Creating racing drones in Fusing 360 to Flow Design

The Step by Step Insider Guide walks readers through basic to advanced drone airframe aerodynamics. Your creative results may vary, experimentation is encouraged.

PD21100-L

Racing-Drone Design Fundamentals with Fusion 360

ELI DElia - Eagle Eye

Taylor Stein - Autodesk

Learning Objectives

- Learn best practices and workflows for creating an aerodynamic racing drone
- Understand airframes and power-trains layouts—learn how to build airframes around imported component files
- Learn how to use Flow Design wind-tunnel simulator to guide UAV form

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Description

Professional drone racing is now and the market is hungry for new dynamic designs to feed the sport! This class will go in depth with Fusion 360 software in tandem with Flow Design wind-tunnel simulator to demystify the working fundamentals of mainstream racing drones. Attendees will learn essential steps in creating a CAM (computer-aided manufacturing)-ready, aerodynamic airframe around imported component files. This session features Fusion 360 and Flow Design.

LEVEL OF EXPERTISE:
All Levels

PREREQUISITE SKILLS OR KNOWLEDGE:
Fusion 360

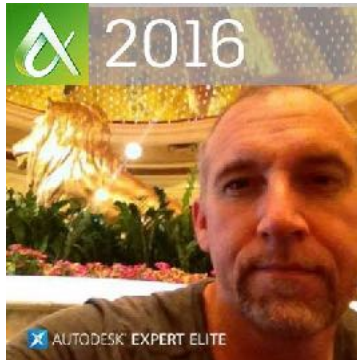PRODUCT :
Fusion 360, Flow Design Wind Tunnel Simulator

Your AU Expert(s)

Taylor Stein, Fusion 360 Evangelist
Bryce Heventhal, Technical Marketing Manager for Fusion 360
Paul Sohi, Autodesk Product designer
Mickey Wake Field, Autodesk CAD and Simulation software manager

About the Speaker:

Commercial Drone Designer, Fusion360 Expert Elite.

Founder of Game of Drones and Aerial Sports League. Owner Hooligan FPV Pro Racing Drones. Eagle Eye Metrics, Aerial Agronomy & Services.

Eli has a number of sports drones in the market. Has been involved with fringe robotics since 1996. Now exclusively in the commercial drone industry as a designer, engineer and certified FAA Pilot in Command.
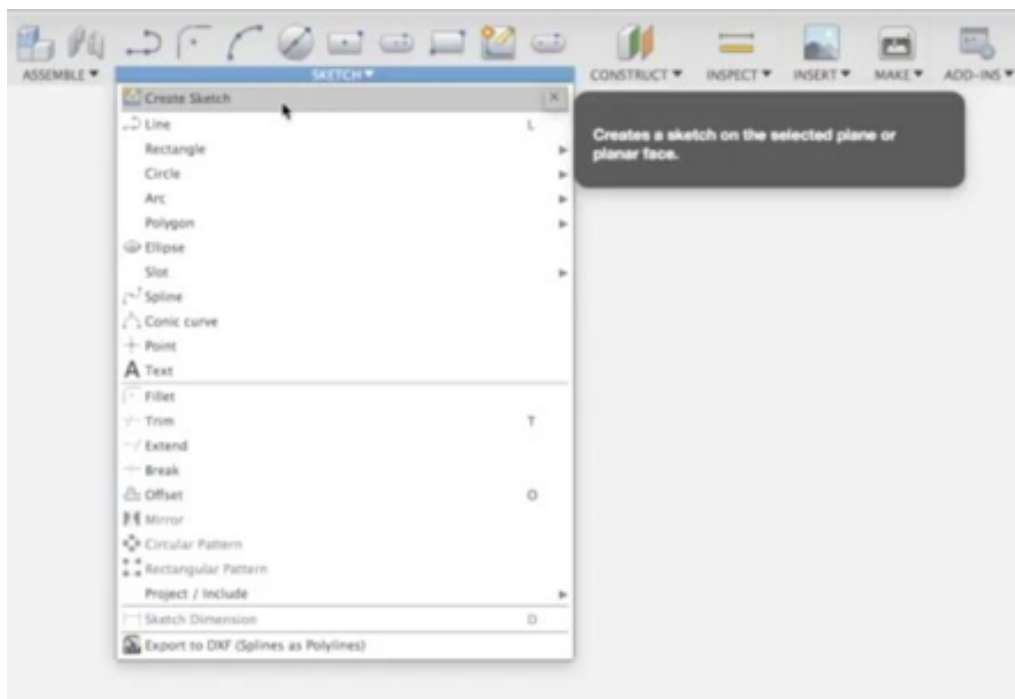
RACING DRONE DESIGN FUNDAMENTALS

**By Eli DElia
UAV Designer**

Section 1 - Modeling A Basic Airframe

Step 1: Creating The Motor Component Plate - Motor Mounts:

1. Launch Fusion 360

2. In the Model Module / Sketch Menu / Create New Sketch.

3. Select the bottom plane so your view orientation is facing down.
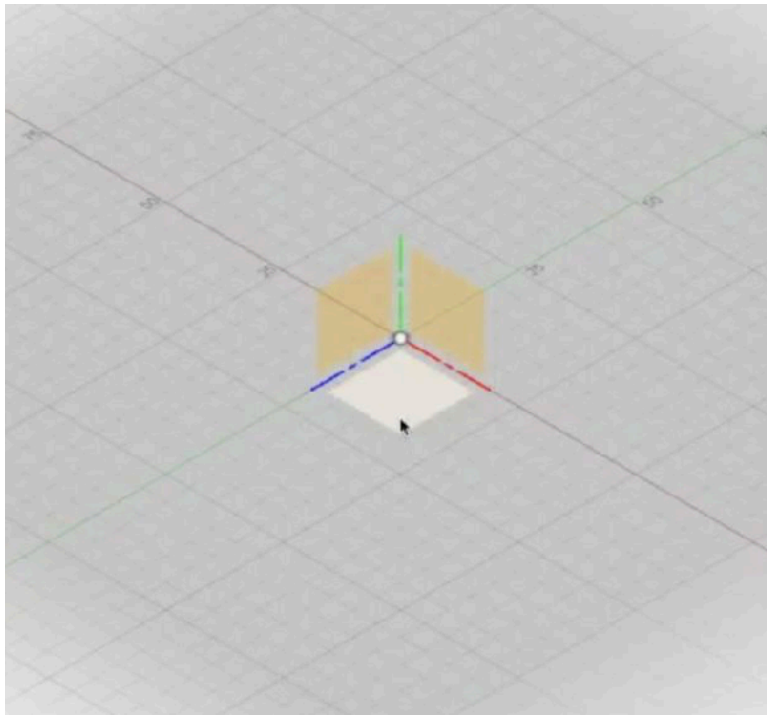
4. Sketch / Center Diameter Circle. From world center draft a 210 millimeter circle. Drag out and input 210 mm in the diameter dialog box.

5. Sketch / Line Tool. Draft a vertical line from center to just past the top of the circle perimeter and hit "X" on your keyboard to convert the line to a construction line.

6. Sketch / Line Tool. Draft out a horizontal line from center to just past the right of the circle perimeter and hit "X" on your keyboard to convert the line to a construction line.

7. Measure out a 45 degree arc from the center vertical and horizontal lines.

8. Sketch / Line Tool. Draft another line tool between the two and type in 45 degrees. Hit "X" on your keyboard to convert the line to a construction line.
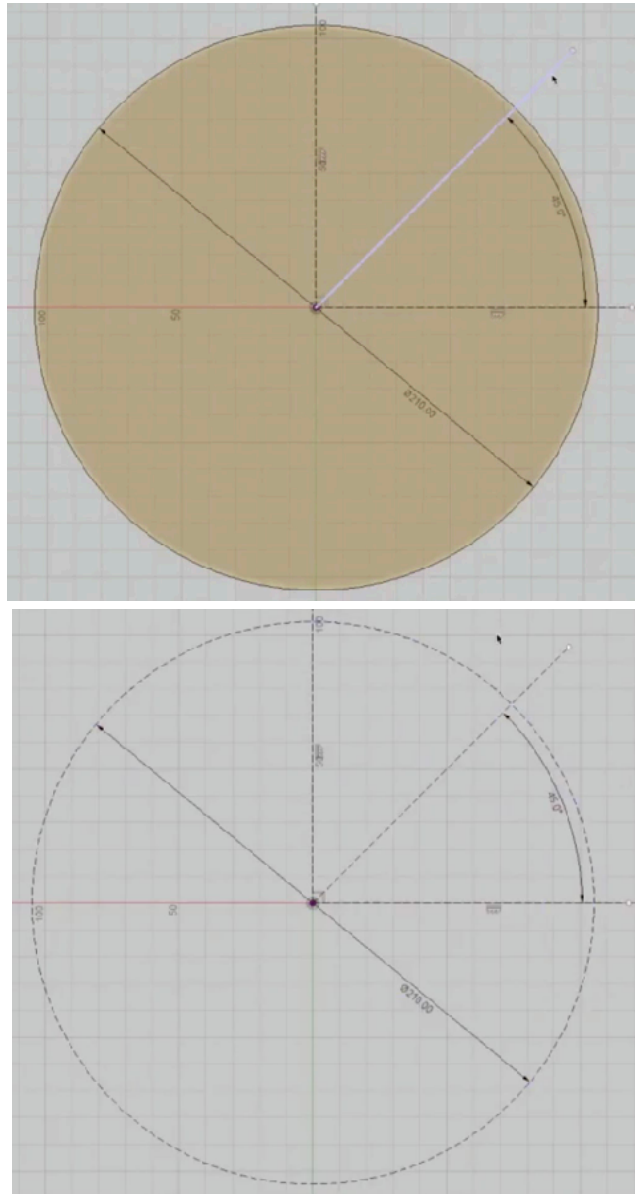
9. Select the Circle and hit "X" on your keyboard to convert the line to a construction circle.

Note: When drafting out a Motor Mount it is key is to assure that the motors are equal distance or square from each other.

10. Create the motor mount, Sketch / Center Diameter Circle. From the 45 degree line intersection draft out a new construction circle and input 25mm. (almost 1 inch)
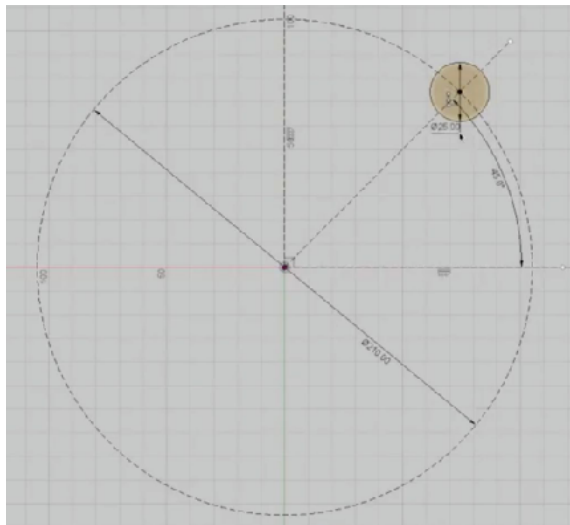
11. Use the 25mm dimension line as a guide, adjust so it is perfectly vertical.

12. Create a center circle which will become a hole to allow the motor's drive shaft to spin freely.

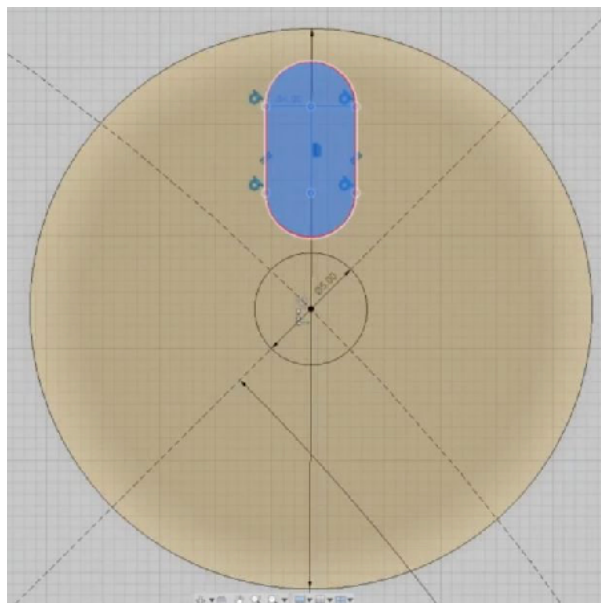13. Sketch / Center Diameter Circle. From motor mount circle center draft out a new circle and type in 5mm.
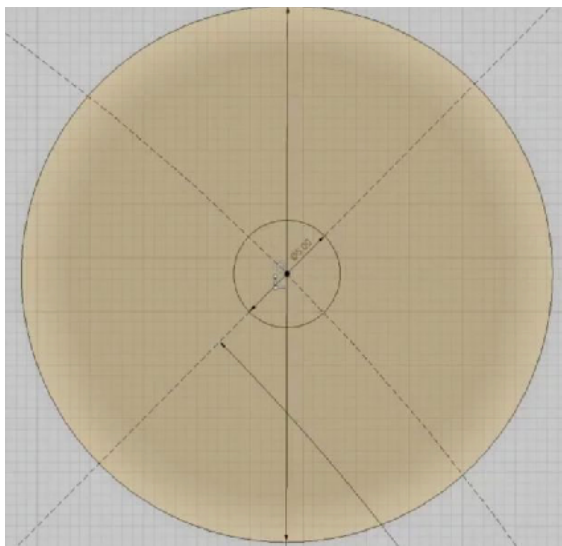
14. Sketch / Center to Center Slot tool. Using the 25mm dimension line as a guide, draft a slot just off the center motor shaft circle. Type in 4mm in width.
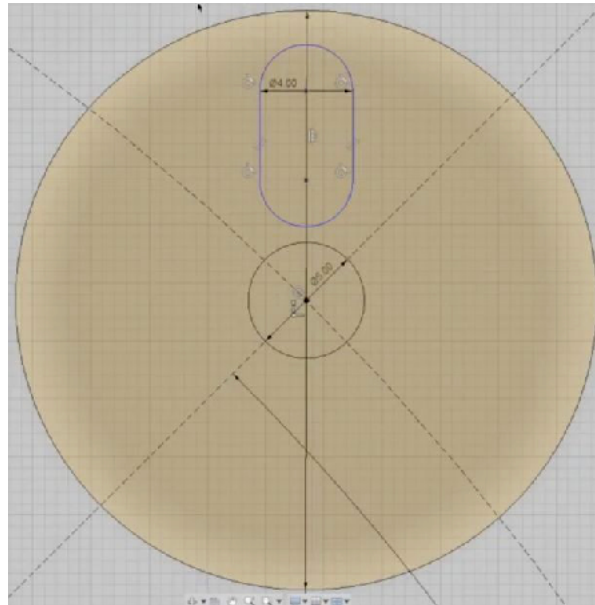
15. Adjust the top and bottom arcs to allow distance from the top circle perimeter and the cent circle diameter.
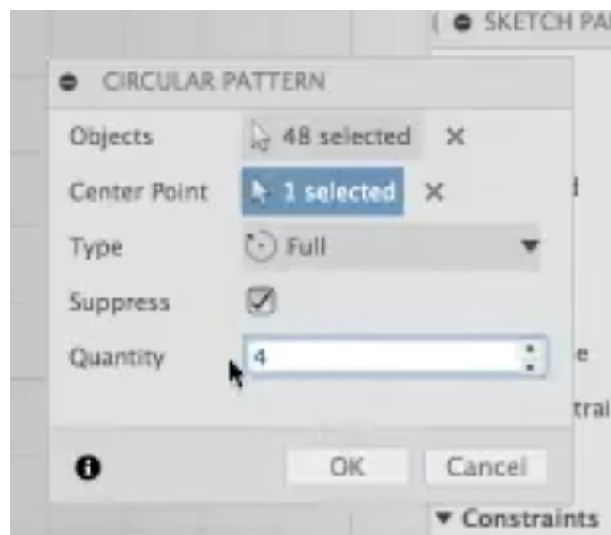
16. Right drag select the motor mount slot.

17. Sketch / Circular Pattern Tool. From the tool's dialogue box check to be sure all 11 elements of the slot tool are selected. Click on center point and select the motor mount circle center point.
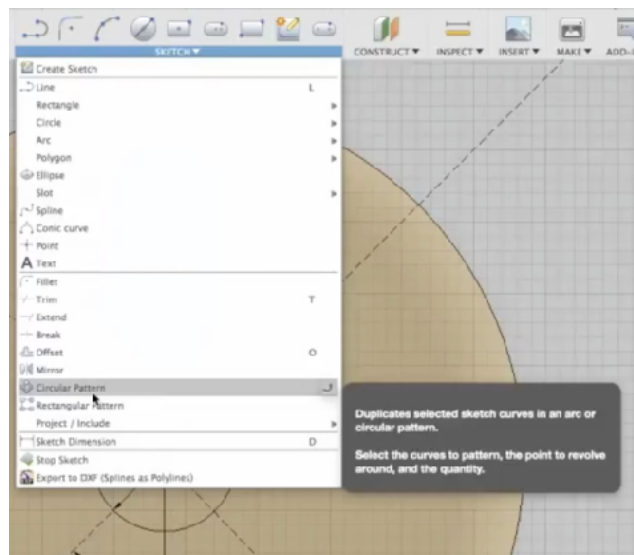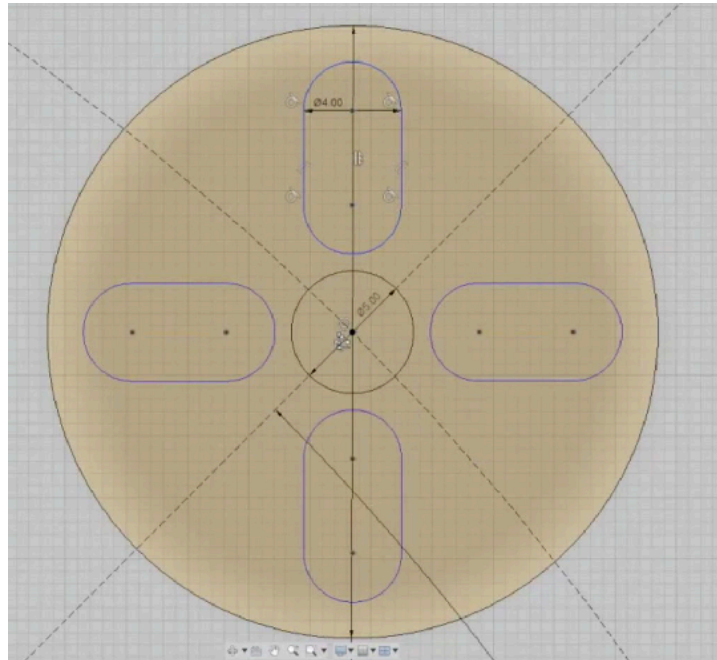


18. Change the default setting from 3 to 4 and click ok.

19. The 1st motor mount is now complete with a motor screw layout to allow good wire flow from the motors to drone center where they will connect to the Power Distribution Board (PDB).

20. Right drag select the complete motor mount.

21. Sketch / Circular Pattern Tool. From the tool's dialogue box check to be sure all 48 elements are selected. click on Drone Center Point, change the default setting from 3 to 4 and click ok.
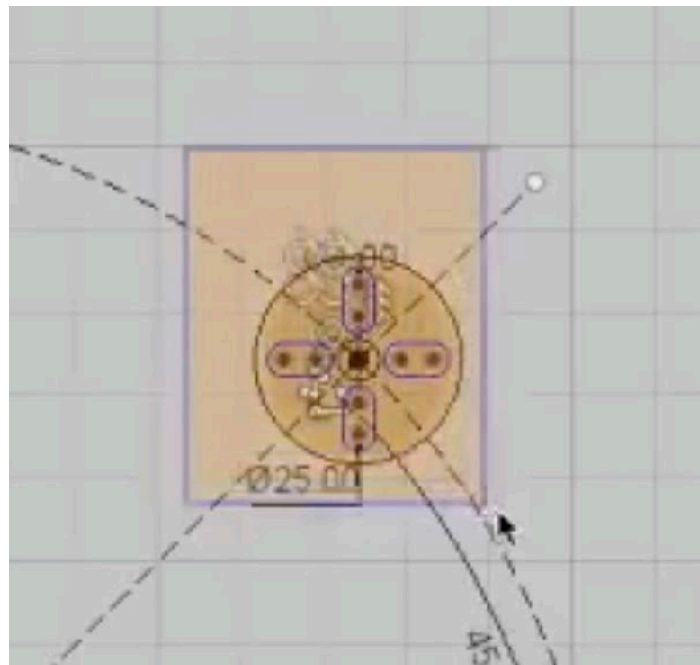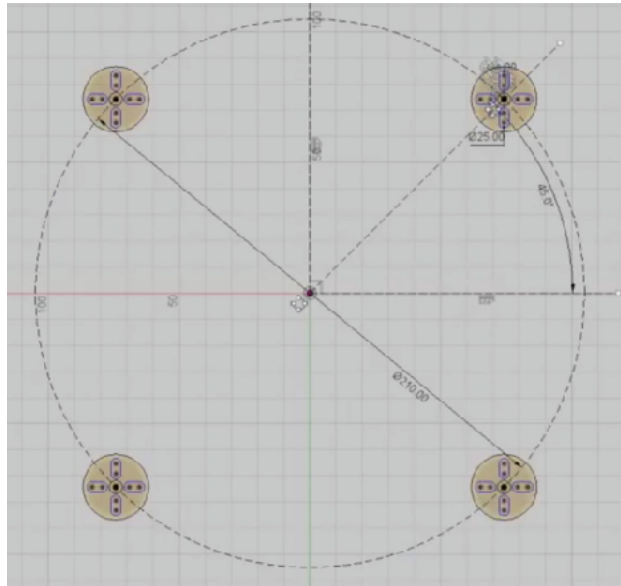
- The result will be motor mounts that are perfectly square.

Step 2: Creating The Motor Component Plate - Component Plate and Motor Booms:

1. Sketch / Center Rectangle tool. From drone center draft a rectangle, type in the values of 160mm vertical by 45mm horizontal. click ok
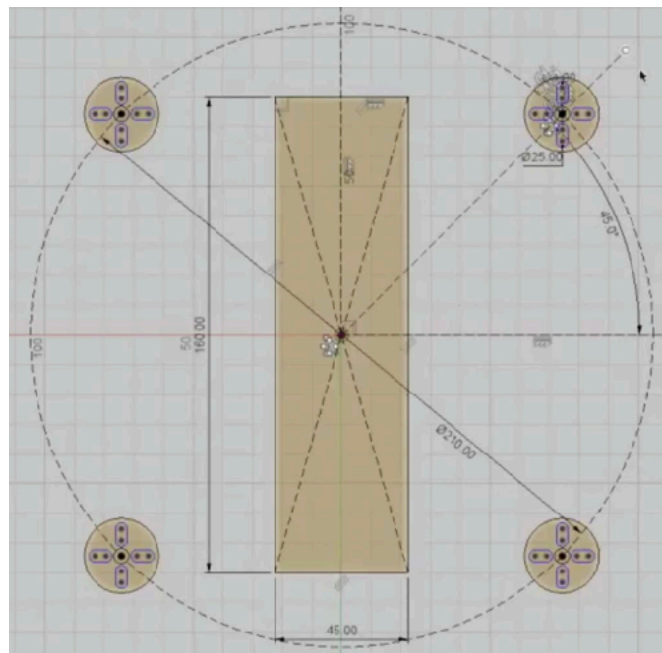
2. Sketch / 3 Point Arc tool. From upper left Motor Mount, in line center with the bottom slot tool, draft a 3 point arc down to the bottom left motor mount, in line center with it's top slot tool, click and drag the arc to just touch the center component plate rectangle.
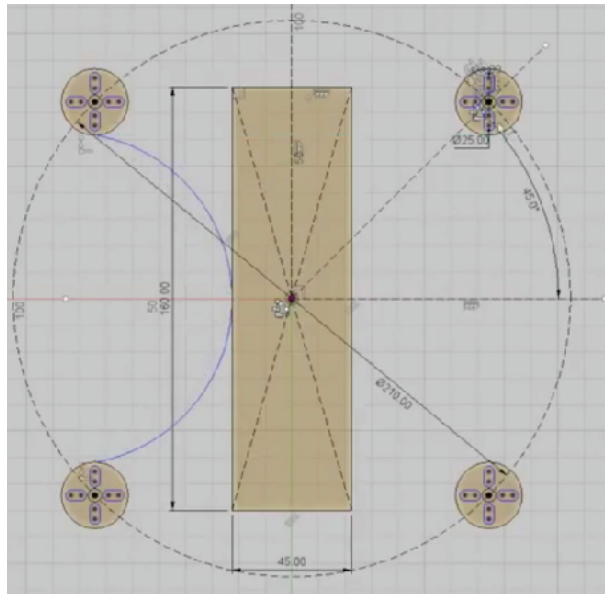
3. Repeat the process for the right side.
4. For top and bottom arcs use the circle construction line as a guide. Draft a new arc from top left motor mount to the correspond position of the top right motor mount and drag the arc in to the center rectangle as illustrated.
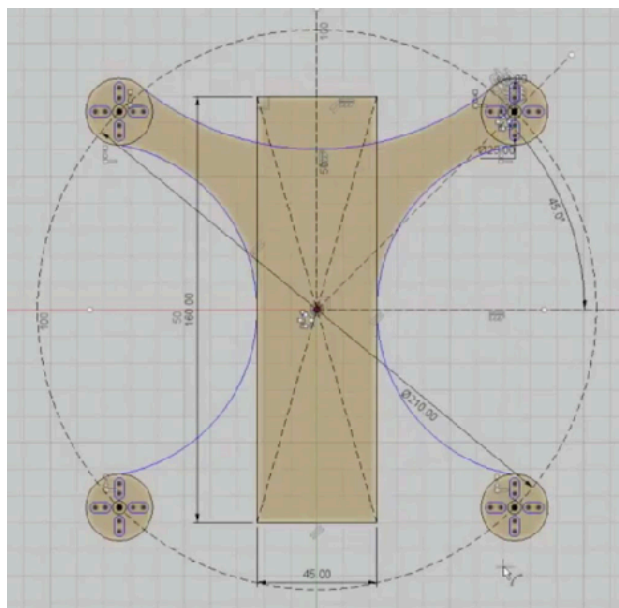
5. Repeat the process for the bottom arc to complete the motor boom layout.

6. To add more creative control over your design it is good practice to now Tangent Constrain the arc tool points to their motor mounts.
7. Select an arc tool, from the Sketch Pallet click on Tangent Constraint and select a motor mount. Repeat the process for all remaining arcs by re-selecting the arc / tangent constraint, select the corresponding motor mount.
8. You may have to adjust your arc. Click the arc and drag it to the original position. Tangent Constraint allows the center to move independently of the top and bottom arc points, resulting in more fidelity of your design.

9. As a rule the motor booms width should not be much more than the propellers, for a racer of this size that equals 12mm.
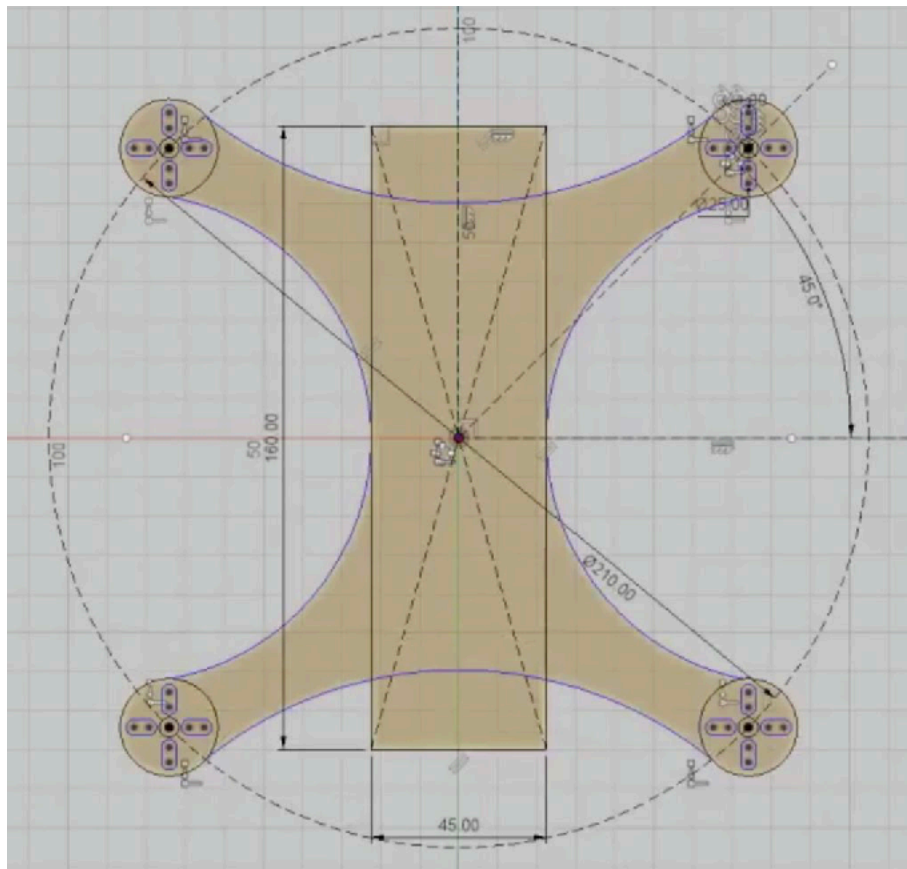
Step 3: Creating The Motor Component Plate - PDB and Stand Off Hardware holes:

Drafting the Power Distribution Board hardware holes:

1. Sketch / Center Rectangle Tool. From drone center draft out a square and type in the values 30.5mm x 30.5mm, click ok.
2. Select the lines of the rectangle and hit X on your keyboard to make a construction square.
3. Sketch / Center Diameter Circle Tool. From the corner of the construction square, draft out a 4mm circle. Click ok. right drag select the new circle.
4. Sketch / Rectangle Pattern Tool.
5. Select the horizontal arrow handle and type in a value of -30.5mm. Set the quantity value to 2. Select the vertical arrow handle and input a value of 30.5mm x a quantity of 2. hit return to complete the process.
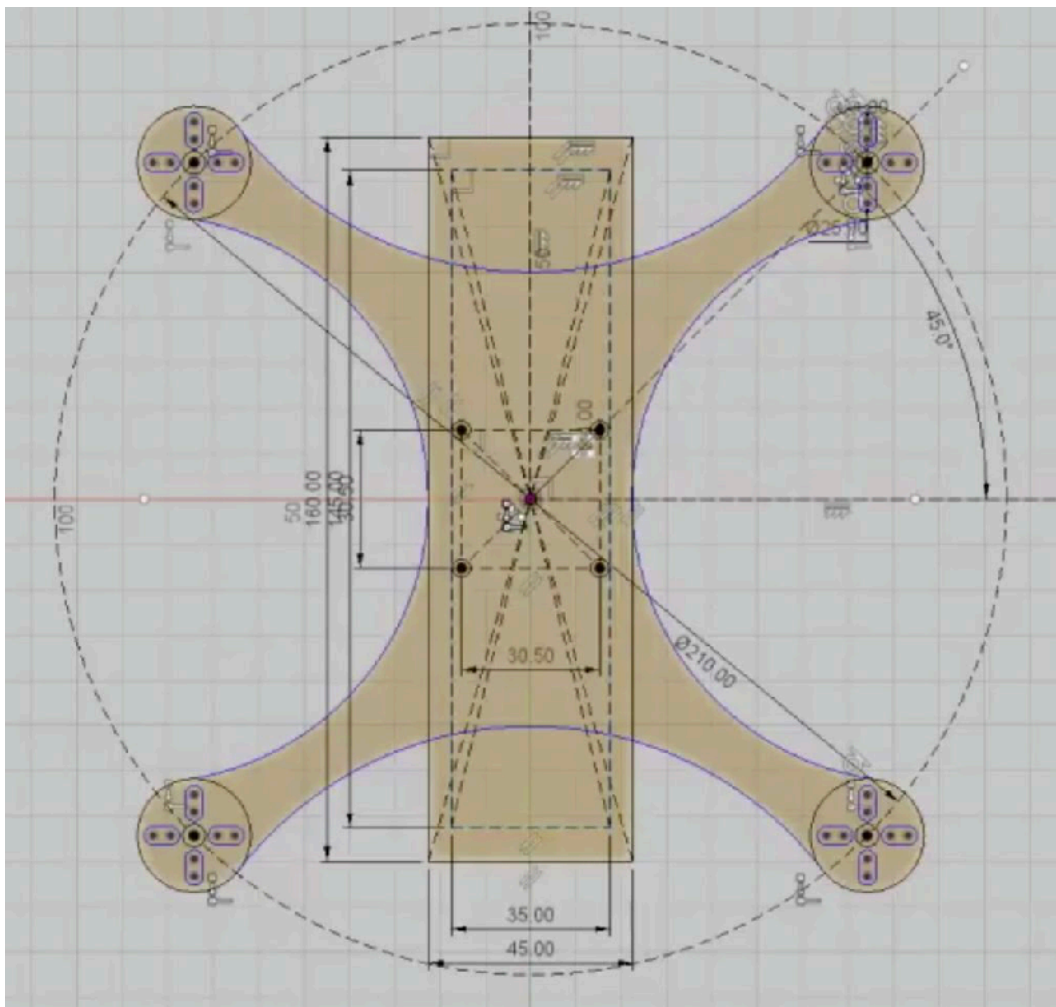
Repeat the process for the stand off hardware holes:

6. Sketch / Center Rectangle Tool. From drone center draft out a square and type in the values 145mm x 45mm, click ok.
7. Select the lines of the rectangle and hit X on your keyboard to make a construction square.

8. Sketch / Center Diameter Circle Tool. From the corner of the construction square, draft out a 4mm circle. Click ok. right drag select the new circle.

9. Sketch / Rectangle Pattern Tool.

10. Select the horizontal arrow handle and type in a value of -45mm. Set the quantity value to 2. Select the vertical arrow handle and input a value of 145mm x a quantity of 4. hit return to complete the process.

-This completes the basic sketch for the Motor Component plate.

11. Next extrude the plate to create geometry. Adjust the view by click and dragging the View Cube.

12. Modify / Press Pull Tool. Or Q on your keyboard.
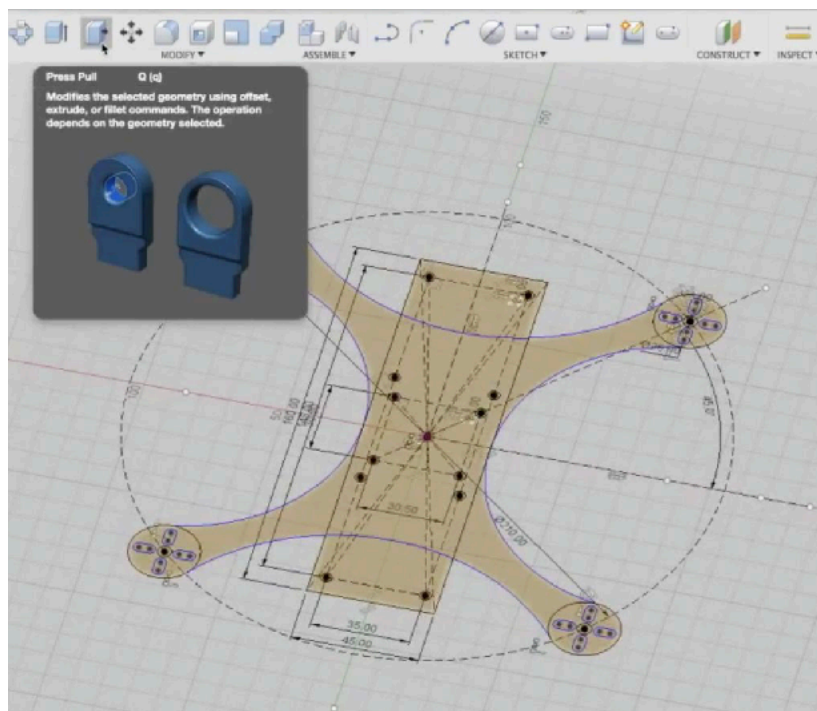
13. Select the Motor component plate. The selected elements will turn blue. Avoid selecting any hardware holes.
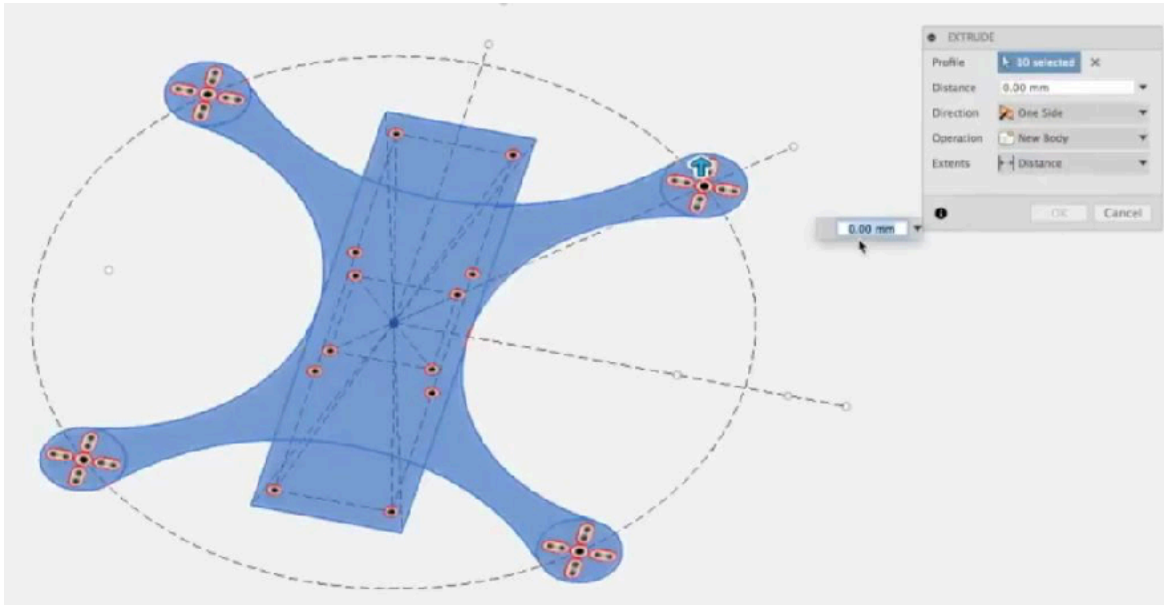
14. In the Press Pull Dialogue box enter a value of 3mm, click ok.
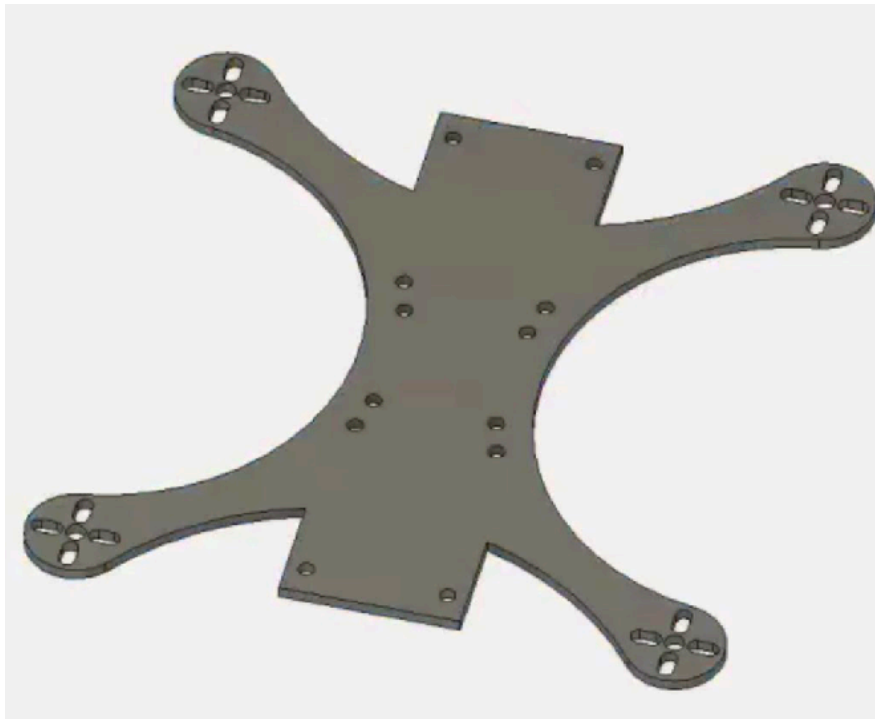
Step 4: Round off the corners and hard edges:
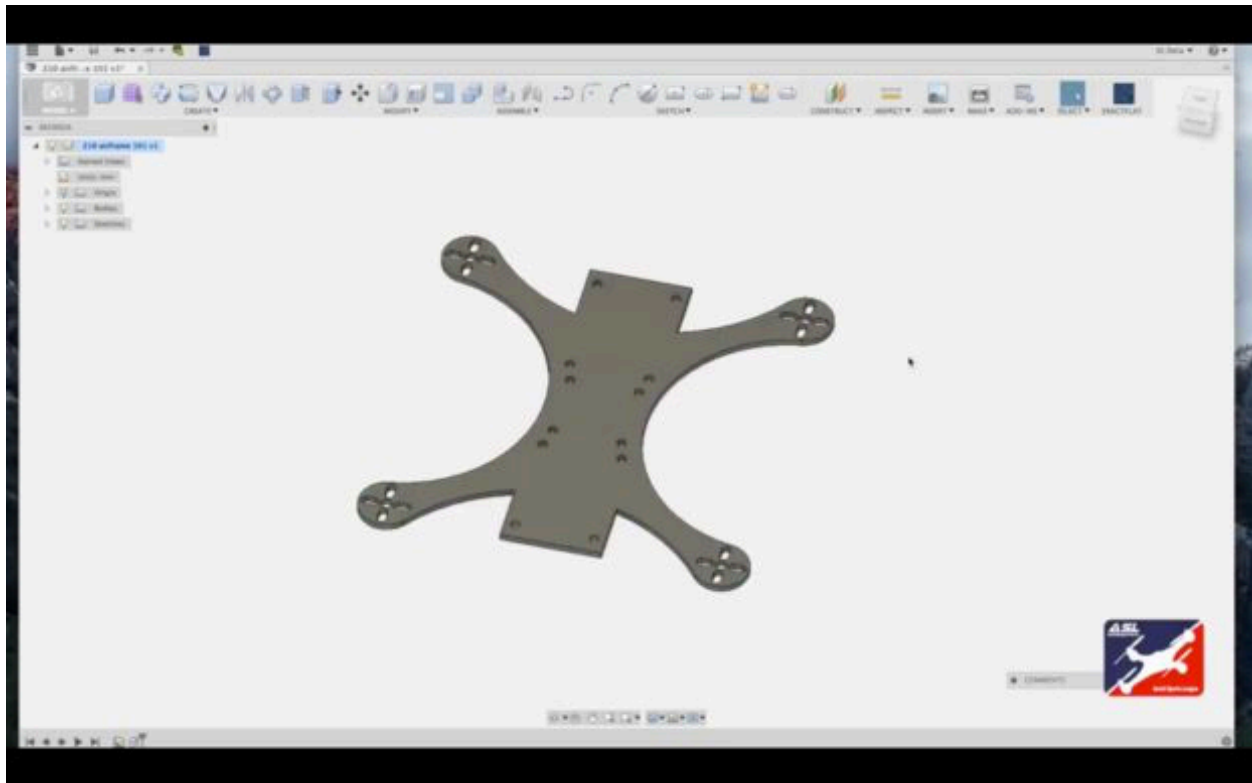
1. Modify / Fillet tool or use hot key F. Zoom into the sharp corner where the Motor Booms meet the Component Plate.
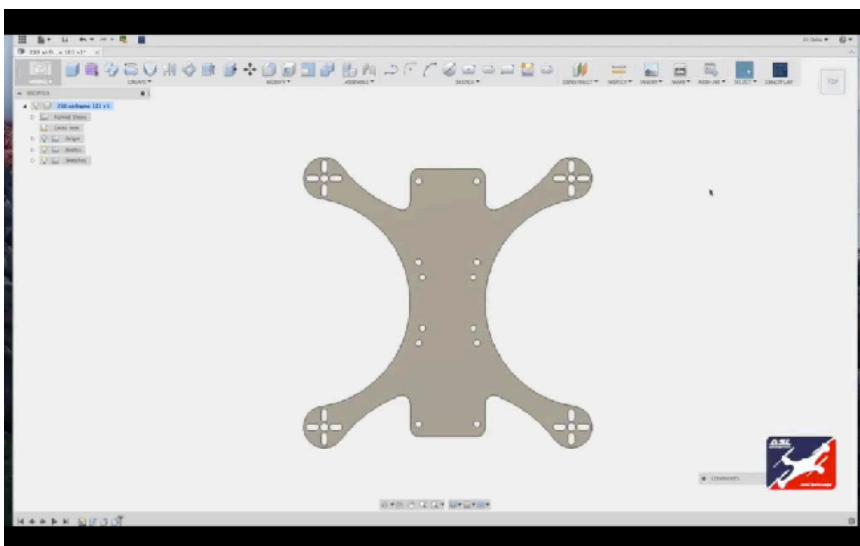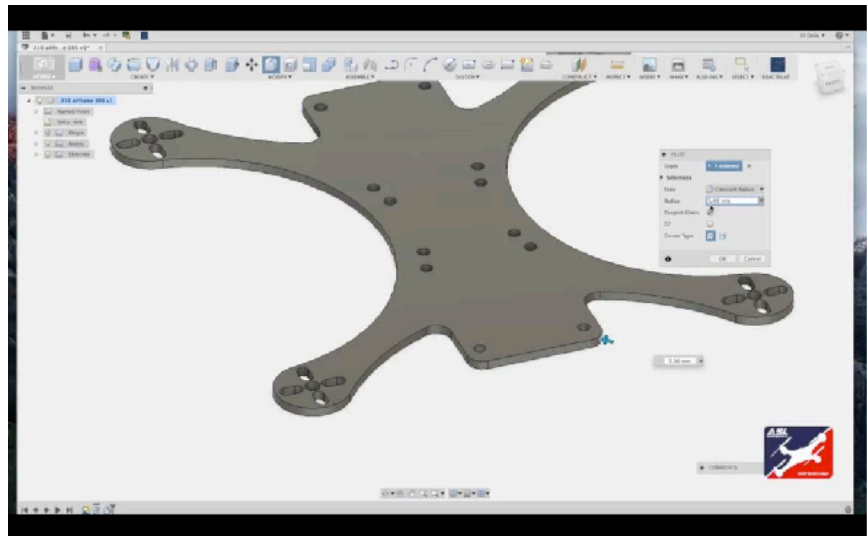
2. Select each corner of the airframe.
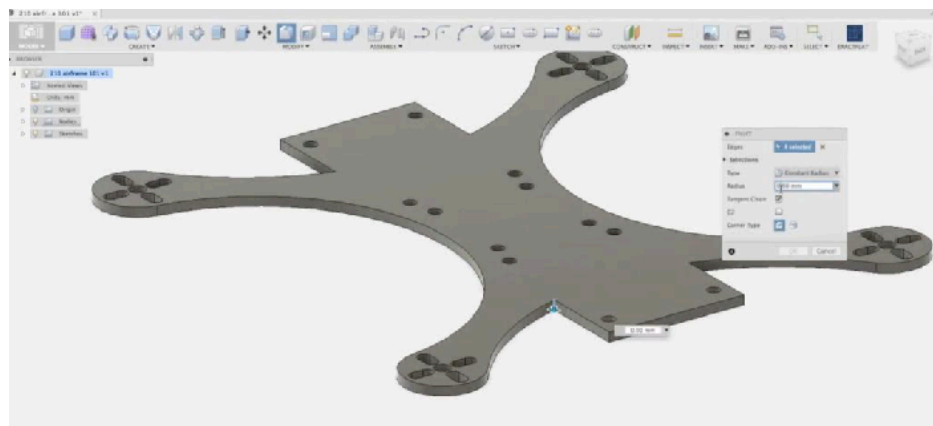
3. In the Fillet Dialogue box enter a value of 5mm. Click ok to complete the process.

4. Repeat the process rounding out the component plate's sharp edges.

5. Hit Hot Key F and select all four corners of the component plate, in the dialogue box enter a value of 5mm. Click ok to complete the process.

Note: It is crucial to round off any sharp edges with a fillet of 5mm in order to add significant strength and durability to an airframe. Sharp corners and edges create potential breaking points in a harsh crash. Crashing is unavoidable in drone sports so take steps in the design stage to increase your airframe's longevity.

Step 5: Creating the Top Component Plate:
In the Browser Hierarchy Menu / Sketch, Right click the sketch and select Edit Sketch.
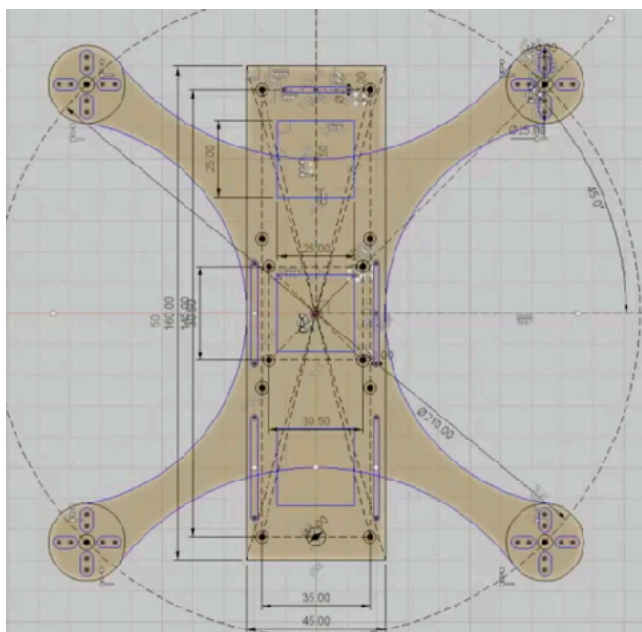
FPV Camera Bracket Slots:
1. Sketch / Center Point Slot Tool.
2. In the center forward section of the airframe use the construction guide lines to draft out a Center Point Slot. Input a value of 1.5mm. Hit return.

Battery Strap Slots:
3. Sketch / Center Point Slot Tool.
4. Using the construction lines on the right, center frame, draft out the center slot tool and make the thickness value 2mm.
5. Adjust the length to be 30mm. using the Center Slot control line adjust it so the center point rests on the airframe's center construction line. Be sure to give it enough room from the the edge and away from the screw holes.

6. Right drag select the new slot tool.
7. Sketch / Rectangle Pattern tool. Select and drag the horizontal arrow handle into the airframe. In the Rectangle Pattern Tool dialogue box, enter a value of -39.5 and a quantity of 2.
8. Select the vertical arrow handle, drag down and enter a value of -50 and a quantity of 2. Click OK to complete the process.

FPV antenna hole:
9. Sketch / Center Diameter Circle Tool.
10. In the rear section of the airframe, from center of the construction guide line. Drag and enter a value of 6mm. Return to end the process.

Cut in additional holes to reduce airframe mass:
11. Sketch / Center Rectangle Tool.
12. From airframe forward center, draft a rectangle and enter the values of 25mm x 25mm. Hit enter to complete the process.
13. Right Drag select the new square.
14. Sketch / Rectangle Pattern Tool.
15. Using the vertical arrow handle drag and enter a distance value of -100mm with a quantity count of 3. Hit return to end the process.

This completes the Top Component Plate sketch. Use the View Cube to adjust your view to a perspective.

16. Modify / Press Pull Tool or hit hot key Q.

17. Select the new component plate sections. Extrude to a value of 1.5mm in the dialogue box, hit return to complete the process to create the new geometry.
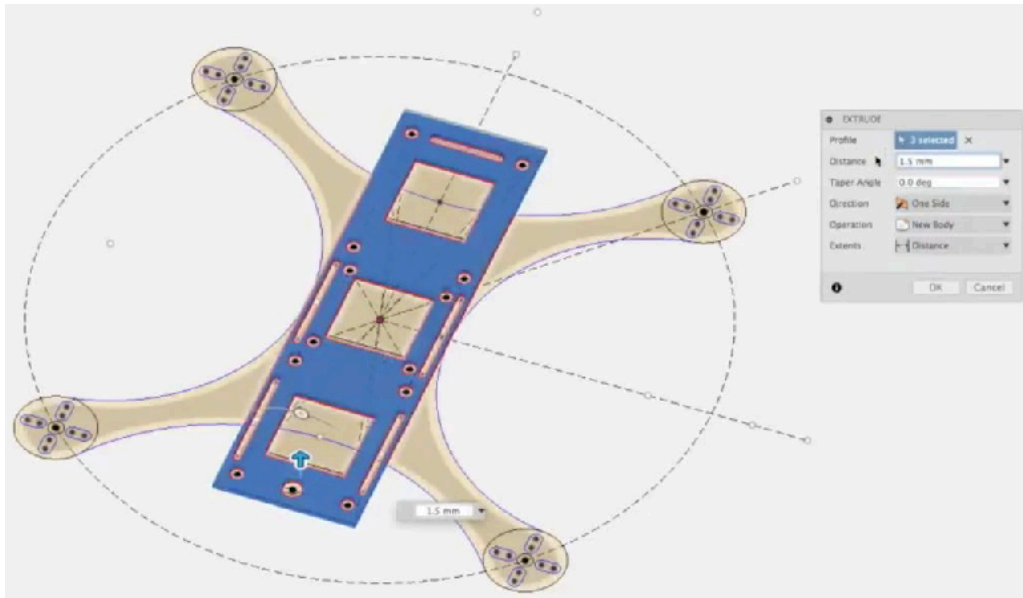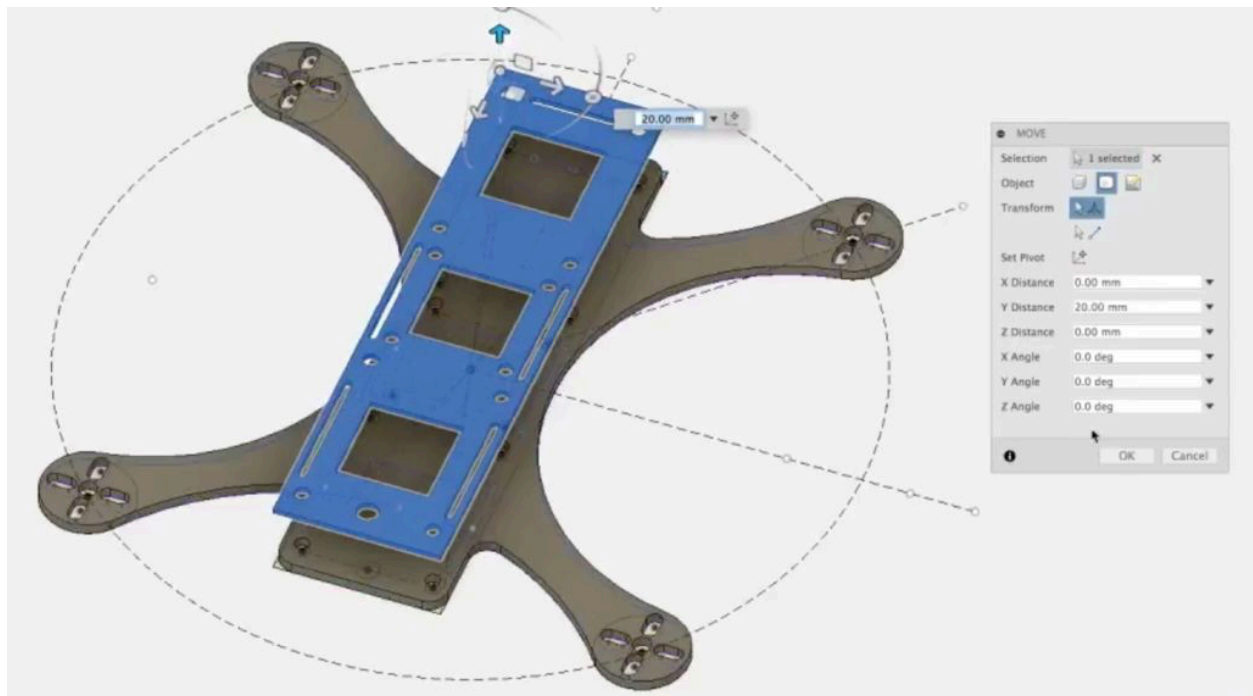

18. Browser Hierarchy / open the Bodies menu and select Body #2.
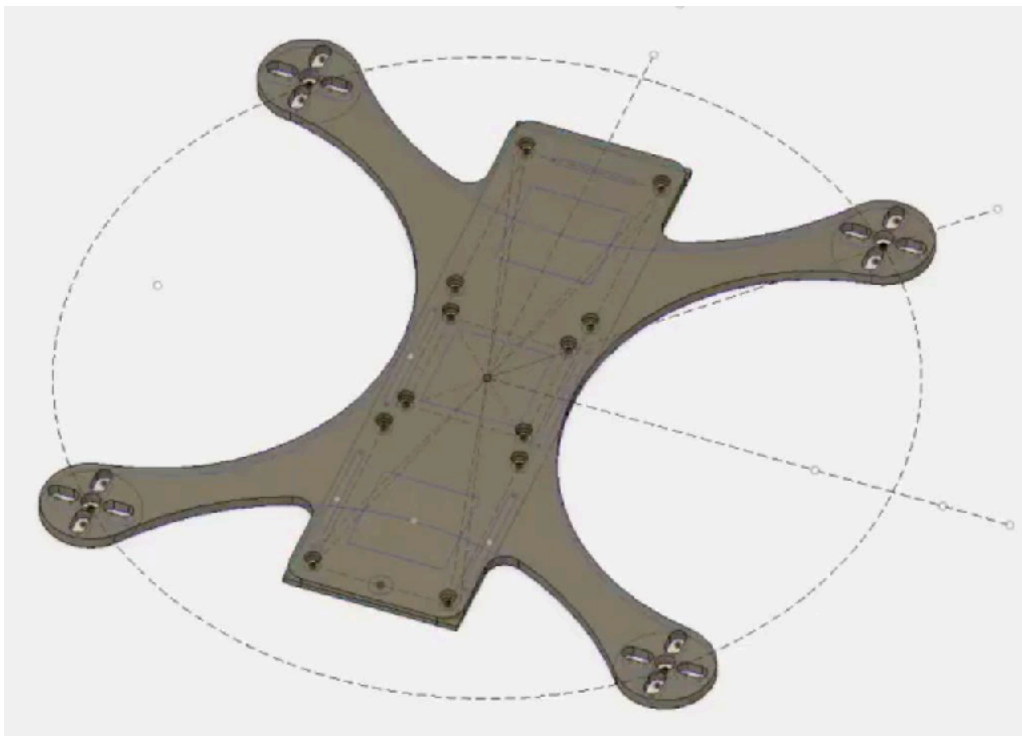
19. Modify / Move Tool. Drag the new body geometry up to a value of 25mm.
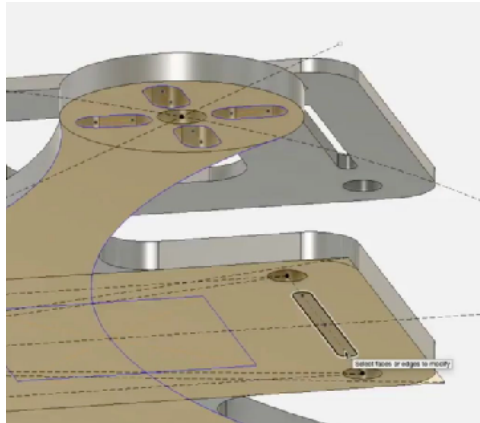

Round out the sharp edges:
20. Modify / Fillet Tool.
21. Select all 4 corners of the new component plate's perimeter. In the Fillet Tool dialogue box enter a value of 5mm, click ok.

22. Repeat the process for the corners of the square within the Top Component Plate w/ a Fillet radios of 5mm.

Step 6: FPV Camera Bracket Slot and making revisions without modeling new geometry:

1. Browser Hierarchy / Sketches, click the light bulb to make the sketch visible.

2. Use the View Cube to orientate the window to view the sketch looking up words the bottom forward of the airframe.

3. Modify / Press Pull Tool or Hot Key Q.
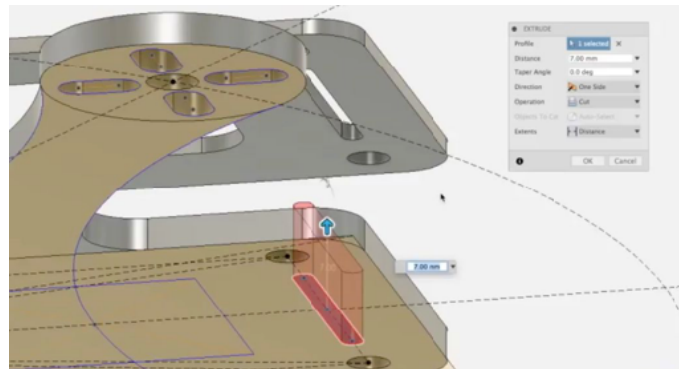
4. Select the forward FPV Camera Bracket slot and drag up so a red ghosted slot cuts through the bottom airframe. Hit Return to complete the process.

Modifying the model's geometry

The bottom Motor Component plate is now complete however there may be feature you wish to add or adjust to your airframe design. This is a very simple process to accomplish. By simply modifying the sketch your geometry will update accordingly. For this example adjust the FPV Bracket Slot from one long slot down to two short slots.

5. Browser Hierarchy / Sketches / Sketch1 right click Edit Sketch.
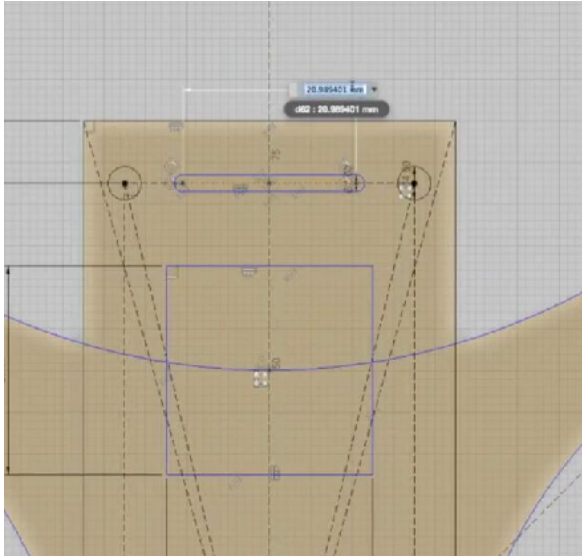
6. Select the forward most line of the FPV Camera Bracket slot and hit hot key D to Dimension the slot. Drag out the Dimension box and enter a value of 6mm and hit enter. The slot then updates in size.
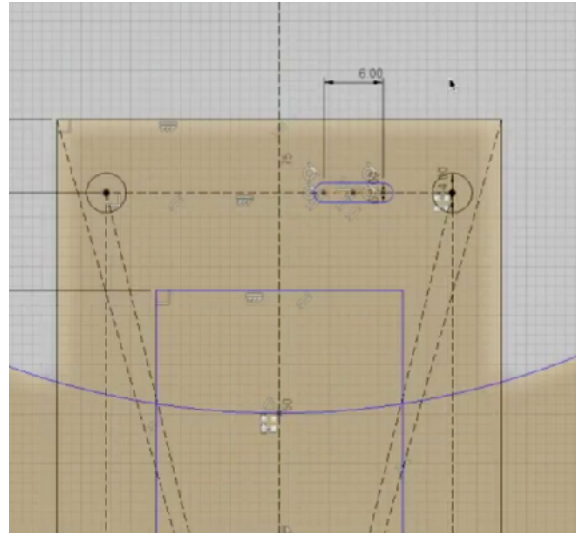
7. Right drag select the slot.
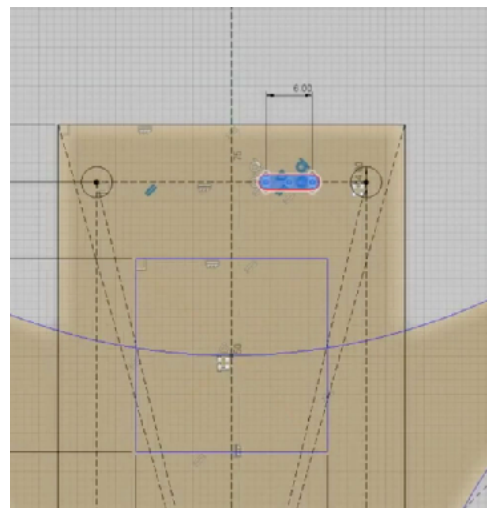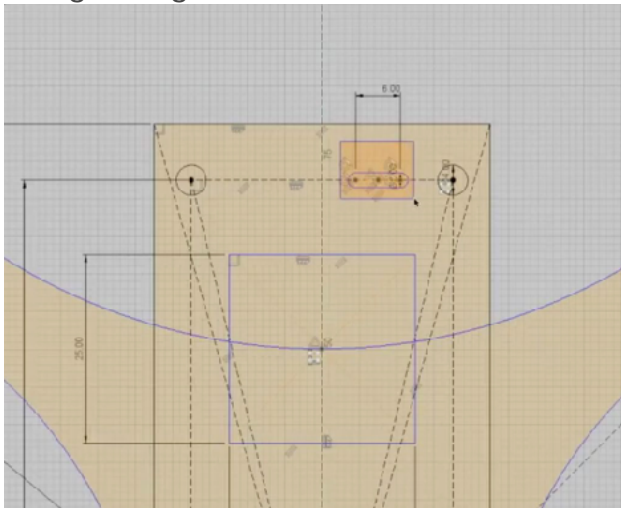
8. Sketch / Rectangle Pattern Tool. Select and drag the horizontal arrow handle and enter a value of -15mm and a quantity value of 2. hit return to complete the process.
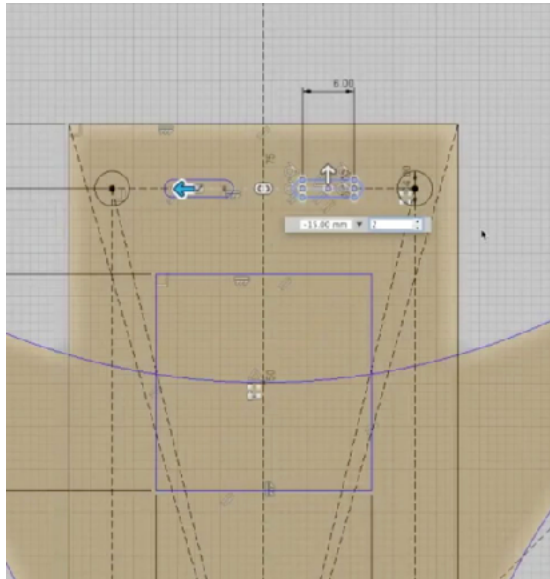
9. Stop Sketch. Notice how the model has updated with the new, modified slot.

10. Use the View Cube to orientate the perspective looking up from the sketch.

11. Hit Hot key Q and drag out the new slot so it cuts through both top and bottom plates. Hit return to complete the process.
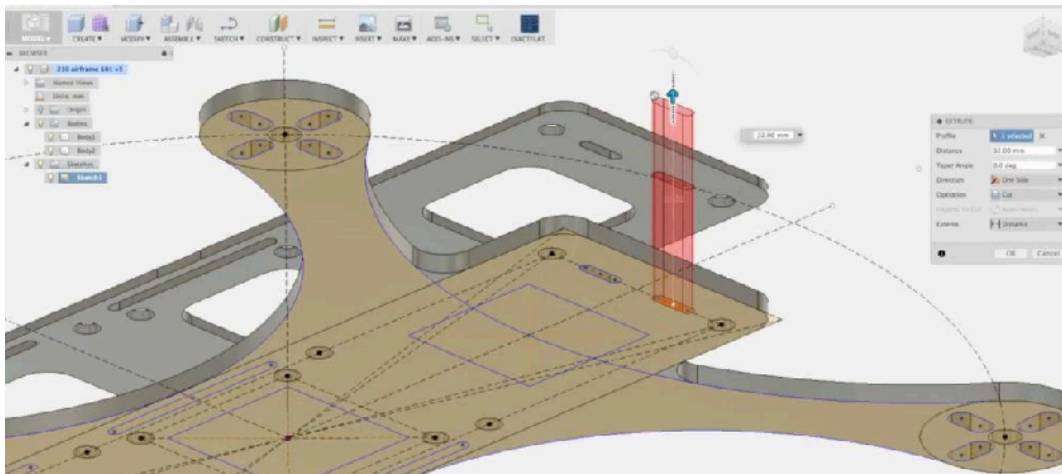
Resulting in two new camera mount slots.
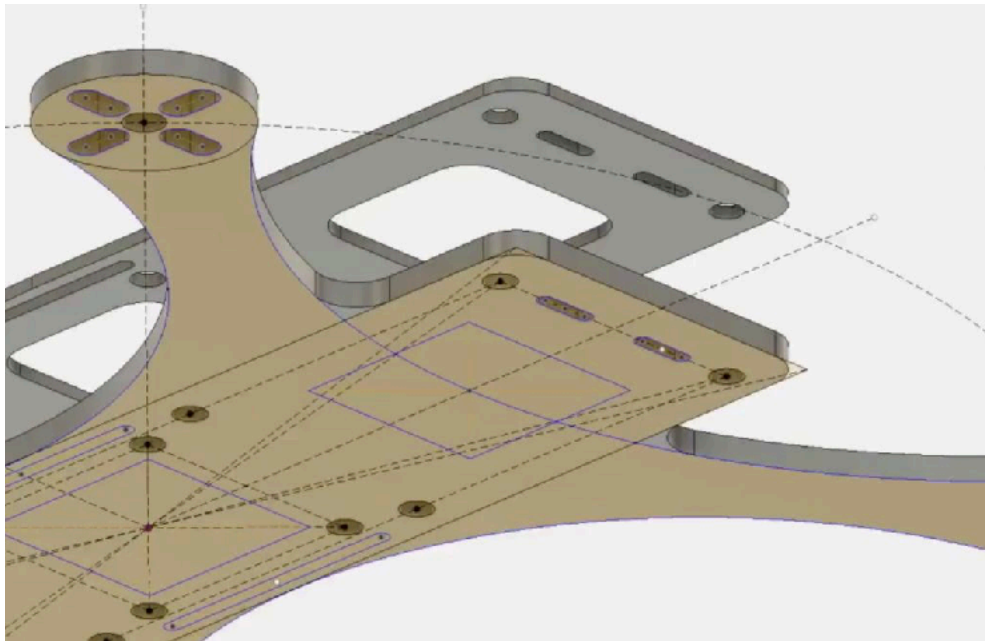
Step 7: First Person Video (FPV) Camera Bracket:

1. From the Browser Hierarchy turn off the light bulb icons for the geometry.

2. Sketch / Create New Sketch. Select the Forward view Plane.
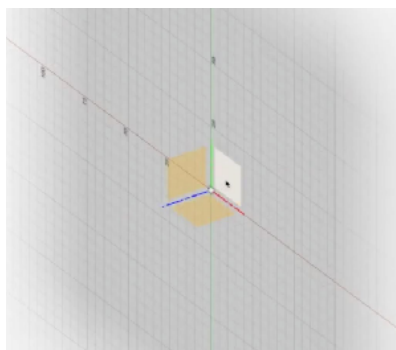
3. Sketch / Center Rectangle Tool.

4. From world center click and drag out then enter a value of 23.614mm x 27.014, hit return.
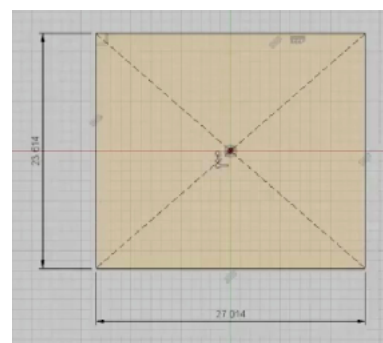
5. Sketch / Center Diameter Circle.

6. From rectangle center, drag out and enter a value of 16.789mm.
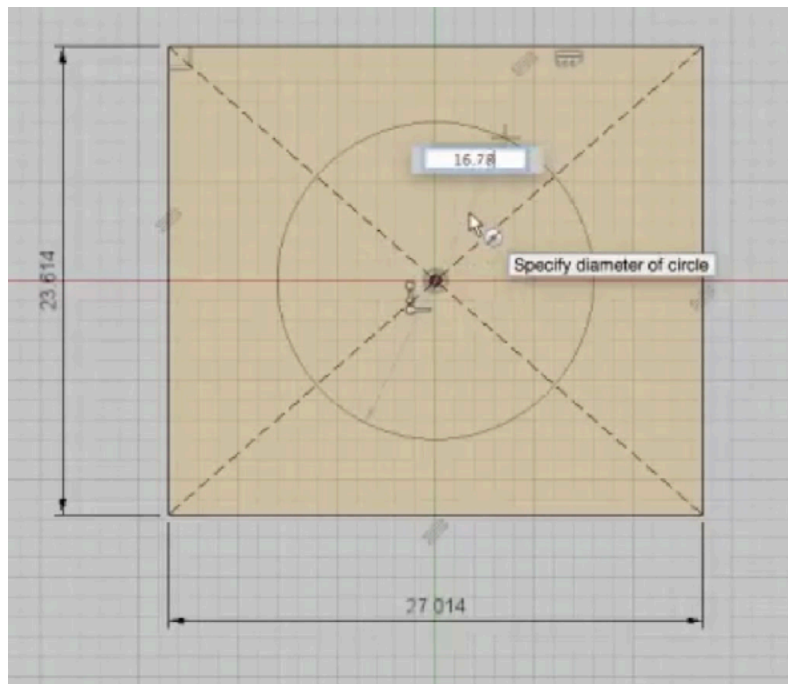
7. Sketch / Center Rectangle Tool.

8. From the top center of the rectangle click and drag out, enter a value of 4mm tall x 10.16mm wide.

9. Repeat this process for the bottom center of the rectangle
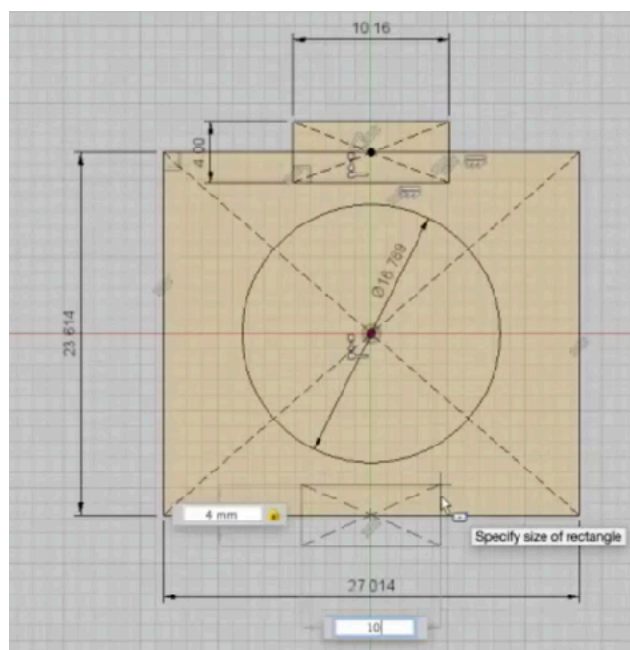
10. Sketch / Two Point Rectangle Tool.
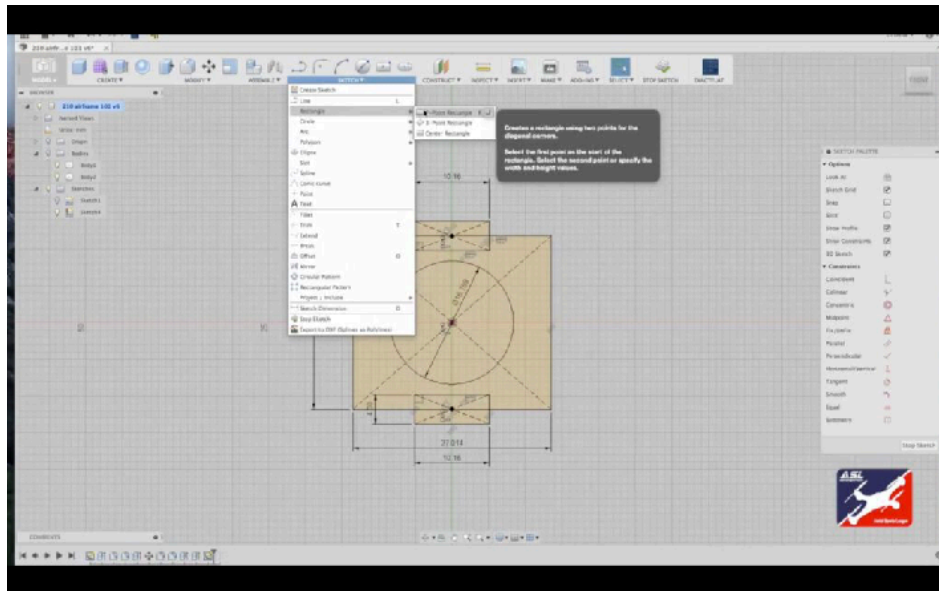
11. From the top right corner click, drag out and enter values 2mm x 3.58mm hit return.

12. Repeat for the remaining three corners.
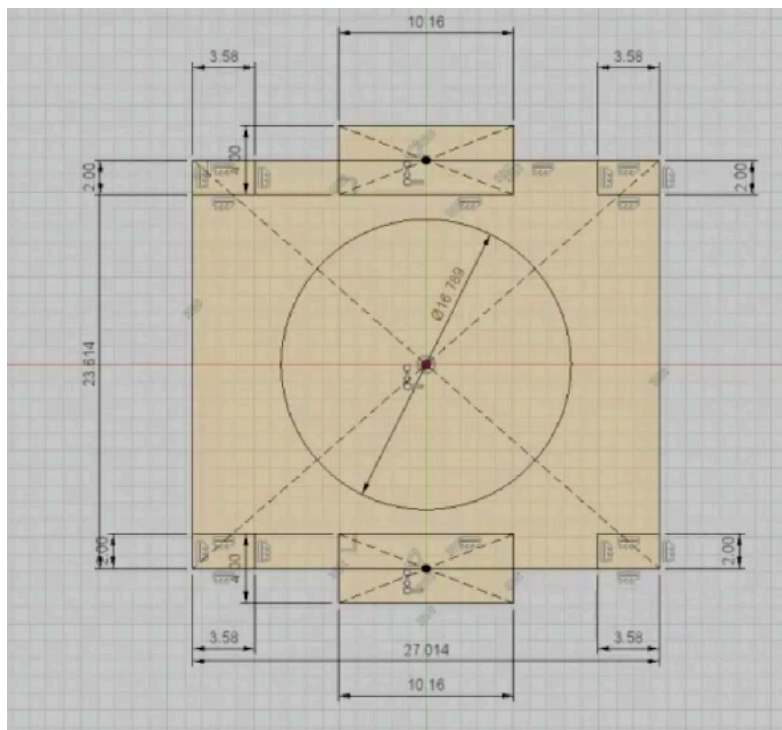
13. Sketch / Center Rectangle Tool.

14. From top center of the rectangle drag out so it cuts through bot the top rectangle and center diameter circle, tab down and enter a value of 3mm. Hit return to complete.
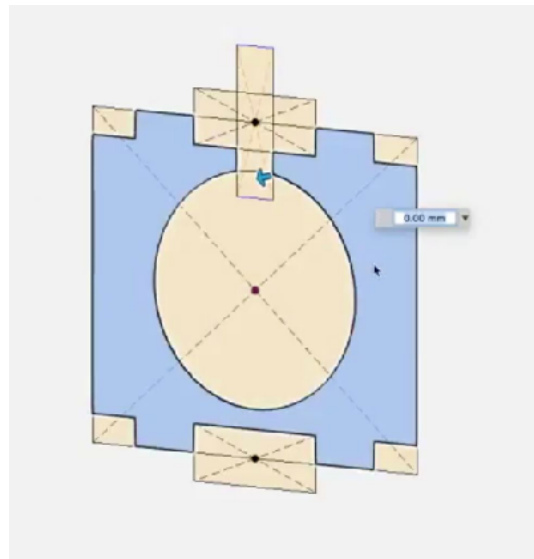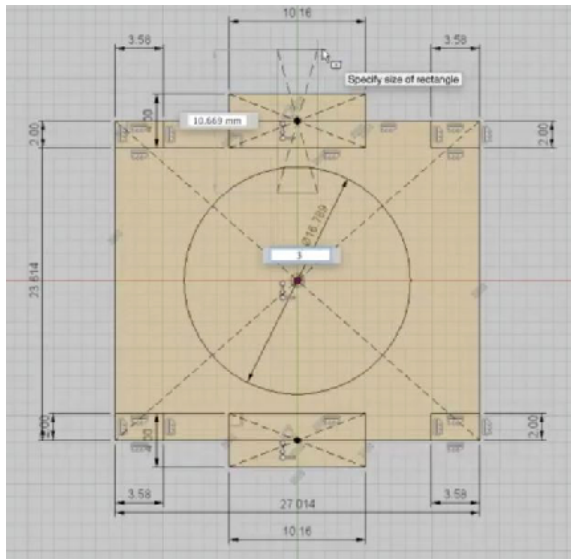
15. Hit Hot Key Q for the Press Pull Tool. Select the new Bracket sketch drag and enter a value of 1.5mm. Hit return to complete.
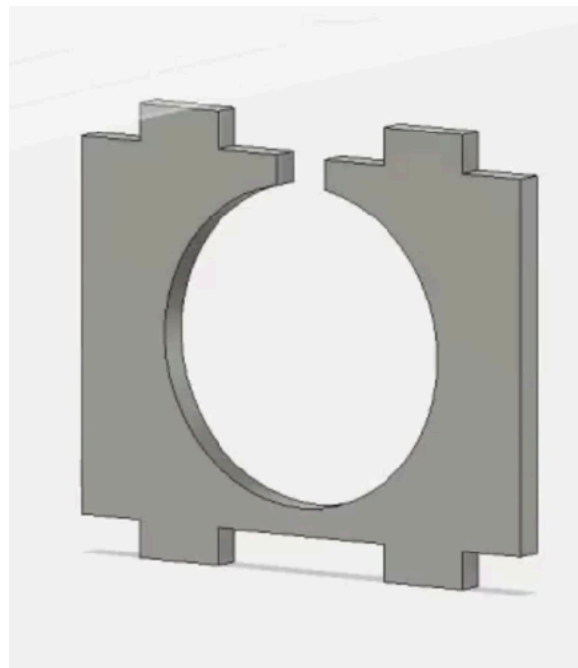
16. From Browser Hierarchy select the new bracket body.
17. Modify / Move Tool.

18. Drag the new Bracket into place so it fits into the top and bottom plate bracket slots. Adjust geometry to fit.
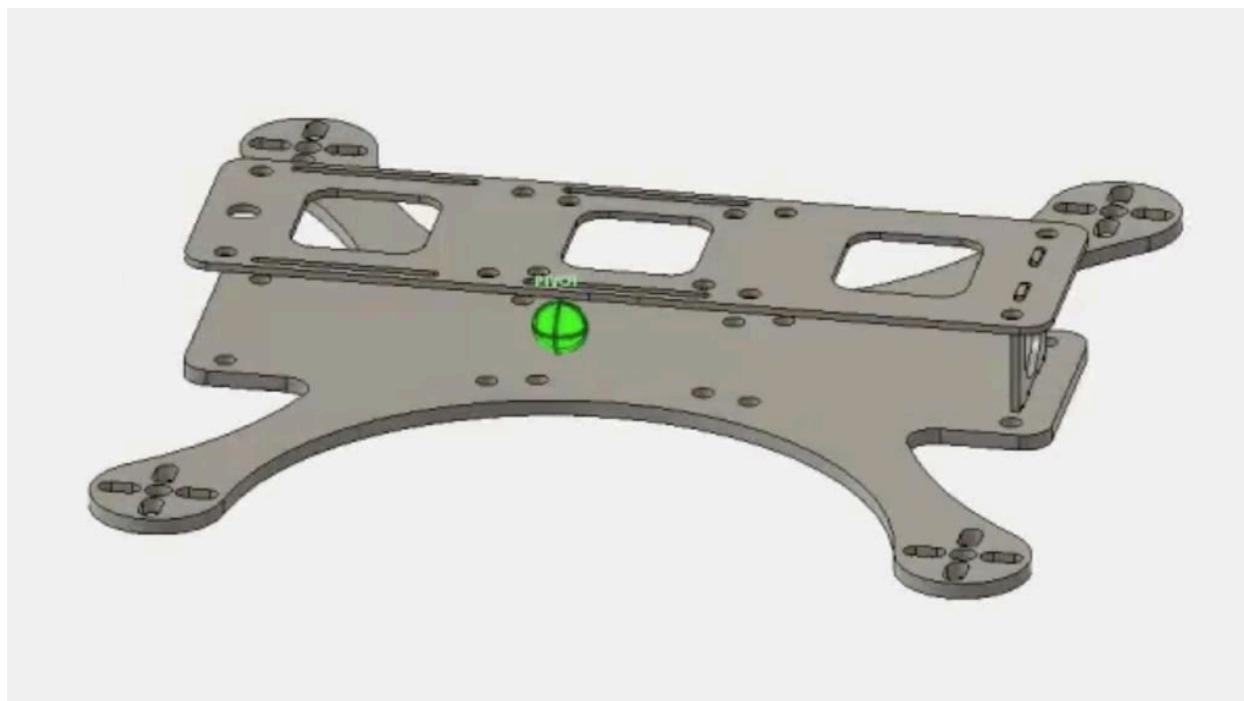
Step 8: The airframe is done!

Your new 210mm "H" FPV Racing frame design is complete and ready for CAM or 3D printing. Be sure to save your work!

For 3D printing select a frame body model and click the **Make** menu button / 3D Print to send it to your 3D Printer's set up software or **Autodesk's Meshmixer.** Repeat this process until all 3 airframe parts are ready to print.
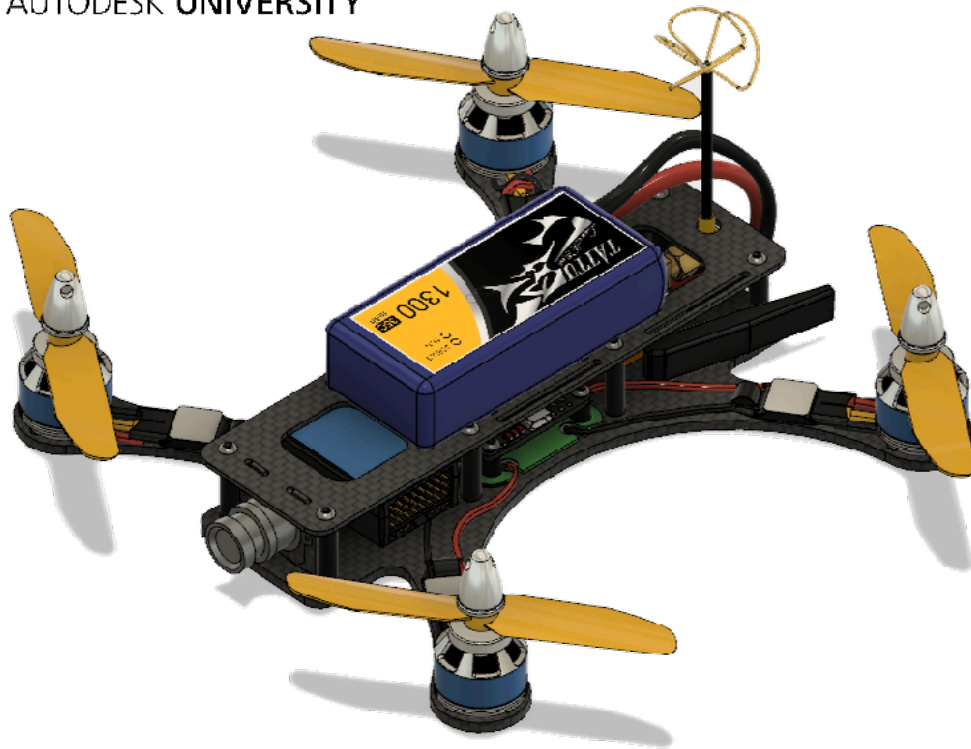
Section 2. Combine the build.

Download the "210H Components" file here. and add it to your Fusion360 Drone Racer Database. Use this file to study the drone's power train, wiring and video components.
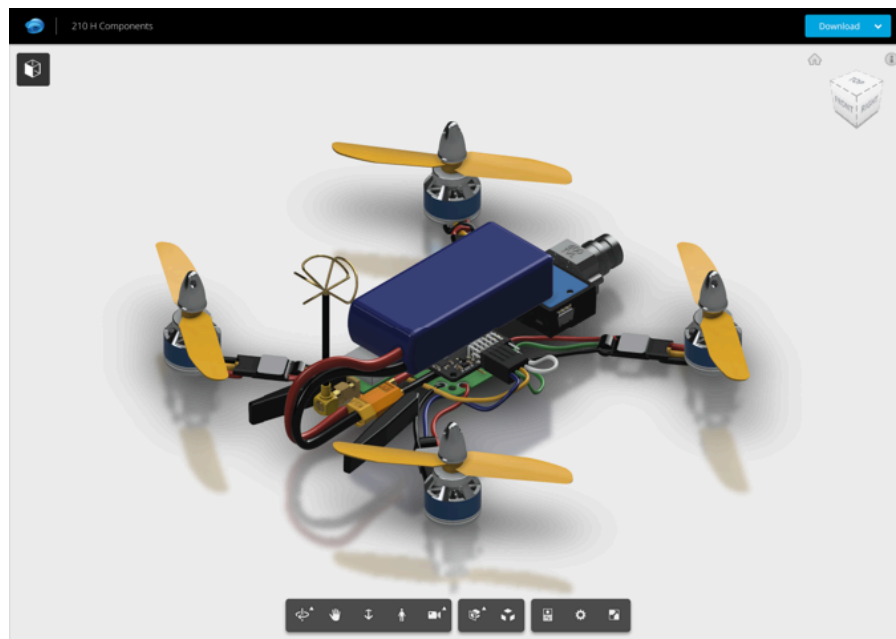
Combine the drone files.
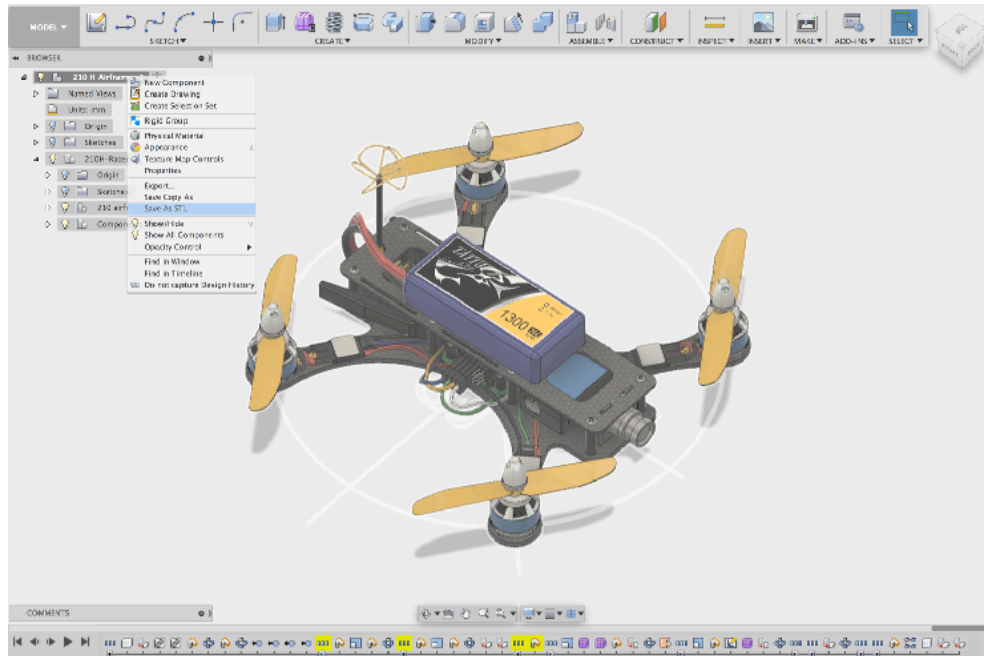
Be sure to save your new airframe model into a Fusion 360 Database.
Close out the air frame model and create a new file.

From the Fusion 360 Data Panel right click on the "210H Components" file and select Insert into current design.

Repeat the process for the 210H Airframe
After a moment the components file will merge with the airframe file to look close to this.

From the hierarchy tree, expand the airframe so all components are visible.
Select "**210H Components**" then drag and drop onto the top "**210H Airframe**".

This merges to the two model files into one manageable hierarchy tree.
Select the top of the 210H Airframe Tree so the entire drone is selected.

Rt Click / Save STL /Save the file to a folder on your desktop.

The force is with you young Skywalker, but you are not a Jedi yet.

Section 3: Flow Design Wind Tunnel Simulation and Iteration

1) Start Flow Design, Import / Local / Select the model .STL / click open
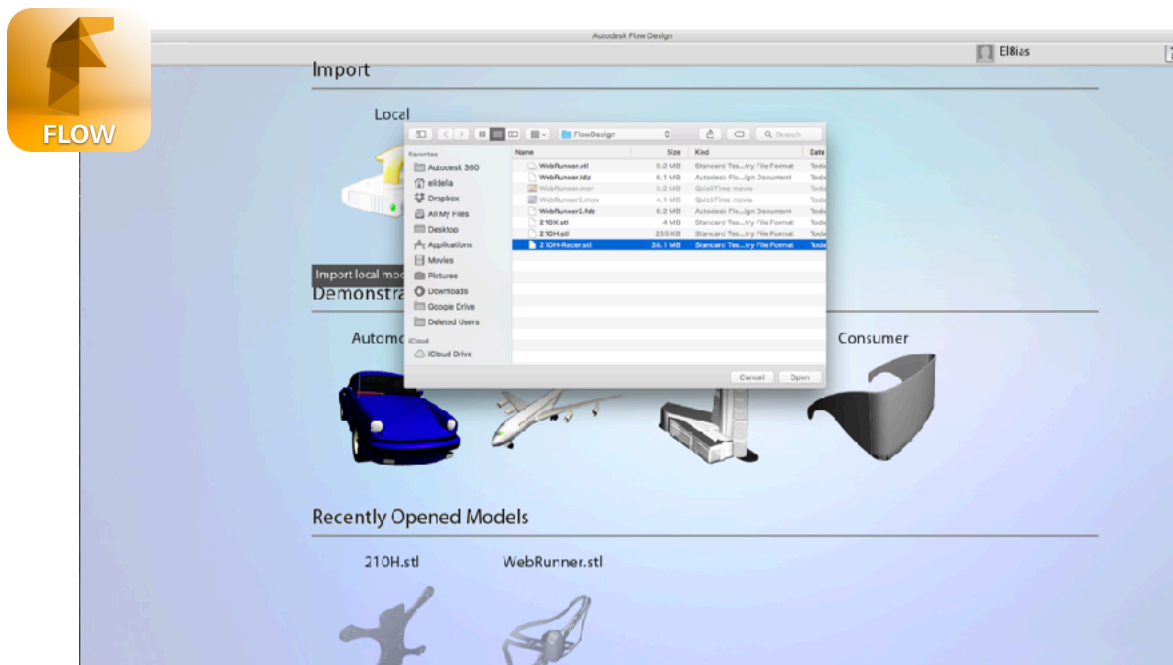
2) The model will import at an odd angle. The simulator starts automatically and cannot be paused or stopped while adjusting the file for simulation.
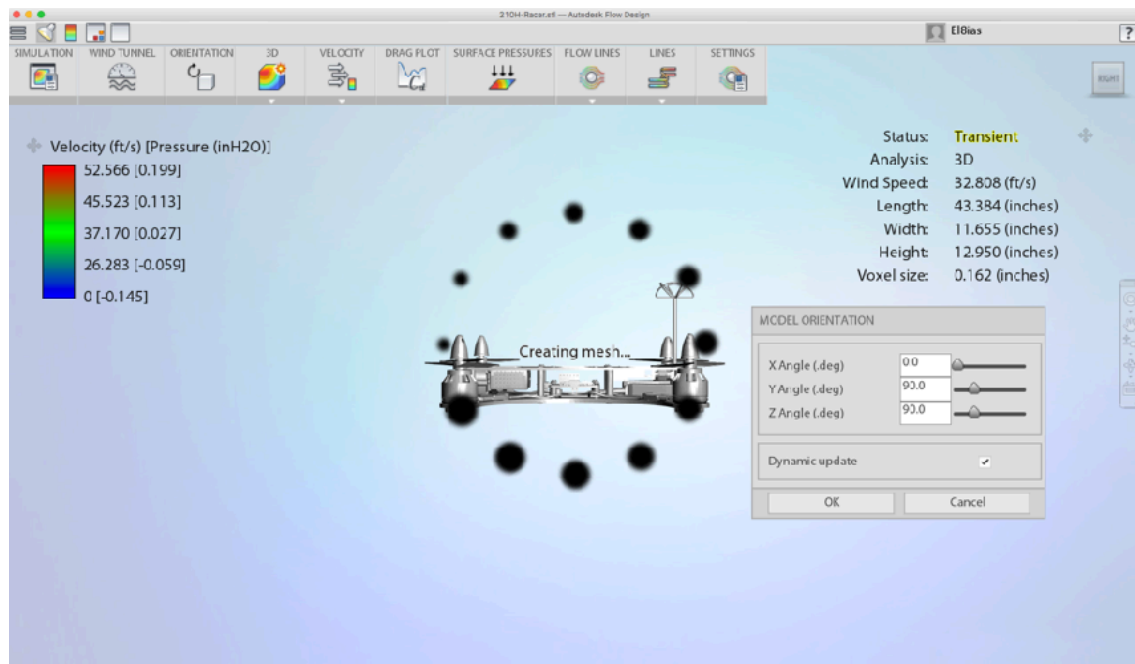
3) Tool bar / Orientation / Orientation dialogue box / adjust the Z angle slider to 90 / Y Angle to 90 / OK.
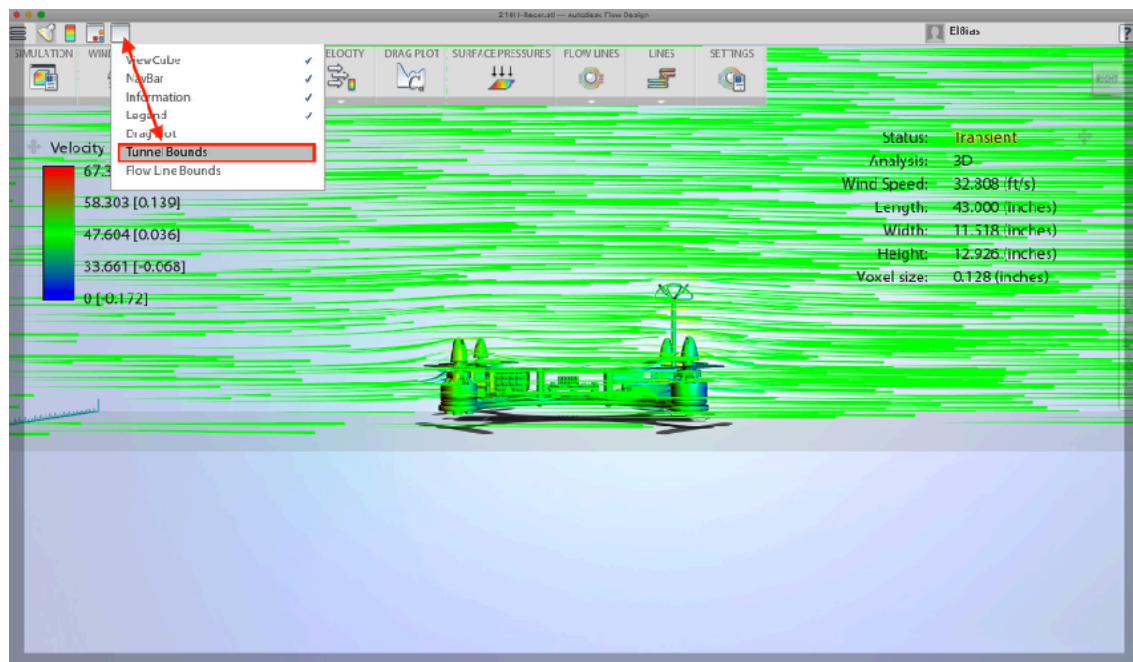
4) In the top tool bar / Click the blank box icon / Tunnel Bounds.
Use the blue handle arrows to fully encompass the drone model. Be sure to drop the floor well below the drone's motor plate simulating altitude. Adjust the bounding box so the drone sit in the center.
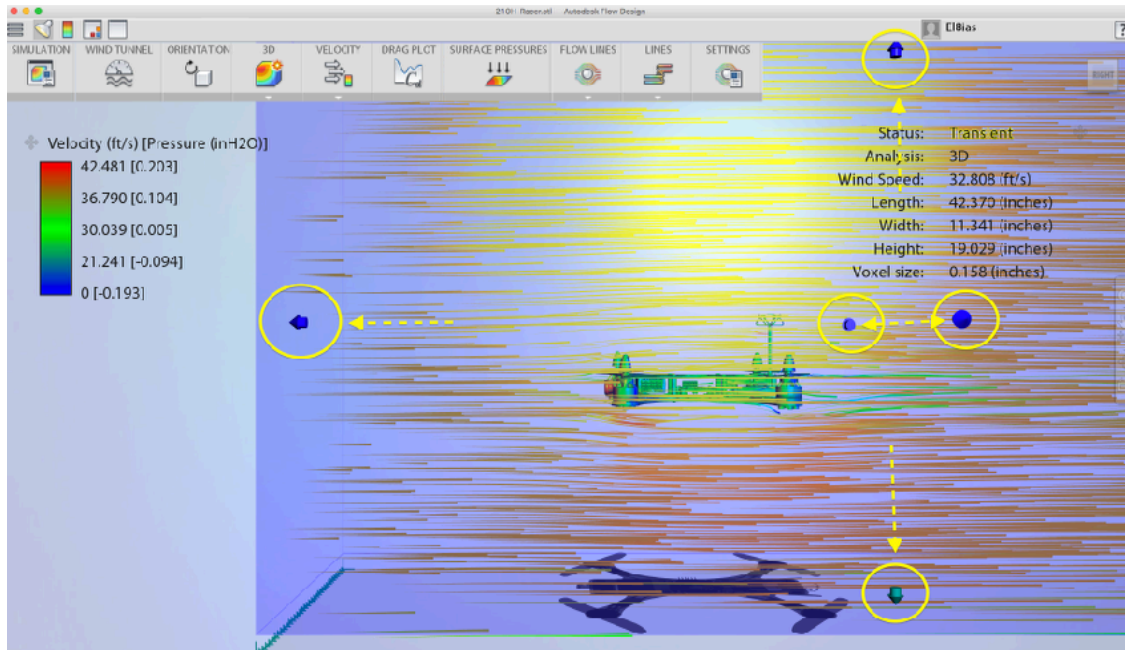
5) Use the right side view tool bar to pan, pivot and zoom to your preferred view.
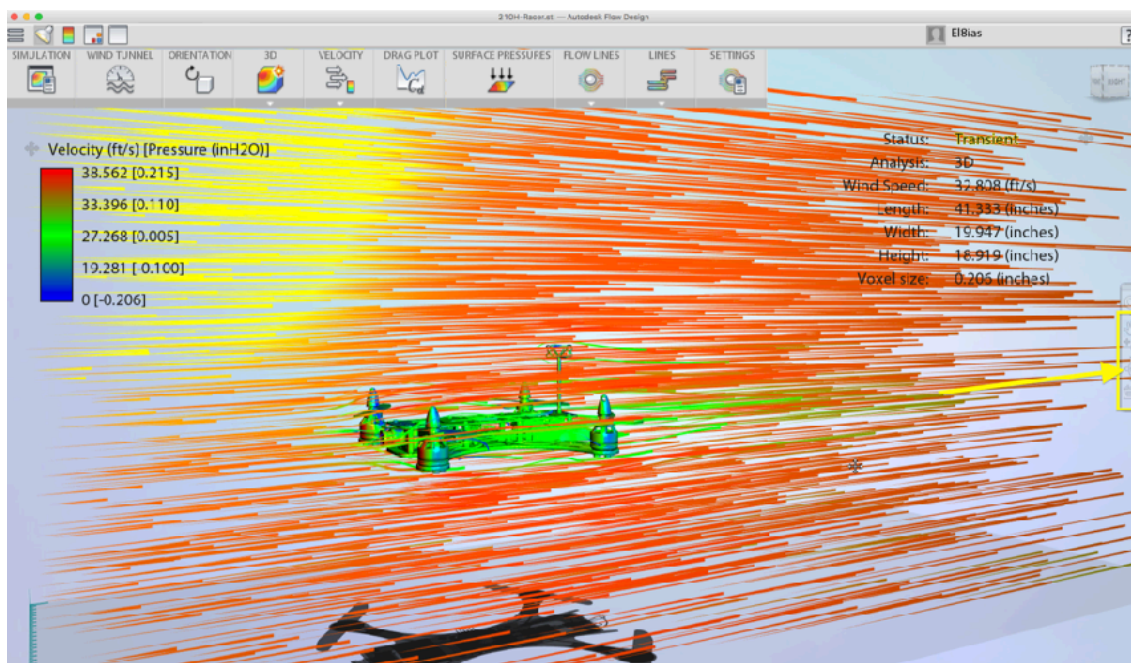
Here it's easy to determine this drone airframe has a flow state with no turbulence at the tail end. Unfortunately racing drones pitch forward by 30º and more at speed. For a more accurate representation you will need to pitch the model.
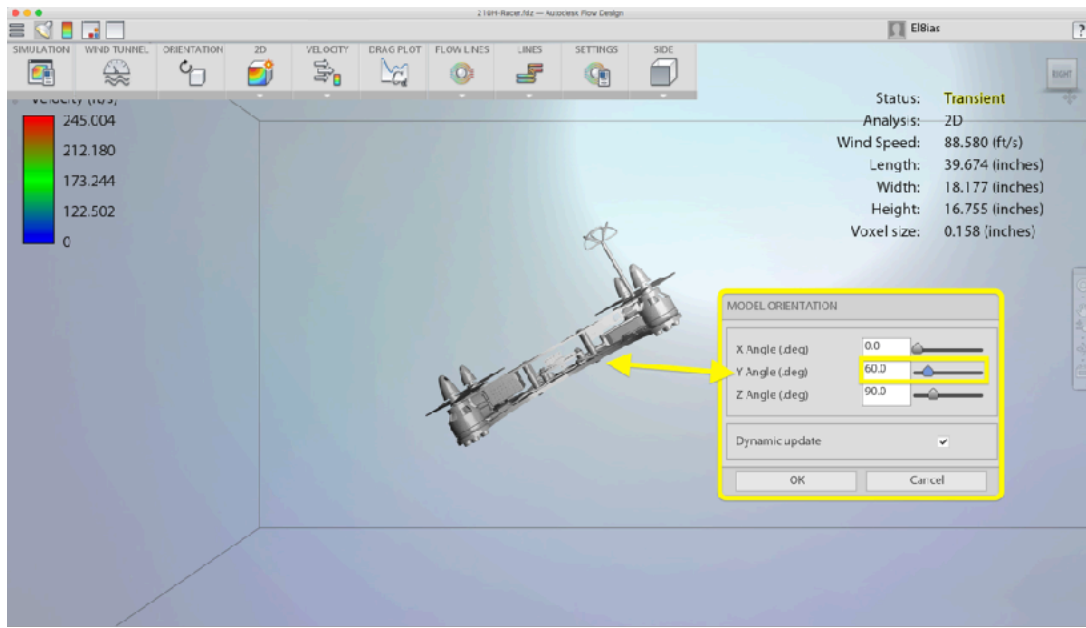
In the model tool bar select **Orientation** and set the **Y Angle (deg)** slider to 60º.
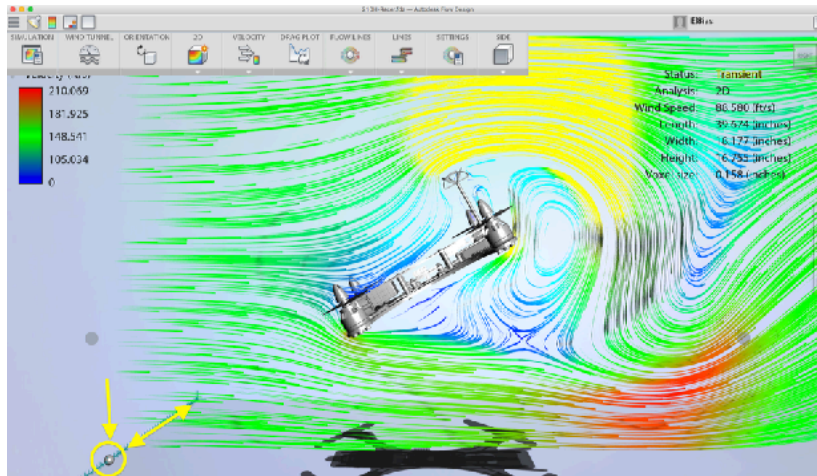
In 2D mode the wind simulation is confined to a vertical plane. Adjust the plane position with the ball slider on the bottom left of the UI to the center section of the drone.

The Flow Design interface is overly simplistic with most of it's more powerful features buried in the combinations of sections within the spartan toolbar. Take to explore and note these features. It's wise practice to then Export your simulation to your work folder as a means of saving your preferences.

The dark mode interface is easy to see wind flow effects.
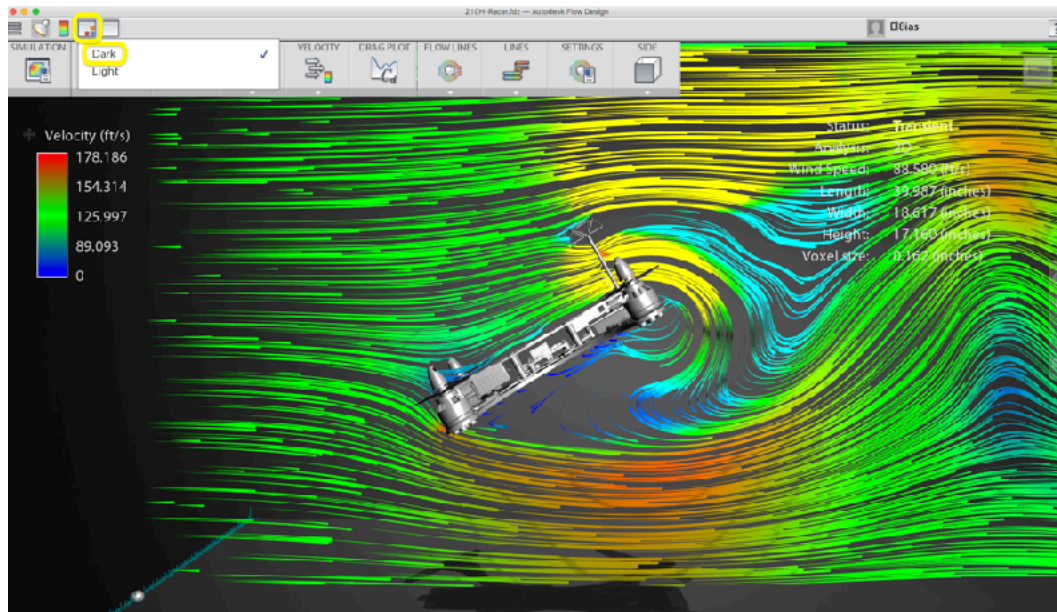
In the top menu, click the box icon with a few little colored boxes inside it / click Dark. The simulation window will instantly change to dark and the wind force will be brightly illustrated.

Section 4: Aerodynamic Racing Drone Design.

Taking what was observed in the wind tunnel simulation, switch back over to Fusion and open the X 210 drone file. The drone's core electronics can be configured in a number of combinations to improve power to weight ratios in line with the build's center of gravity.

Re configure the airframe's layout and electronics considering Flow Design's wind force effects, reducing drag and turbulence on the drone's angle of attack.

Beginning with the airframe Hide the FPV components in the browser, then rotate or pitch the motor plate by 30°. Work out a Layout so the drone's battery pack in the rear, center and level flight controller aligned with the receiver and fpv camera components are level and center to the x axis as illustrated below.
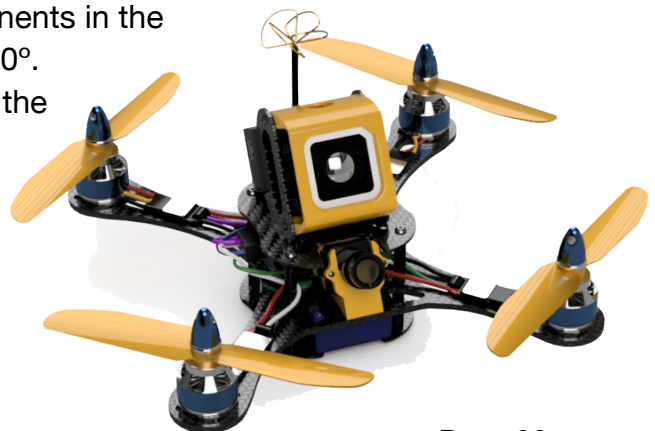
Side and front views. Motor plate and components pitched to 30º. Center of Gravity is balanced between the forward camera and the rear battery pack.
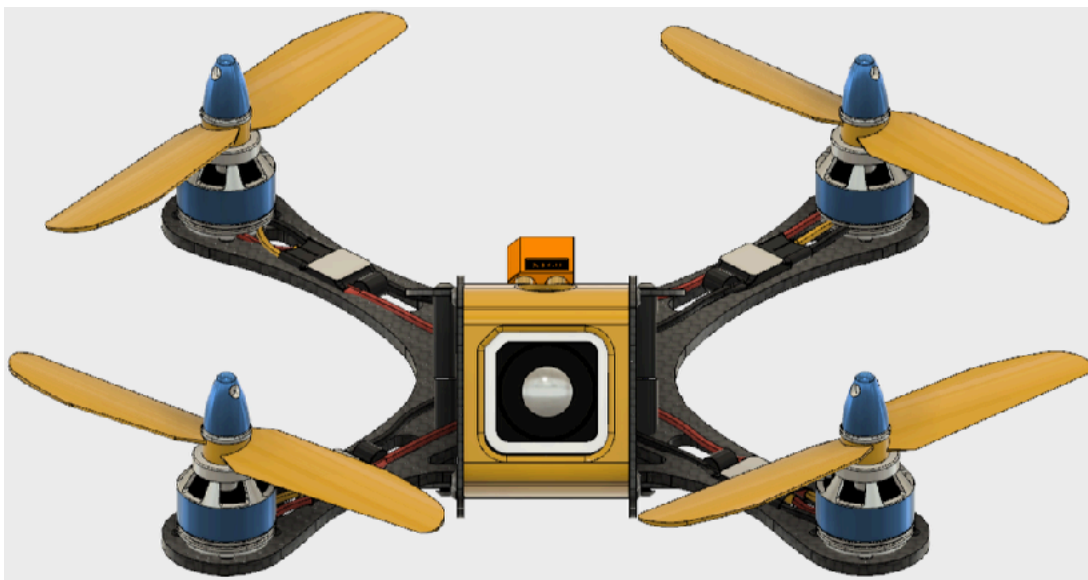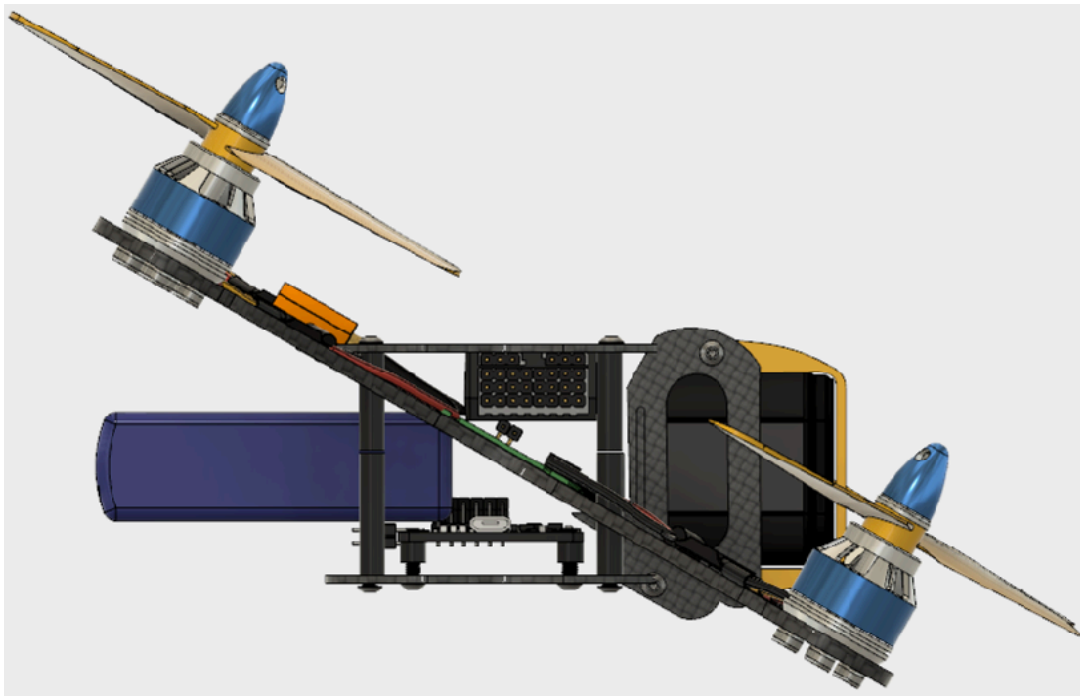
When Happy with your layout, enter T-Spline Sculpt Module to build out a monocoque hull. Create / Create Form.
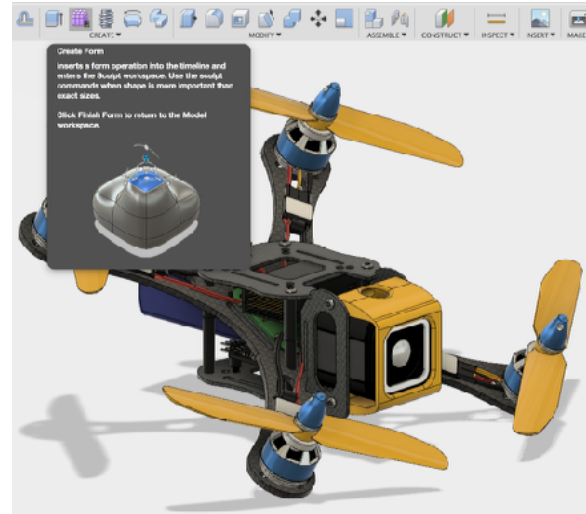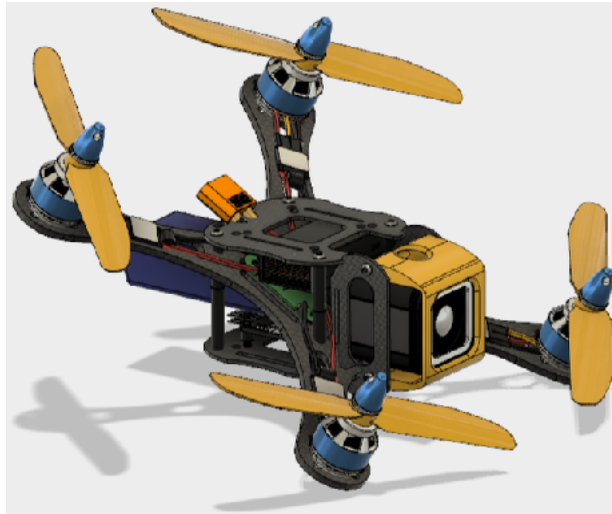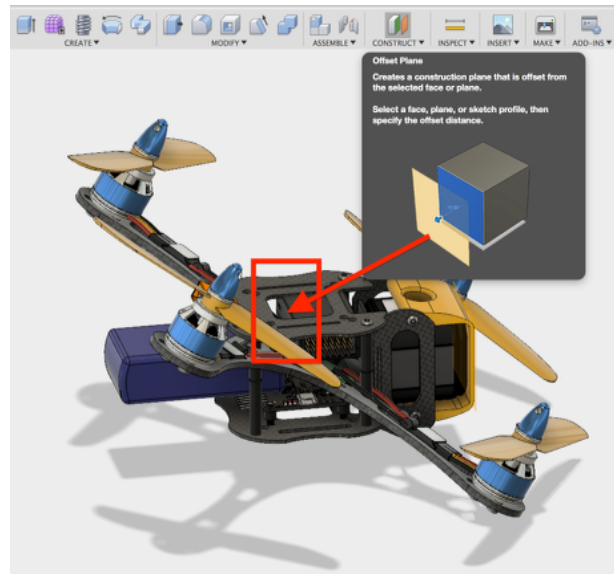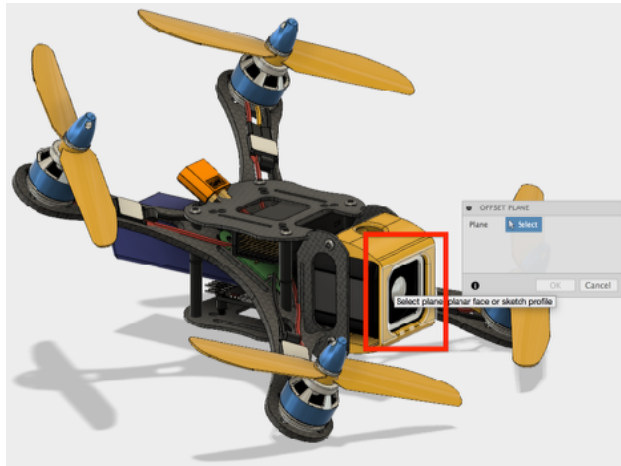

Offset Construction Planes.

Next set up 3 construction planes starting from camera grip face, center back plate of the receiver, and another from the same receiver back plate, drag the construction plane the rear just past the battery as illustrated below.
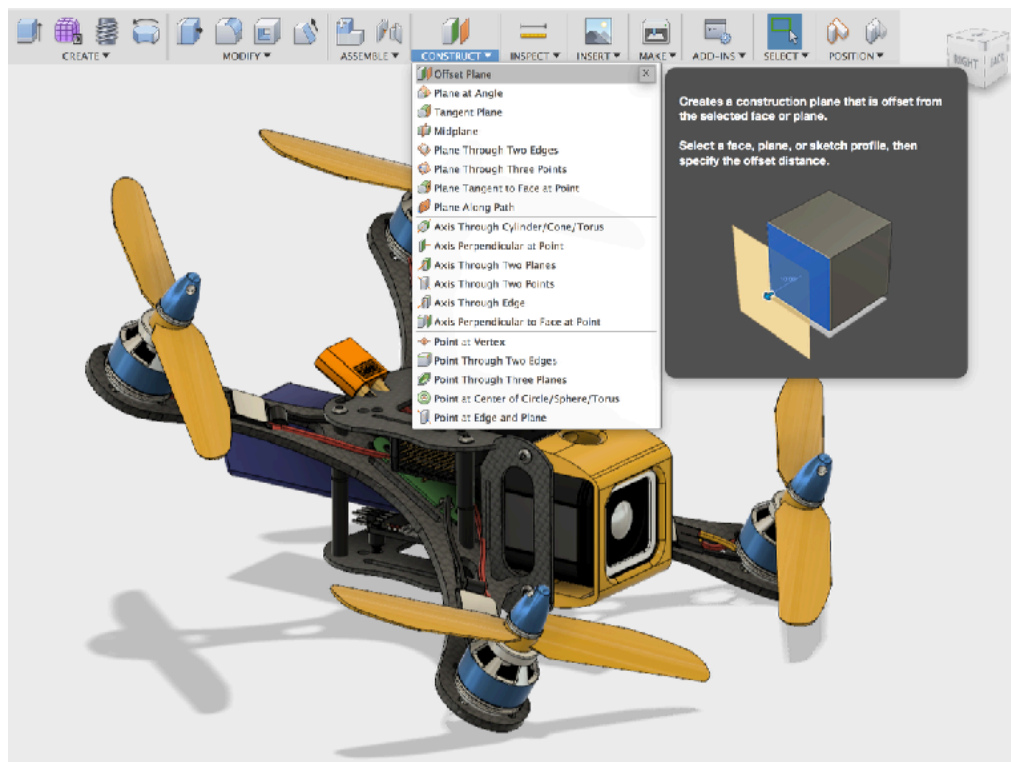
Create the Offset Construction Plane Loft tool guides
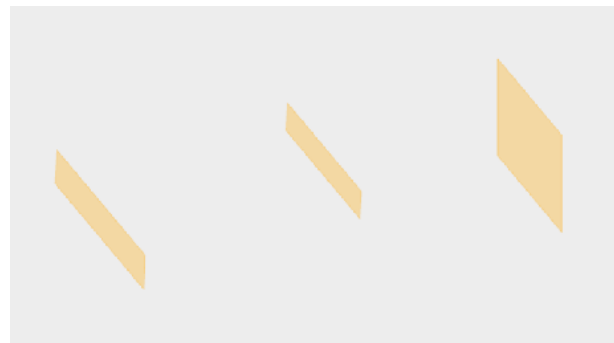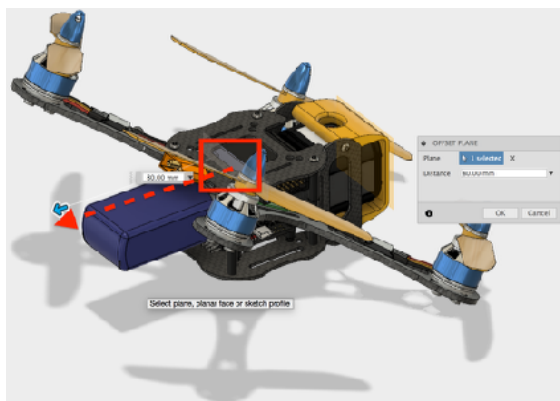
From the drone's front, resize each plane so they fit the fuselage comfortable within.

Create the basic fuselage mesh with the Loft tool.

In the browser tree, hide the drone's geometry by clicking the lightbulb at the model's top level.

From the Sketch menu select the Center Diameter Square. Select the first construction plane's center point, drag out a circle to the border of the plane. Select Stop
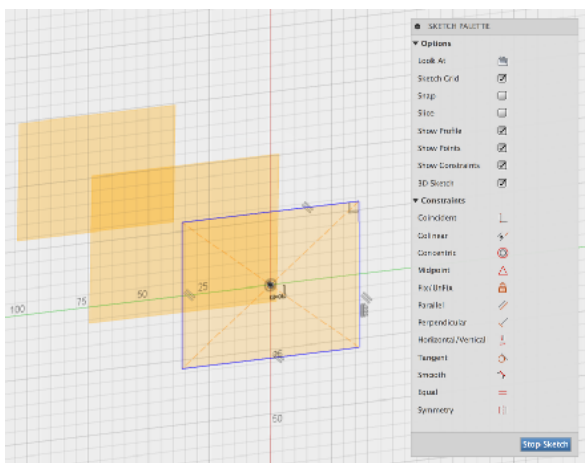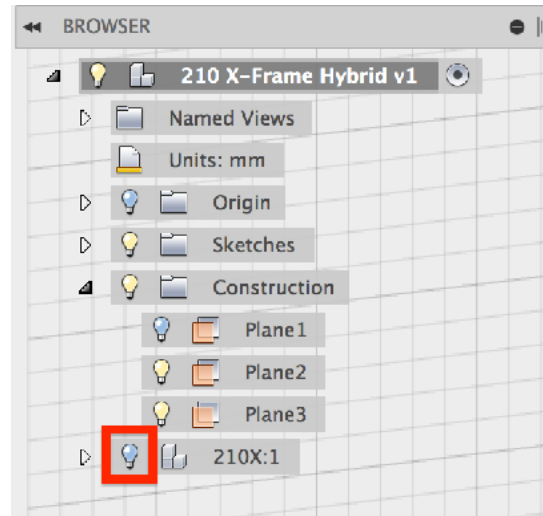
Sketch from the Sketch Pallet.

Repeat the steps for the center construction plane then stop sketch again.

Last select Center Diameter Circle from the Sketch menu and drag out to the border of the last , most rear construction plane and select Stop Sketch.
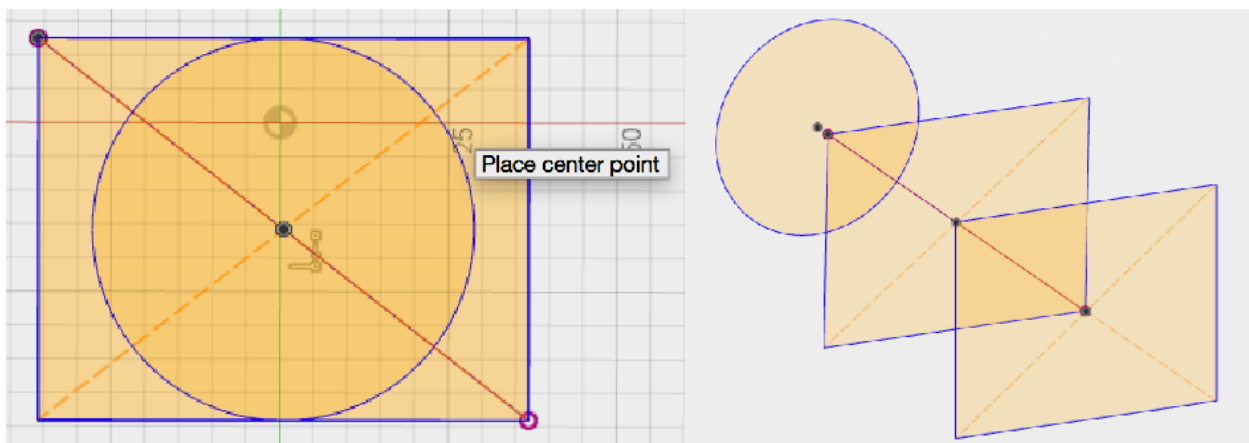
In the Browser, right click the front Center Diameter Square sketch and select Edit Sketch. Choose the Fillet tool from the Sketch menu and click each of the square's border lines clockwise until the entire square is rounded off. Enter a value of 10 in the Fillet dialogue box and hit OK.

Repeat these steps for the center square sketch.
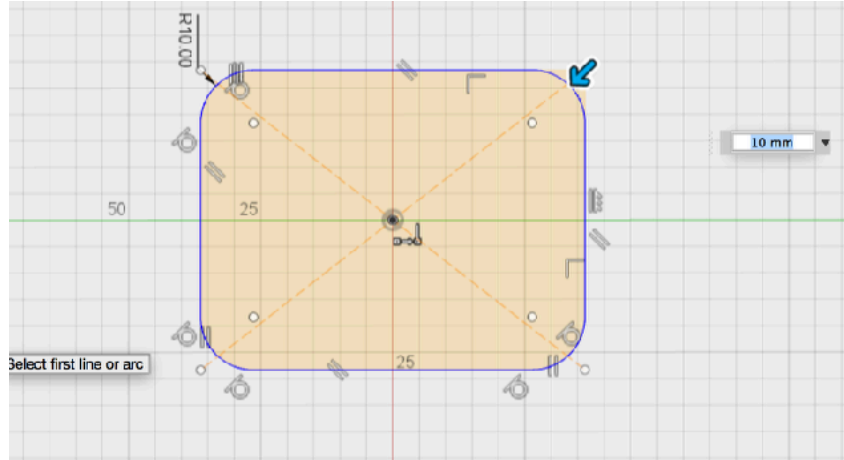
Lofting the Fuselage

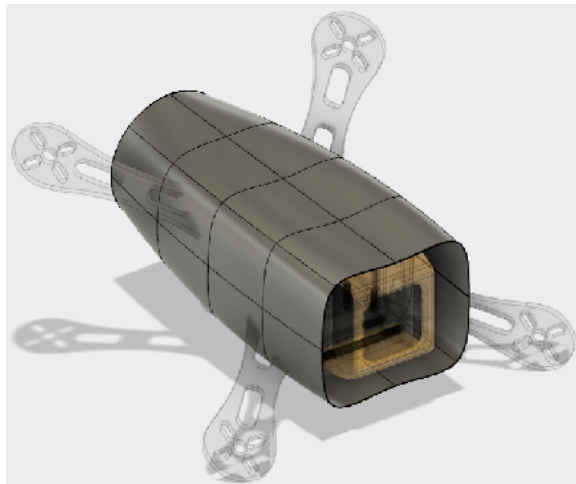From the Sculpt module, select Create / Loft. Click each sketch profile in order from front to back.
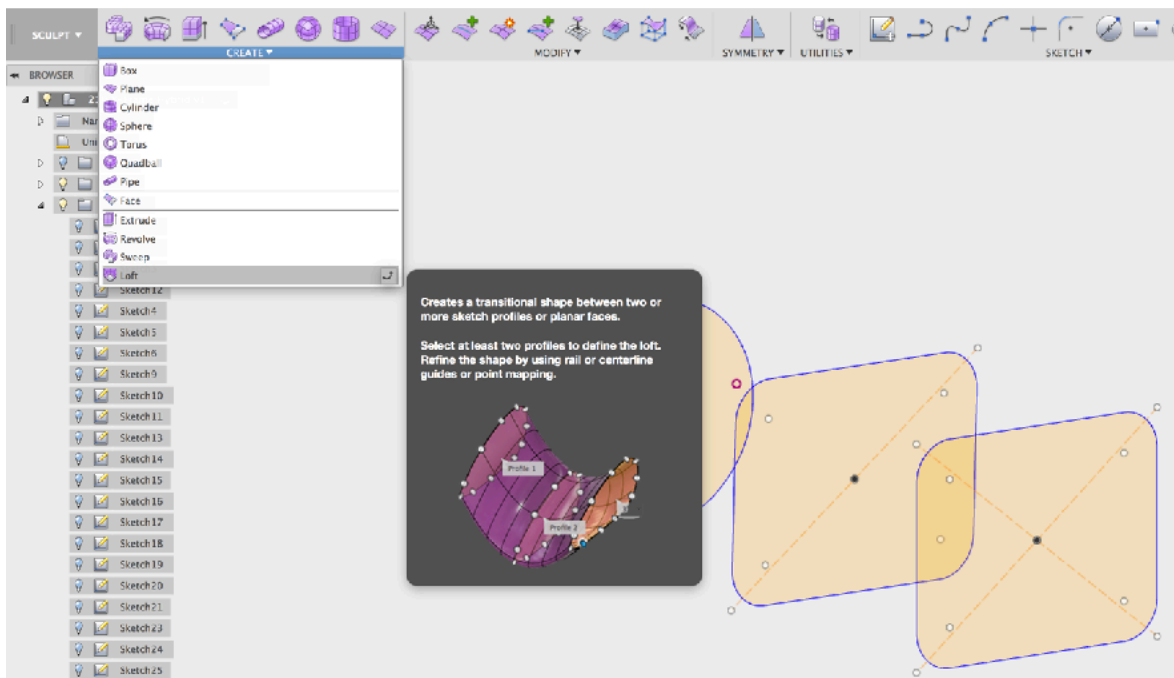
In the Loft dialogue box / Width Spacing, enter a value of 8 and click OK.
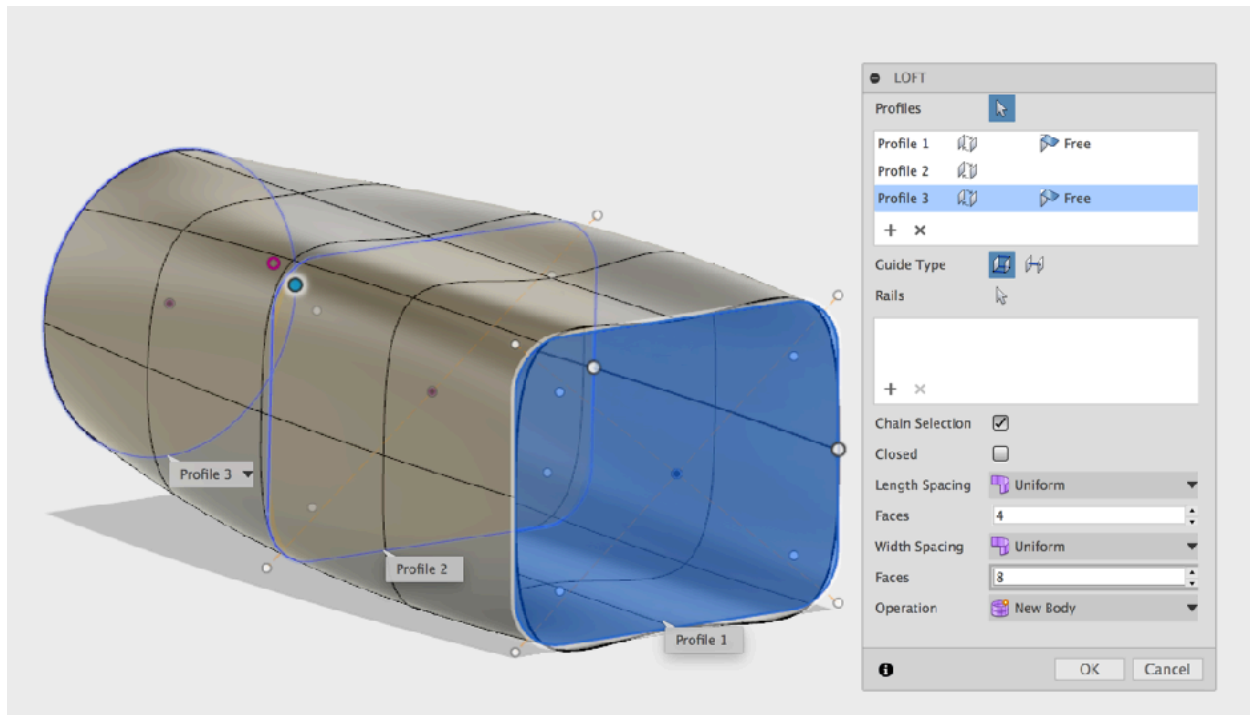
Now close and hide the Sketch and Construction Plane trees in the Browser.

Show and expand the the X-210 model tree, then hide the "Components" branch.

Shift select the faces of the left half of the lofted fuselage model and hit Delete on your keyboard so only half of the model remains.
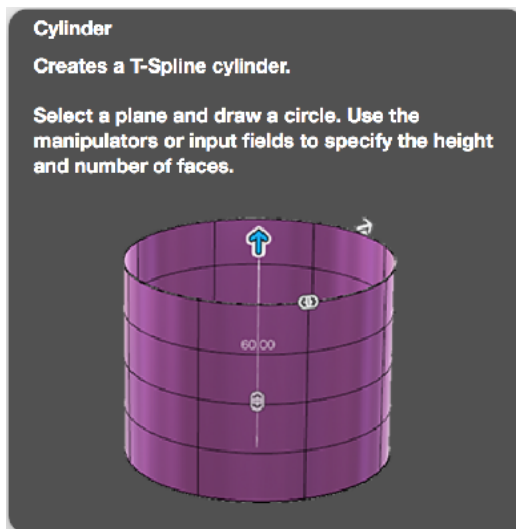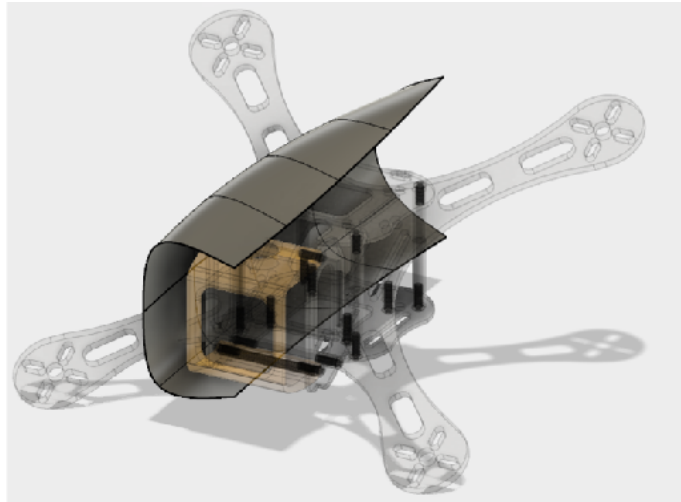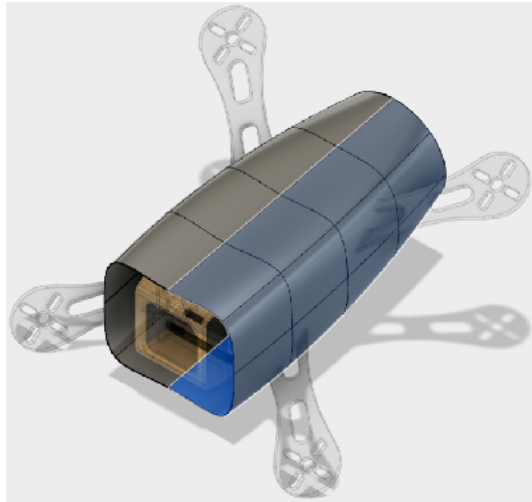
Motor Mounts

From the Create menu, select the Cylinder tool. Select the "ghosted" angled motor plate. From the back motor mount hover over the center hole and click and drag to create a cylinder. Enter a value of 31mm and hit return.

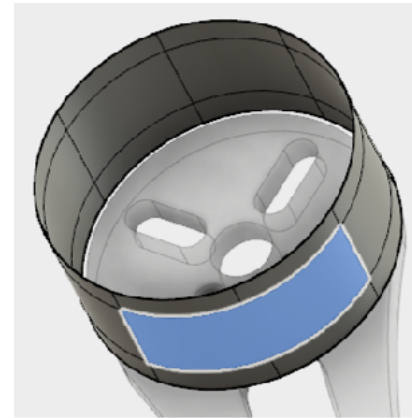Repeat the process for the forward right motor mount.
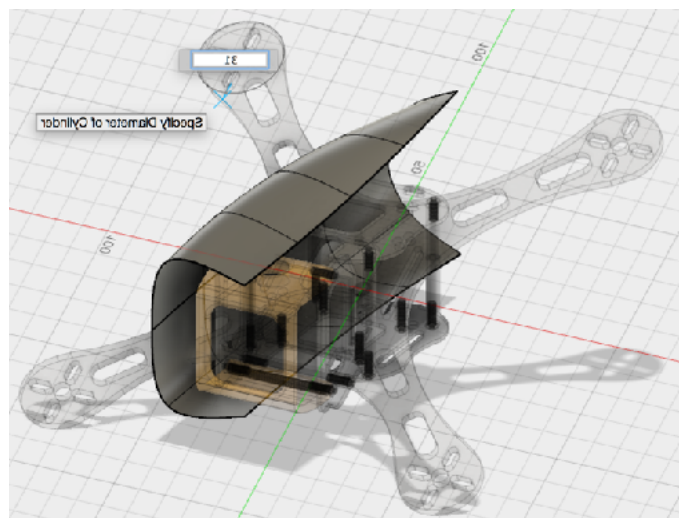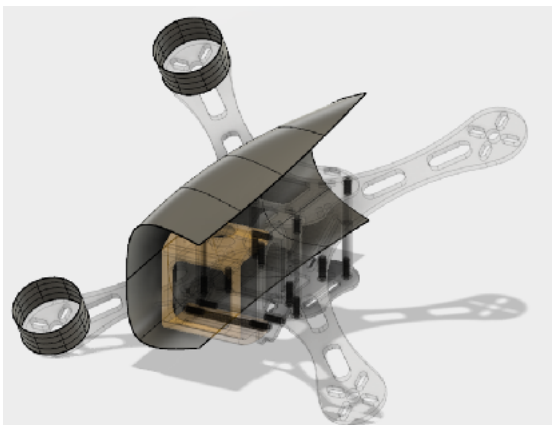
Creating the Motor Booms

Next edit the new motor mount cylinders to best match the topography of the fuselage model for a clean Bridge connection.
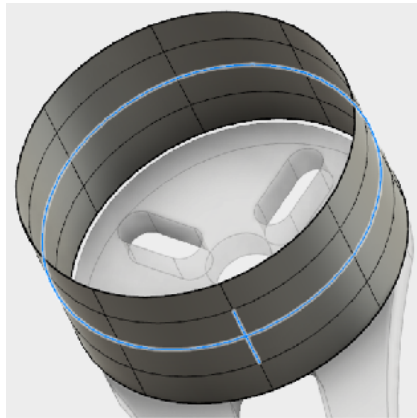
Start by Double tap selecting the center horizontal ring and two vertical splines that face the fuselage model and delete them.
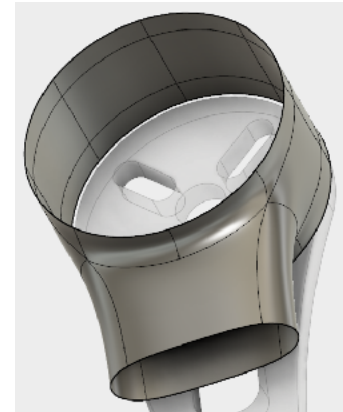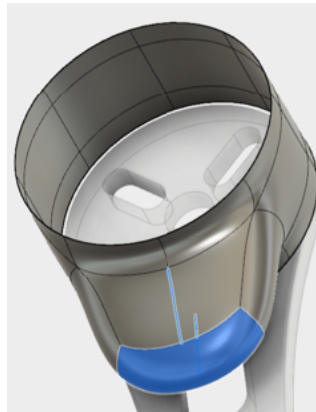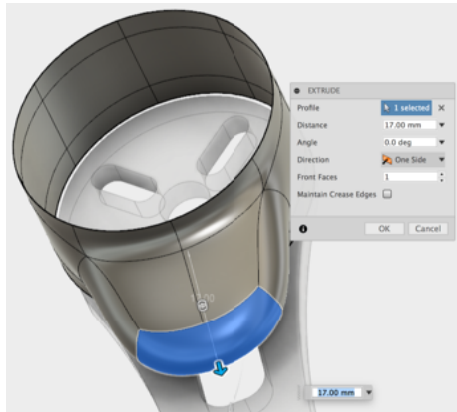

Select the resulting face. In the Create menu, select the Extrude tool.
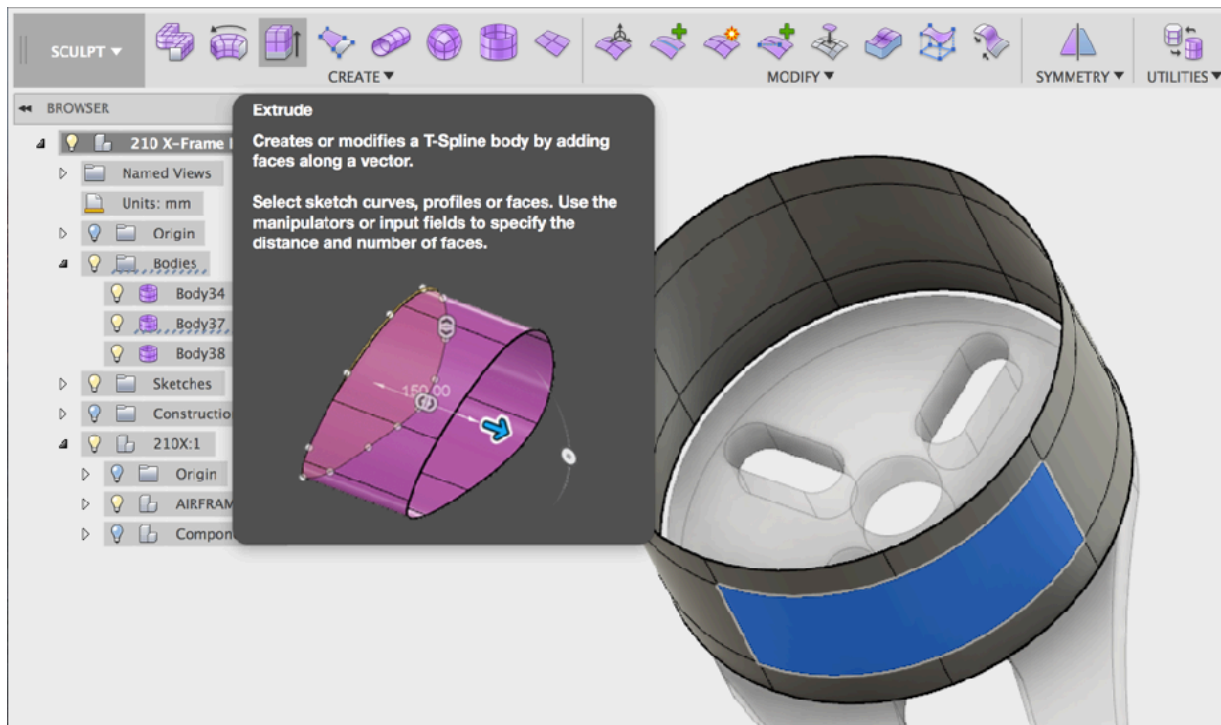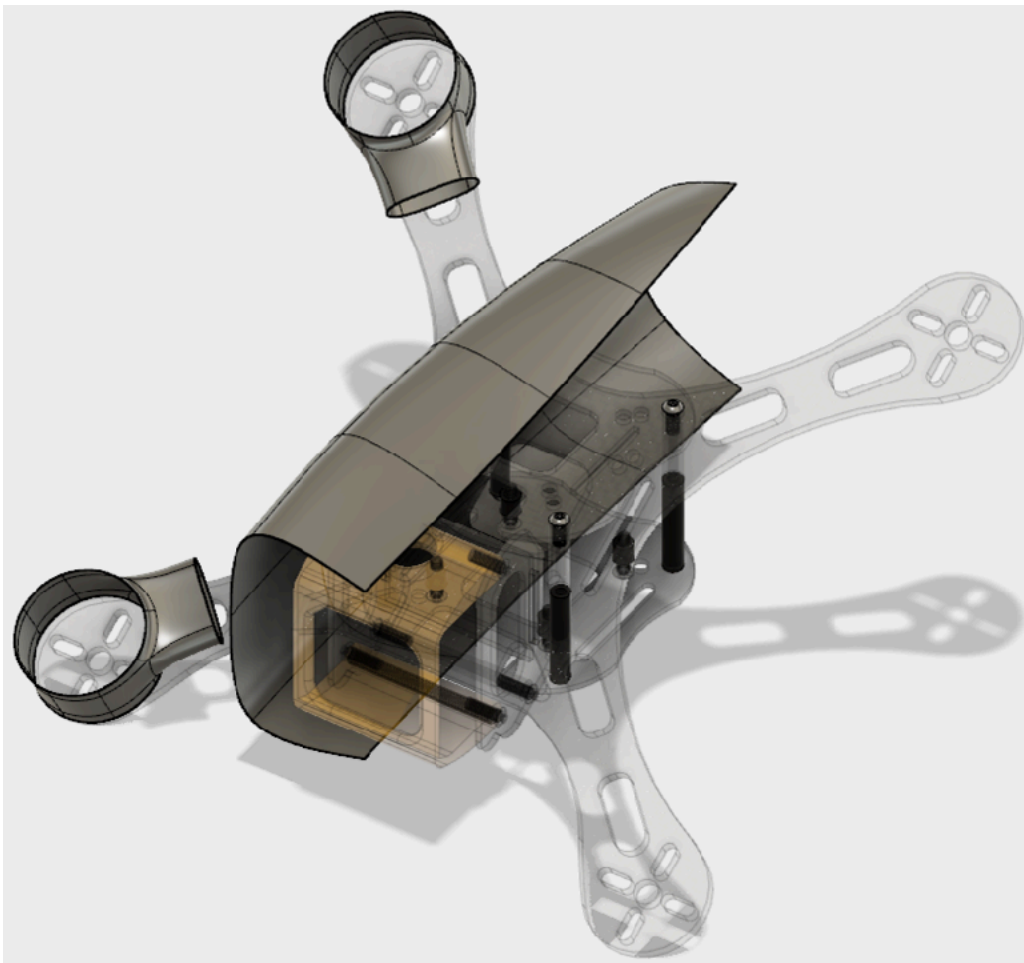
Drag extrude the face approximately 17mm. and hit return.
Select the extrusion's resulting center top and bottom lines and the face and hit delete.
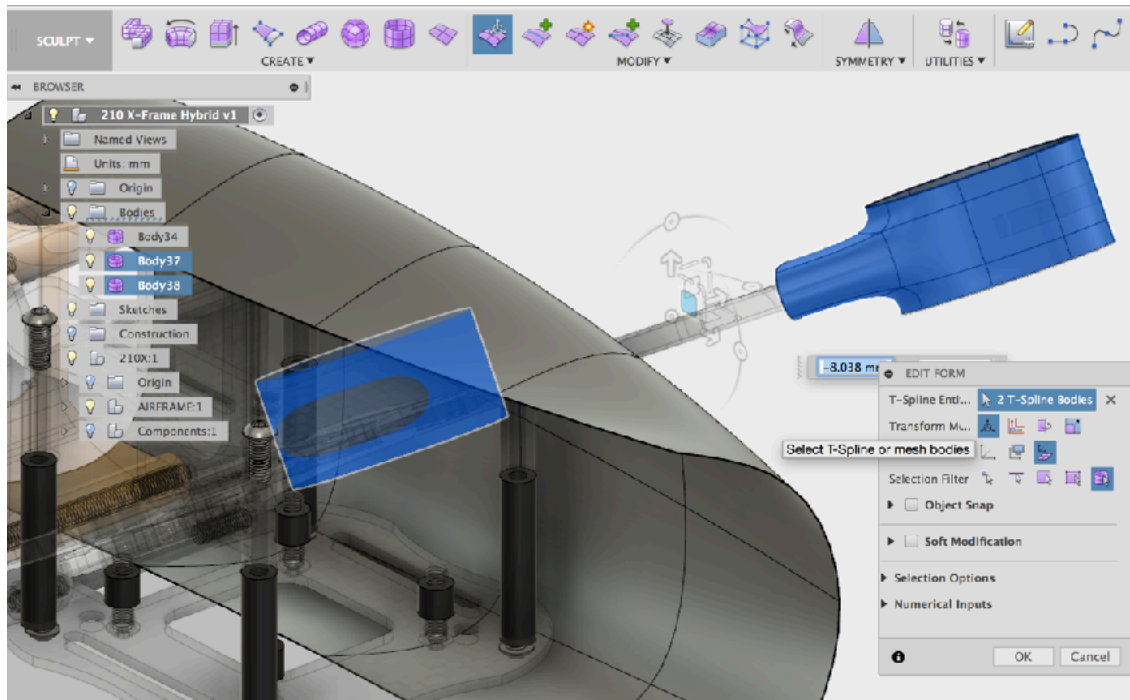

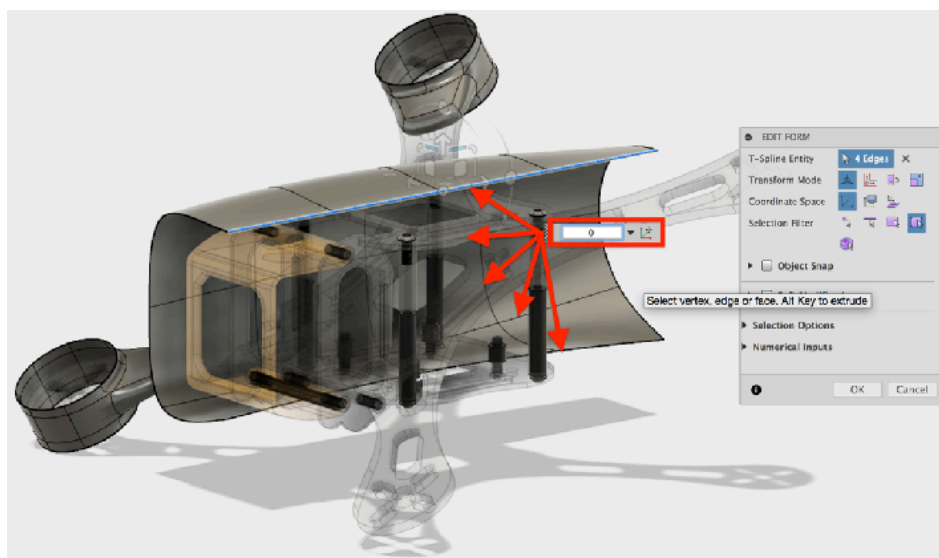Repeat these steps for the other motor mount cylinder.

With the Modify / Manipulator tool, select both motor mount cylinders and adjust their position from resting on top of the motor plate so they line up center to the height of the motor plate.


Often the fuselage topography will need to be "cleaned up" before Bridging the motor mounts to the main mesh.


Double click each of the fuselage splines, from the Modify menu select the Manipulator tool and scale the line to 0 in X, horizontally and Z, vertically. Repeat for each of the body splines until the mesh is squared off.
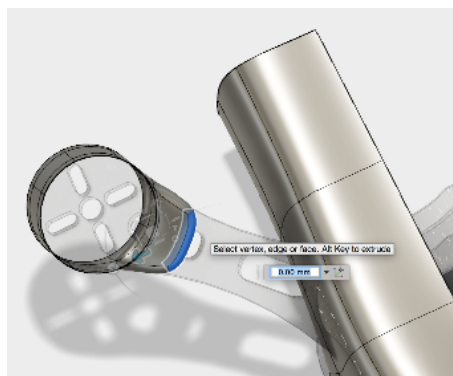
Next add edges to support the shape continuity when . Select an edge, Modify menu, select the Insert Edge tool and add horizontal spline to the top and bottom corners of the fuselage mesh.
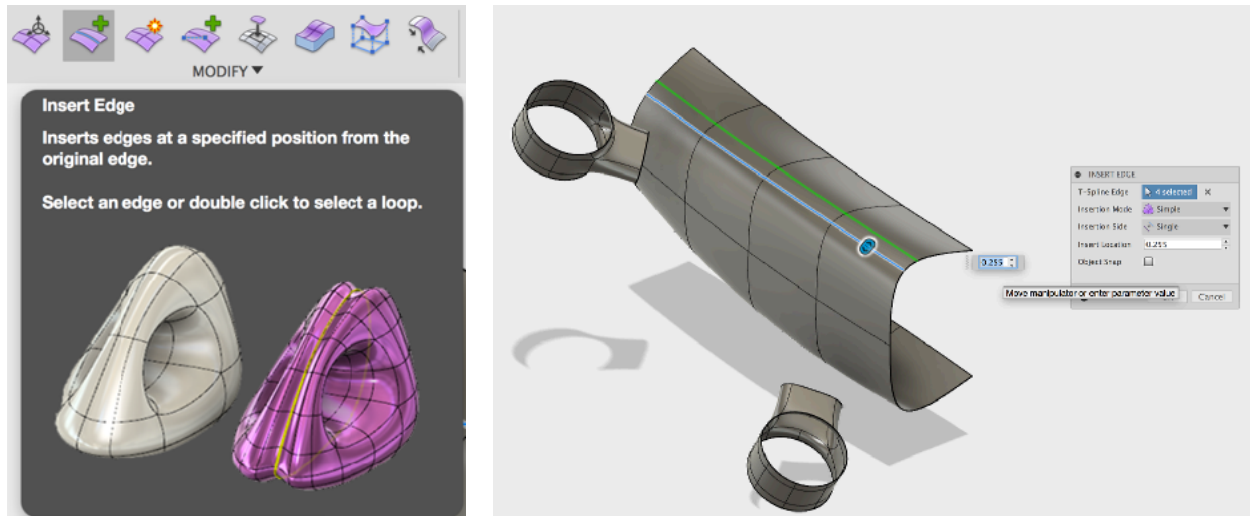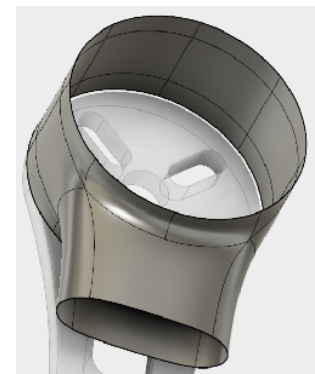

Bridging the motor booms. The bridge tool works best at "close range".
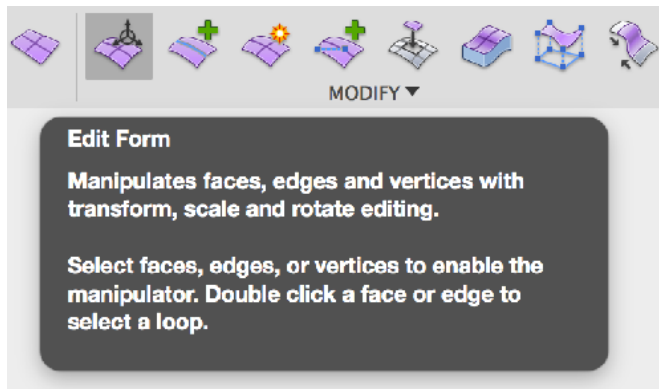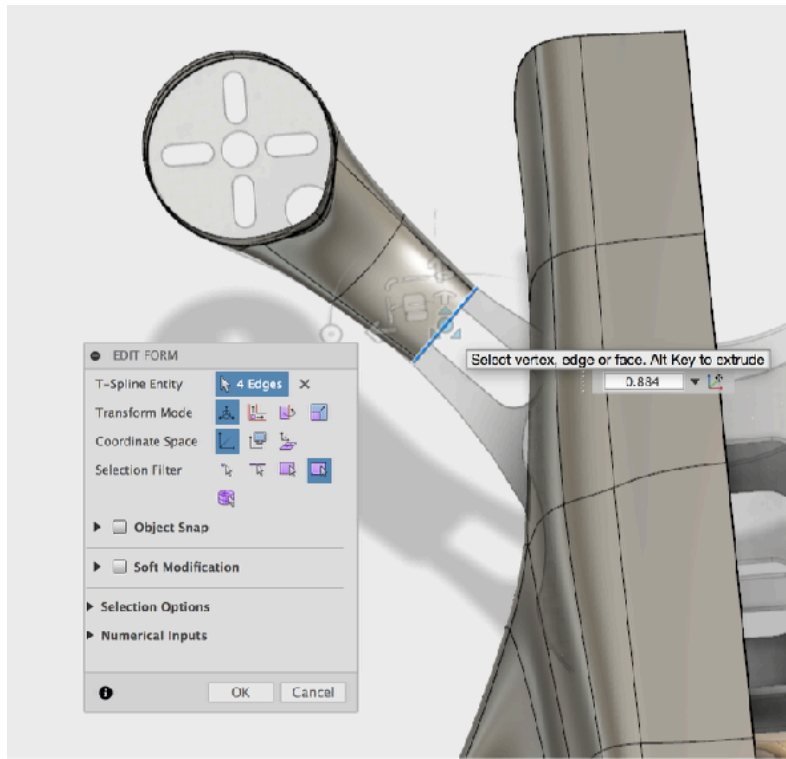

For this operation, the Manipulator tool and the Edit Form Manipulator tool are key.
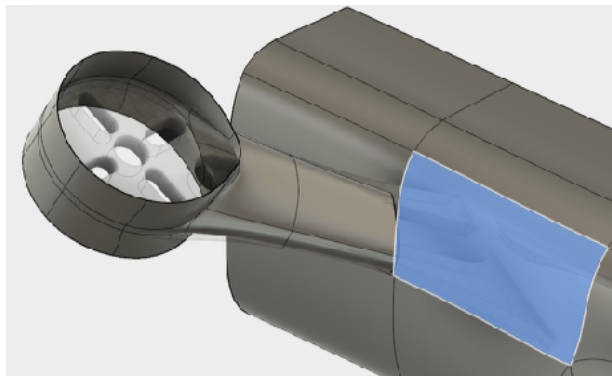

Select the extruded end face of the motor cylinders and delete it.

Use the underlying "ghost" geometry as a guide, While holding down the Option key on the Mac, Alt key on the PC, drag the selected end to the center of the "ghosted" motor boom.
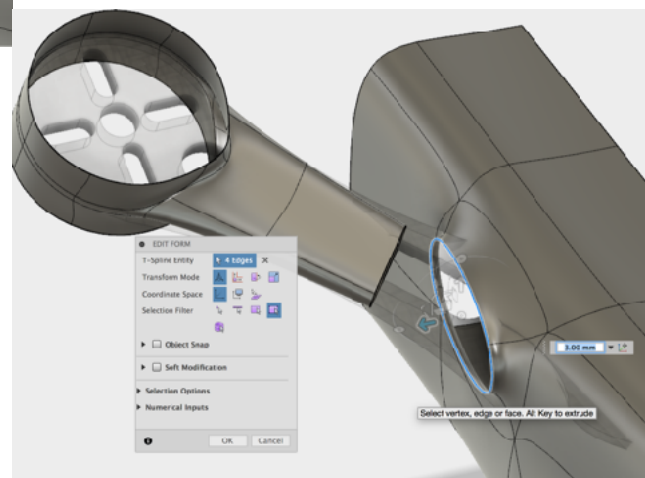
Keep the new extruded geometry in line, while adjusting the shape by shape to match.


Next select the matching face on the fuselage geometry and delete it.

Prepare the fuselage mesh to connect to the motor boom. Modify / Form Edit tool, double click the edges on the new
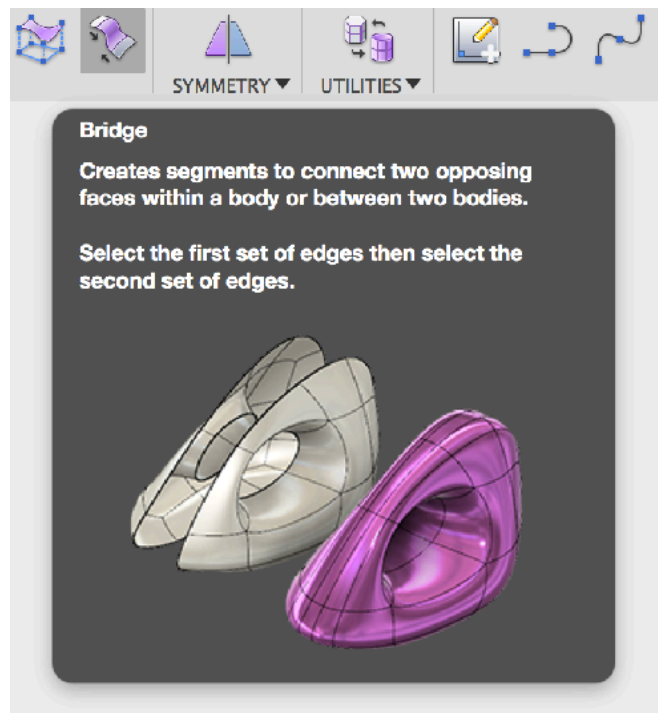
fuselage hole. Hold down the option / alt key and drag out towards the motor mount boom a few millimeters.

With the Form Edit Tool rotate to angle the fuselage connection sleeve towards the motor boom.
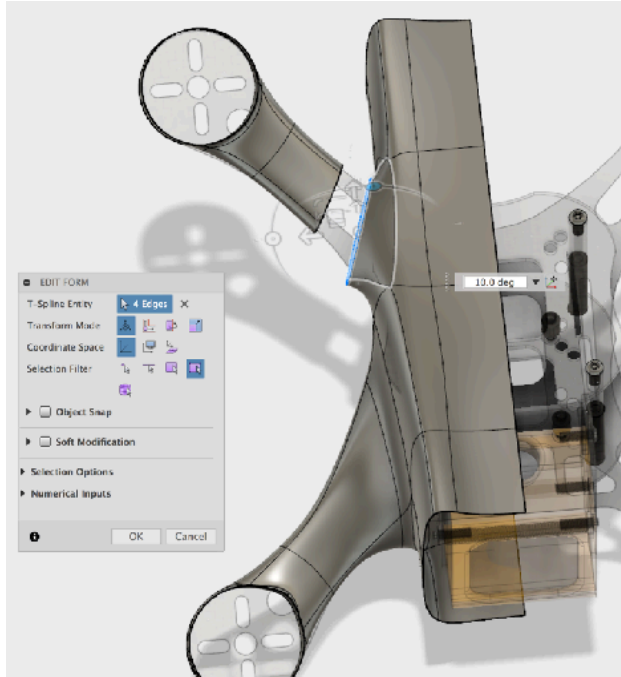
Bridge Motor booms to the Fuselage.

The motor boom is ready to be Bridged to the fuselage mesh.

From the Modify menu, select the Bridge tool.

Bridge

Creates segments to connect two opposing faces within a body or between two bodies.

Select the first set of edges then select the second set of edges.

In the Bridge dialogue box, click the Step One arrow icon then double click the motor boom's open edge.
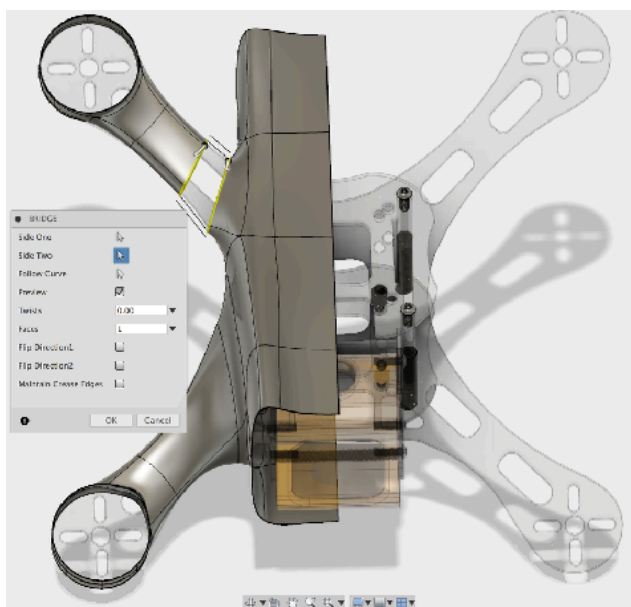
Click Side Two then double click fuselage connection sleeve edge. Select the Preview check box. The two arrows halite the flow of the topography. Click OK to create the Bridge and join the two models into a single mesh.

Rotate the view to inspect the resulting blend connection. Repeat the bridging steps to the other motor mount.
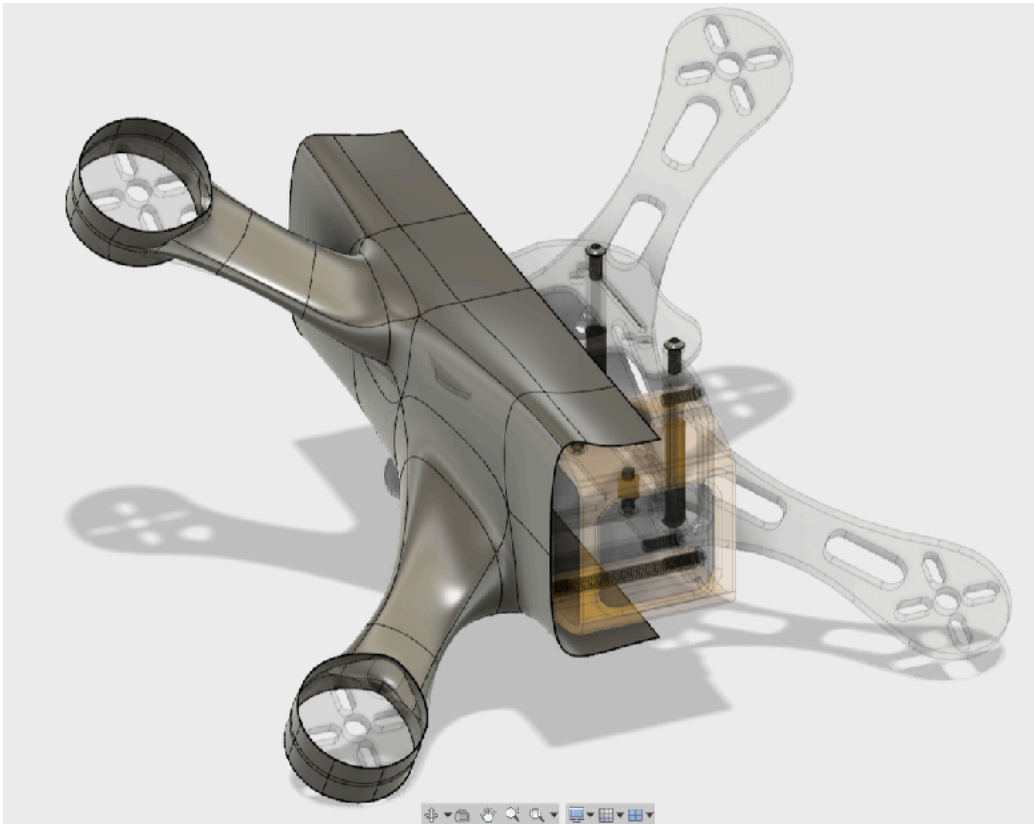
With the Edit Form Manipulator, inspect the bridge mesh at the connection to the fuselage. Constantly adjust the resulting model to work with the underlying geometry.
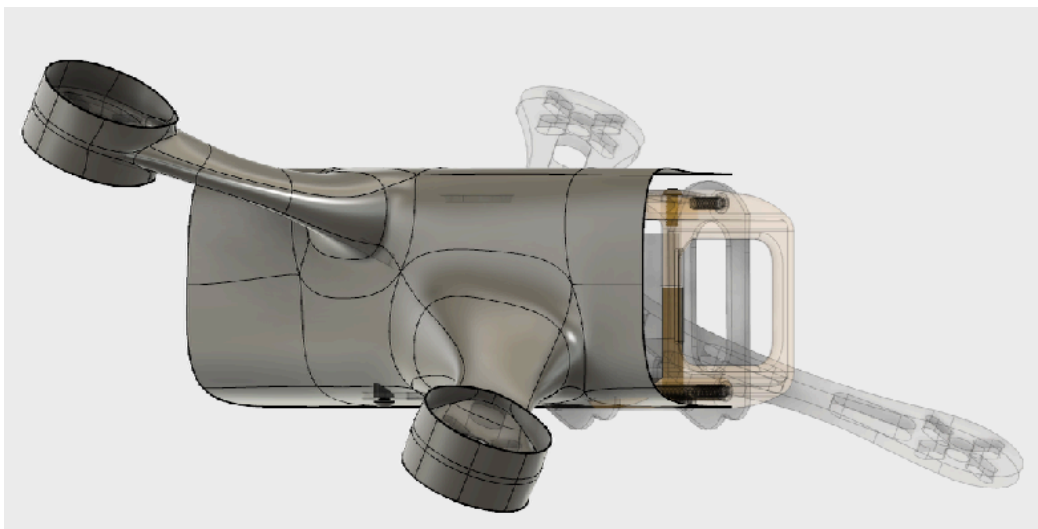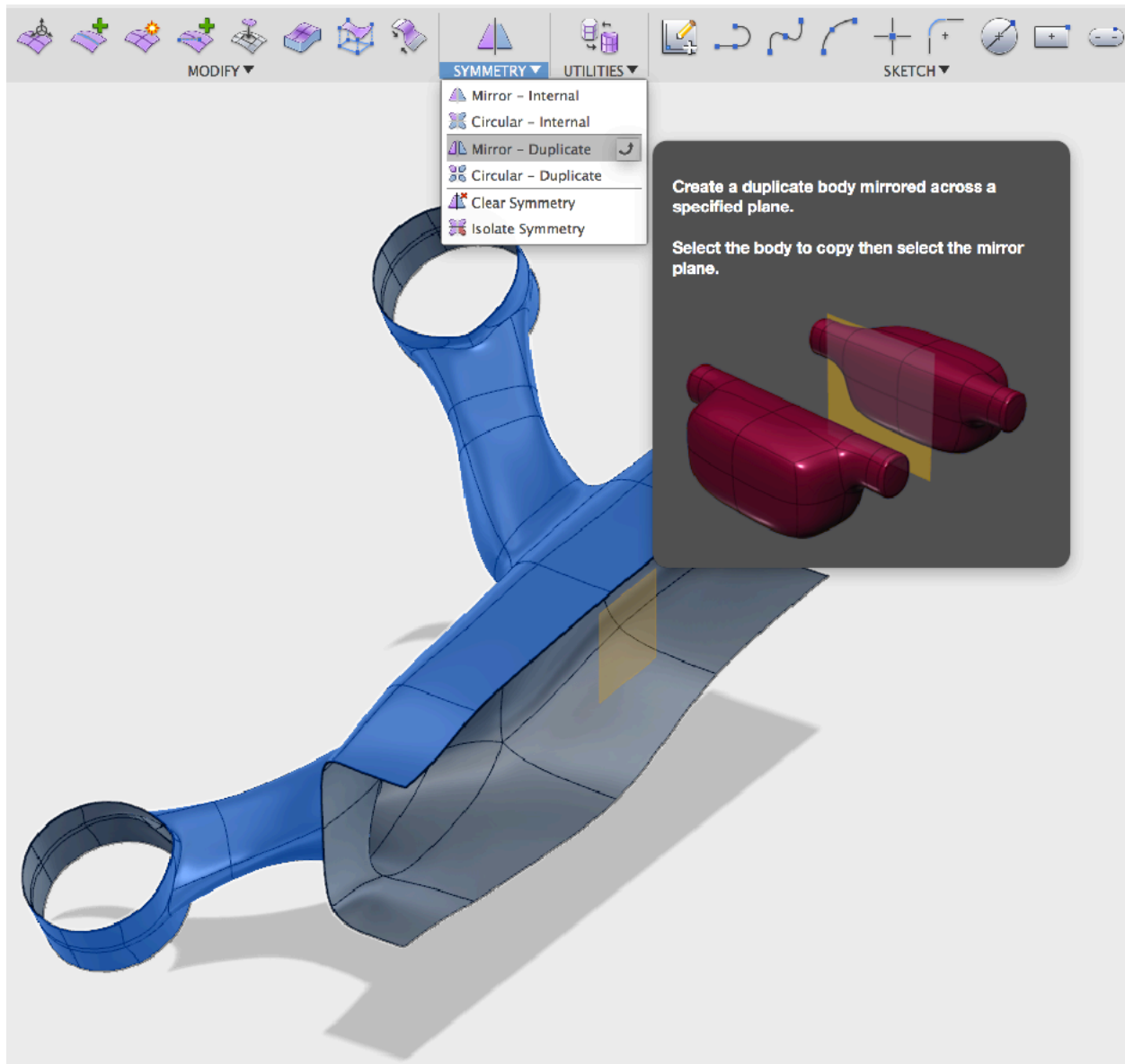
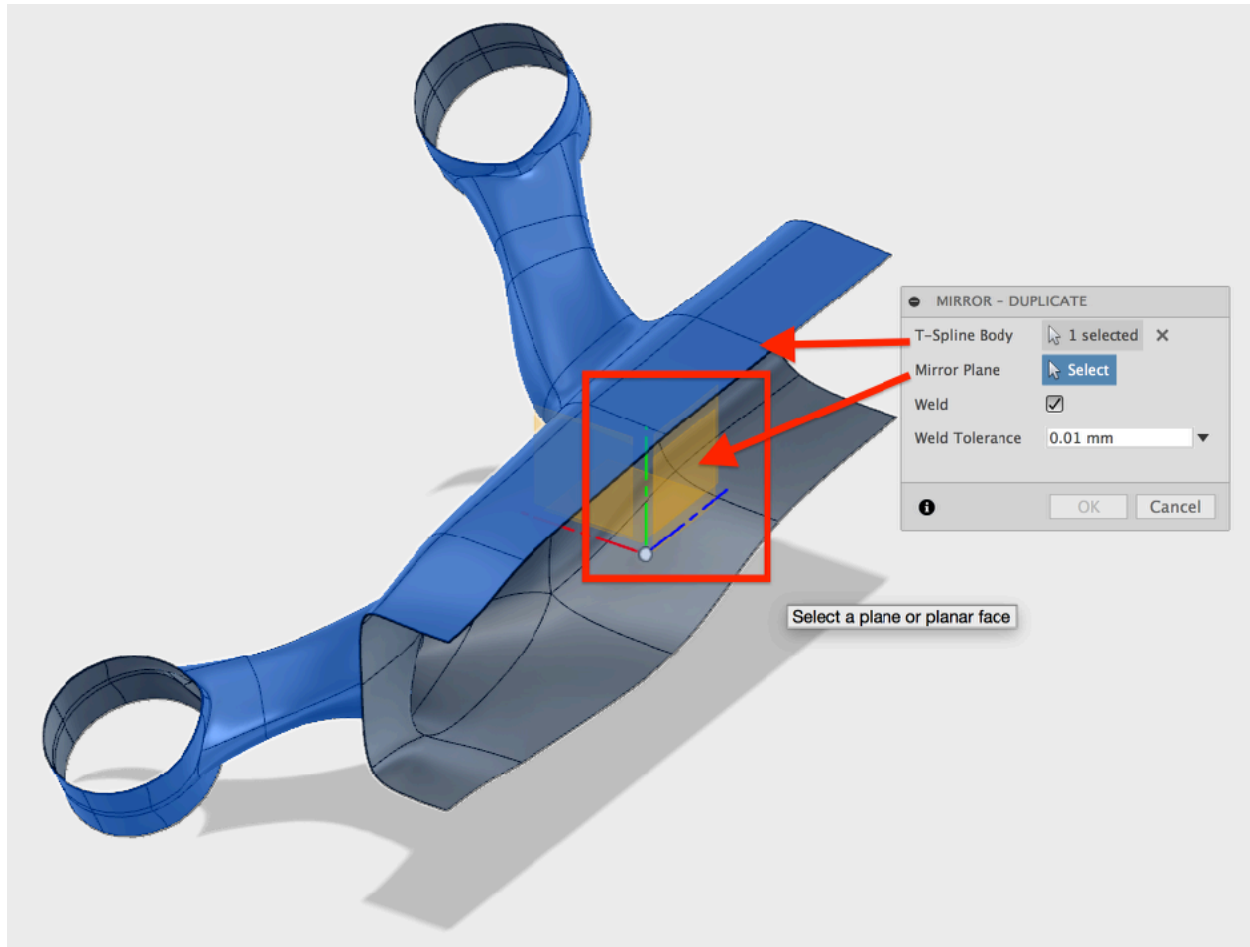Continue shaping the mesh working towards a profile conducive to aerodynamics.

Mirror Duplicate The Results.
Symmetry menu / Mirror duplicate the drone body using a Construction or Origin Z axis plane off of model center.
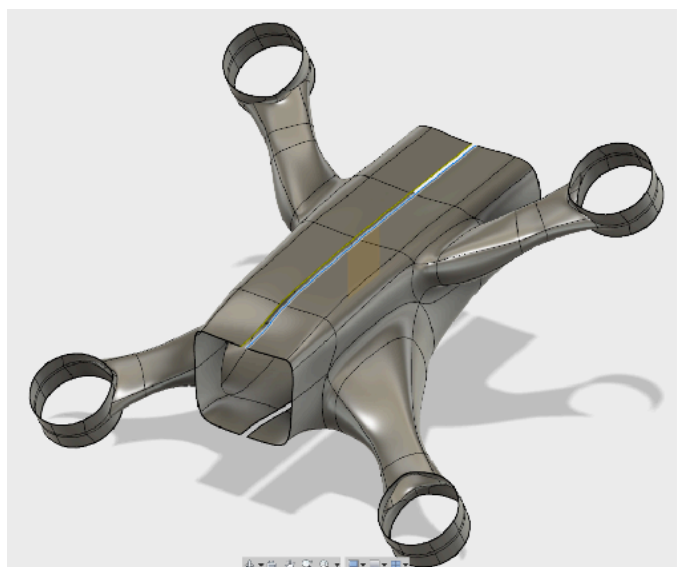
In the Mirror Duplicate dialogue box, select the 1st select the T-Spline mesh, then the Z axis plane. Select OK.


The geometry is mirrored with symmetrical modeling active.

Often the center top and bottom splines will need to be cleaned up and joined together. The best approach is to simply delete the center spline and connect the two half withe the Bridge tool.

From Modify menu, select the Bridge tool dialogue box, select Side one top open spline, then side two. With preview active, the white arrows will show the direction of the resulting topography. Both arrows must point in the same direction for usable results.
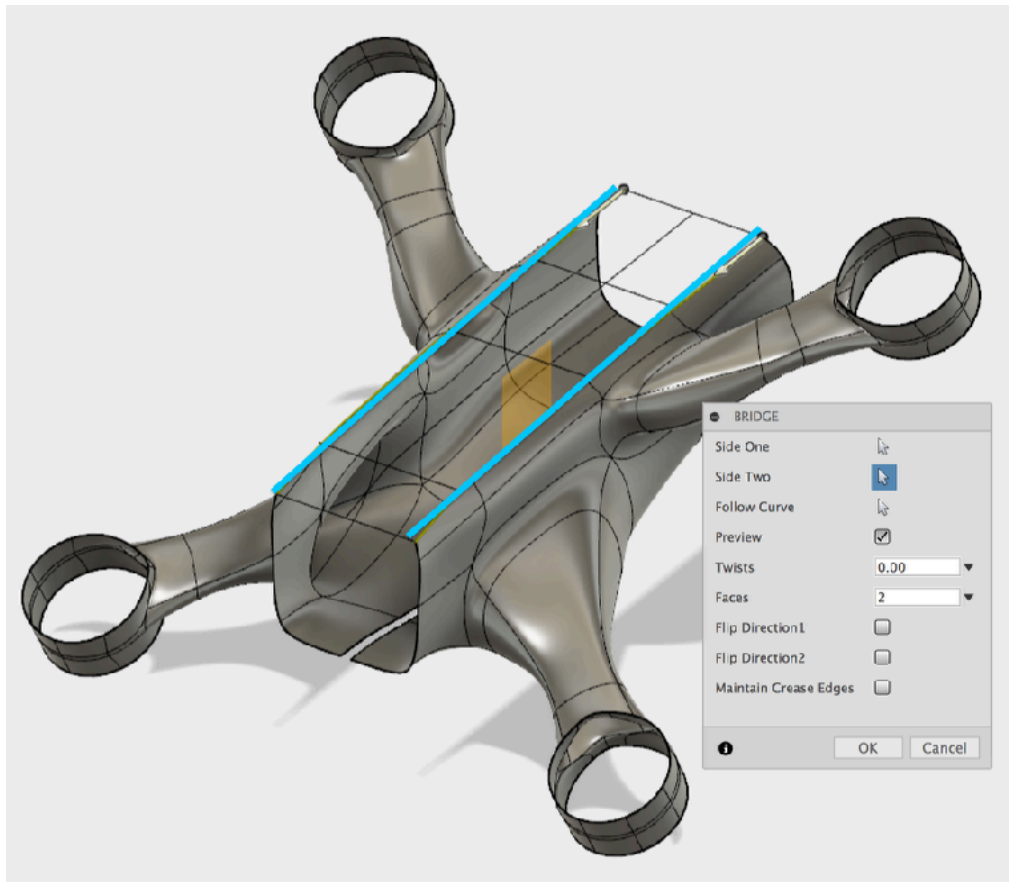

Repeat the Bridge tool procedure for the bottom half. The The resulting model has clean, easy to work topography.
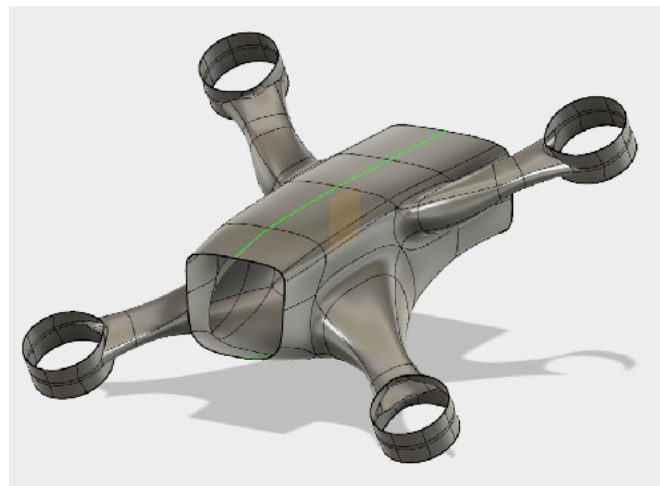
Don't worry to much about the minor shift in center observed when toggling components on and off in the browser tree as they can be easily adjusted when T-Spline model is ultimately finished.

In the Browser unhide the 210-X tree and continue to shape the T-Spline mesh to accommodate the components volume. Keep in mind that underlying airframe will be later re-drafted, most of the power train electronics will be repositioned in favor of the
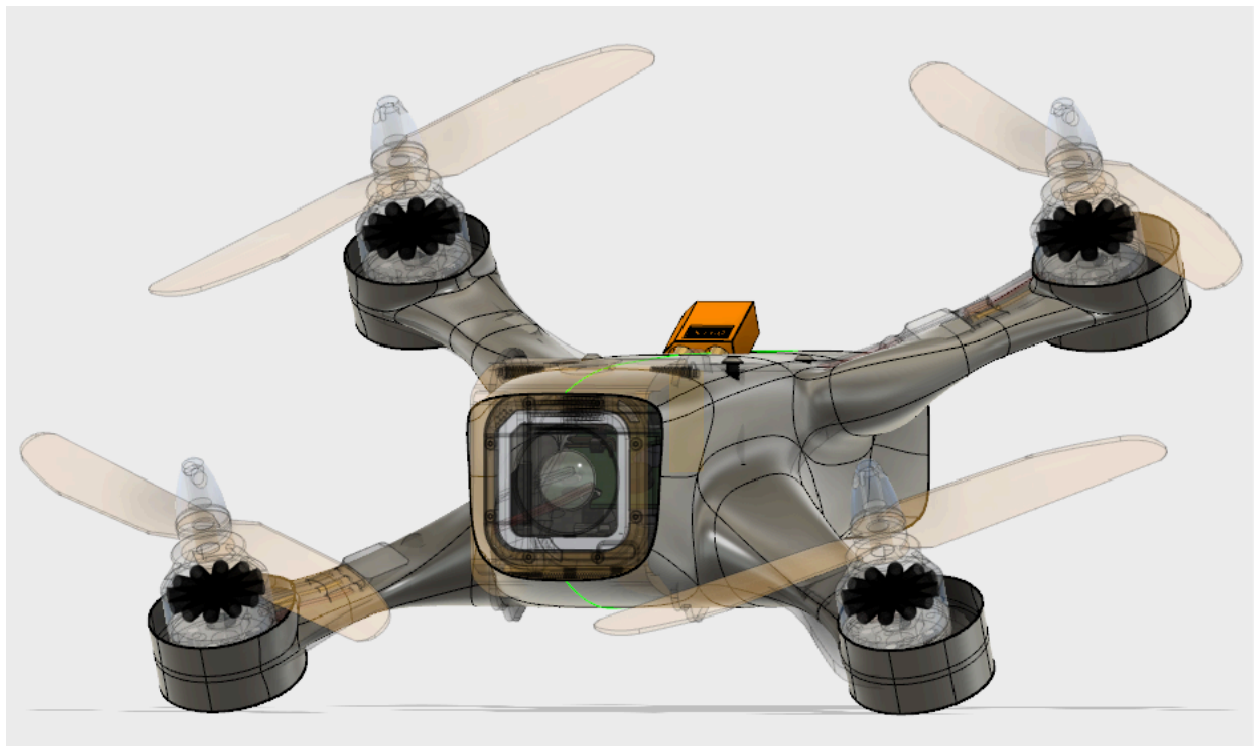
new T-Spline monocoque frame.

The rear battery bay and the forward sports camera placement will both balance the craft and dramatically define the model's overall shape.
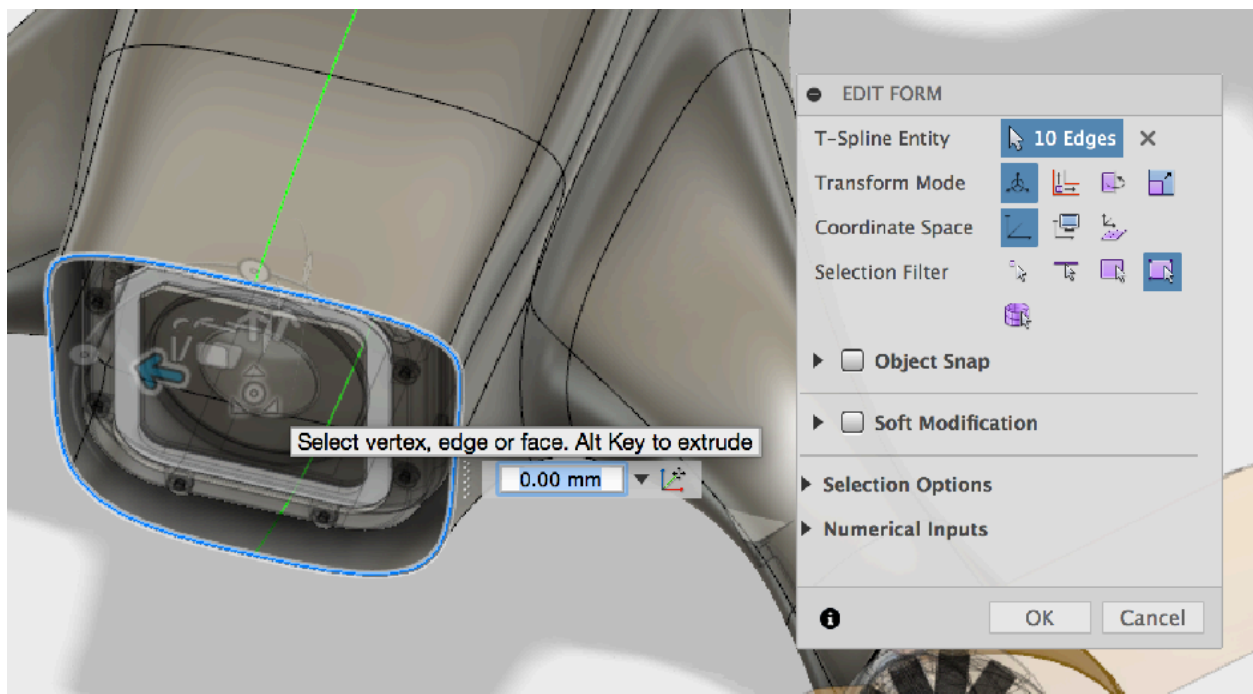
Flow Design results and the layout of the internal components still allow for imagination it's say over the model's aesthetics.
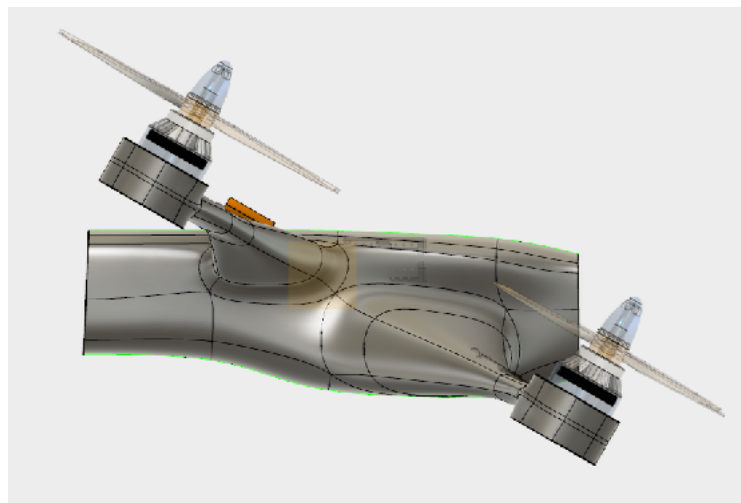
Finishing the T-Spline Racing Drone.

Now focus on the forward camera port. Using the Edit Form Manipulator tool, double click the open camera port splines so they are hi-lighted as a blue ring. Select the very


center of the Manipulator tool for global scaling. Hold down the option / alt key to extrude scale a new faces around the camera lens.

Toggling the electronics Browser tree on and off to aid visualization.
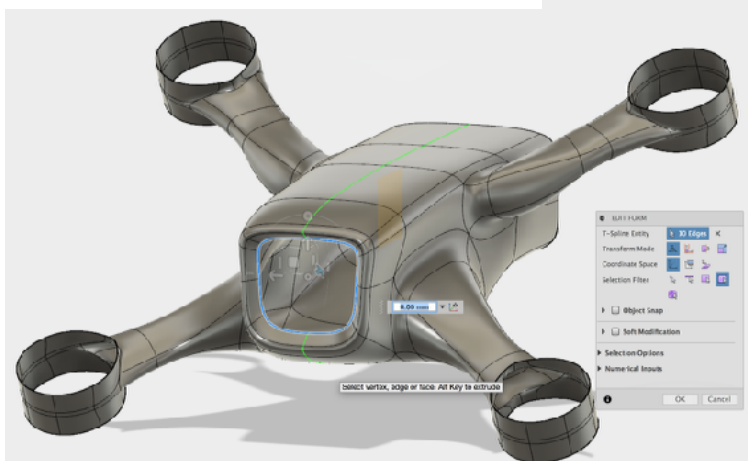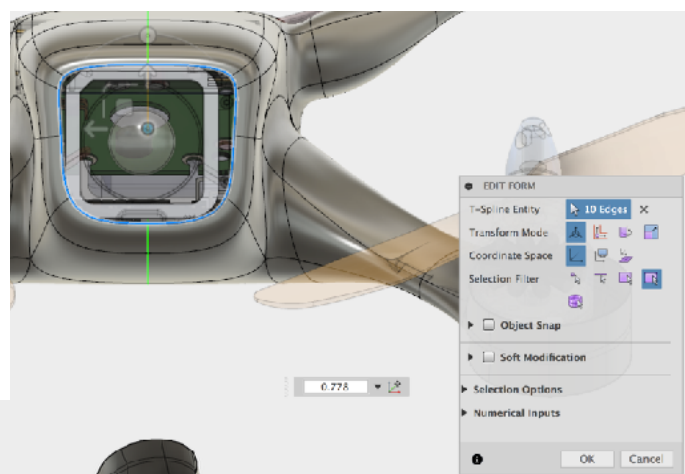
Repeat the process for the rear open port. It's up to the individual to have the final say weather or not to leave the rear port open or close it off with the Fill Hole tool from the Modify menu.
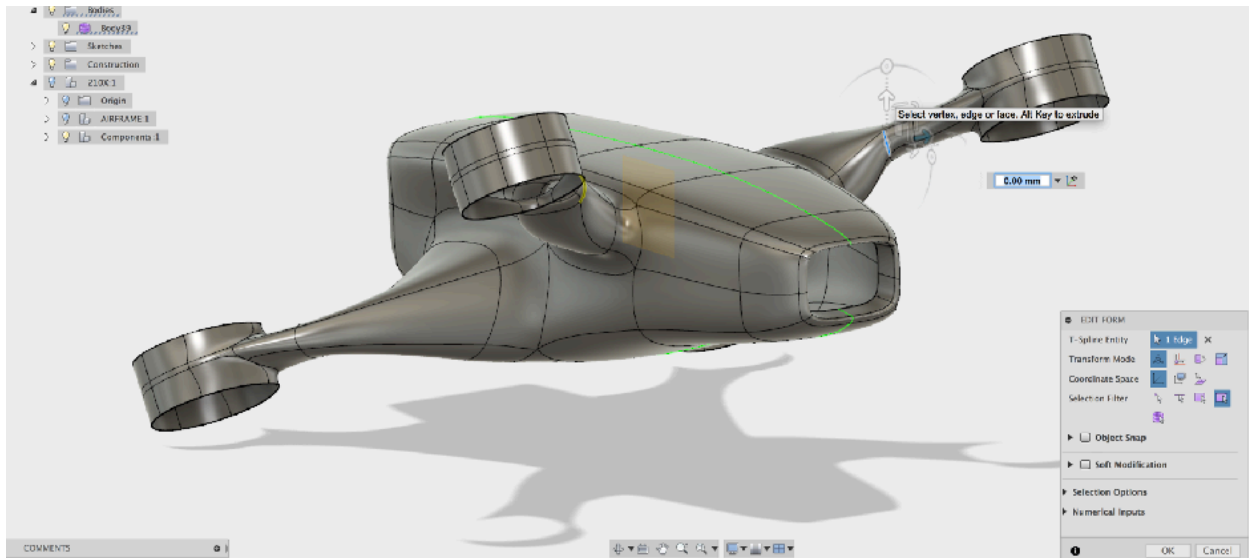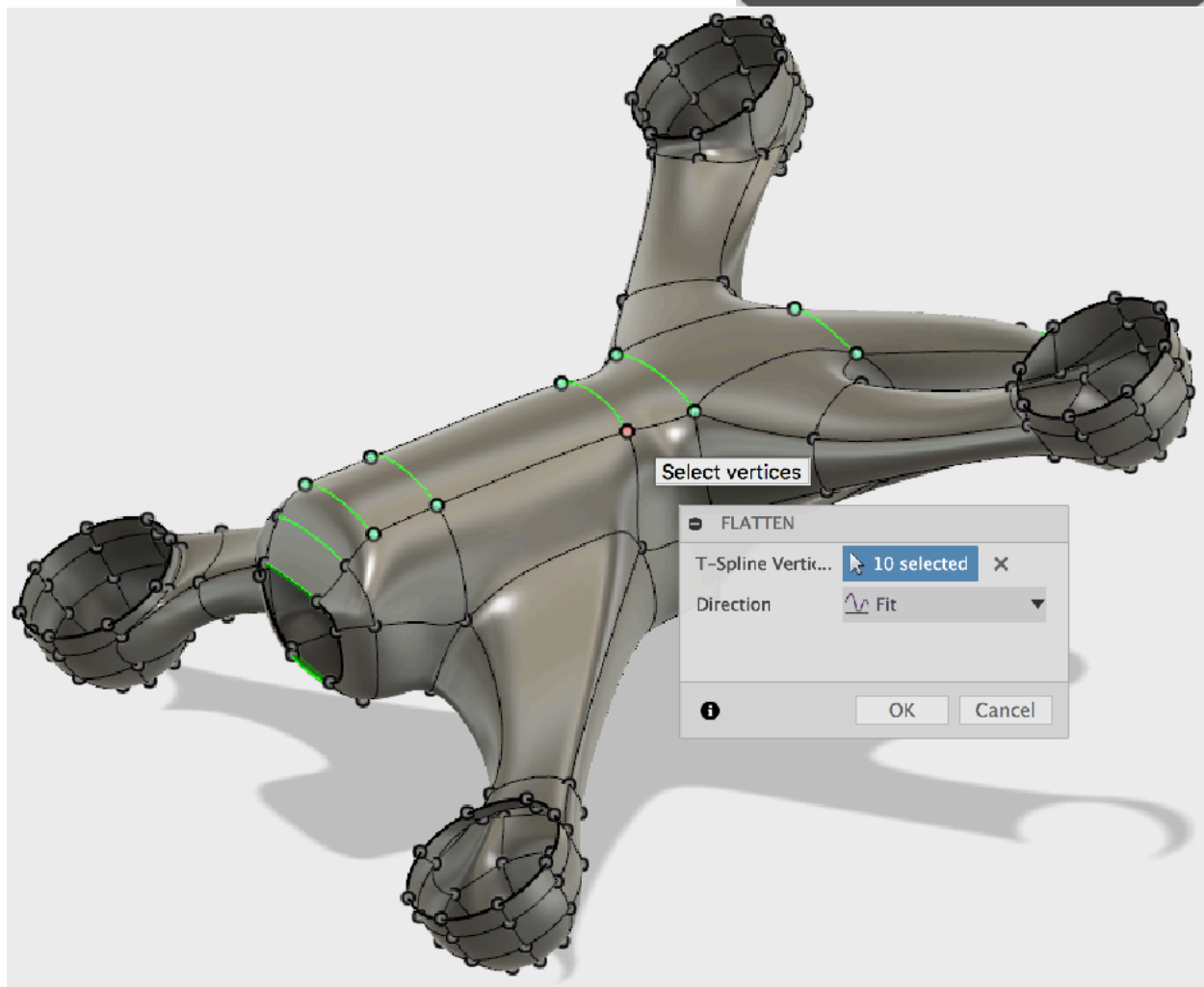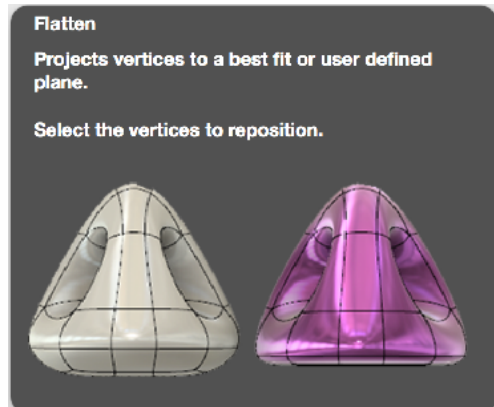

Close off the bottoms of the motor mounts with Modify menu / Fill Hole tool. In the dialogue box select the edge to close and Fill Star in the Fill Hole Mode.
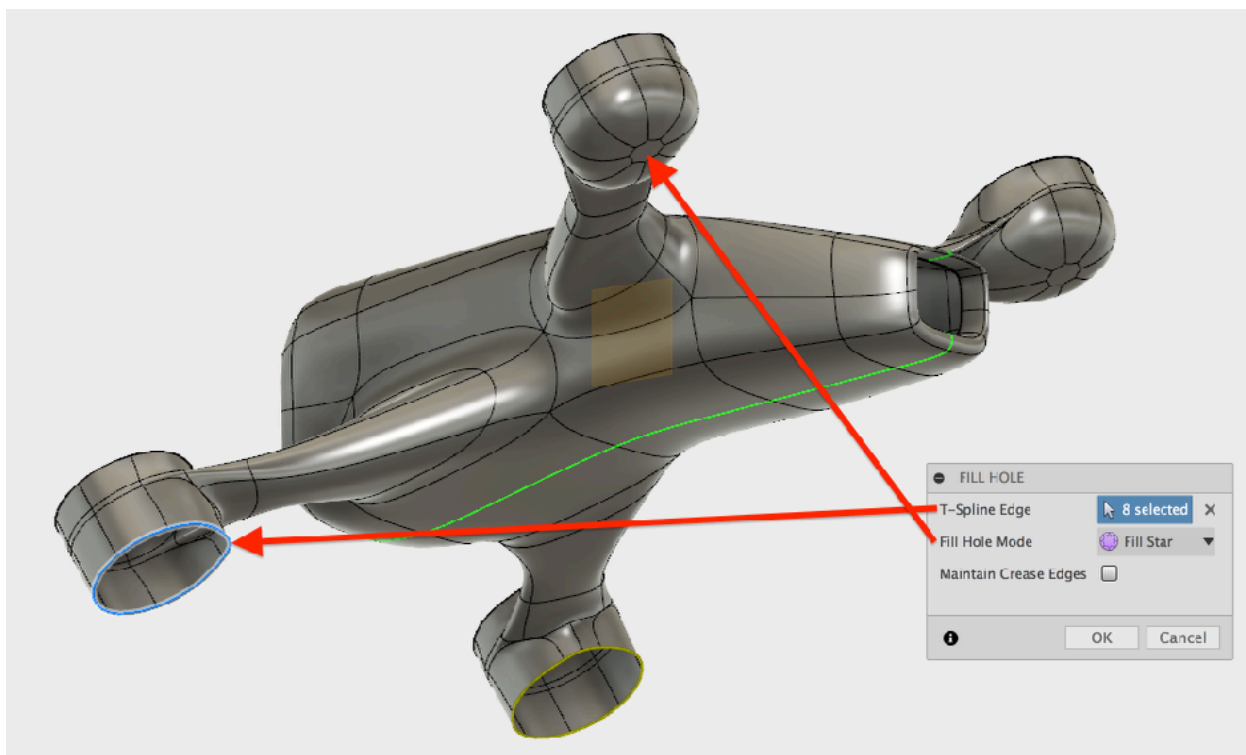
Use the Modify menu / Flatten tool to level off and make surfaces uniform. Leaving the dialogue box settings to default is usually best.

When active, the model's vertices are shown. Click each vertex of the surface you wish to flatten. Clicking the vertex again will deactivate that point.

Flatten

Projects vertices to a best fit or user defined plane.

Select the vertices to reposition.

Select vertices

FLATTEN

T-Spline Vertic...	10 selected	✕
Direction	Fit	▼

OK   Cancel

**Crease Tool. Adding a top access port lid**.

Just few more features to add before the model is ready to go another round in Flow Design.
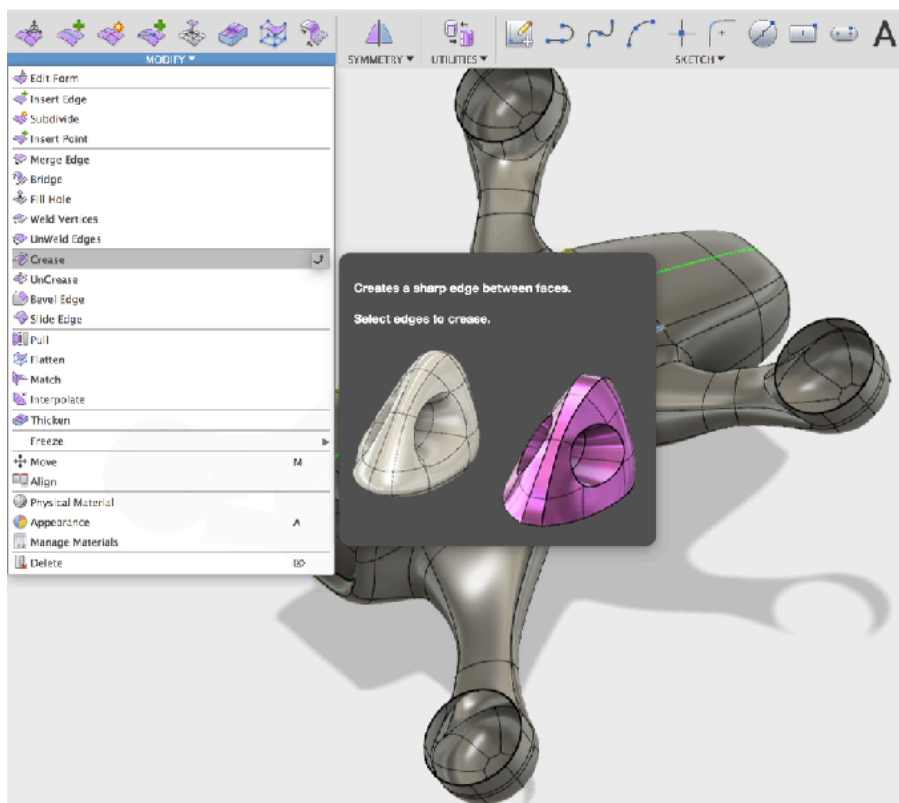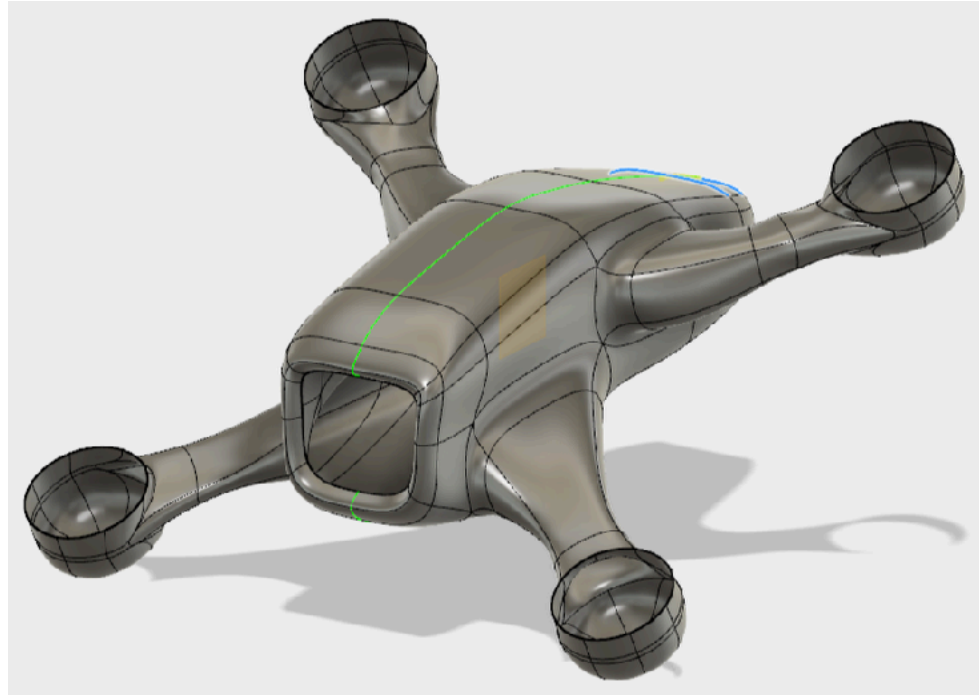
Add hard surface features that can be made into the crafts main access lid using the Modify menu / Crease tool.
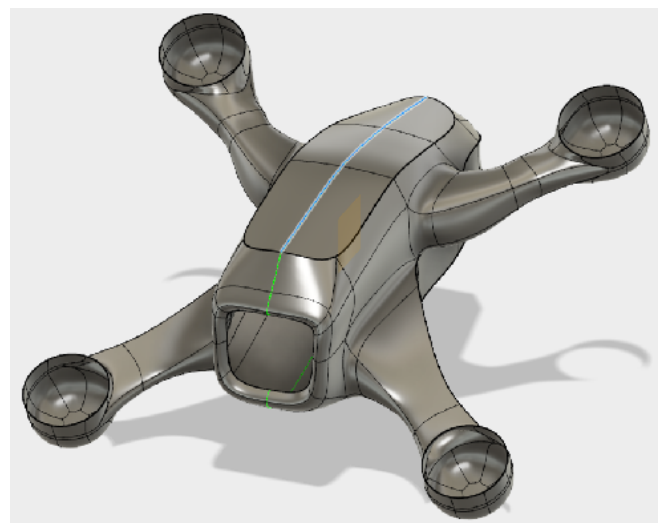
When activated the model will turn yellow. Systematically select the top splines of the hull. With model symmetry active you only need do one side of the model.
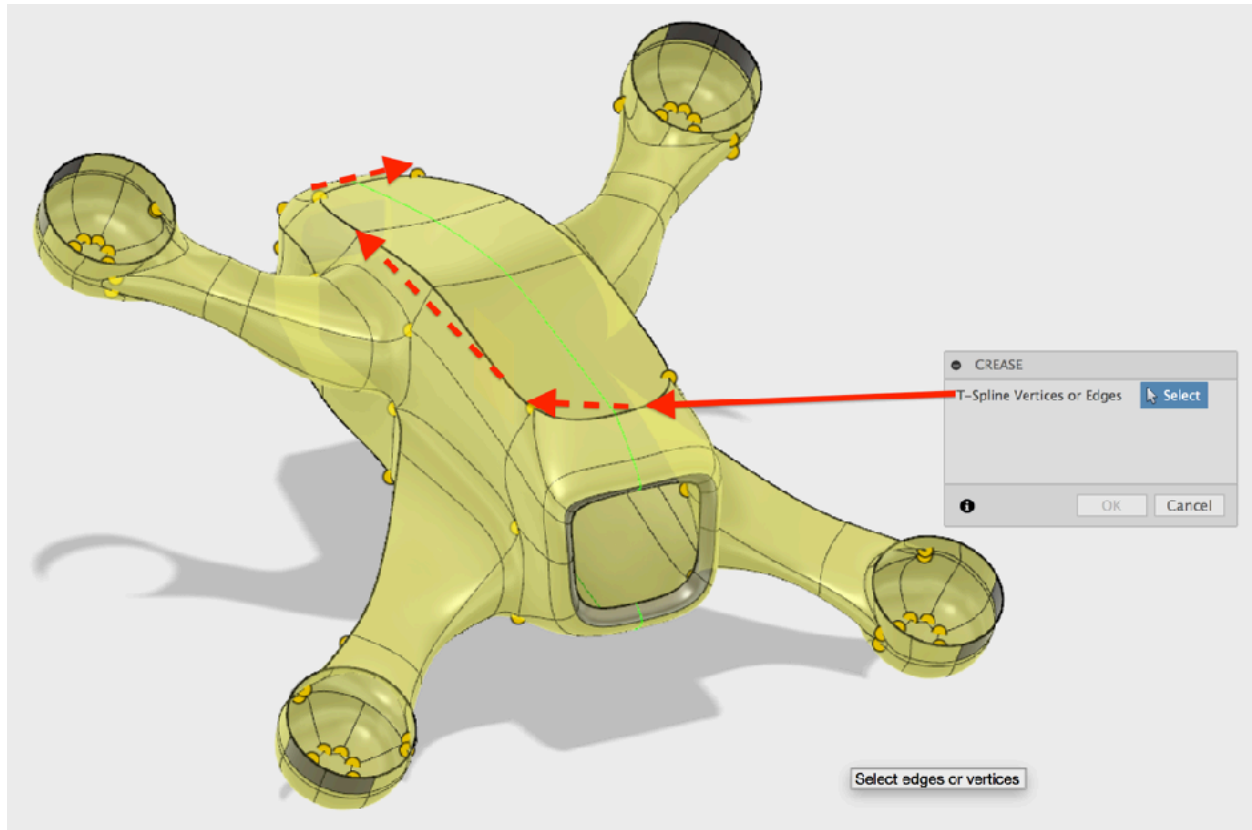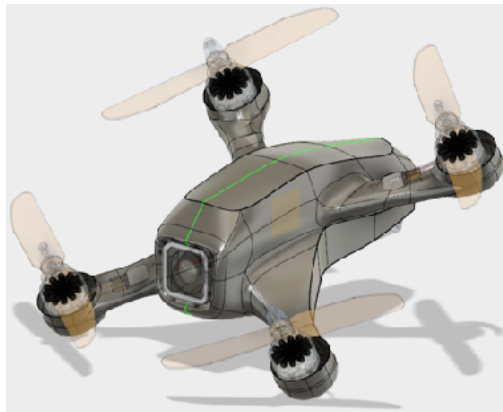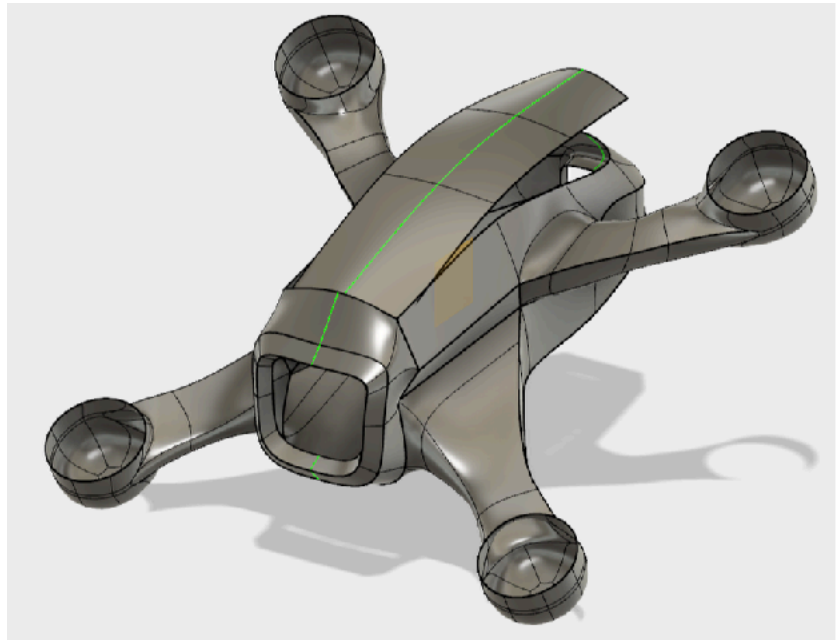

The results are ready to become the access port lid.

Use the Modify menu / Un-Merge Edge tool and again select the creased edges. A new body T-Spline body will appear in the Browser tree.
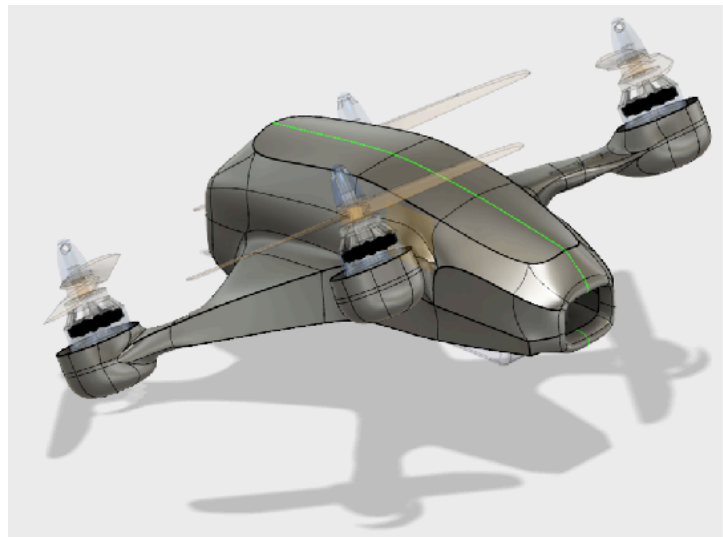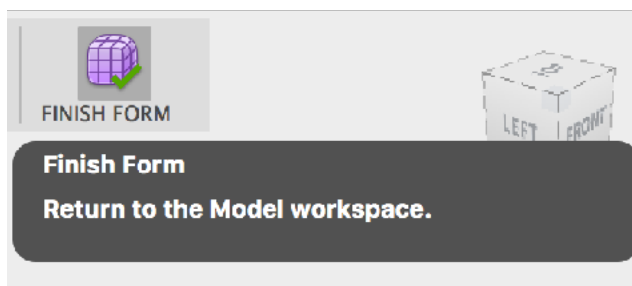
Use the Edit Form Manipulator tool to move and adjust the new door open.

Un hide 210-X components to inspect the final before sending it into Flow Design.

When satisfied click Finish Form, last right button option in the in the Sculpt Menu.

FINISH FORM

Finish Form
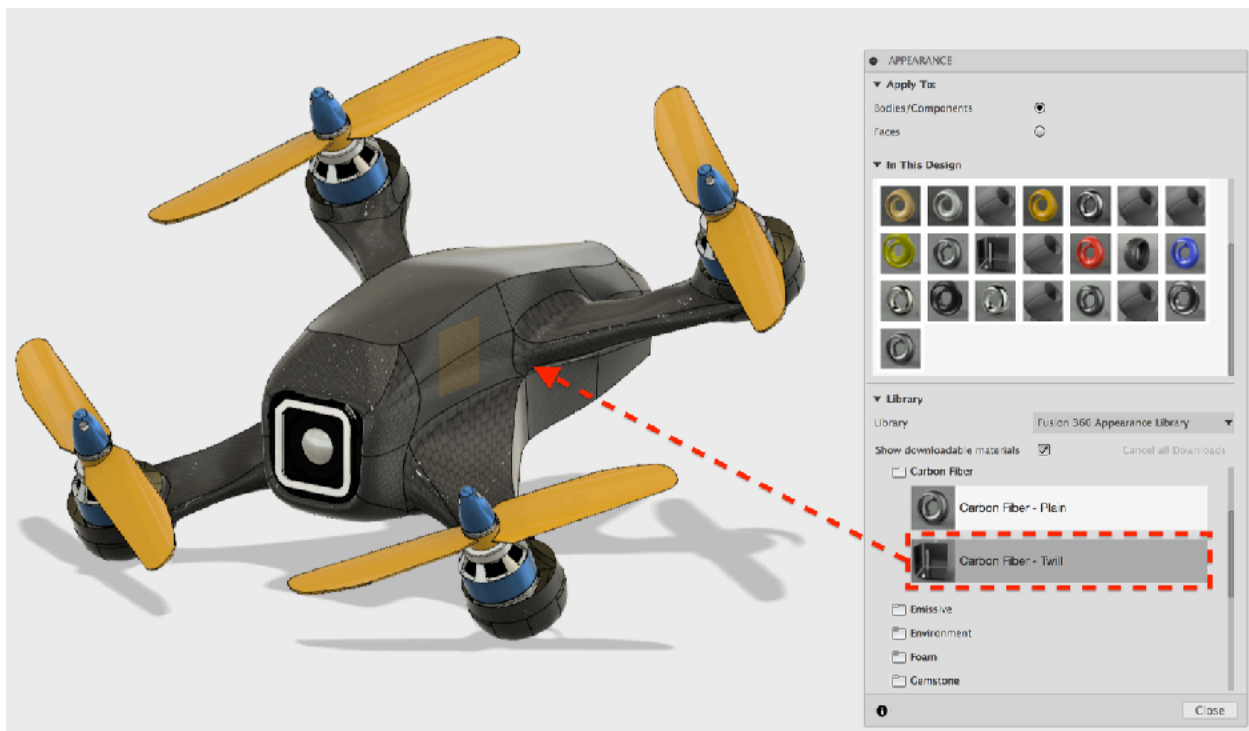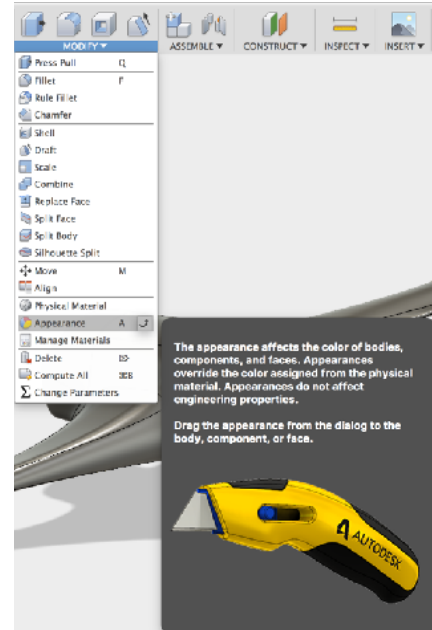**Return to the Model workspace.**

Add a Carbon Fiber Material

Lastly add a material to the model by hitting A on the keyboard or Modify Menu / Appearance.

From the Appearance dialogue box scroll to the folder called "Other" / Carbon Fiber. Download, drag and drop the "Carbon Fiber Twill" material directly onto the done model.

Back to Flow Design

SAVE YOUR WORK!!!
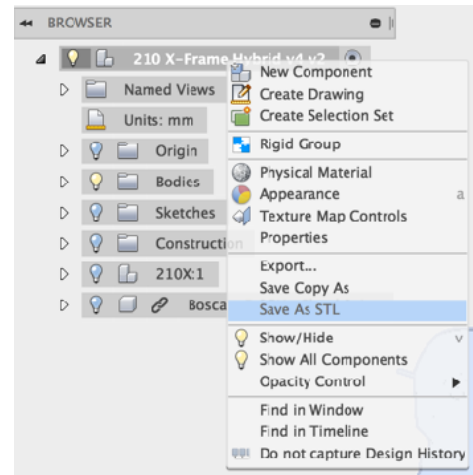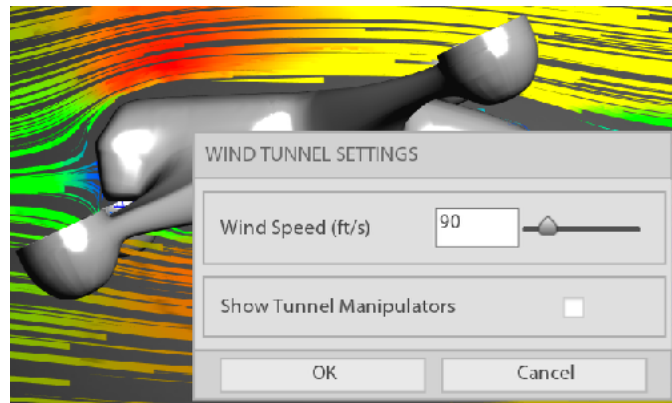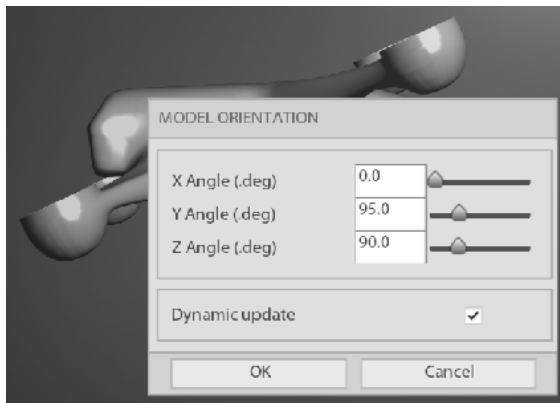
Now it's time to test the new model's surface features in the wind tunnel simulator!
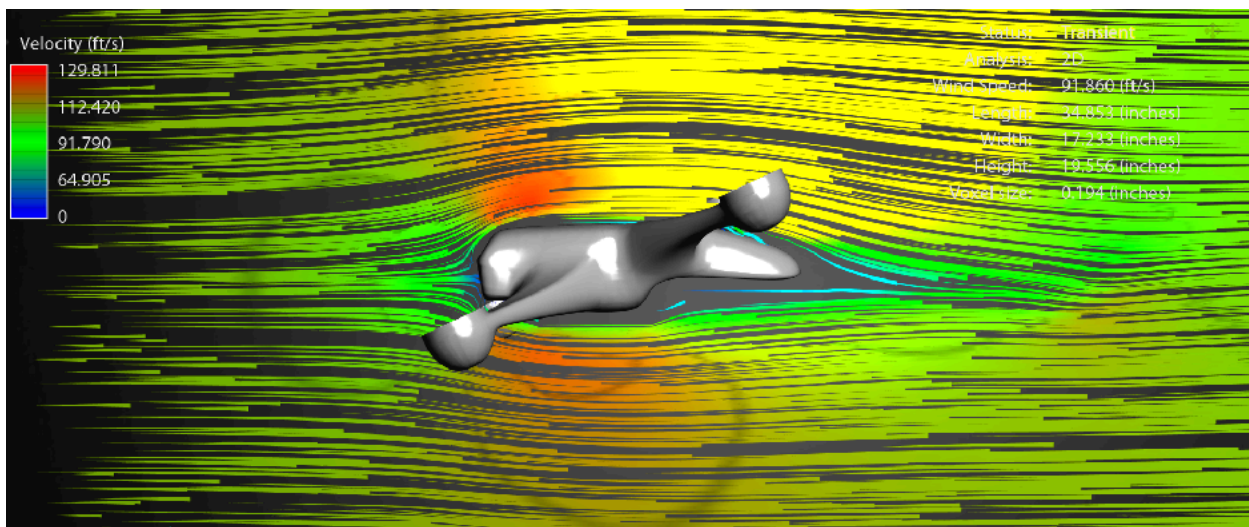
To recap the process. Right click the very top of the browser tree and select Save as STL. Save to your project folder.

Next minimize / hide Fusion360 then open Flow Design. Import and orientate the new model.

With the new aerodynamic monocoque airframe Flow Design results are dramatically improved.

Flow Design in tandem with **Fusion 360** is a powerful combination in producing next generation of "super" drone racers. The goal is to modify the basic build by visualizing wind current force effects against the model in order to iterate flight vibration turbulence out of the drone's design.

For the continued learning video versions of the lessons in this guide please subscribe to my YouTube Channel

Download and study the 210-X Racing Drone Fusion360 file.
Accurate wiring and layout

Here is a complete racing drone parts and components list:

Drone Power train:
- 4 x 2204 / 2100 kv Motors by RCManChild
- 4 x 22 Amp RCManChild ESCs
- Power Distribution board w/ built in BEC
- Naze32 Flight controller w/ "Borris B." firmware programmed on Clean Flight.
- Orange 6channel RC
- FPV kit (Camera, 5.8gHz Transmitter, Antenna)
- Turnigy 3cell, 1800 Lipo Battery.

Additional Drone Hardware:
- 8 x 25mm Standoffs
- 32 x 3m x 6mm button head screws
- 3M double sided tape
- Velcro Straps
- Zip Ties

Pilot:
- FatShark FPV Goggles
- Orange 6 Channel Radio Controller
- Lipo Battery Charger
- Metric tool kit
- Drone Back Pack

For more check out www.eagleeyemetrics.com and www.Hooliganfpv.com

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I do hope this guide was effective and you find great value from it's contents.
To share your drone builds, get feedback and questions answered email me at
dsfx@mac.com.

For announcements, news and updates, please follow me on Twitter: @El7ias
Hope to see you at the races!
                    - Eli DElia

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