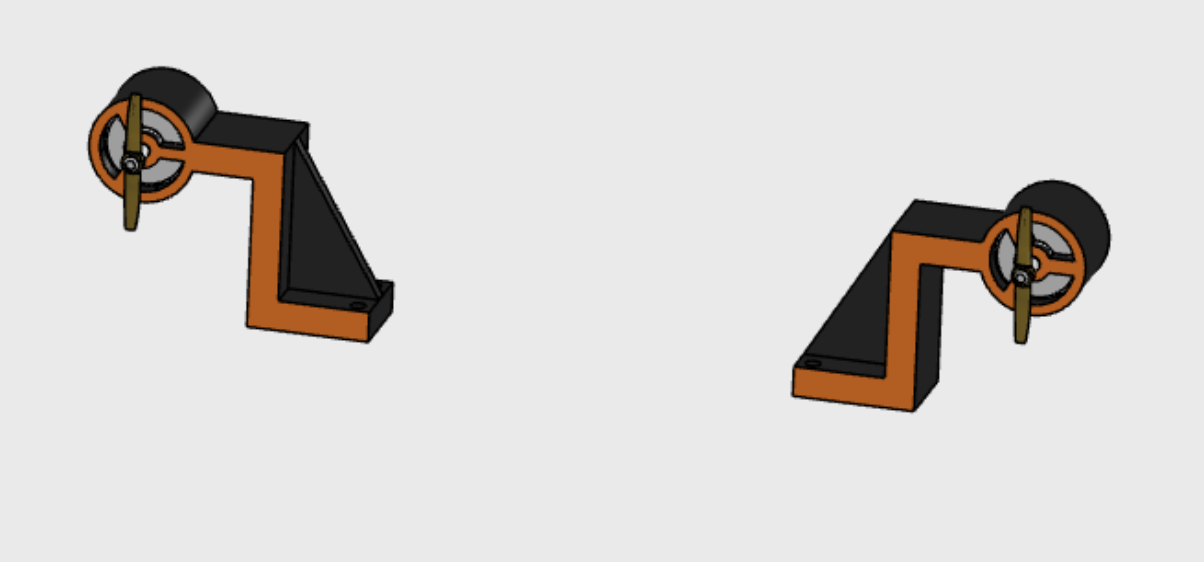
Side view of Modified RC Hovercraft



Back view of RC Hovercraft



Modified RC Hovercraft



Modified Model (Motor holder)

- **CONCLUSION**

The mini project course was introduce to us to develop knowledge in reverse engineering. Project involves designing of models using "3D Experience CATIA" by Dassault systems, it is developed by French software corporation .It is one of the largest software companies that develops software for 3D product design, simulation and manufacturing. The best thing of using CATIA is that it is Cloud based and data driven platform and has some significant changes to their 3D modelling interface layout as well.

This project is presented by a team of 5, initially we selected a product (RC hovercraft) according to given constraint, as mini project is based on reverse engineering we dismantled the product and measured each & every parts of the product .After taking dimensions we started preparing the 2D, 3D sketches using CATIA software .In this software we got to explore in designing 2D drawing, Mechanical Part model, Generative shape design, Mechanical assembly and Drafting. This software helped us to design the tricky parts of the product. The tools available in this software was quite comfortable while designing the product. Even it made us easy while drafting the part model and complex part design.

As it is Product life cycle Management software in which it manages data during product development. This improves productivity and workflow and it also tracks the changes made to the product during development. This software is mainly used in automotive, aerospace and aeronautics industries which requires high accuracy and complex parts to design, which helped us in maintaining the accuracy in our product design. After completing design BOM (Bill of material) was prepared.

In the end we just want to convey that it was great experience using catia software which helped our mini project to complete our product design successfully. Not only in the field of design , it has helped us in knowing detailed parts of a product and its working.