DESIGN PROJECT

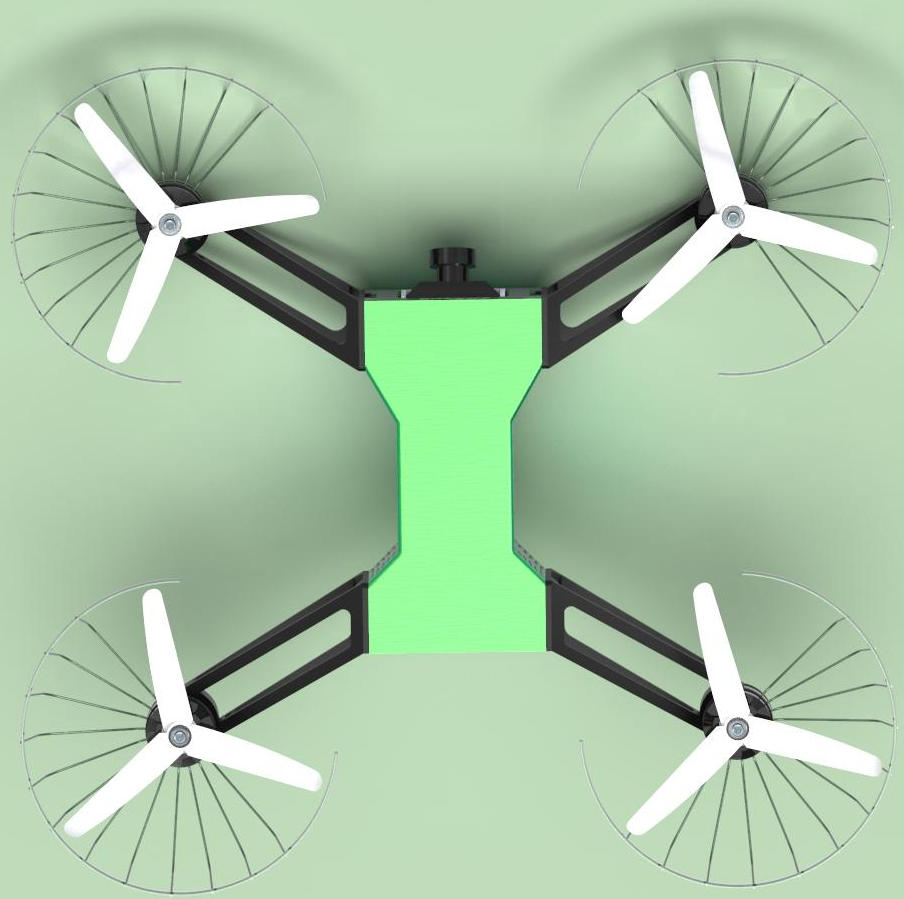
SECOND EVALUATION

JONATHAN REGGIE EBENEZER

S5 ME

ROLL NO: 38

IAM3D DRONE



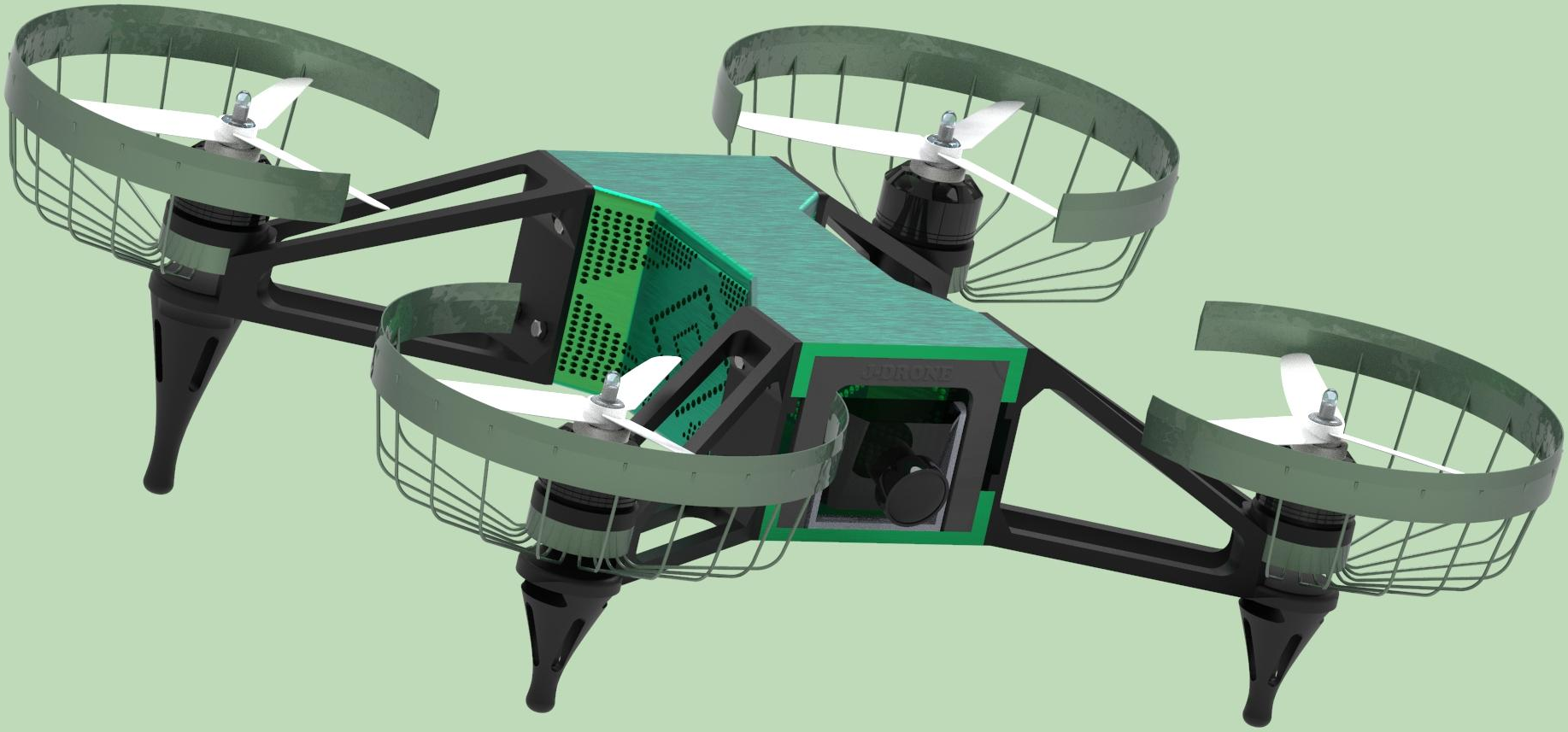
CONTENT

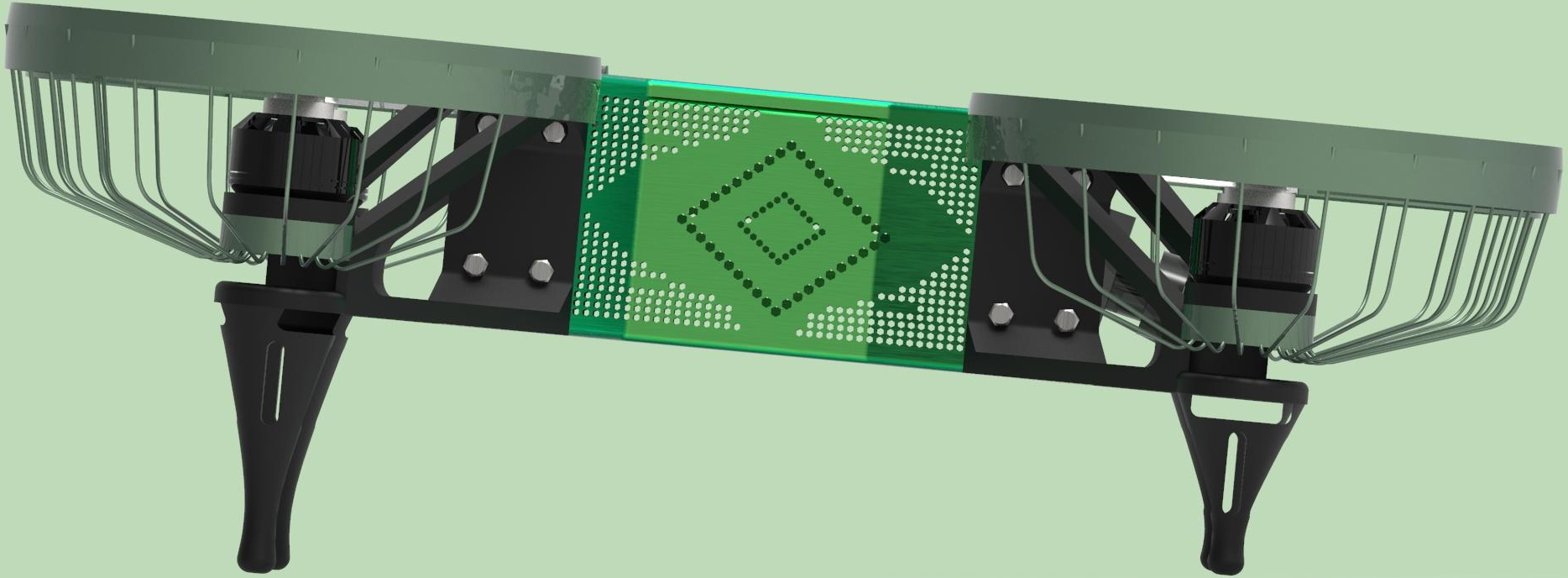
- INTRODUCTION
- RENDERING
- DESIGNING
- ANALYSIS
- SLICING

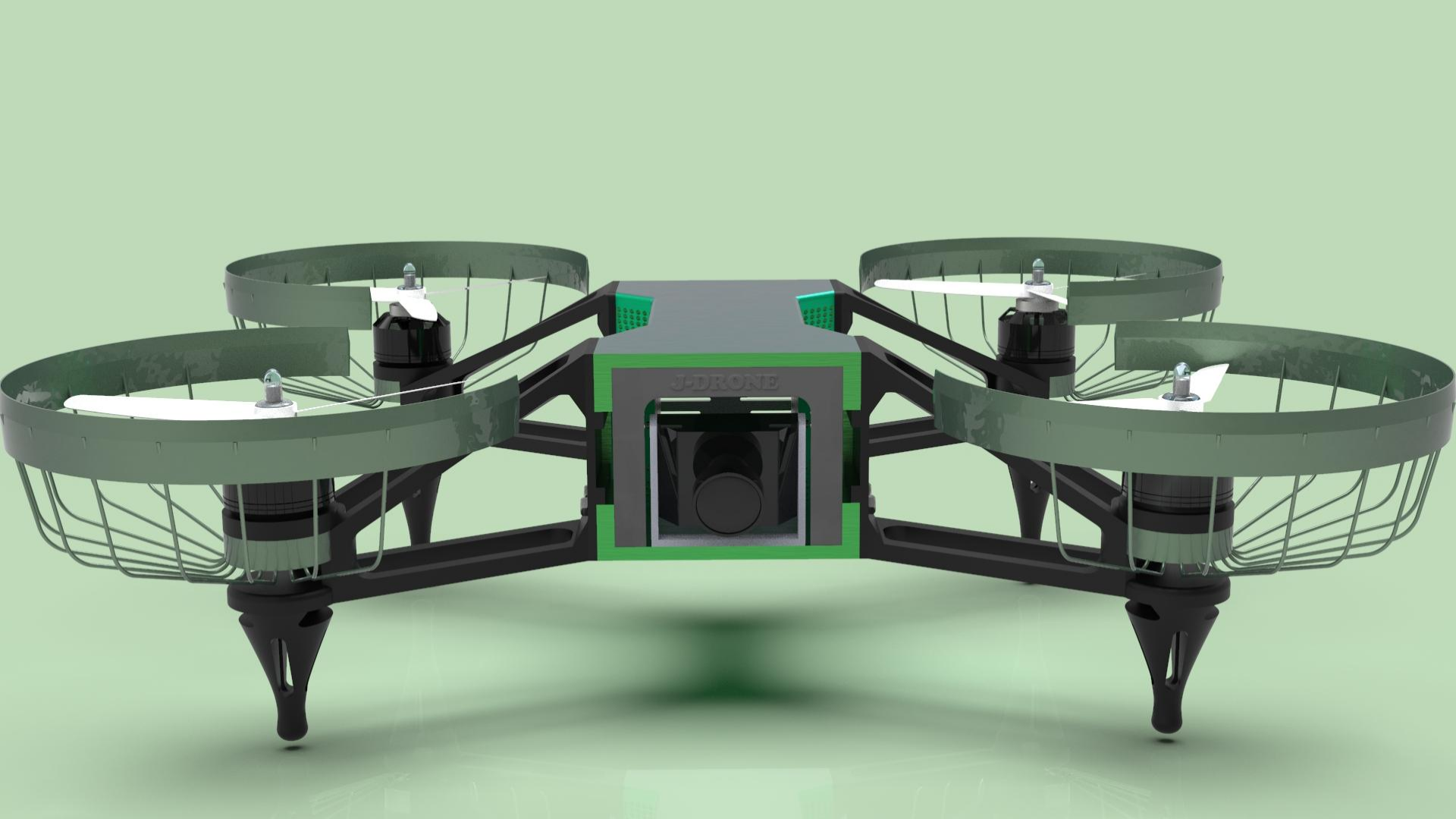
INTRODUCTION

IN PREPARATION FOR THE UPCOMING **ASME** IAM3D COMPETITION, I DECIDED TO MAKE USE OF THIS OPPORTUNITY TO DESIGN A DRONE WHICH SATISFIES THE CONDITIONS GIVEN IN THE IAM3D RULE BOOK.

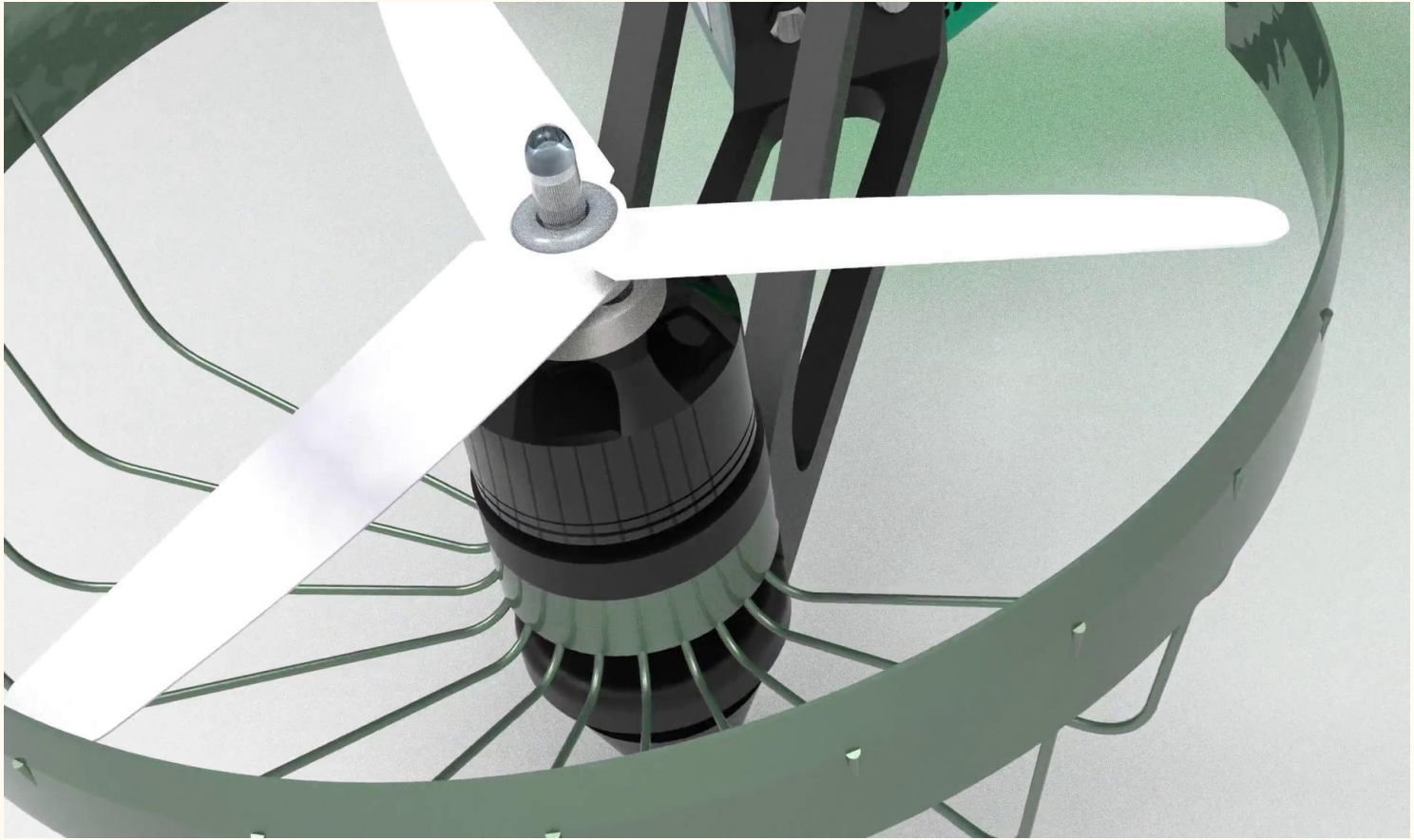
THE DESIGN IS RENDERED IN A SOFTWARE CALLED **KEYSHOT**






J-DRONE

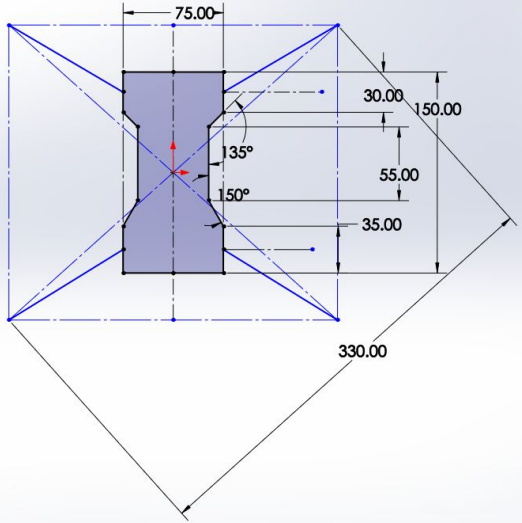
MADE A PROMO VIDEO USING **KEYSHOT** ANIMATION AND PREMIERE PRO



EXPLODED VIEW

THE DRONE WAS DESIGNED IN A CAD SOFTWARE CALLED

SOLIDWORKS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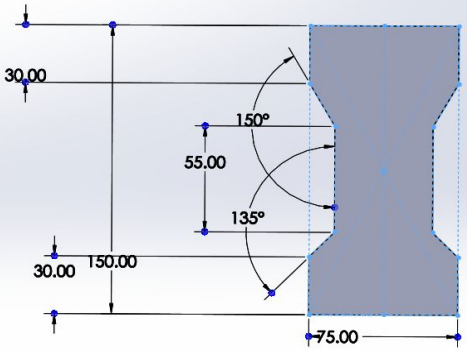
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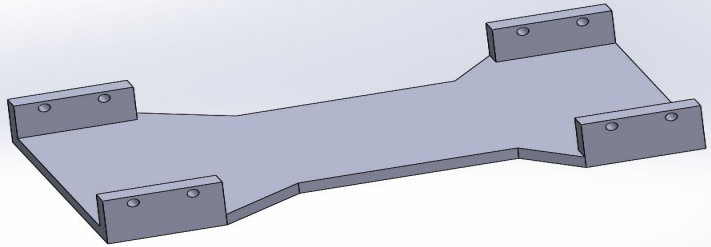

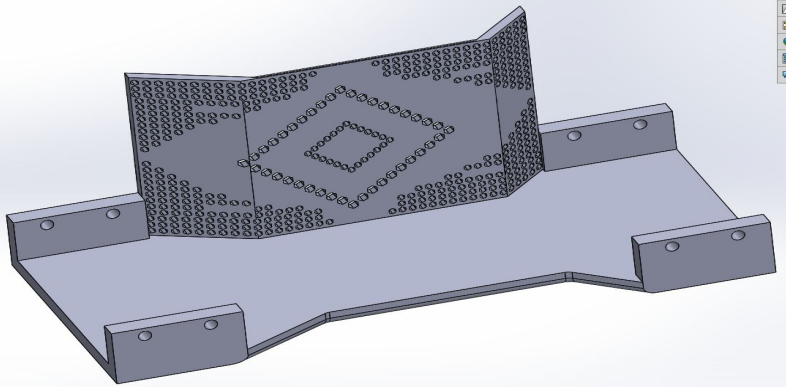

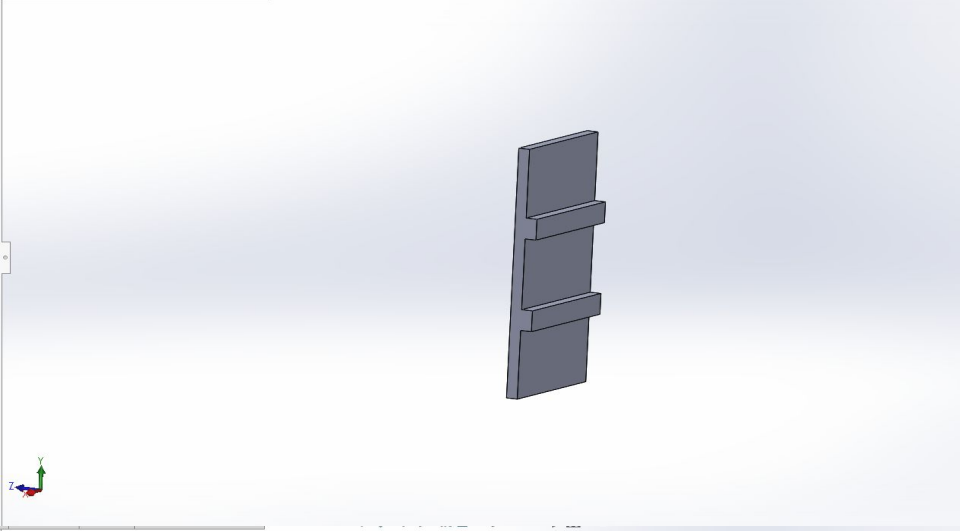

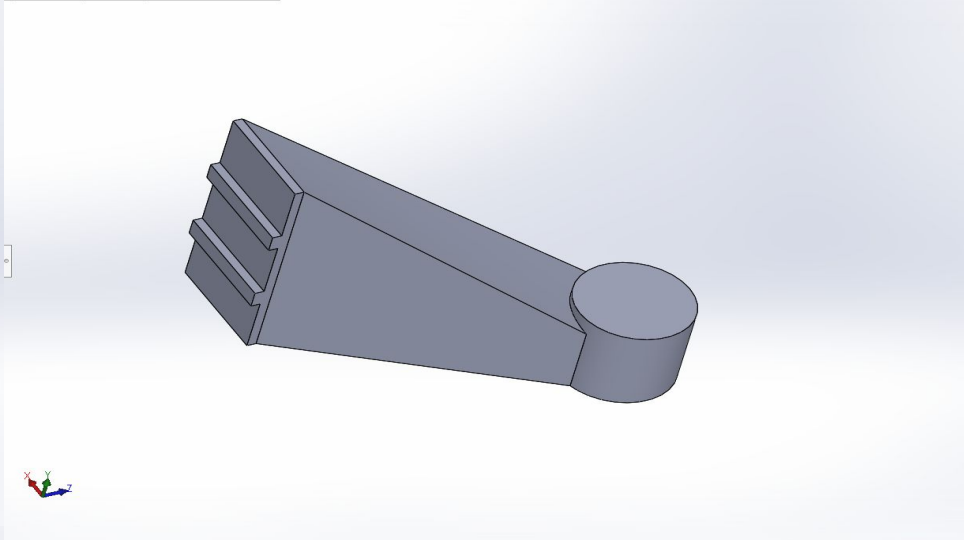

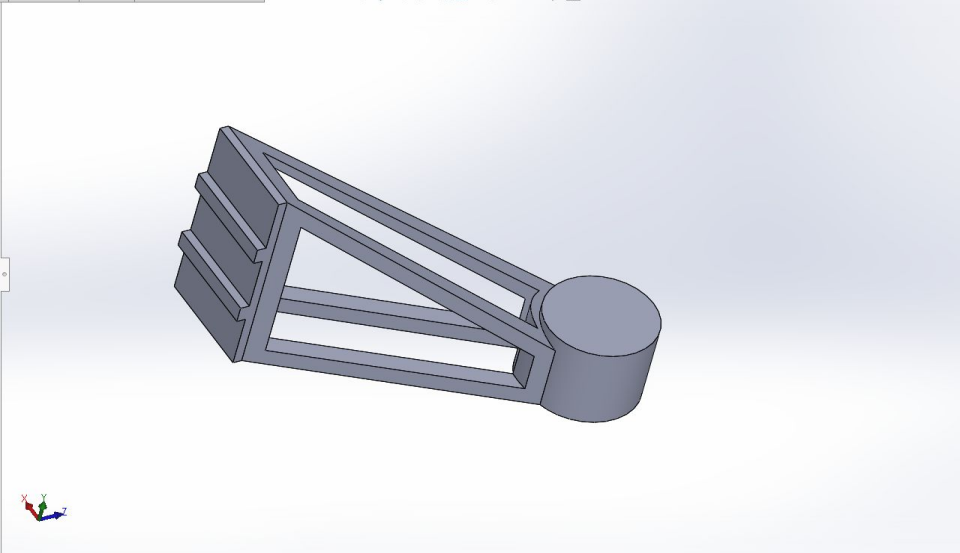

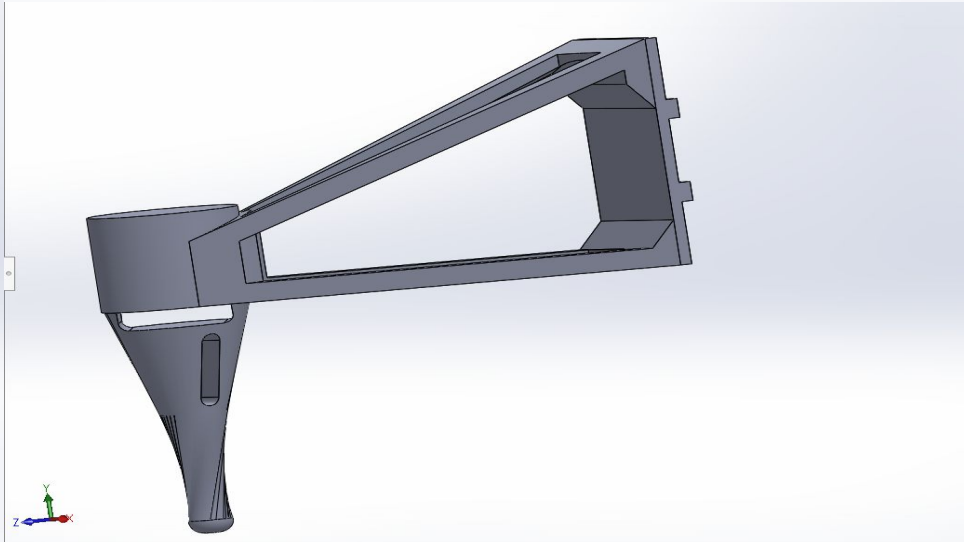

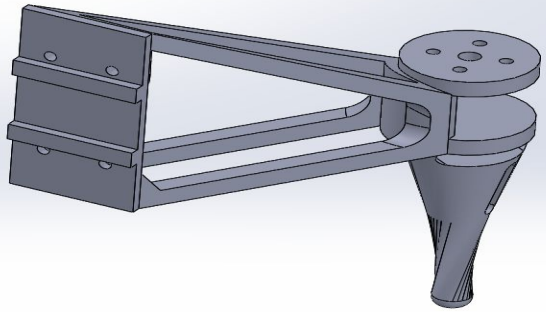

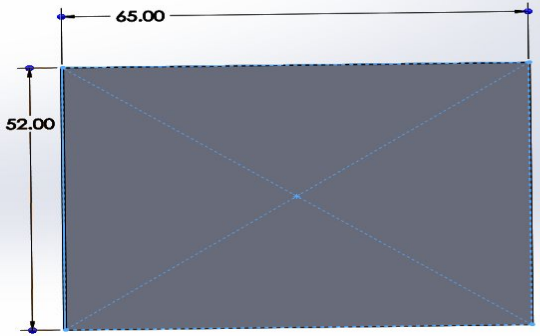

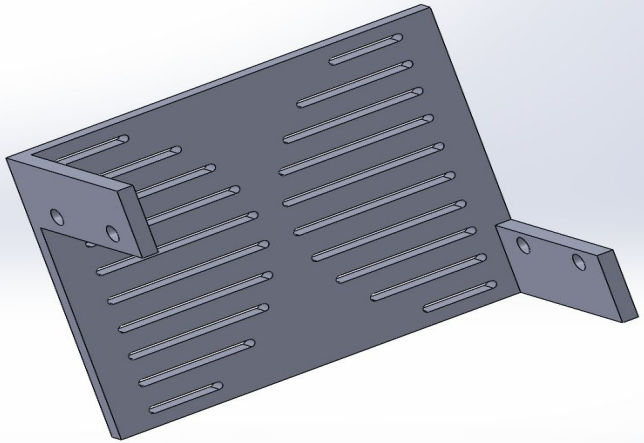

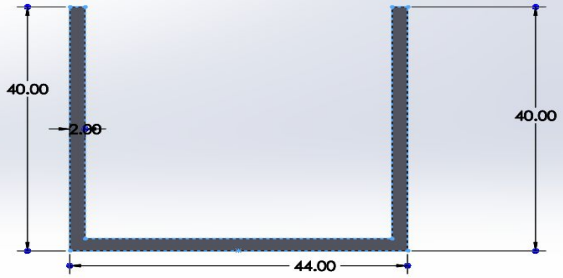

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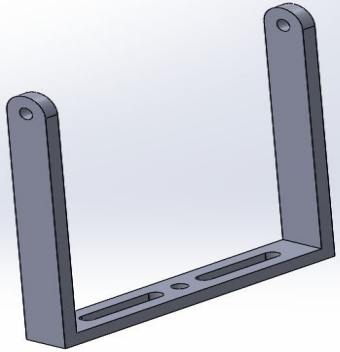

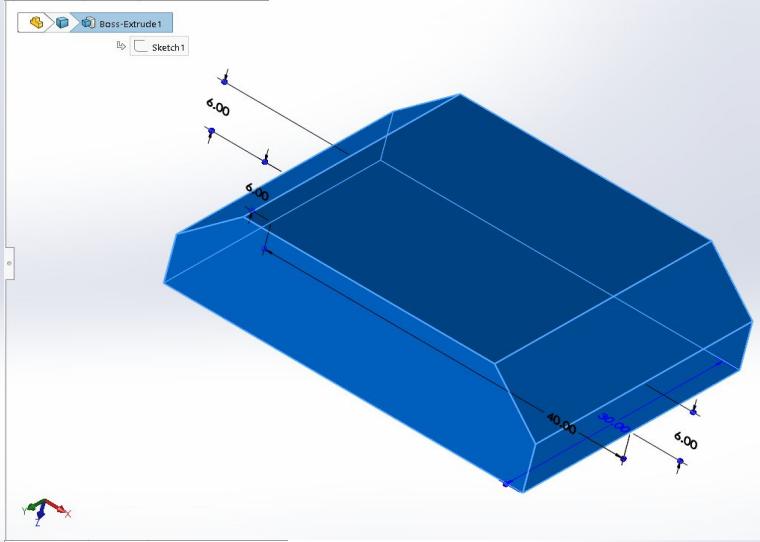
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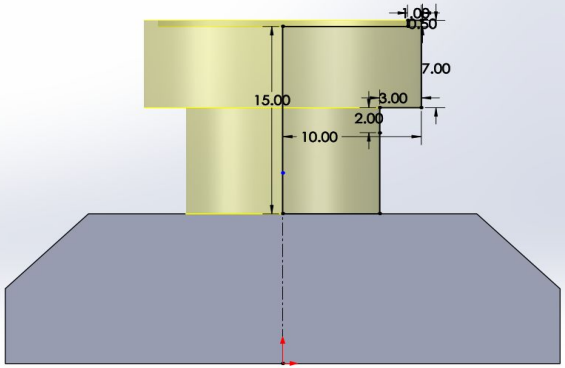
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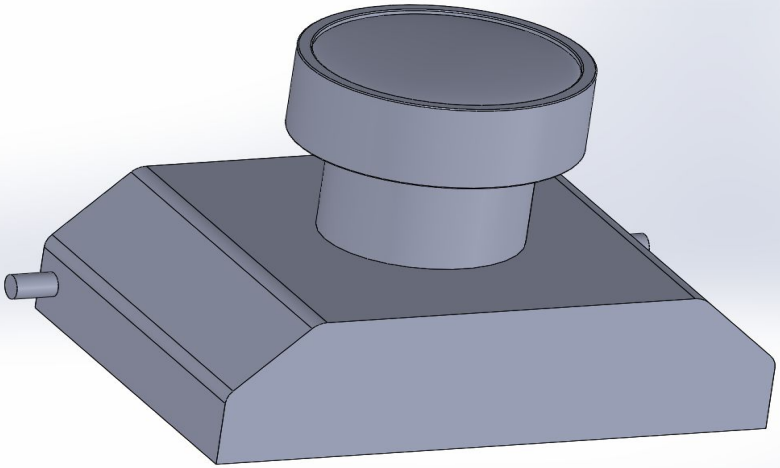

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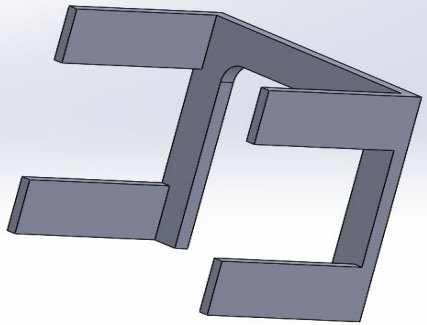
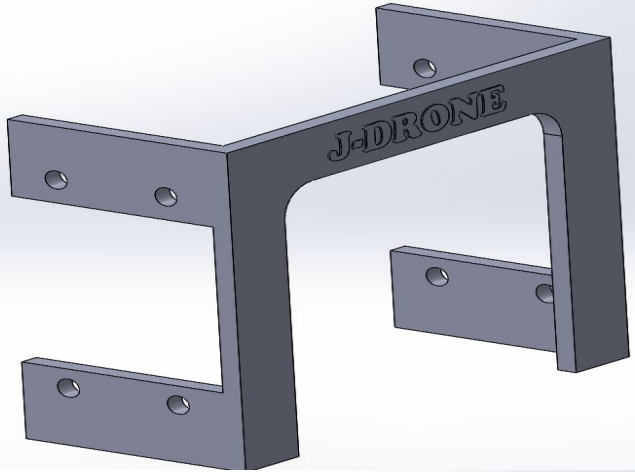
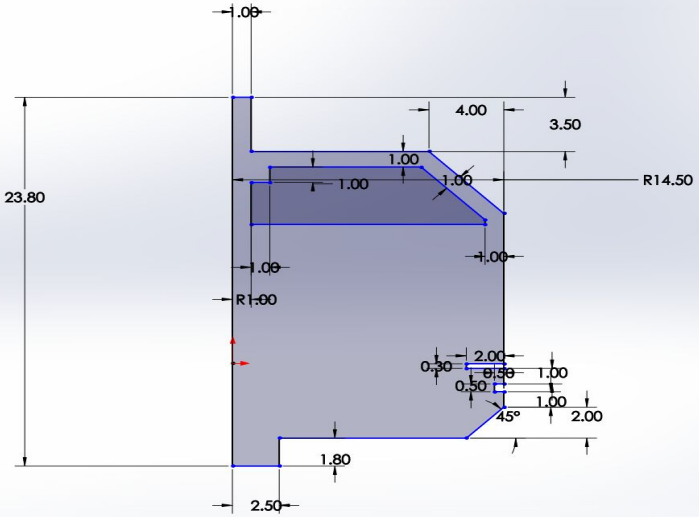



J-DRONE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2.00
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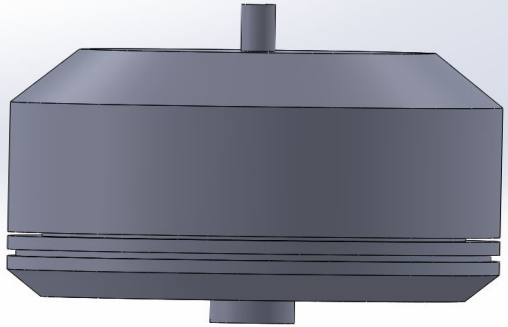

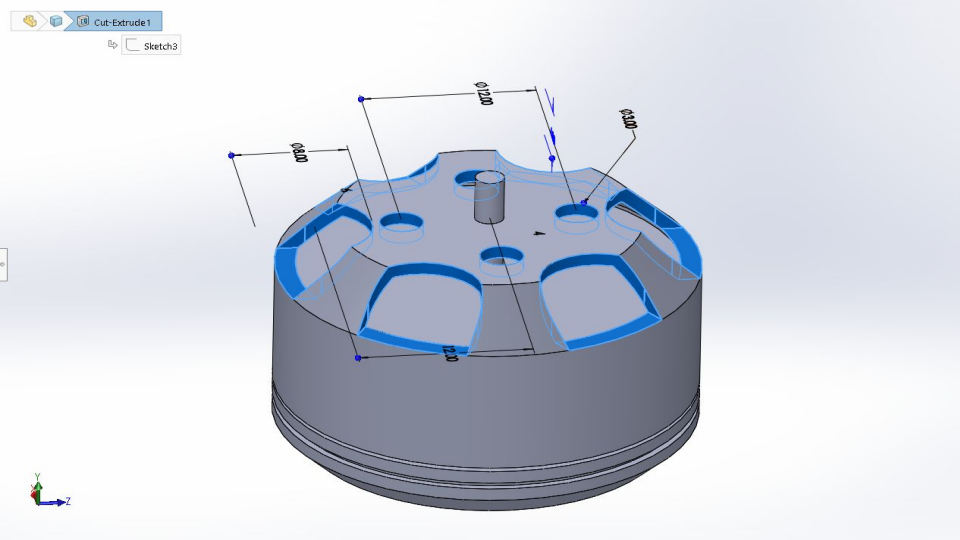
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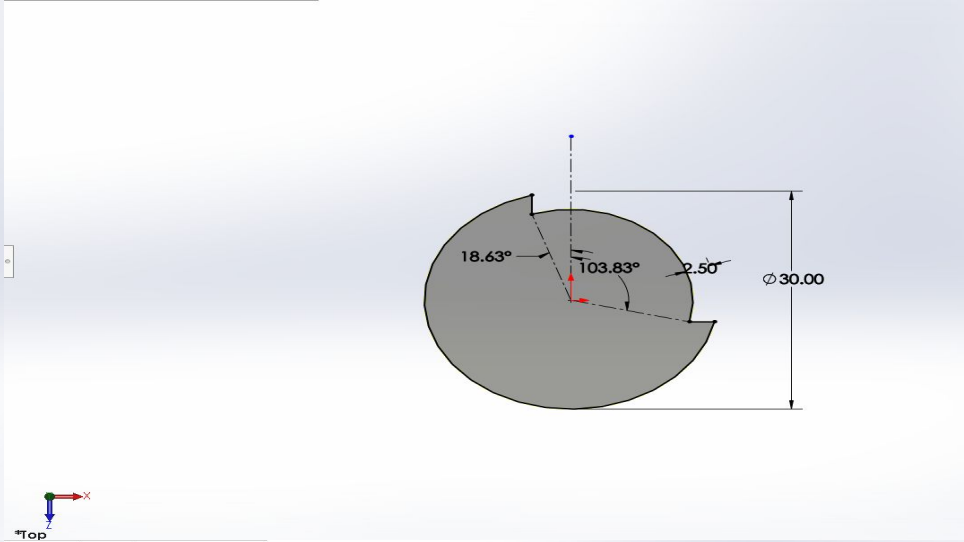
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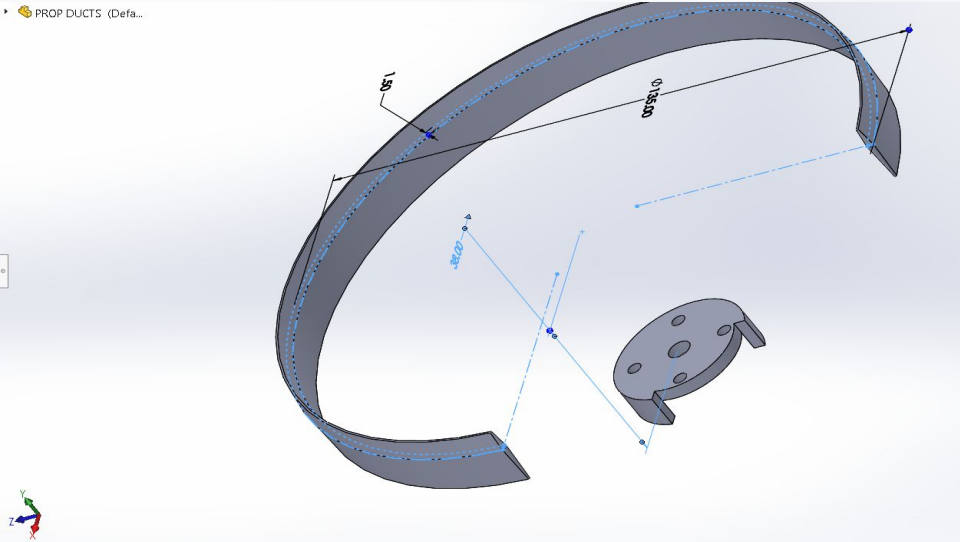
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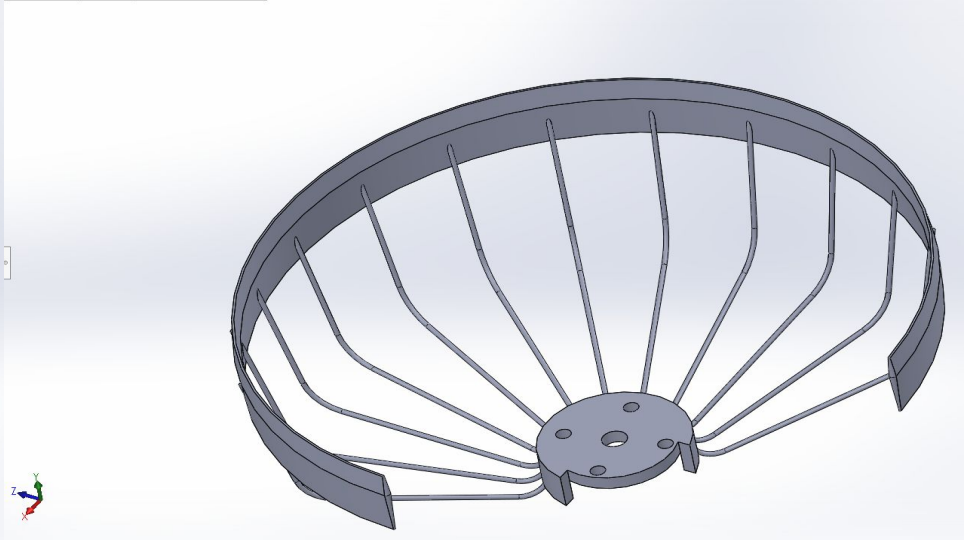

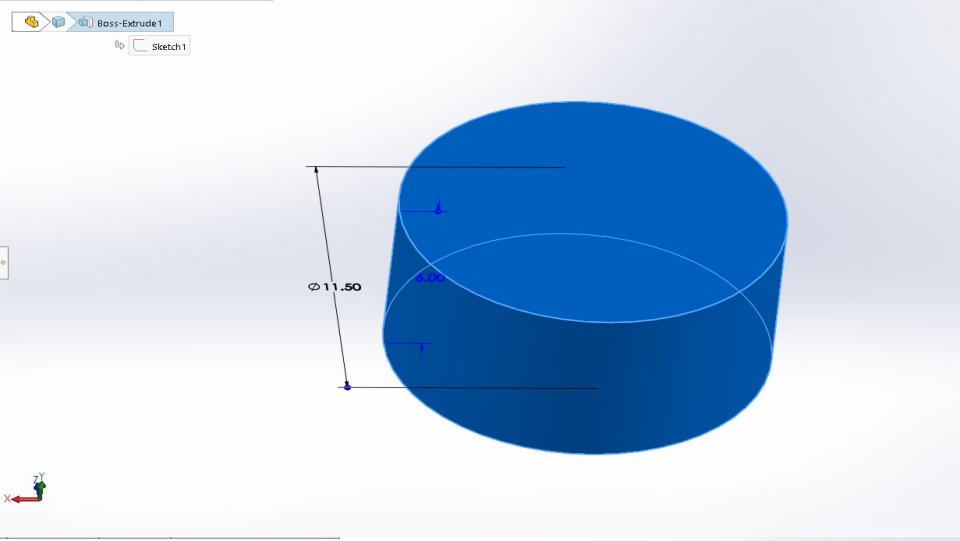
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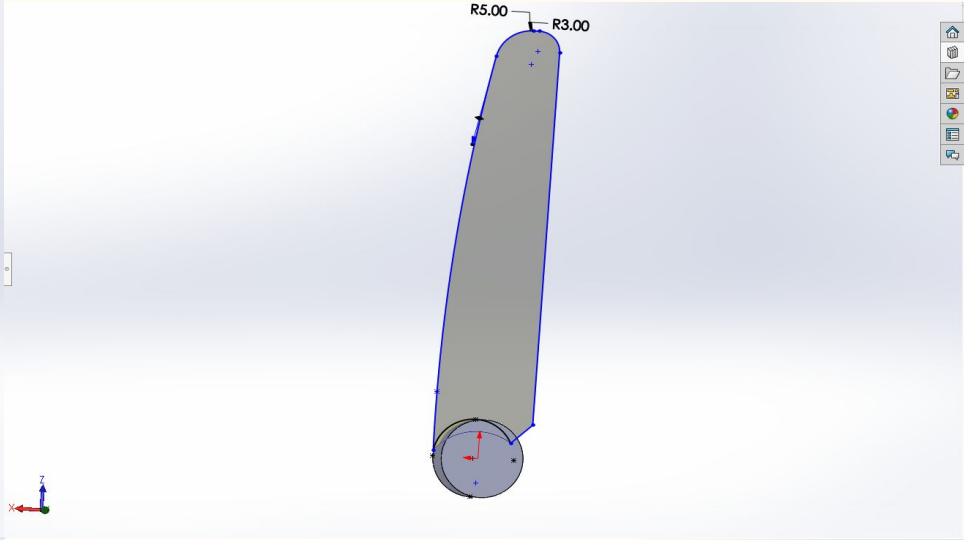
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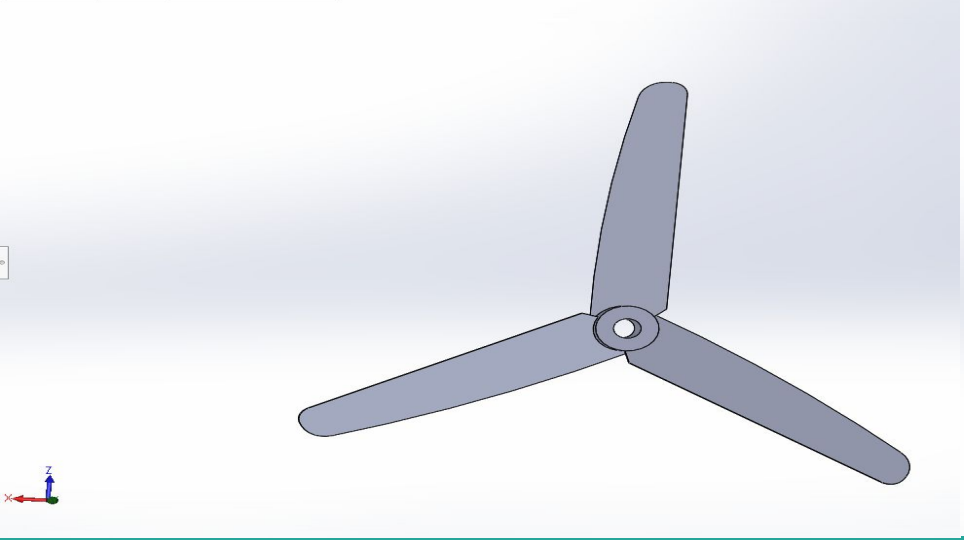

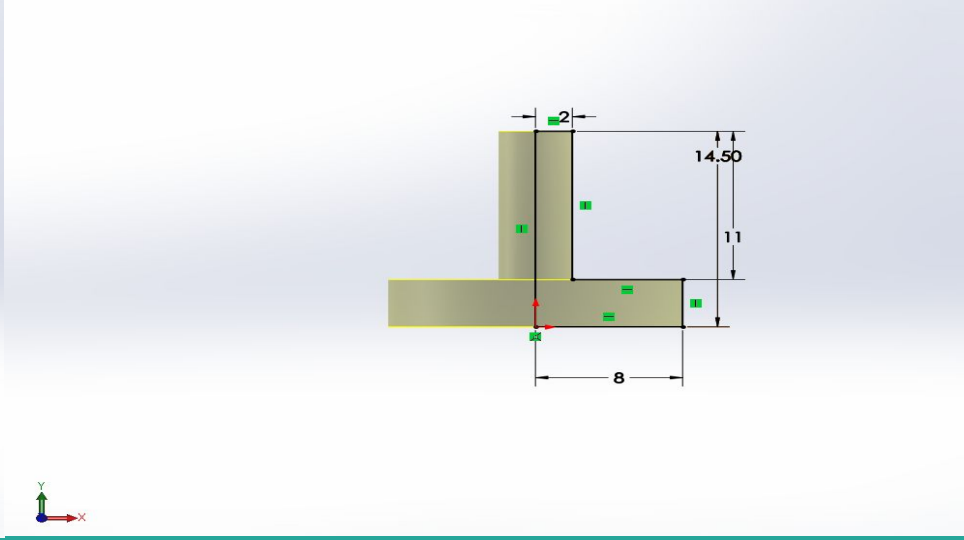
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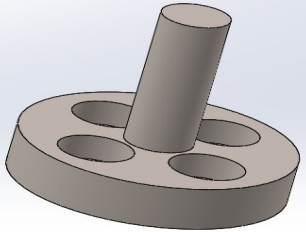

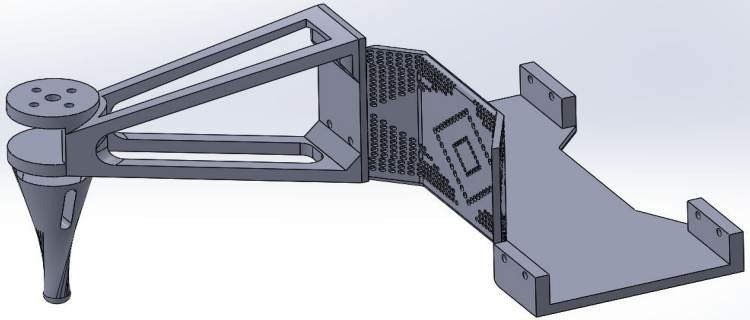

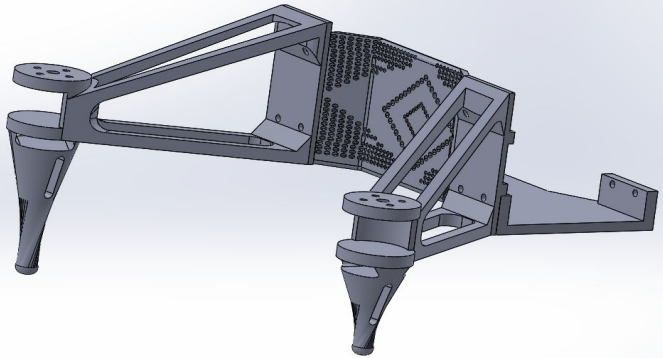

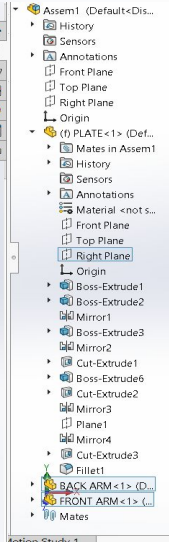
Assem1 (Default<Dis...
History
Sensors
Annotations
Front Plane
Top Plane
Right Plane
Origin
(f) PLATE<1> (Def...
Mates in Assem1
History
Sensors
Annotations
Material <not s...
Front Plane
Top Plane
Right Plane
Origin
Boss-Extrude1
Boss-Extrude2
Mirror1
Boss-Extrude3
Mirror2
Cut-Extrude1
Boss-Extrude6
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Plane1
Mirror4
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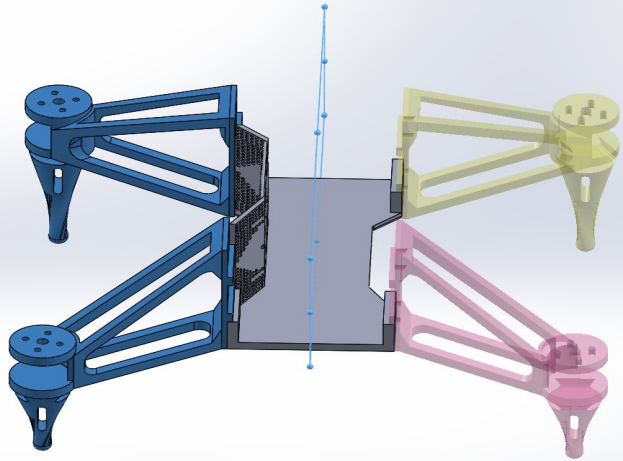
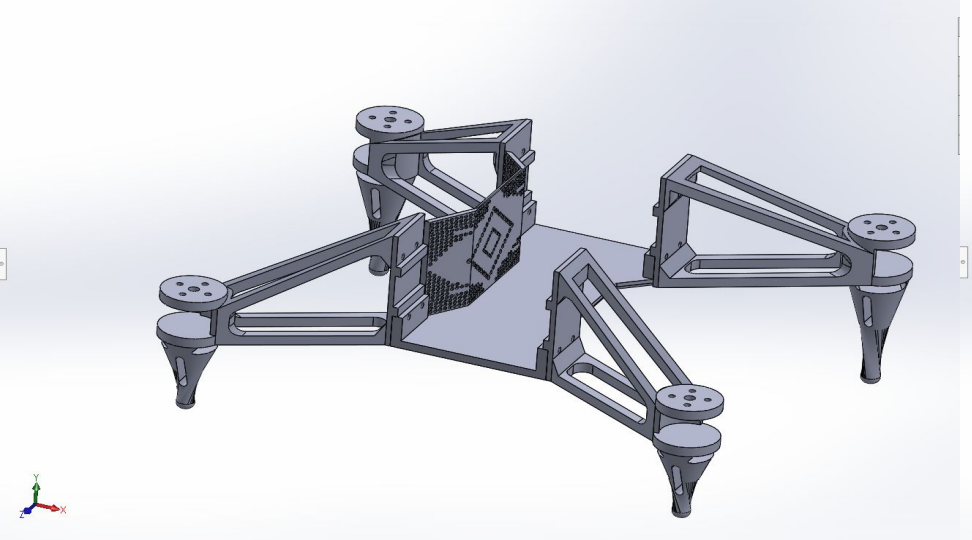
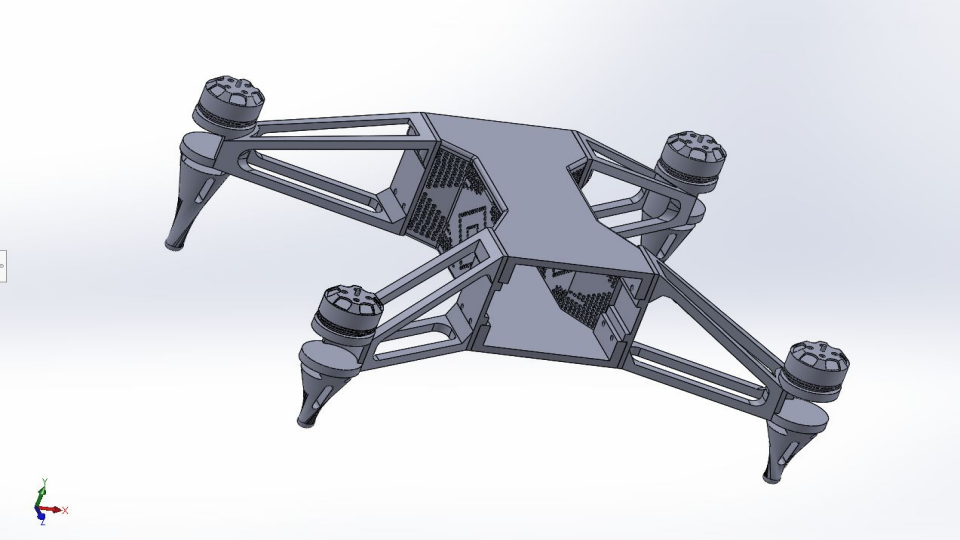
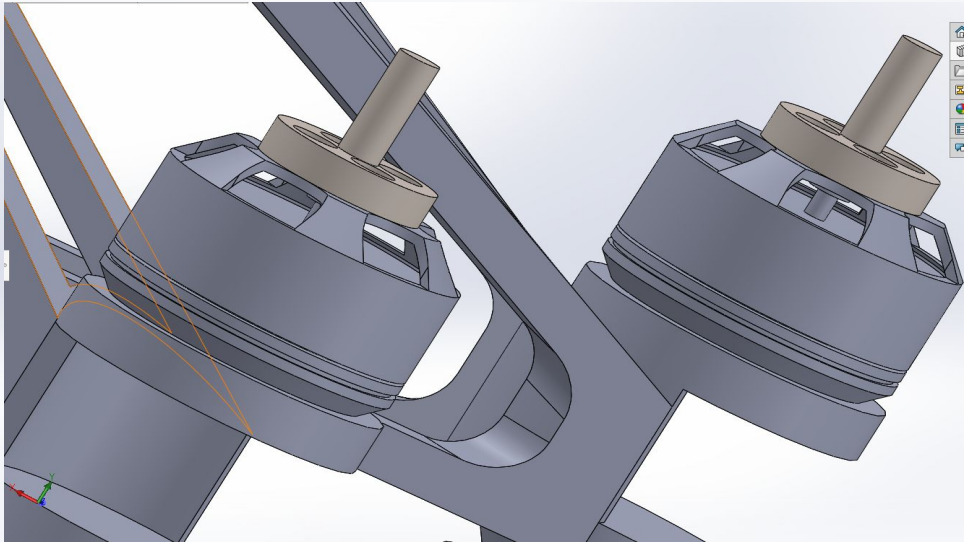
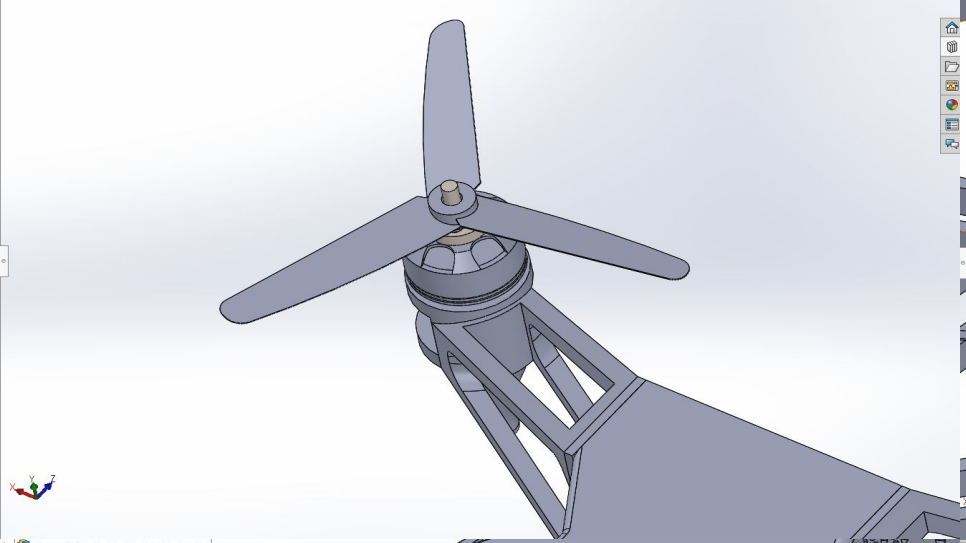
Fillet1
BACK ARM<1> (D...
FRONT ARM<1> (...
Mates

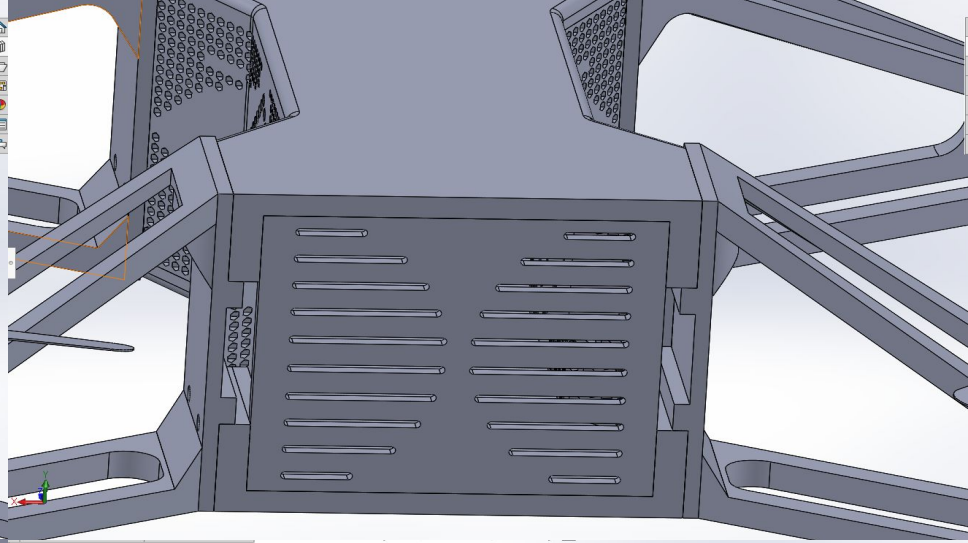


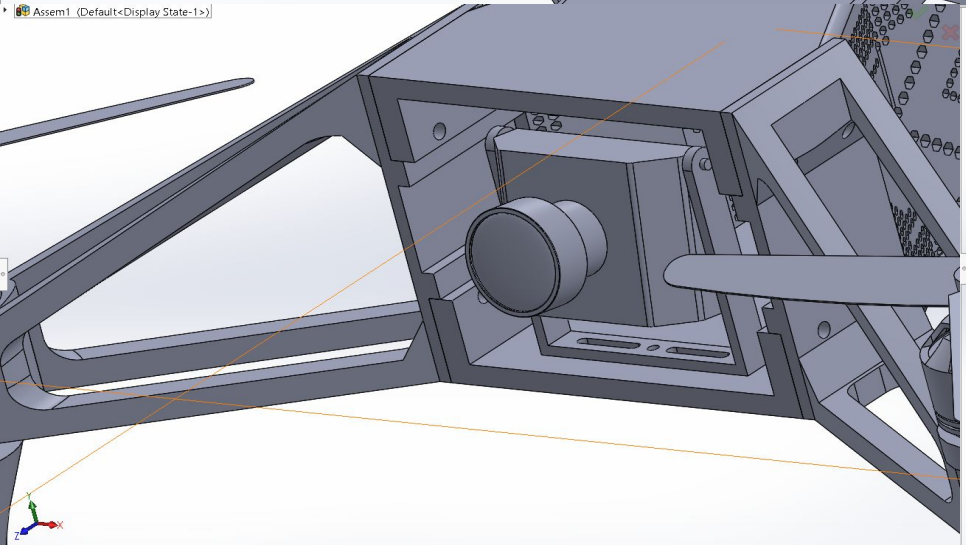








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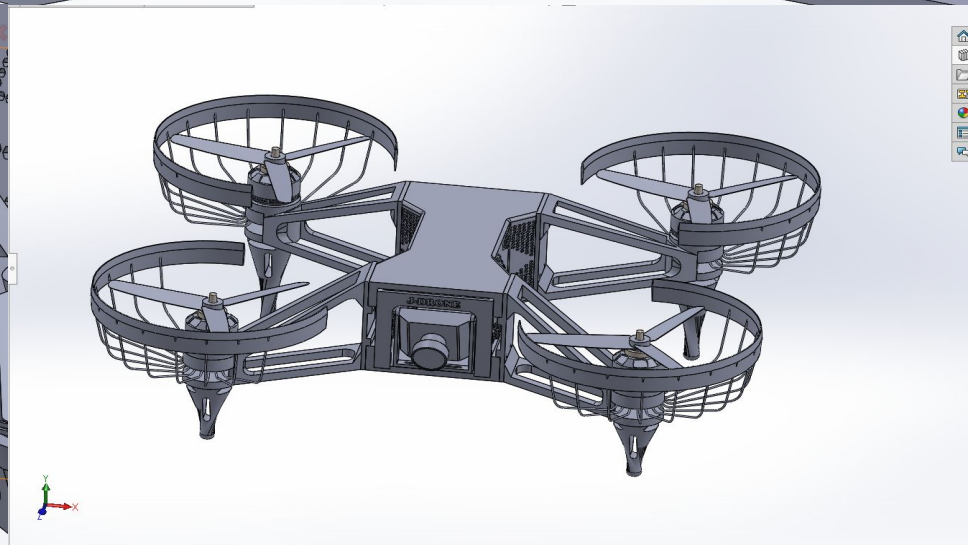
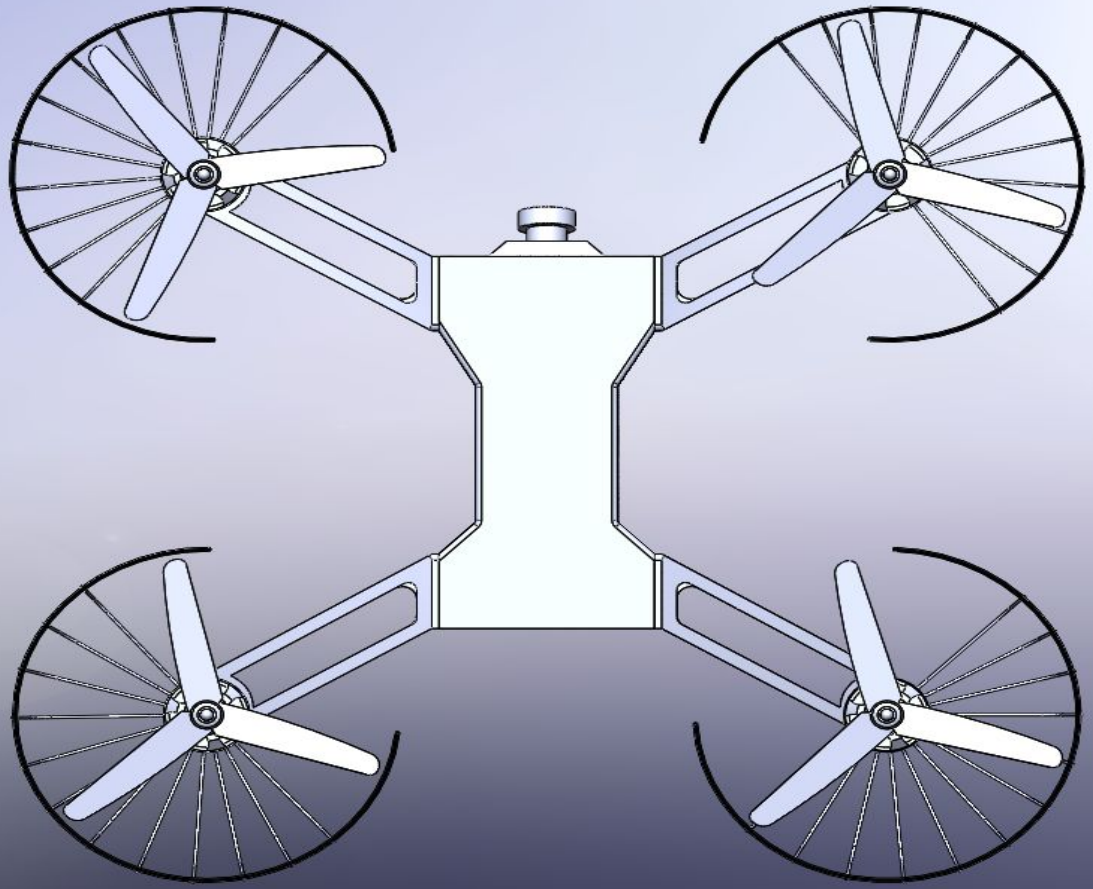
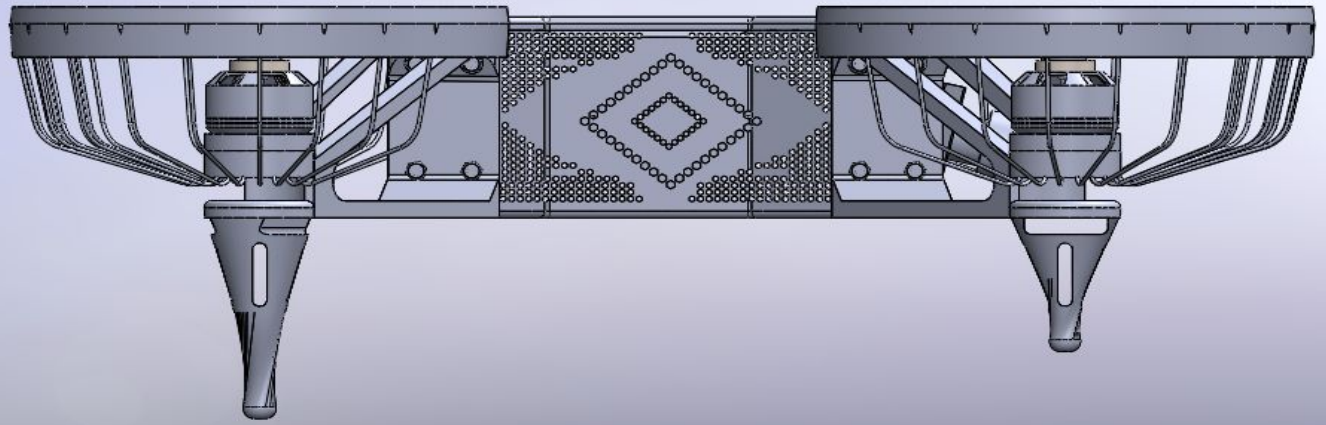


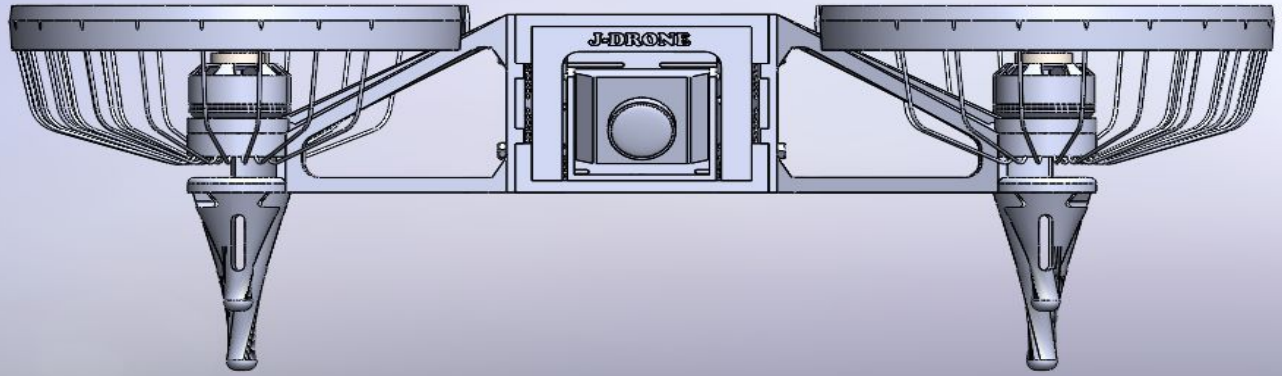
TOP VIEW



SIDE VIEW

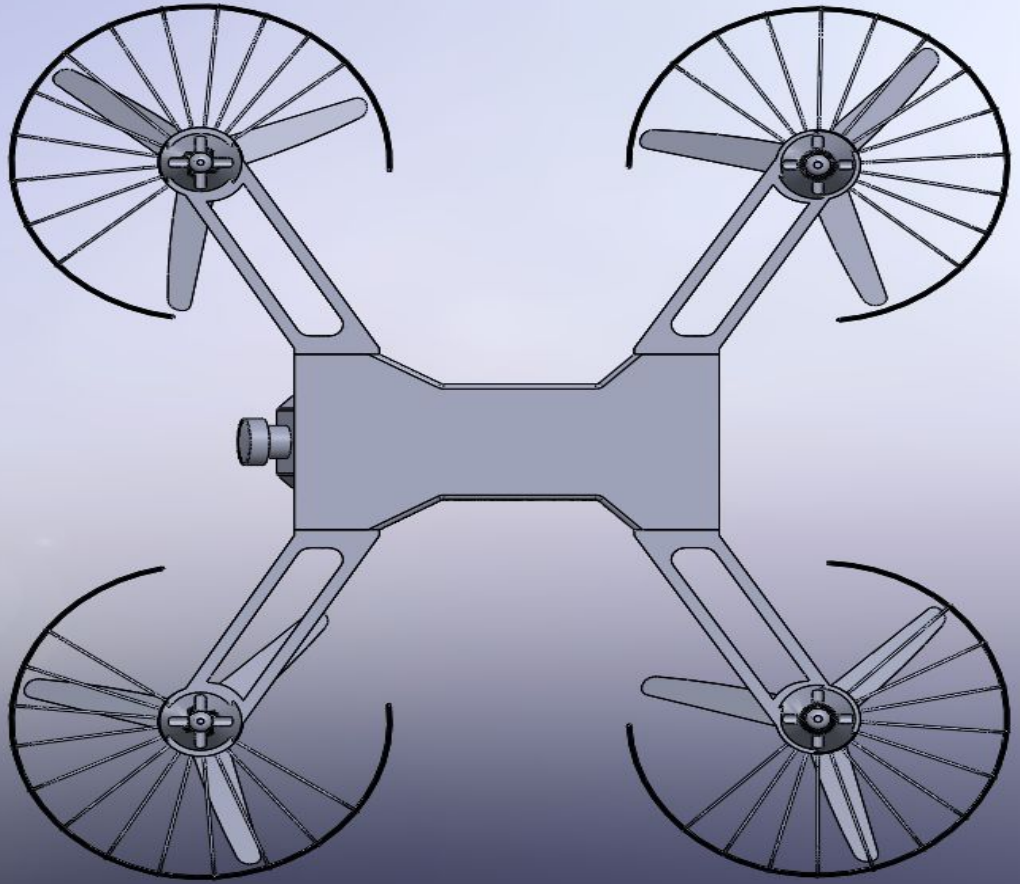


FRONT VIEW

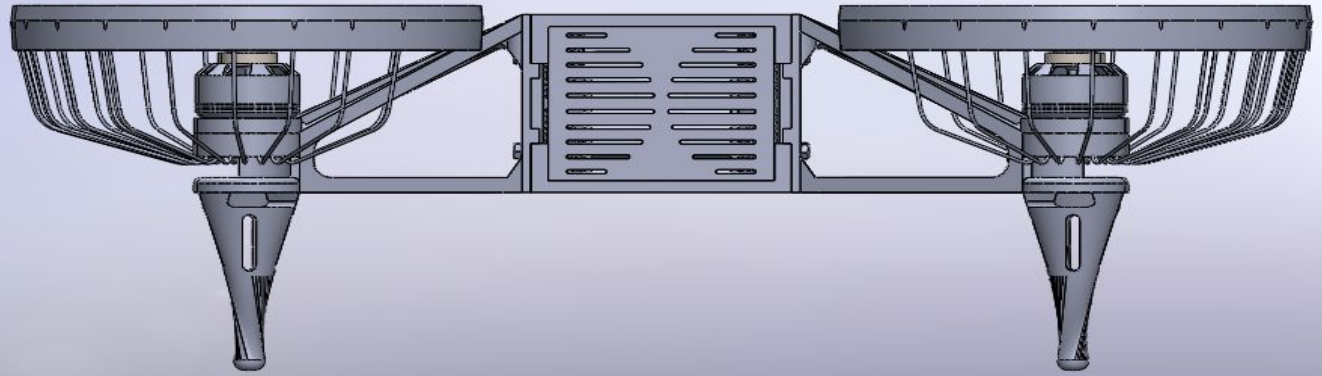


*Front

BOTTOM VIEW



BACK VIEW



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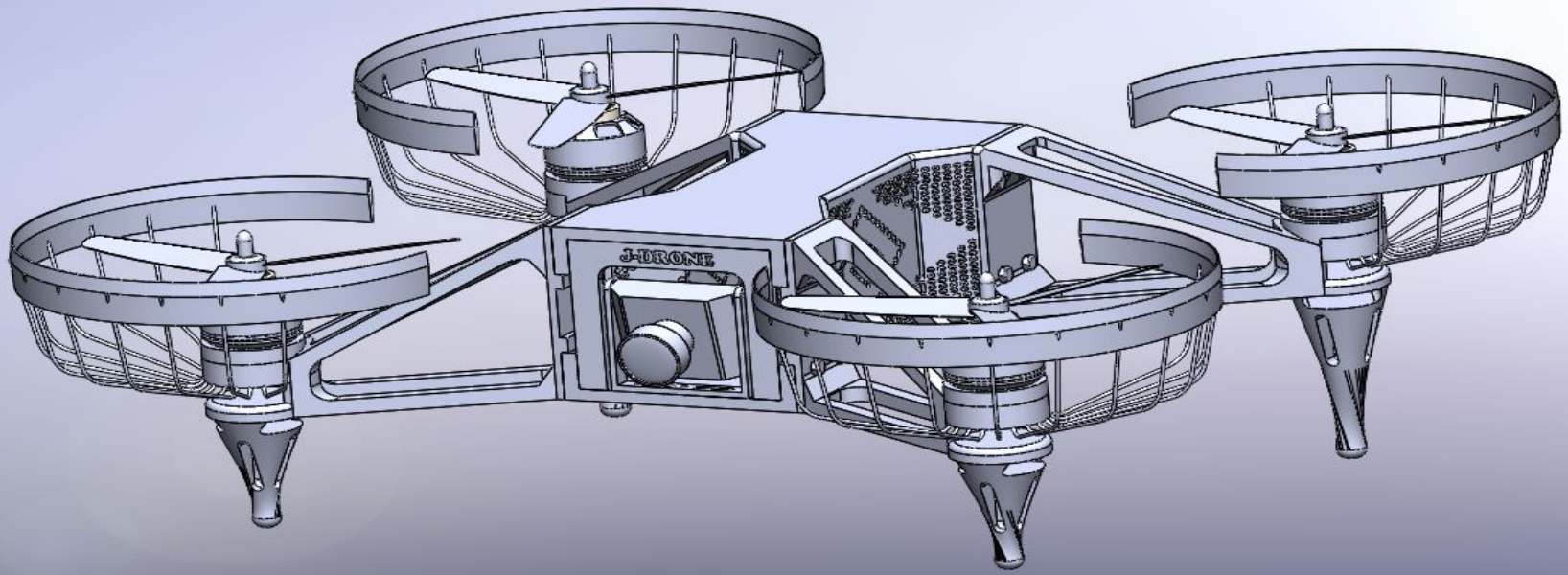
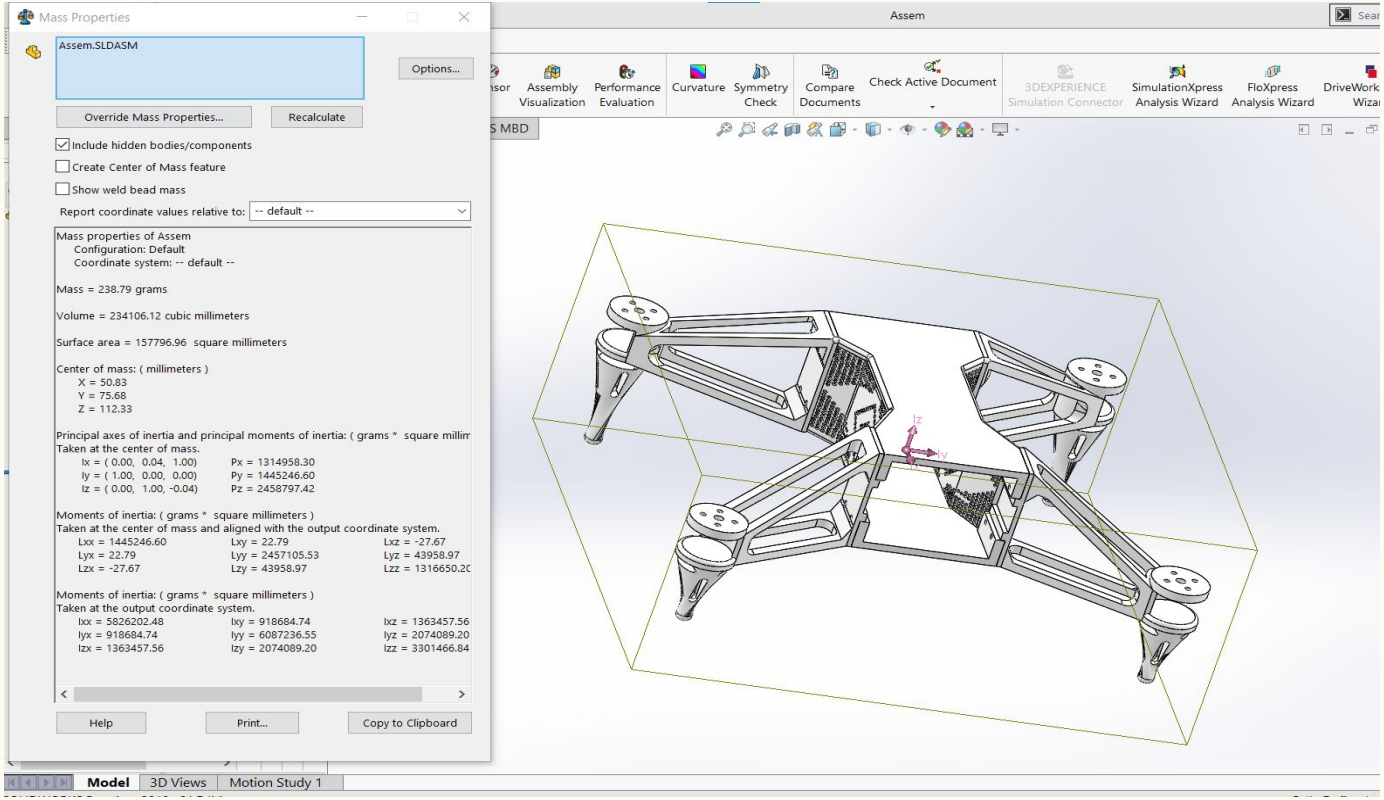
ANGLE VIEW



WHEN THE MATERIAL OF THE FRAME IS GIVEN AS **ABS**, THE WEIGHT OF THE DRONE FRAME IS APPROXIMATELY **238 GRAMS**



- FIXED GEOMETRY IS ASSIGNED IN THE FRAME
- FORCES WERE ASSIGNED (**5N** (A RANDOM VALUE GREATER THAN ITS OWN WEIGHT)) FROM BOTH THE TOP(IN THE TOP OF THE COVERING OF THE FRAME) AND THE BOTTOM (JUST BELOW THE MOTOR).
- IN THE NEXT STEP MESHING WAS DONE.
- AND FINALLY A SIMPLE STATIC STRUCTURAL ANALYSIS WAS FOUND.

Assem1 *

Assembly Visualization | Performance Evaluation | Curvature | Symmetry Check | Compare Documents | Check Active Document | 3DEXPERIENCE Simulation Connector | SimulationXpress Analysis Wizard | FloXpress Analysis Wizard

SOLIDWORKS MBD

Mass Properties

Assem1.SLDASM

Options...

Override Mass Properties... | Recalculate

- [x] Include hidden bodies/components
- [ ] Create Center of Mass feature
- [ ] Show weld bead mass

Report coordinate values relative to: -- default --

Mass properties of Assem1
Configuration: Default
Coordinate system: -- default --

Mass = 238.79 grams

Volume = 234106.12 cubic millimeters

Surface area = 157796.96 square millimeters

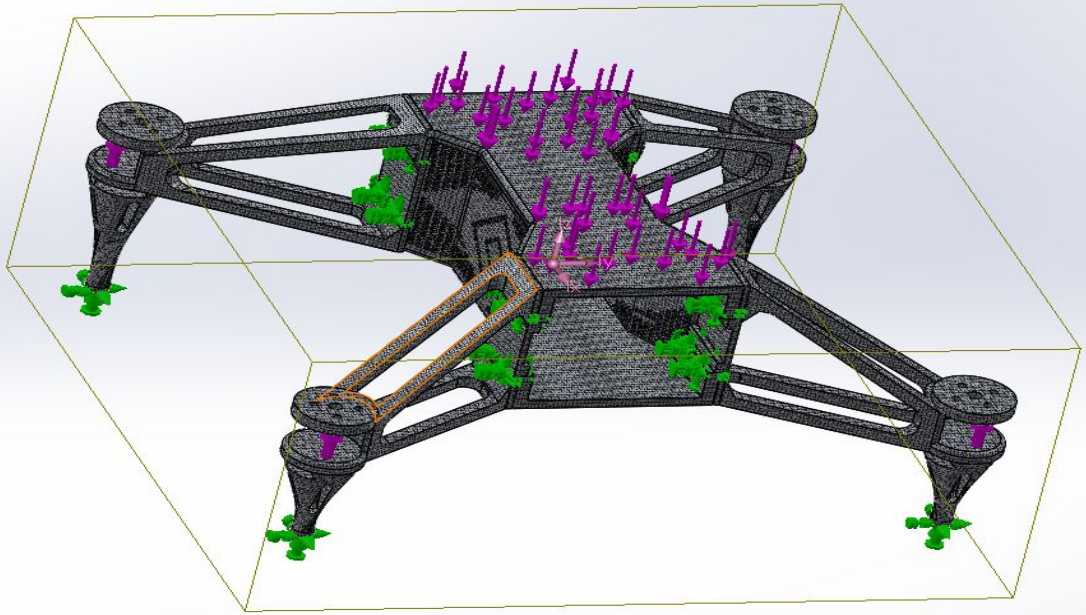
Center of mass: (millimeters)
X = 50.83
Y = 75.68
Z = 112.33

Principal axes of inertia and principal moments of inertia: (grams * square millim
Taken at the center of mass.
Ix = (0.00, 0.04, 1.00) Px = 1314958.30
Iy = (1.00, 0.00, 0.00) Py = 1445246.60
Iz = (0.00, 1.00, -0.04) Pz = 2458797.42

Moments of inertia: (grams * square millimeters)
Taken at the center of mass and aligned with the output coordinate system.
Lxx = 1445246.60 Lxy = 22.79 Lxz = -27.67
Lyx = 22.79 Lyy = 2457105.53 Lyz = 43958.97
Lzx = -27.67 Lzy = 43958.97 Lzz = 1316650.20

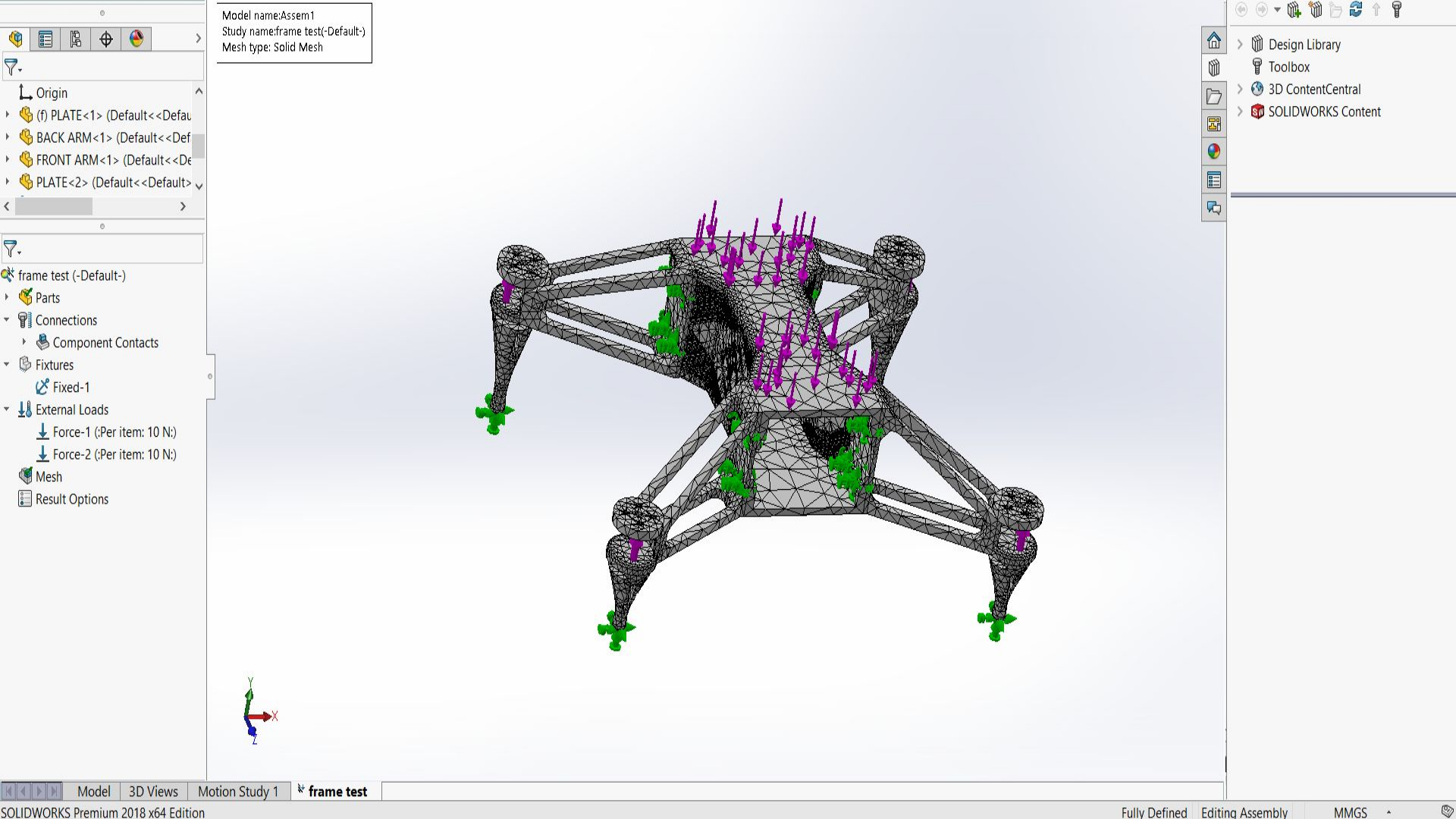
Moments of inertia: (grams * square millimeters)
Taken at the output coordinate system.
Ixx = 5826202.48 Ixy = 918684.74 Ixz = 1363457.56
Iyx = 918684.74 Iyy = 6087236.55 Iyz = 2074089.20
Izx = 1363457.56 Izy = 2074089.20 Izz = 3301466.84

Help | Print... | Copy to Clipboard

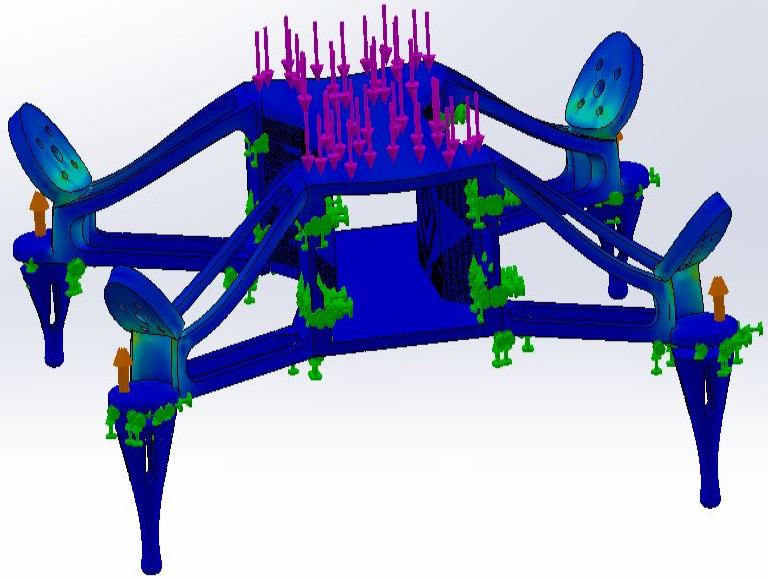


Model | 3D Views | Motion Study 1 | frame test

SOLIDWORKS Premium 2018 x64 Edition


Model name:Assem1
Study name:frame test(-Default-)
Mesh type: Solid Mesh
Origin
(f) PLATE<1> (Default<<Defau
BACK ARM<1> (Default<<Def
FRONT ARM<1> (Default<<De
PLATE<2> (Default<<Default>
frame test (-Default-)
Parts
Connections
Component Contacts
Fixtures
Fixed-1
External Loads
Force-1 (:Per item: 10 N:)
Force-2 (:Per item: 10 N:)
Mesh
Result Options
Design Library
Toolbox
3D ContentCentral
SOLIDWORKS Content
Model
3D Views
Motion Study 1
frame test
SOLIDWORKS Premium 2018 x64 Edition
Fully Defined
Editing Assembly
MMGS

Model name:Assem1
Study name:frame test(-Default-)
Plot type: Static nodal stress Stress1
Deformation scale: 614.223



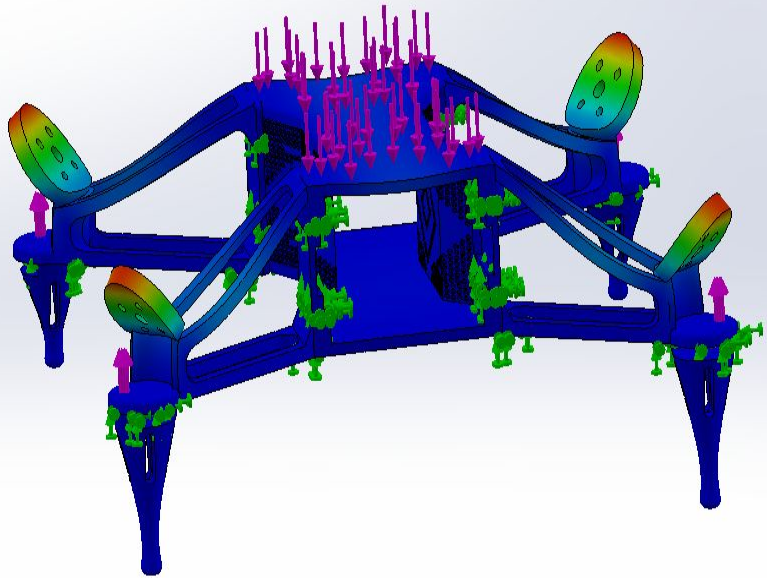
- Assem1 (Default<Display State-10#>
  - History
  - Sensors
  - Annotations
  - Front Plane
  - Top Plane
  - Right Plane
  - Origin
  - (f) PLATE<1> (Default<<Default>
  - BACK ARM<1> (Default<<Defaul
  - FRONT ARM<1> (Default<<Defa
  - PLATE<2> (Default<<Default>_D
  - Mates
  - MirrorComponent1
    - MirrorBACK ARM<2> -> (Defa
    - MirrorFRONT ARM<2> -> (De
- Force-1 (:Per item: 5 N:)
- Force-2 (:Per item: 5 N:)
- Mesh
- Result Options
- **Results**
  - **Stress1 (-vonMises-)**
  - Displacement1 (-Res disp-)
  - Strain1 (-Equivalent-)

- Design Library
- Toolbox
- 3D ContentCentral
- SOLIDWORKS Content

Model | 3D Views | Motion Study 1 | **frame test**

SOLIDWORKS Premium 2018 x64 Edition | Fully Defined | Editing Assembly | MMGS

Model name:Assem1
Study name:frame test(-Default-)
Plot type: Static displacement Displacement1
Deformation scale: 614.223



- Assem1 (Default<Display State-10#>
  - History
  - Sensors
  - Annotations
  - Front Plane
  - Top Plane
  - Right Plane
  - Origin
  - (f) PLATE<1> (Default<<Default>
  - BACK ARM<1> (Default<<Defaul
  - FRONT ARM<1> (Default<<Defa
  - PLATE<2> (Default<<Default>_D
  - Mates
  - MirrorComponent1
    - MirrorBACK ARM<2> -> (Defa
    - MirrorFRONT ARM<2> -> (De
- Force-1 (:Per item: 5 N:)
- Force-2 (:Per item: 5 N:)
- Mesh
- Result Options
- **Results**
  - Stress1 (-vonMises-)
  - **Displacement1 (-Res disp-)**
  - Strain1 (-Equivalent-)

- Design Library
- Toolbox
- 3D ContentCentral
- SOLIDWORKS Content

Model | 3D Views | Motion Study 1 | frame test

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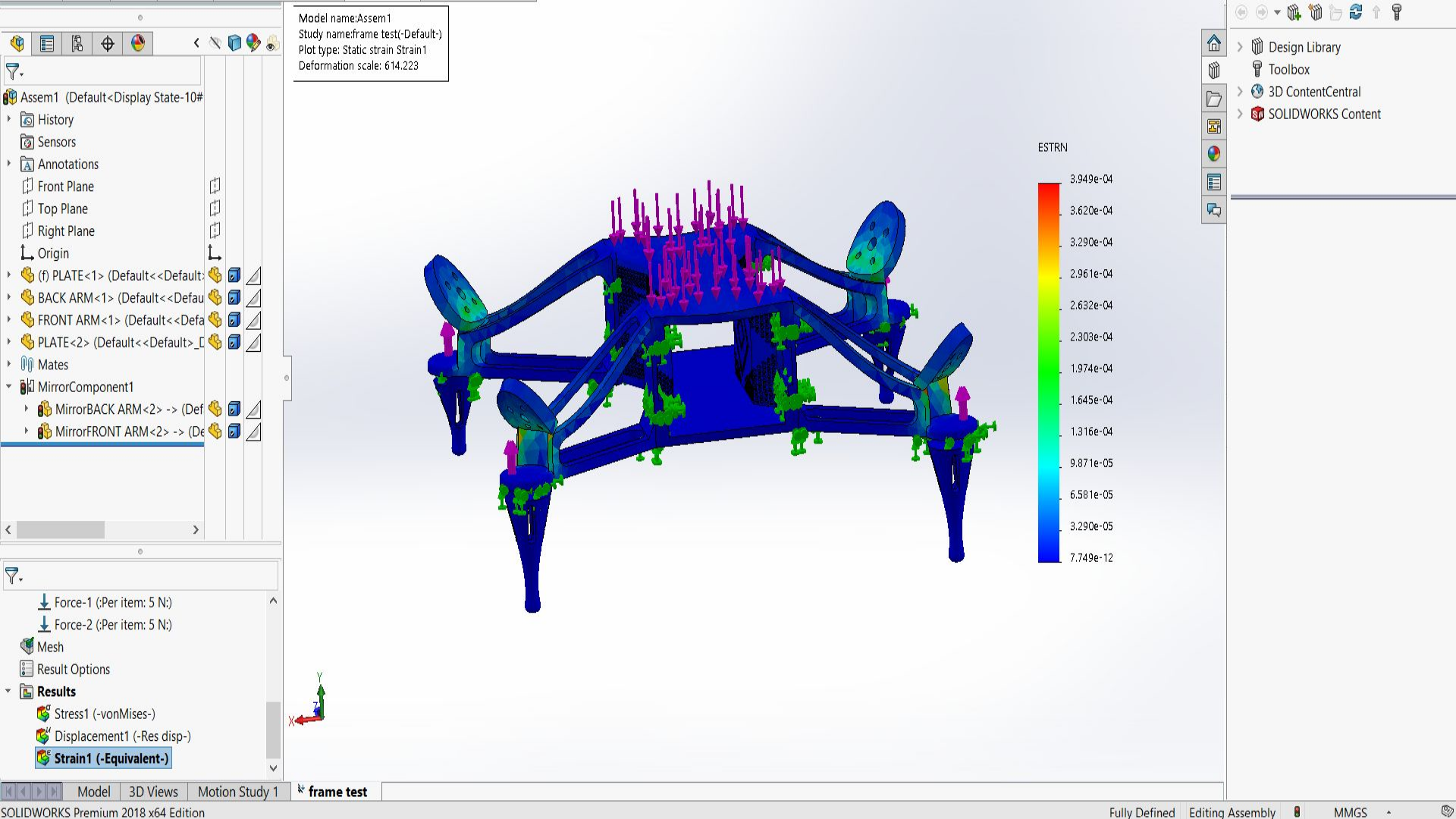
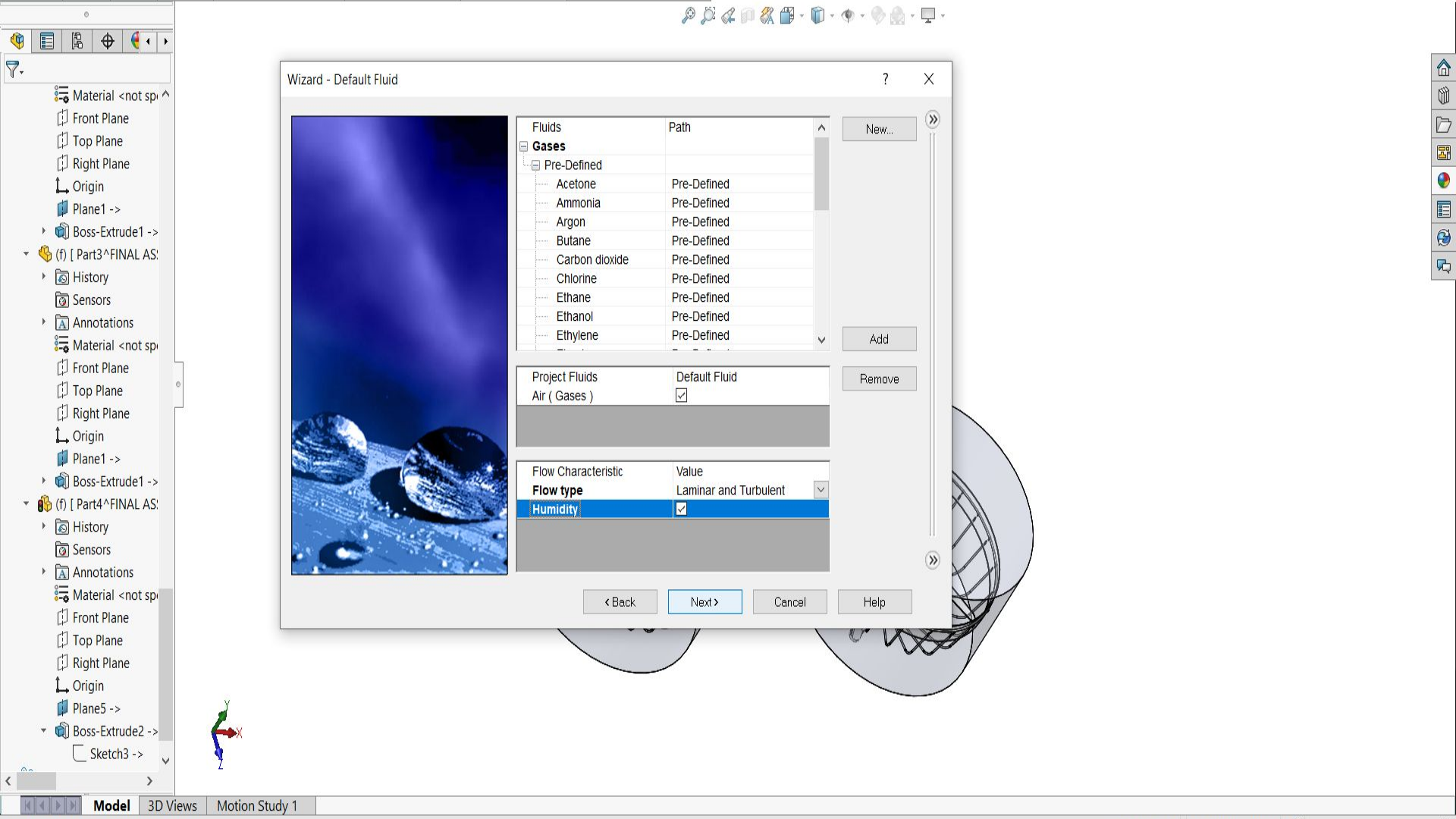
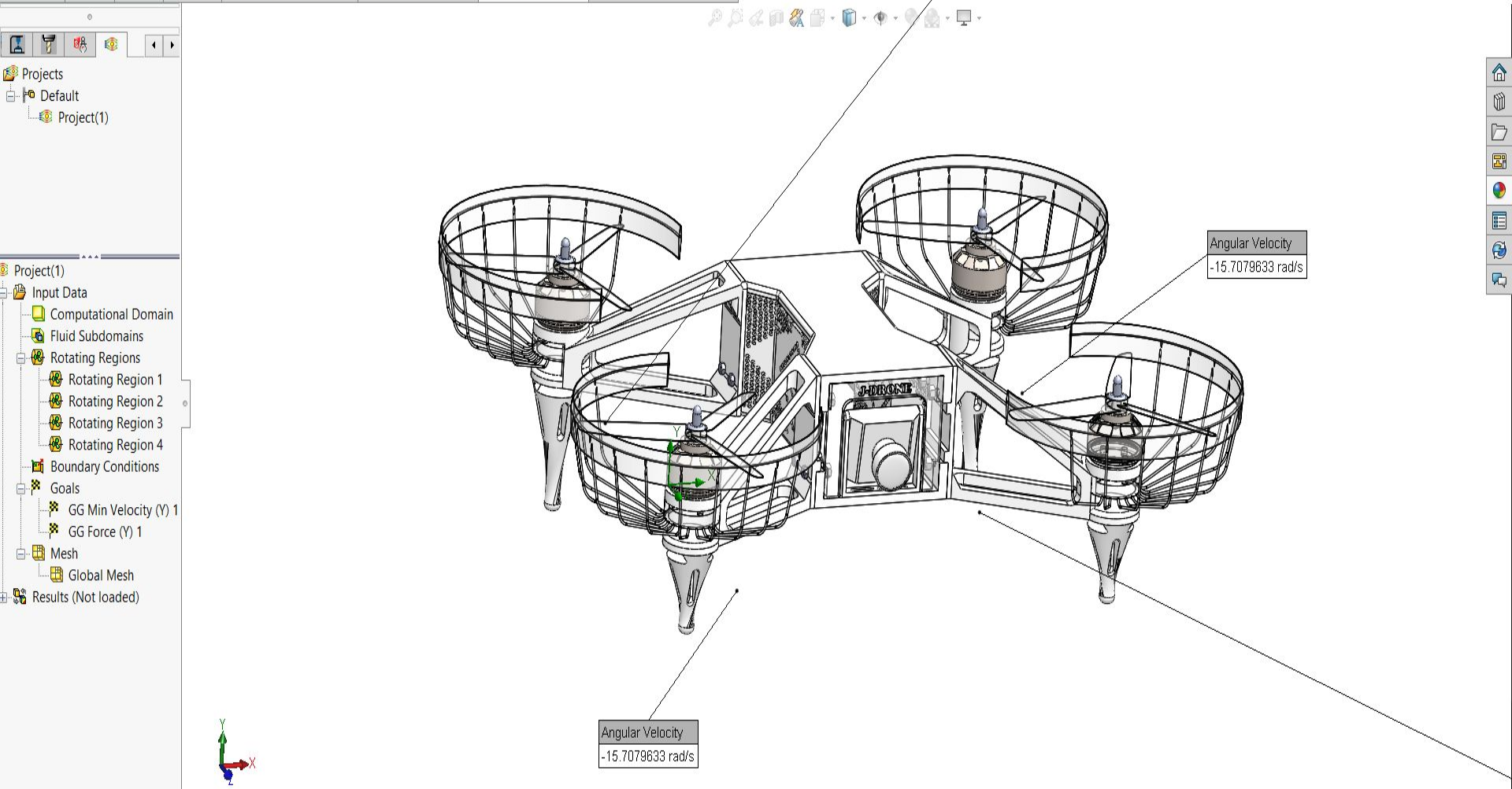
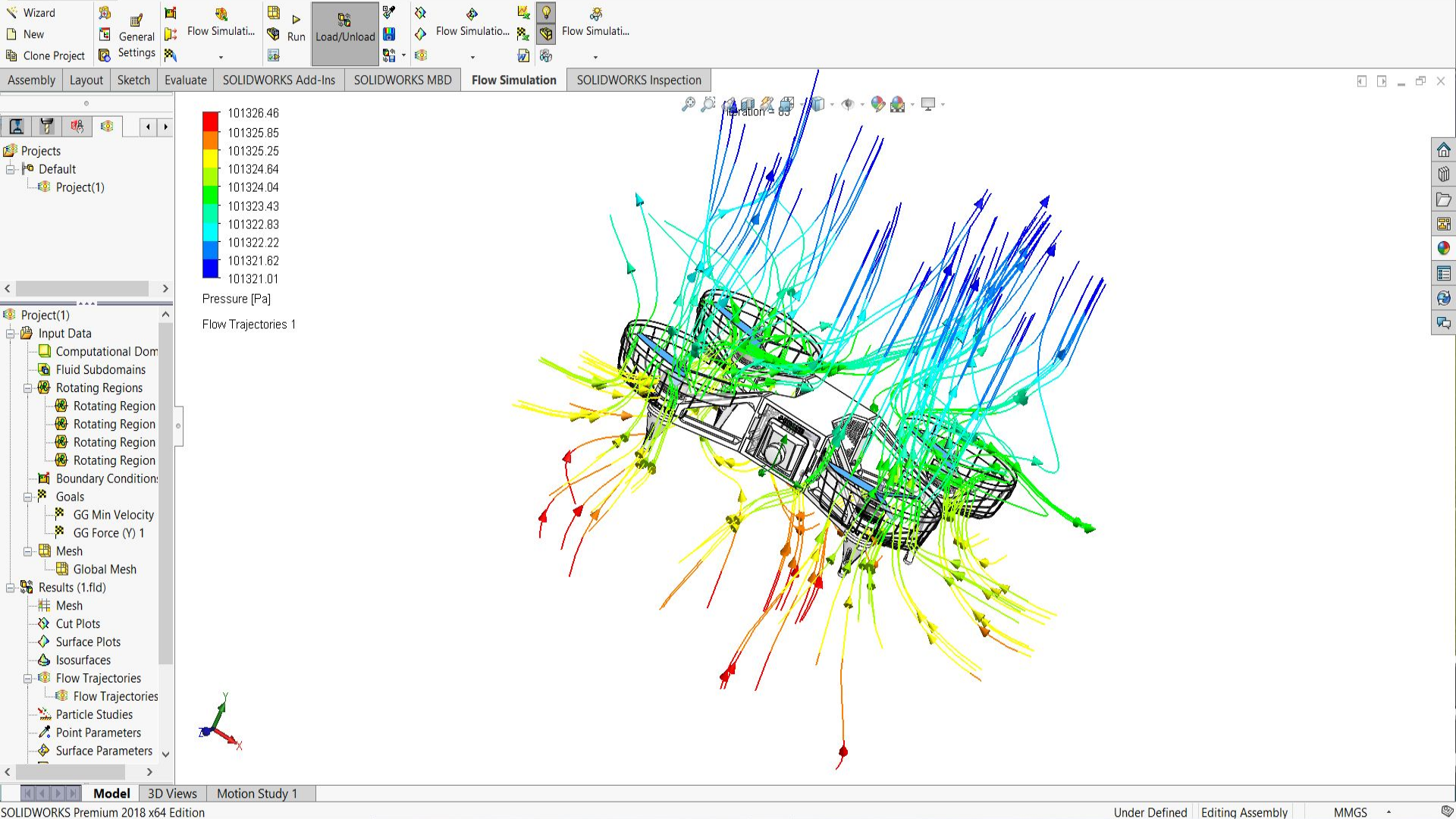

Model name:Assem1
Study name:frame test(-Default-)
Plot type: Static strain Strain1
Deformation scale: 614.223
Assem1 (Default<Display State-10#
History
Sensors
Annotations
Front Plane
Top Plane
Right Plane
Origin
(f) PLATE<1> (Default<<Default
BACK ARM<1> (Default<<Defau
FRONT ARM<1> (Default<<Defa
PLATE<2> (Default<<Default>_D
Mates
MirrorComponent1
MirrorBACK ARM<2> -> (Def
MirrorFRONT ARM<2> -> (De
ESTRN
3.949e-04
3.620e-04
3.290e-04
2.961e-04
2.632e-04
2.303e-04
1.974e-04
1.645e-04
1.316e-04
9.871e-05
6.581e-05
3.290e-05
7.749e-12
Design Library
Toolbox
3D ContentCentral
SOLIDWORKS Content
Force-1 (:Per item: 5 N:)
Force-2 (:Per item: 5 N:)
Mesh
Result Options
Results
Stress1 (-vonMises-)
Displacement1 (-Res disp-)
Strain1 (-Equivalent-)
Model
3D Views
Motion Study 1
frame test
SOLIDWORKS Premium 2018 x64 Edition
Fully Defined
Editing Assembly
MMGS

THE FINAL ASSEMBLY OF THE DRONE IS PREPARED FOR THE PRESSURE FLOW SIMULATION WHICH IS IMPLEMENTED IN THE FOUR BRUSHLESS MOTORS.


Wizard - Default Fluid
Fluids
Path
Gases
Pre-Defined
Acetone Pre-Defined
Ammonia Pre-Defined
Argon Pre-Defined
Butane Pre-Defined
Carbon dioxide Pre-Defined
Chlorine Pre-Defined
Ethane Pre-Defined
Ethanol Pre-Defined
Ethylene Pre-Defined
New...
Add
Remove
Project Fluids
Default Fluid
Air (Gases)
Flow Characteristic
Value
Flow type
Laminar and Turbulent
Humidity
Back
Next
Cancel
Help
Material <not sp
Front Plane
Top Plane
Right Plane
Origin
Plane1 ->
Boss-Extrude1 ->
(f) [Part3^FINAL AS
History
Sensors
Annotations
Material <not sp
Front Plane
Top Plane
Right Plane
Origin
Plane1 ->
Boss-Extrude1 ->
(f) [Part4^FINAL AS
History
Sensors
Annotations
Material <not sp
Front Plane
Top Plane
Right Plane
Origin
Plane5 ->
Boss-Extrude2 ->
Sketch3 ->
Model
3D Views
Motion Study 1


Projects
Default
Project(1)
Project(1)
Input Data
Computational Domain
Fluid Subdomains
Rotating Regions
Rotating Region 1
Rotating Region 2
Rotating Region 3
Rotating Region 4
Boundary Conditions
Goals
GG Min Velocity (Y) 1
GG Force (Y) 1
Mesh
Global Mesh
Results (Not loaded)
Angular Velocity
-15.7079633 rad/s
Angular Velocity
-15.7079633 rad/s
J-DRONE
Model
3D Views
Motion Study 1


Wizard
New
Clone Project
General Settings
Flow Simulati...
Run
Load/Unload
Flow Simulatio...
Flow Simulati...
Assembly
Layout
Sketch
Evaluate
SOLIDWORKS Add-Ins
SOLIDWORKS MBD
Flow Simulation
SOLIDWORKS Inspection
Projects
Default
Project(1)
101326.46
101325.85
101325.25
101324.64
101324.04
101323.43
101322.83
101322.22
101321.62
101321.01
Pressure [Pa]
Flow Trajectories 1
Iteration = 60
Project(1)
Input Data
Computational Dom
Fluid Subdomains
Rotating Regions
Rotating Region
Rotating Region
Rotating Region
Rotating Region
Boundary Condition
Goals
GG Min Velocity
GG Force (Y) 1
Mesh
Global Mesh
Results (1.fld)
Mesh
Cut Plots
Surface Plots
Isosurfaces
Flow Trajectories
Flow Trajectories
Particle Studies
Point Parameters
Surface Parameters
Model
3D Views
Motion Study 1
SOLIDWORKS Premium 2018 x64 Edition
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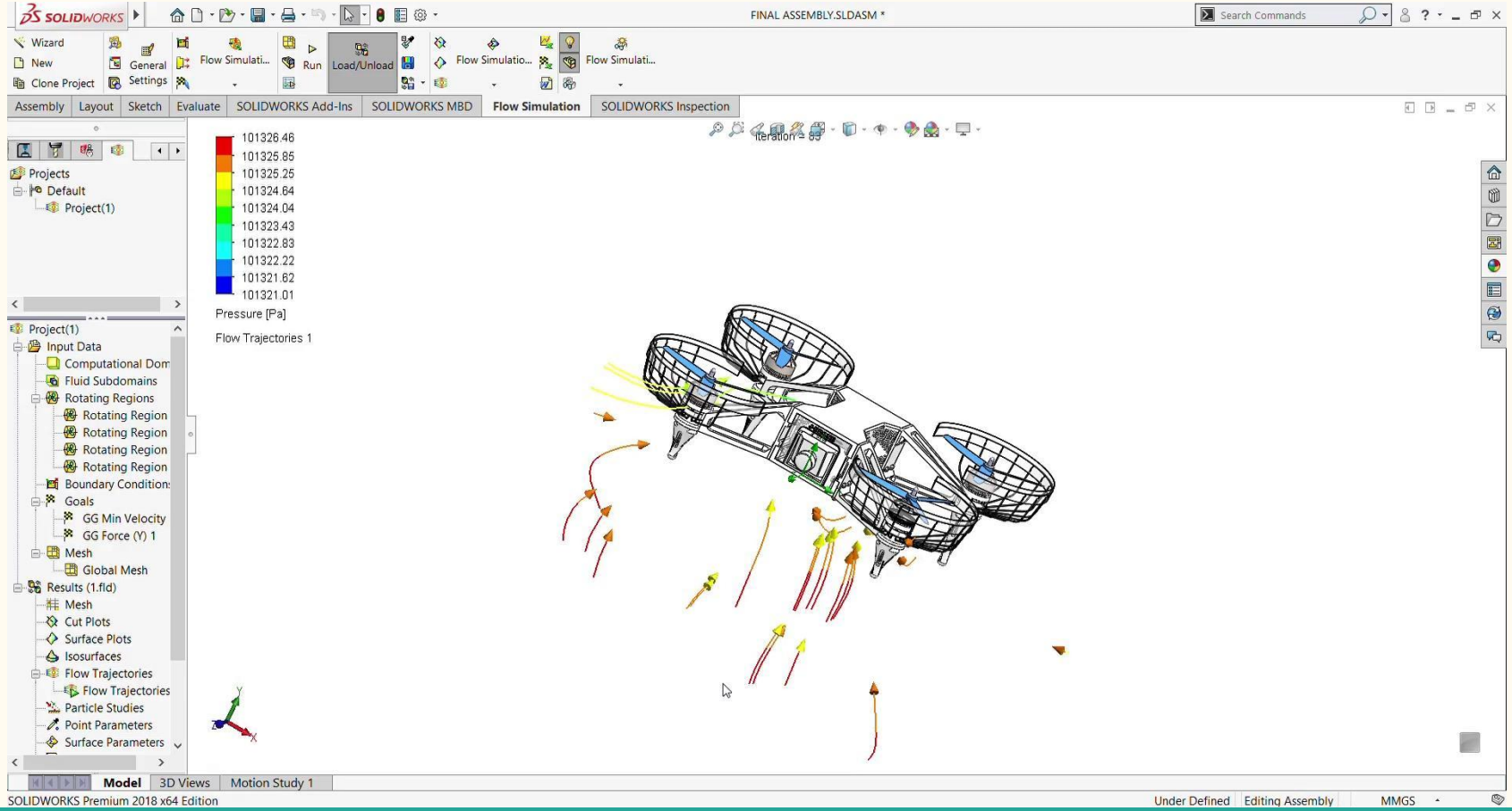
Editing Assembly
MMGS

FLOW SIMULATION VIDEO



SINCE THIS DRONE IS USED FOR A RACING COMPETITION (IAM3D COMPETITION) THAT CONSISTS OF IT TO FALL DOWN AND FACE ROUGH ENVIRONMENTS, THE PARTS ARE USUALLY REPLACED AFTER SOME TIME.

SO ANALYSIS AND SIMULATION OF THE DRONE HAD PROVEN THAT IT CAN BE USED FOR FURTHER PROTOTYPING AND FINALLY USING IT FOR RACING.

THE FRAME IS PREPARED FOR PROTOTYPING USING THE SLICING SOFTWARE **CURA**

- FOR NOW THE PARTS THAT ARE TO BE PRINTED ARE GIVEN EQUAL VALUES FOR 3D PRINTING.

  I.E,

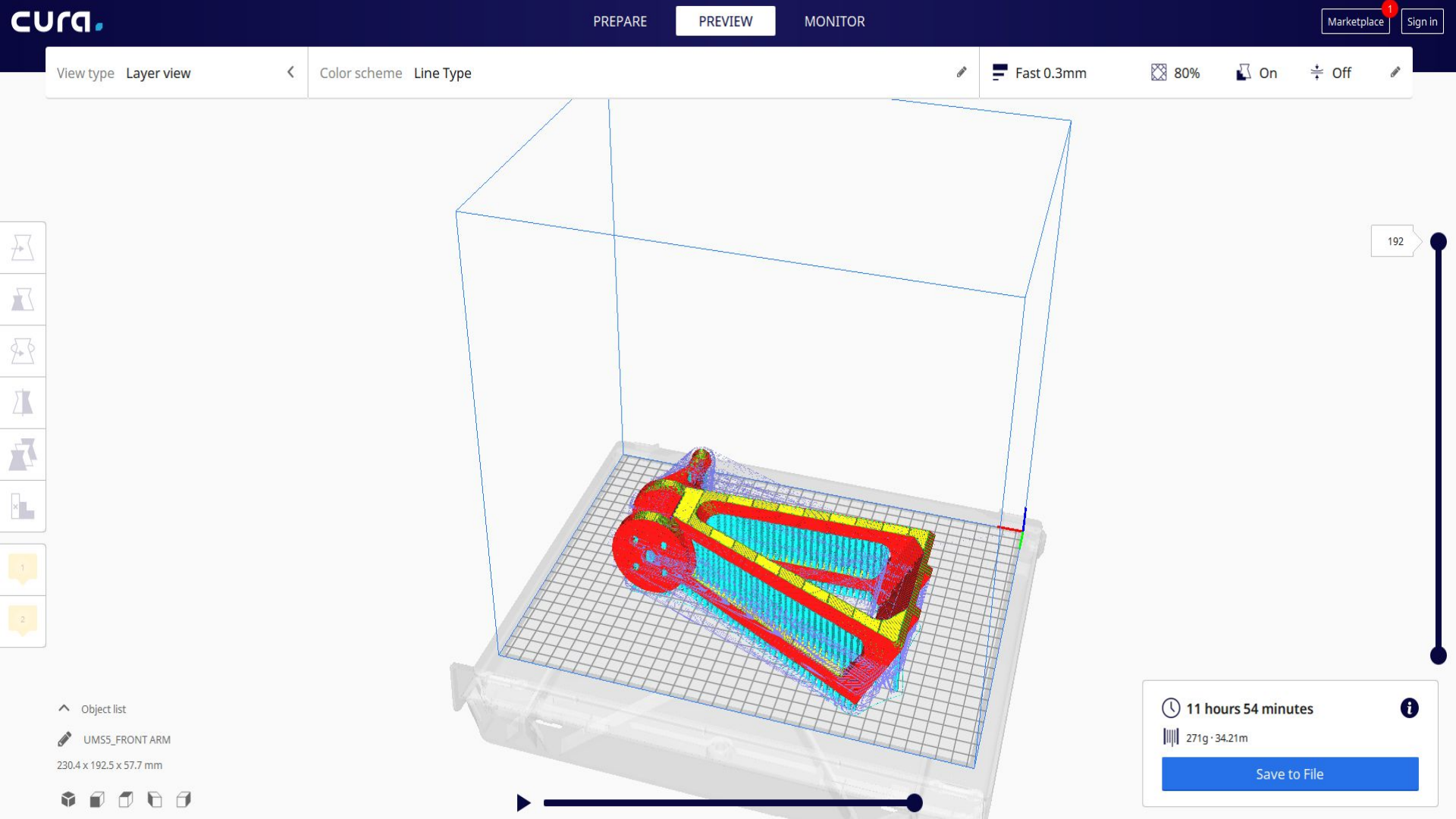
  i) INFILL DENSITY= 80 & INFILL PATTERN= GYROID

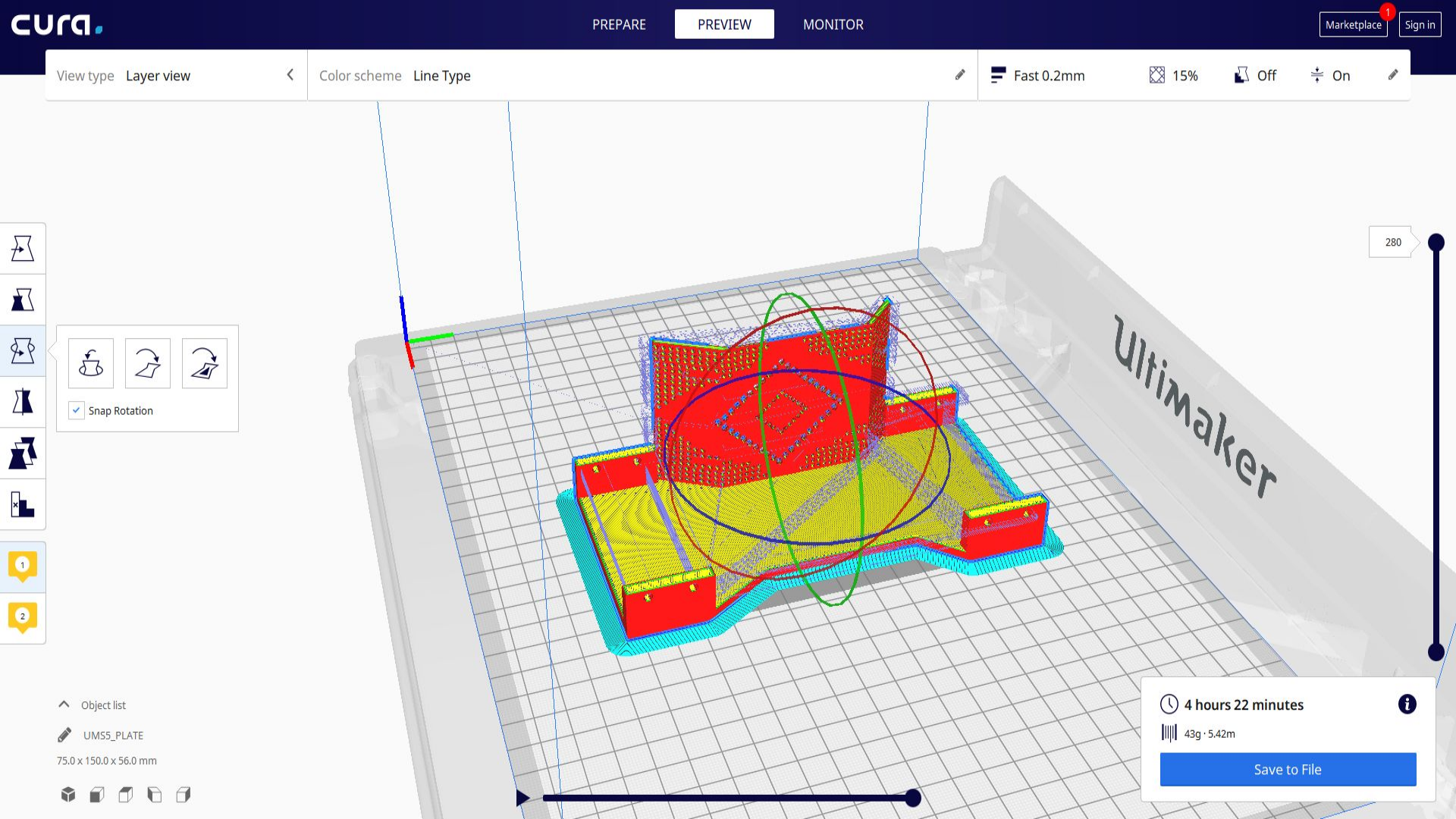
  ii) SUPPORT PLACEMENT= EVERYWHERE &

  SUPPORT OVERHANG ANGLE=60

  iii) LAYER HEIGHT = 0.3, THEREFORE

  NOZZLE DIAMETER=0.3


cura
PREPARE
PREVIEW
MONITOR
Marketplace
1
Sign in
View type Layer view
Color scheme Line Type
Fast 0.3mm
80%
On
Off
192
Object list
UMS5_FRONT ARM
230.4 x 192.5 x 57.7 mm
11 hours 54 minutes
271g · 34.21m
Save to File


cura
PREPARE
PREVIEW
MONITOR
Marketplace
Sign in
View type Layer view
Color scheme Line Type
Fast 0.2mm
15%
Off
On
280
Snap Rotation
Ultimaker
Object list
UMS5_PLATE
75.0 x 150.0 x 56.0 mm
4 hours 22 minutes
43g · 5.42m
Save to File


V-DRONE

THANK YOU