# Maya 2014 - NURBS Modeling Tutorial
# Airship

Airships have captured human imagination for centuries and are featured prominently in books, film and video games. As an introduction to modeling with NURBS (non-uniform rational basis splines), we will be modeling a fictional airship of your own design. The sky's the limit!

## Working from a reference sketch

Whether rooted in reality or fantasy, all great 3D models are based on some kind of reference imagery. Before beginning on our model, we should first create a sketch of what we envision it to look like. You can use real airships (zeppelins, blimps, hot air balloons) or fictional ones as inspiration. Here's a fairly basic one I sketched out:
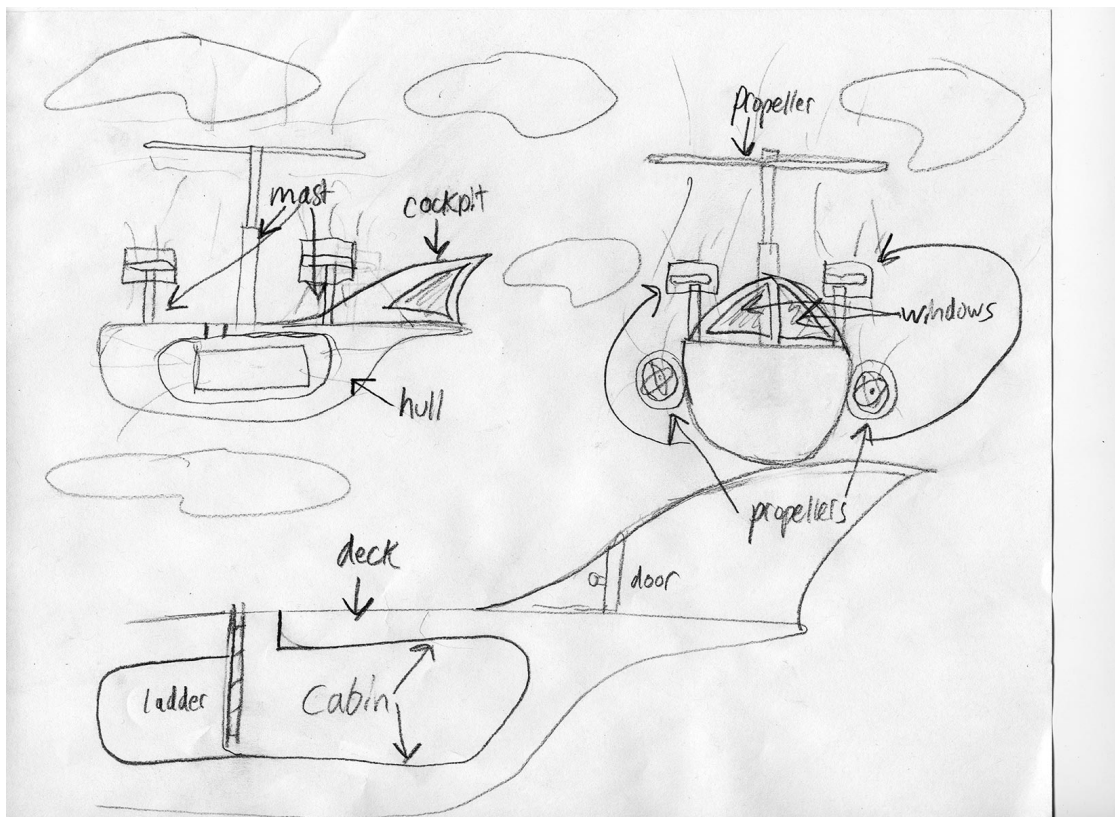


This airship contains all of the basic elements we will create for your model:

- **Hull:** main body of the airship
- **Deck:** flat surface on top of the hull
- **Cabin:** crew's quarters
- **Mast/Boom:** structural element holding up the sail or propellers
- **Sail/Propellers:** what drives the airship forwards (mine has propellers, but yours could have either or both!)
- **Cockpit:** captain's navigational room

Feel free to add many more additional details to make yours unique. I expect that your airship will

look almost nothing like the one I am creating!

## **Setting Up the Scene/Preferences**

- **File/Project Window**
    - Click on 'New' button to create a new project
    - Name our new project "Airship"
    - Use default settings for Project Locations and click **Accept**
    - Maya will automatically create sub-folders within your project folder (usually found in **Documents/maya/projects**)
- **File/Save Scene As...**
    - **Name:** airship1
    - **Type:** Maya Binary
- **Maya/Preferences/Files & Projects/Autosave:**
- Enable AutoSave to have Maya automatically create file backups in defined time intervals. You can also limit the number of files by checking "Limit autosaves."


## **The Hull**

- For the first part of our airship, let's create the main hull from which all of our objects and details will be attached.
- To create the curved surface of the hull, let's draw out a **Curve** to define the shape
    - Switch to the **Top Viewport** by moving the mouse over it and pressing **Spacebar**
    - Go to the **Create/CV Curve Tool Options Box**. Make sure the **Curve degree** is set to **3 Cubic** and **Knot spacing** is **Uniform**.
    - Click the mouse in the viewport to draw out **CV Curve** points
    - Draw out a curve for half of your hull around the **X axis** that is similar to the reference sketch. Don't worry about getting it exactly right; we can edit it later.
    - Press **Enter** to finalize your curve. See the image below for comparison:
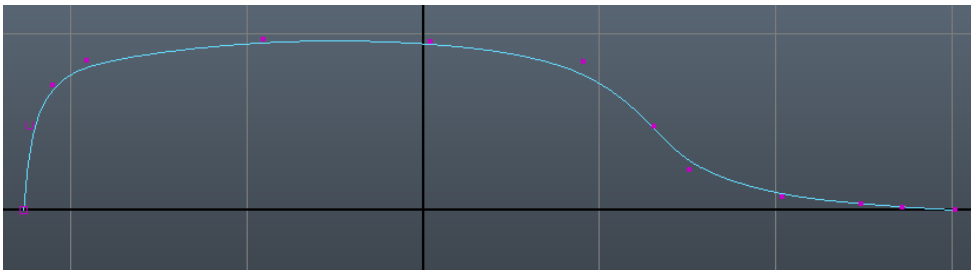


- You can edit the curve by right clicking on it and switching to Control Vertex mode. Simply drag those points around to reshape your curve as you please.
    - To make sure that the **open endpoints** of our curve are perfectly aligned with the **X** axis, select the **End Point** and check the **Snap to Grid** button at the top on the **Status Line**. Now, when you drag along one or more axes, it snaps to the nearest grid point!
- With the curve selected, let's switch to the **Perspective Viewport** by pressing **Spacebar** again to go to the **4 view** and then again on the **Perspective view**.
- To create the curved surface from our curve, we are going to **Revolve** it around the **X** axis by

going to **Surfaces/Revolve Options Box.** Use the following options:
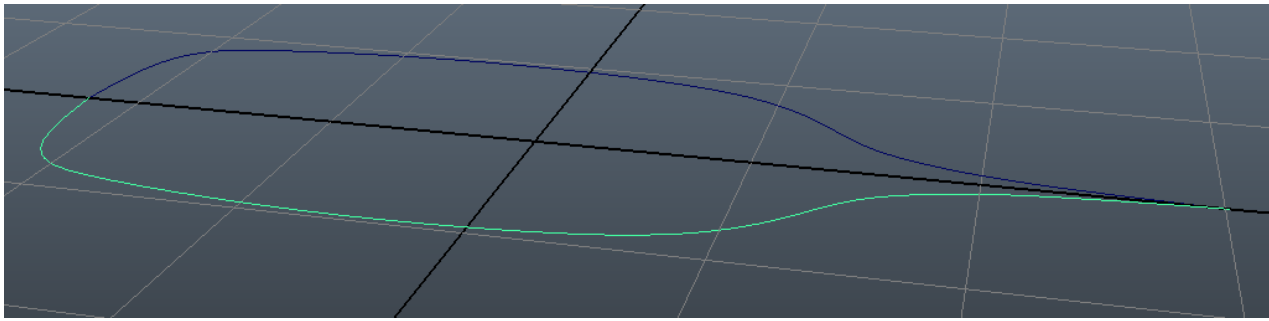
- Go to **Edit/Reset Settings** to use default settings before we start. This works for every tool with an **Options Box.**
- **Axis preset:** X            - What axis the curve will revolve around
- **Start sweep angle:** 0
- **End sweep angle:** 180      - Set to 360 for a complete revolved surface.
- **Segments:** 8                - Increase for additional revolved segments
- Use default settings for the rest and press the **Apply** button
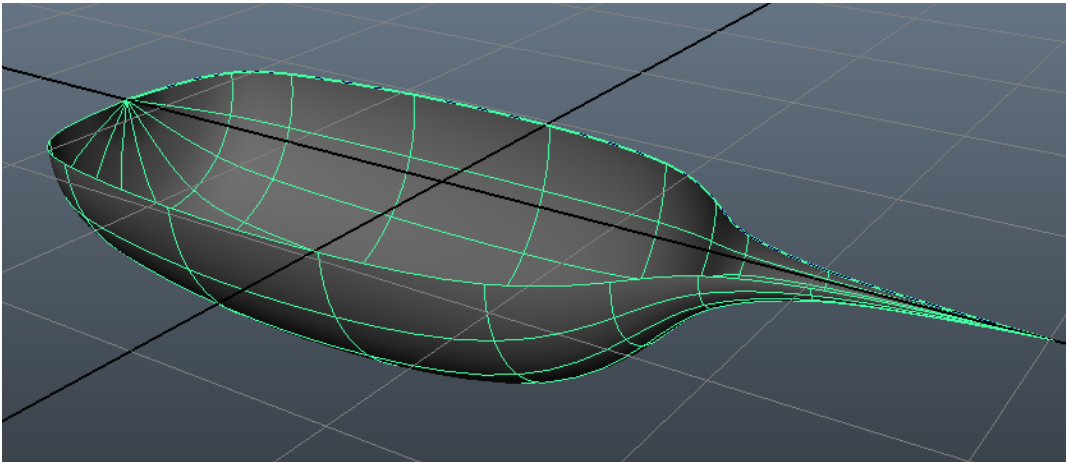


- With just a few easy steps, we have created a revolved hull surface! Let's select its **Name** in the **Channel Box** and rename it "airshipHull"
- Notice that since our curve and new revolved surface are still connected, we can select our curves and drag the control vertices around if we want to reshape our hull.
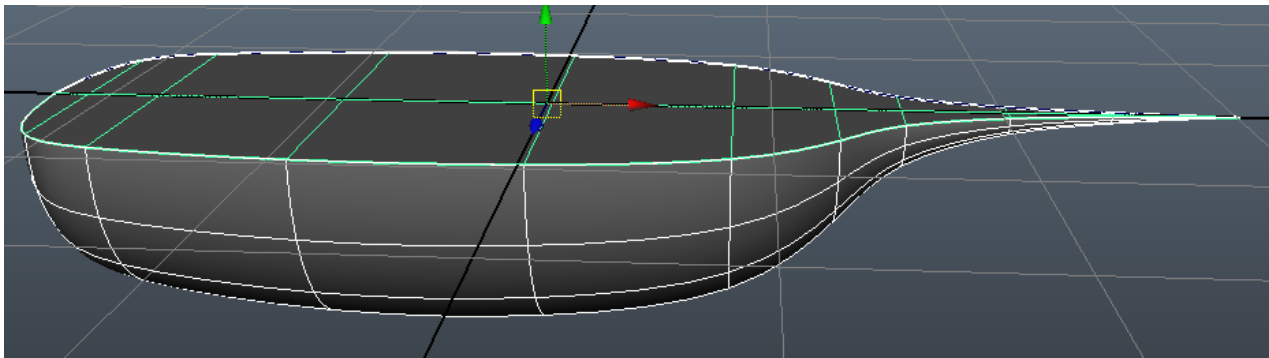
## The Deck

- To make the deck of our airship, we are going to create a new surface that connects one side of the top of the hull with the other with a **Loft**:
- First, select the **Revolved** surface of the hull and go to **Display/Hide/Hide Selection** so that we can more easily select our curves
- Next, select the curve we created in the top view and hit **Command+D** to **Duplicate** it
- With the duplicate copy still selected, change the **Rotate X** value to 180 in the **Channel Box** to mirror it across the X axis
    - You can also mirror an object across an axis by setting that **Scale** value to -1, as long as the object's **pivot point** is along that axis

- Select both curves and go to **Surfaces/Loft Options Box**. Use the following settings:
- **Edit/Reset Settings**
- Section spans: 2           - How many spans to insert in the lofted surface
- Everything else can be left at the default settings
- Press **Loft** to create the deck of our ship. Now we have a lofted surface that connects both curves together. It's that easy!
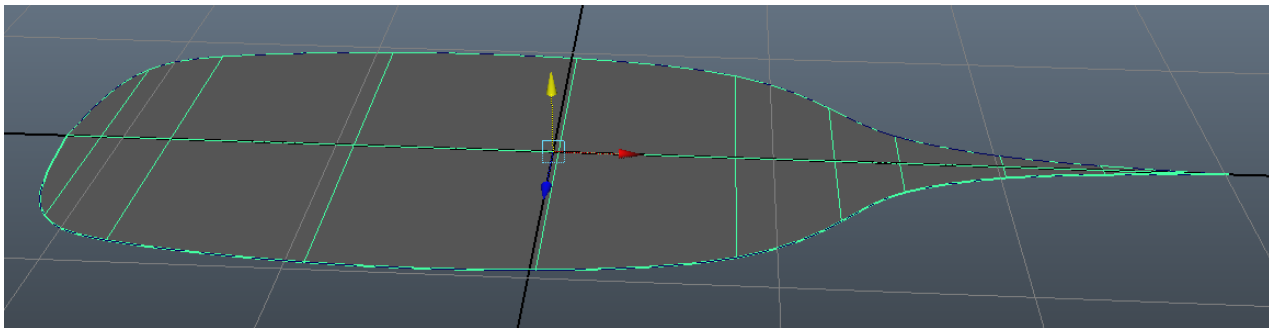


- Rename our new loftedSurface "airshipDeck"
- Go to **Display/Show/All** to show our hidden hull geometry again.



- Now let's get started on the cabin underneath the deck!

## The Cabin

- To better work with the area underneath the deck, select the hull geometry and go to **Display/Hide/Hide Selected.**
- We can also switch to **X-Ray** shading mode within the Viewport window by going to **Shading/X-Ray**. This mode allows us to see through geometry.
- **Duplicate** the two curves we lofted for the ships deck and drag them below the deck where we would like the floor of the cabin to be.

- **Right click** on the curves, switch to **Control Vertex** mode and delete the vertices by the front of the ship. We won't be needing them since the cabin will not extend all the way to the bow.
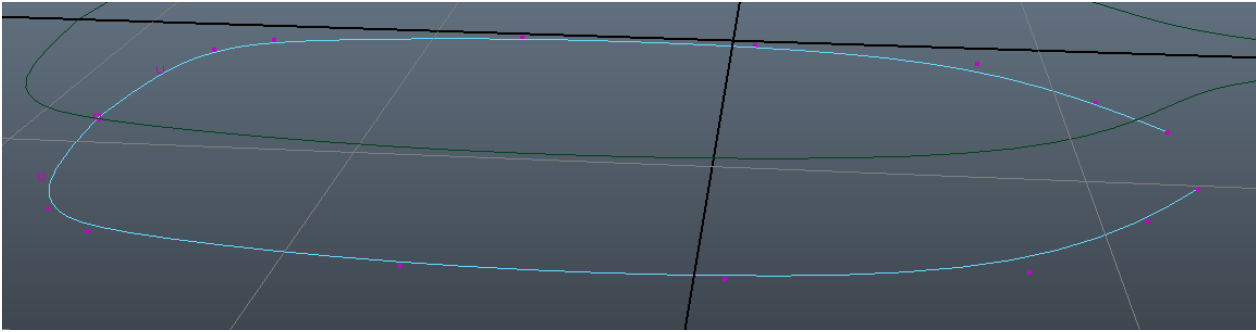


- Select both curves and go to **Edit Curves/Attach Curves Options Box:**
    - Reset the settings
    - **Attach method:** Blend
    - Leave all other settings at defaults
    - Press **Attach** to attach both curves together into one!
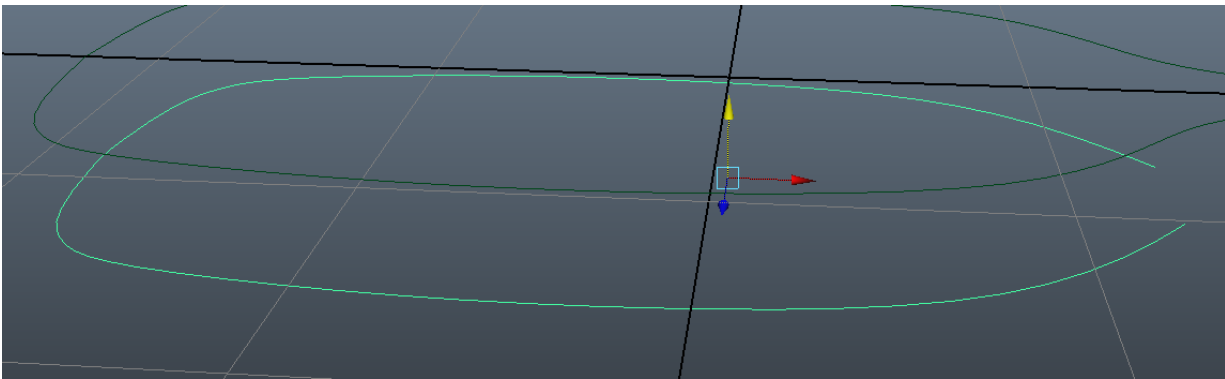


- With our newly attached curve created, we can **select and delete** the duplicated curves we used to make it.
- Select the attached curve and go to **Open/Close Curve Options Box:**
    - Reset the settings
    - **Shape:** Blend
    - Press **Open/Close**
- We now have a closed path that will work beautifully for the floor of our cabin!
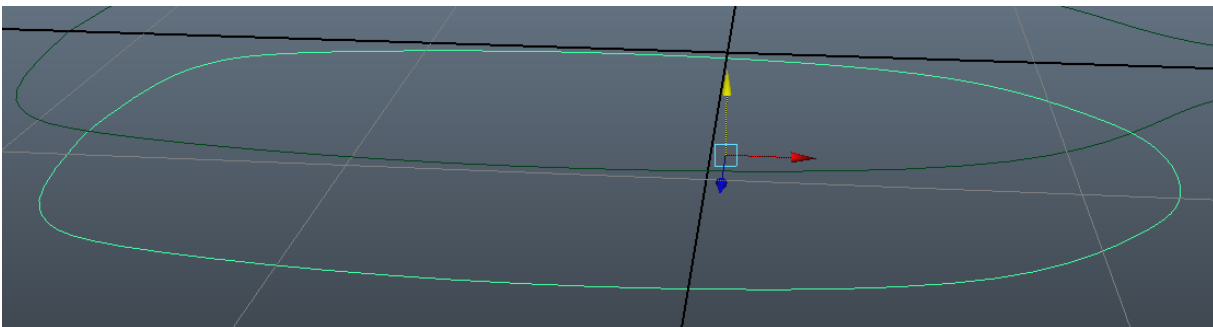


- Go to **Display/Show/Show All** to show our hull geometry again. Resize the floor curve for the cabin so that it fits well inside the hull.

- **Rename** the floor curve "cabinFloorCurve"
- With the floor curve selected, go to **Surfaces/Planar** to create a **Planar Surface**.
    - Reset the settings and leave them at default
    - The **Planar** command allows us to create a flat surface from a curve regardless of it's shape.
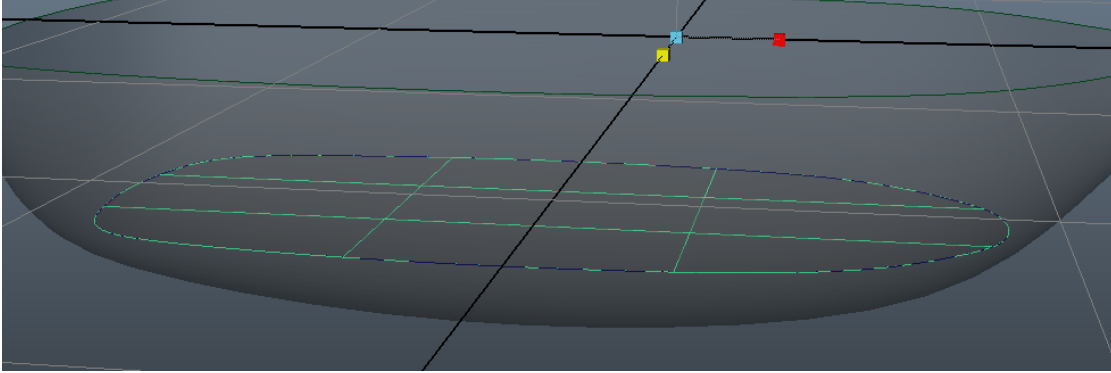


- To add some volume to our cabin, duplicate the floor curve and drag it up on the Y axis.
- **Duplicate** it again, **size it down** and **pull up** slightly on the **Y** axis. Repeat again for a total of **3** duplicated curves that will make up the walls and entrance port to our cabin (as seen below):
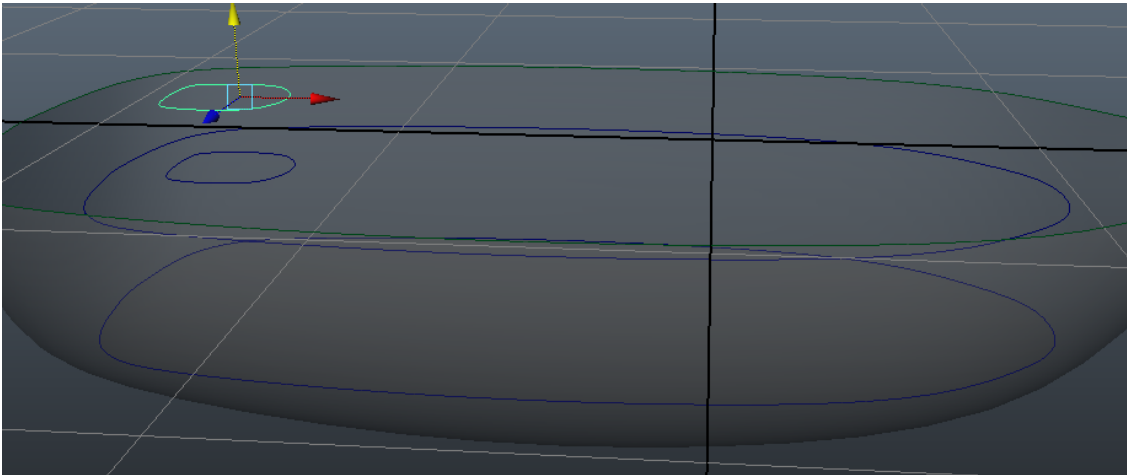


- We will now loft several curves at once to form our cabin:
    - **Select** the curves of the cabin from the bottom up individually
            - When performing a loft, select the curves **in the order from which you would like to loft them.**
    - Go to **Surfaces/Loft** to create the walls of our cabin! We can drag around our curves to reshape the walls as desired.
    - Make sure that the top hole connecting the cabin and the deck protrudes up through the deck.
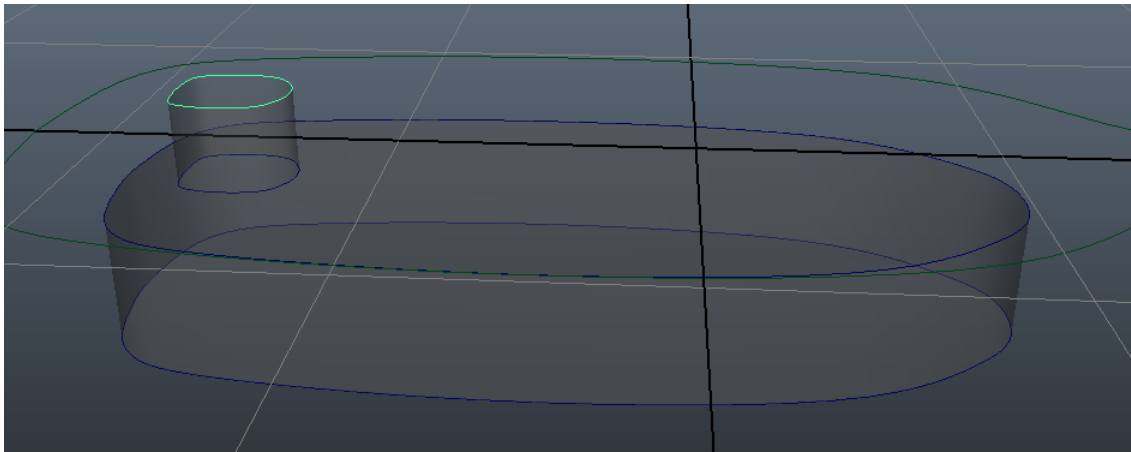
We will now use a **Boolean** command to create a hole in the deck to fully connect it with the cabin:

- Go to **Edit NURBS/Booleans/Difference Tool**. This tool creates new geometry where two (or more) surfaces intersect.
- **Select** the cabin geometry and press **Enter**.
- **Select** the deck geometry and press **Enter.**
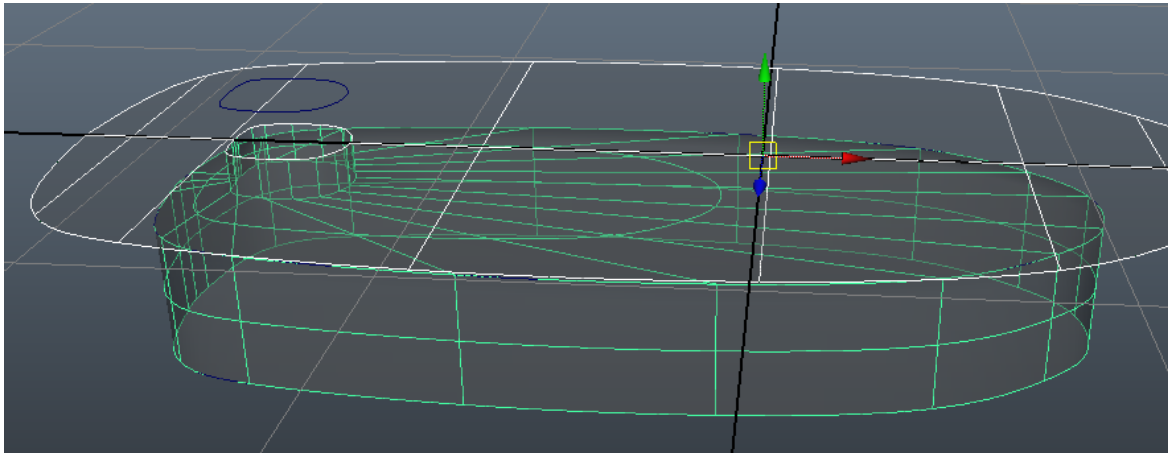


- Notice that the geometry protruding above the deck has disappeared and a hole has been inserted into the deck.
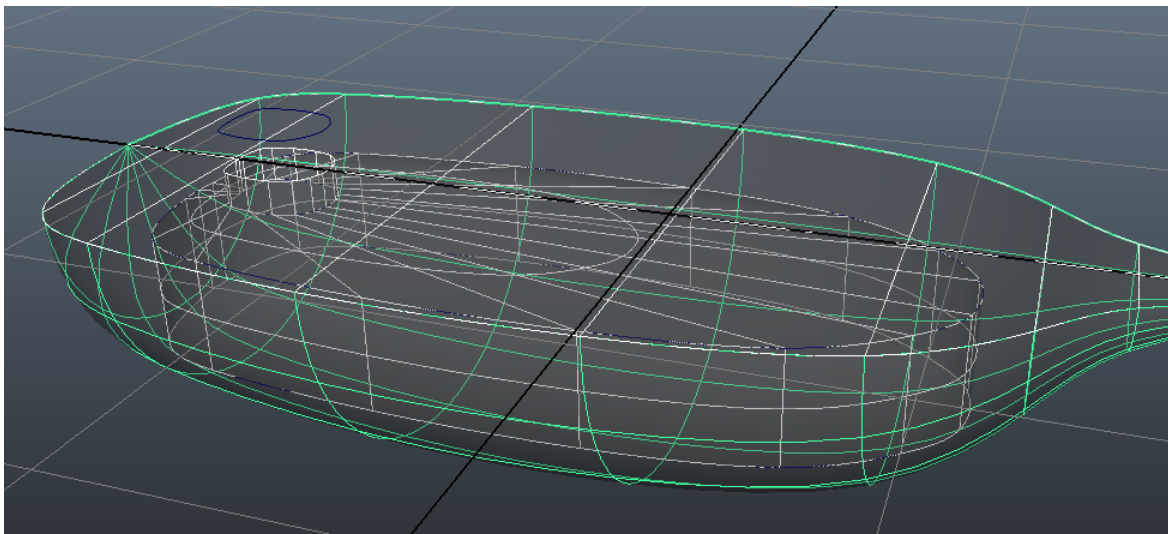
- We are now done with the deck, cabin and hull of our airship! Next up, let's insert some propellers so our airship can fly!

## **The Propellers**

- For the mast that will hold up our propellers, we will be **Extruding** a curve along another curve (note that this functions differently from the **Extrude** command for polygon objects). The steps for this process are shown in an image below:
- In the top view, go to **Create/NURBS Primitives/Circle** and size it down
- In the side view, go to **Create/EP Curve tool**. Draw out a vertical line with two points while holding **Shift** to constrain it to the **Y** axis.
    - The **EP curve tool** automatically builds a curve based on where you click the mouse.
- **Select** the circle and **Shift+Select** the curve line. Go to Surfaces/Extrude Options Box:
    - Reset the settings
    - Result position: At Path
    - Leave all other settings at defaults
    - Press **Extrude** to create our extruded surface!
- **Right click** on the newly extruded surface and switch to **Isoparm mode**. This mode allows us to insert and select isoparms along our surface.
- **Click and drag** from the top of the mesh to somewhere midway down the cylinder. The **yellow dotted line** indicates a temporary position at which to insert our isoparm.
- Go to **Edit NURBS/Insert Isoparm** to insert an isoparm at our dotted line.
- Switch back to **Isoparm** mode and **click** to select our newly created isoparm.
- Go to **Edit NURBS/Detach Surfaces** to **separate** our extruded surface into two meshes along the selected isoparm.
- **Select** the top cylindrical mesh and change the **Scale X** and **Scale Z** attributes to 0.5 to **inset** the geometry from the bottom cylindrical mesh.
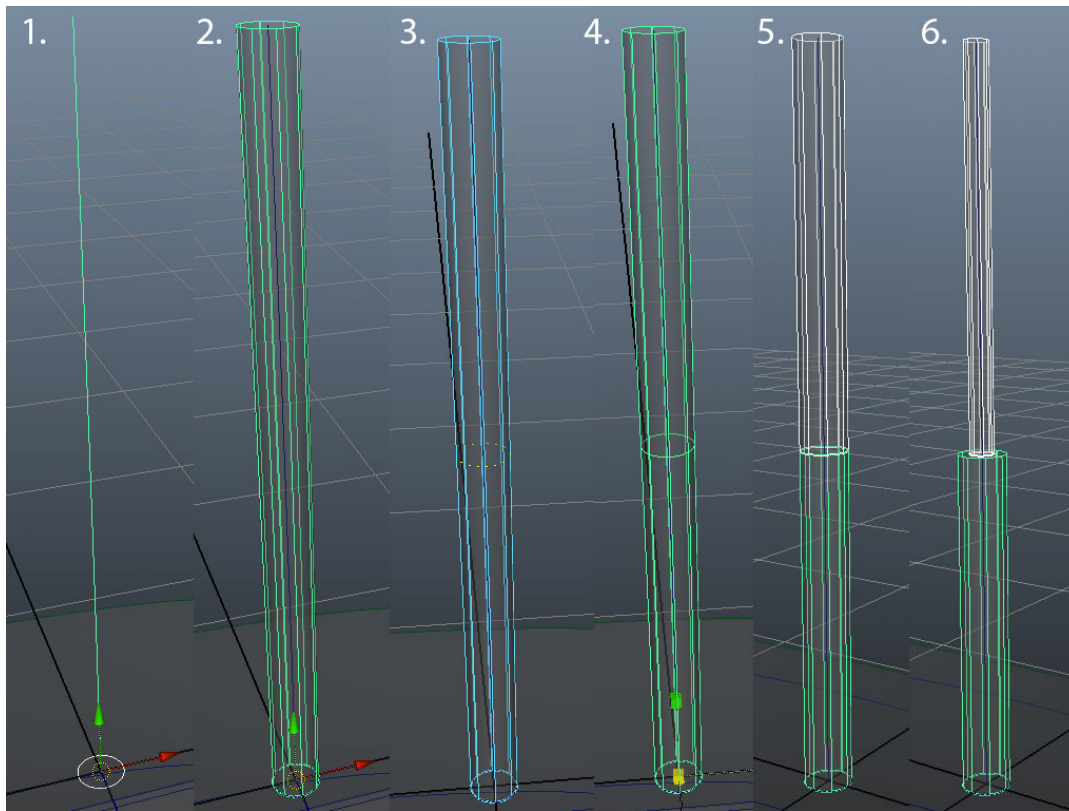
- Switch to Isoparm mode and select the circular isoparm at the top of our mast. Add a Planar trim to seal the open hole. Repeat for the lower mast section.
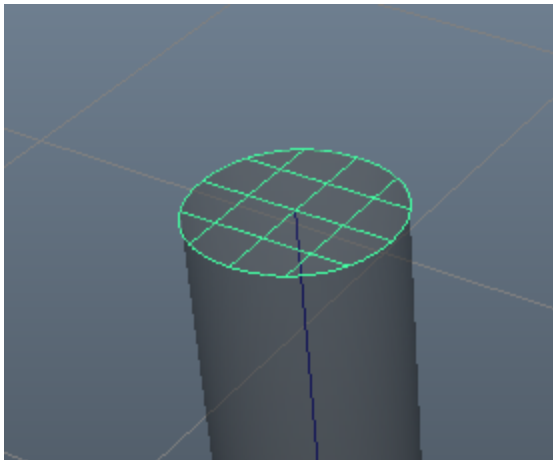


- All done with our mast, now let's add a propeller!
    - Go to **Create/NURBS Primitives/Cylinder** and use the following attributes:
        - Reset settings
        - **Axis:** Y
        - **Radius:** 2
        - **Height:** 0.1
        - **Number of sections:** 20
        - **Number of spans:** 1
        - All other settings at default

- **Place** at the top of the mast
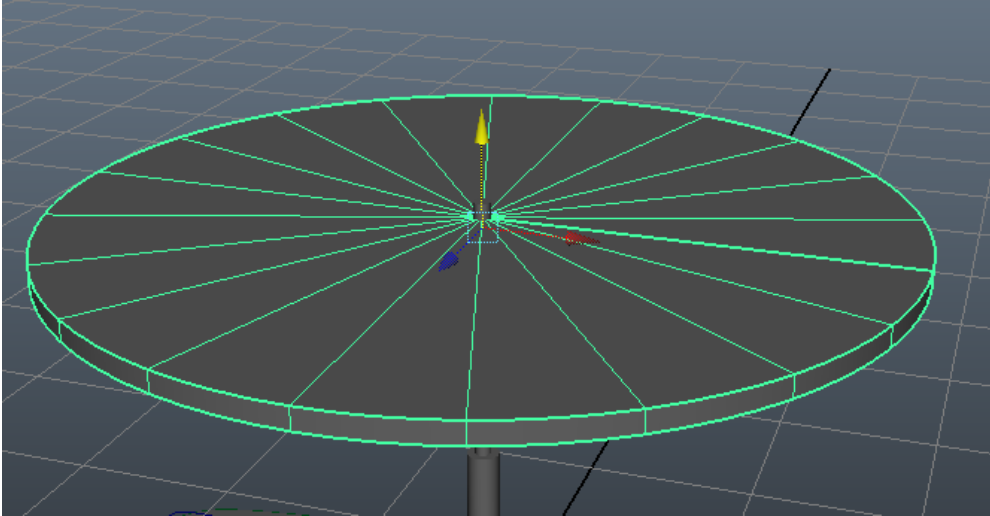


- In the **Outliner**, **delete** the top and bottom caps of the cylinder. We will fill these in later with a **Planar** trim.
- **Right click** on the circular surface and switch to **Control Vertex** mode.
- **Select** the vertices shown below and **scale** in on the **X** and **Z** axes to create the propeller shape.
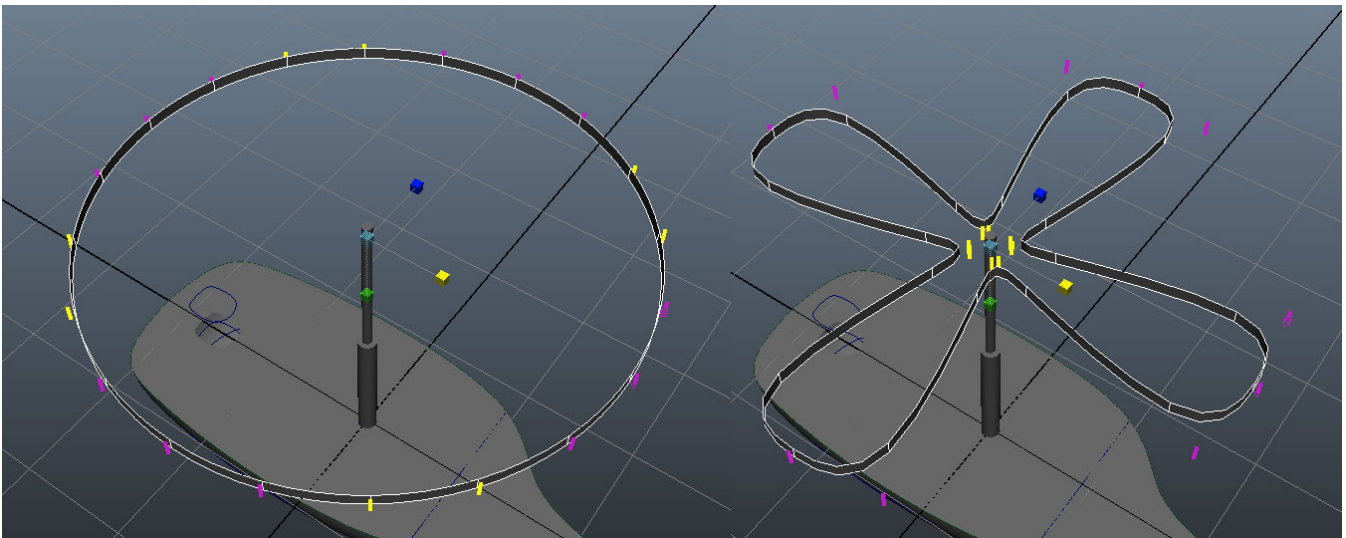


- Switch to **Isoparm** mode, **select** the top isoparm going around the edge and insert a **Planar** trim. Repeat for the bottom isoparm.
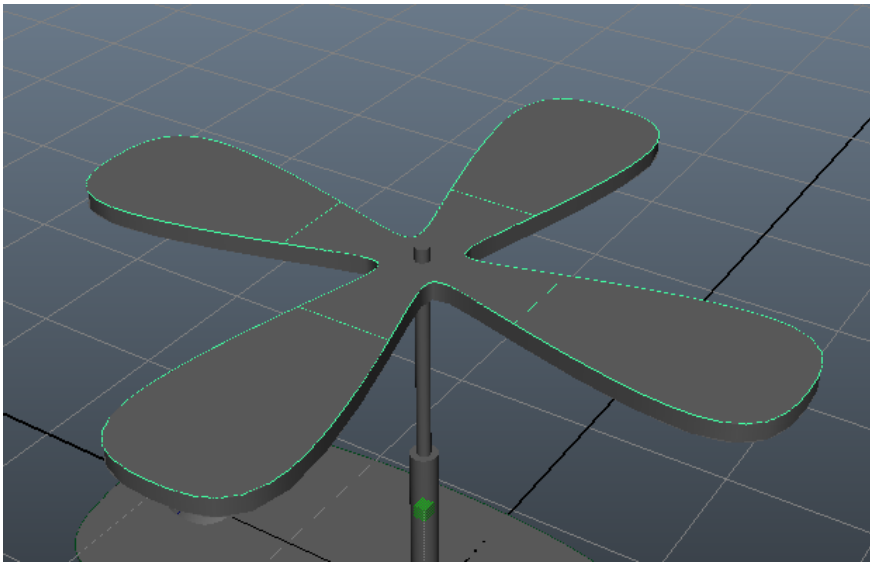
- We have finished our propeller! Once you are fully satisfied with it, **select** all of the propeller geometry and **delete the history**.
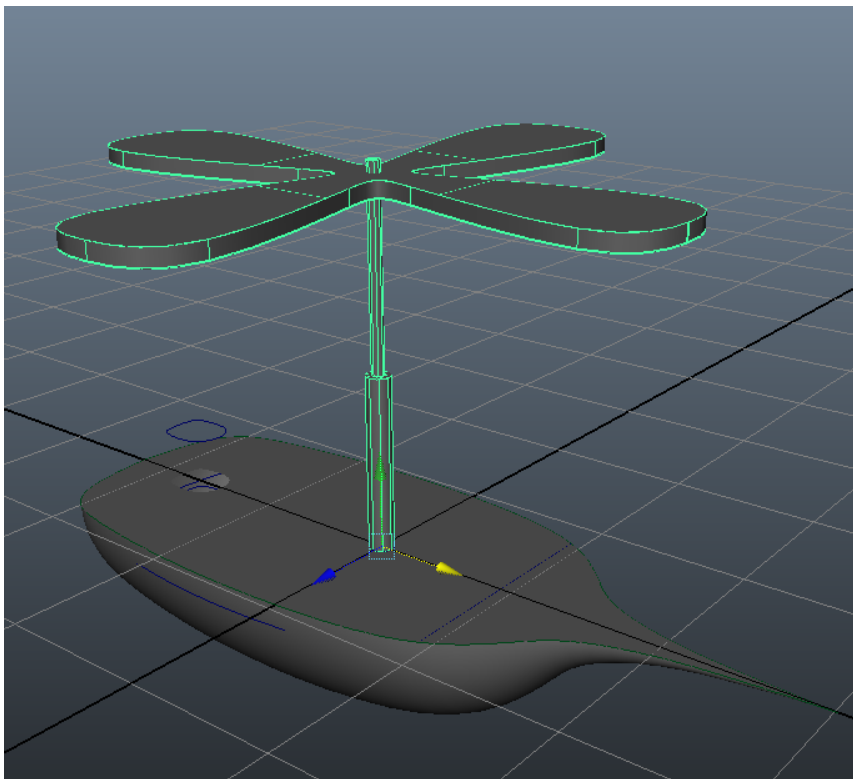


- **Group** the propeller geometry together, duplicate and scale down for multiple propellers!
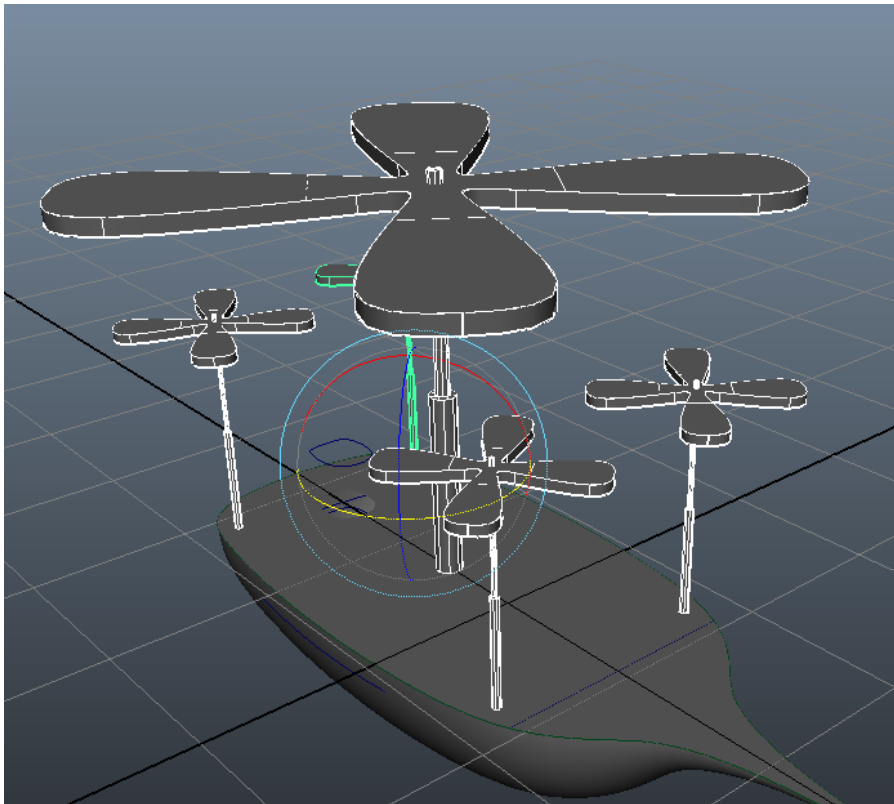
     - **Rotate** the propellers around the **Y** axis to for some some variation. We can also **animate** this attribute to make the airship appear to fly!

- Almost done with our airship! All that's left is the cabin and perhaps a little more flair!

## The Cabin

- Time to finish up our airship by modeling the captain's cabin!

- Make a **duplicate copy** of the curve defining the front of the deck. Switch to **Control Vertex** mode and **delete** the rear CVs so that it looks like the curve below:
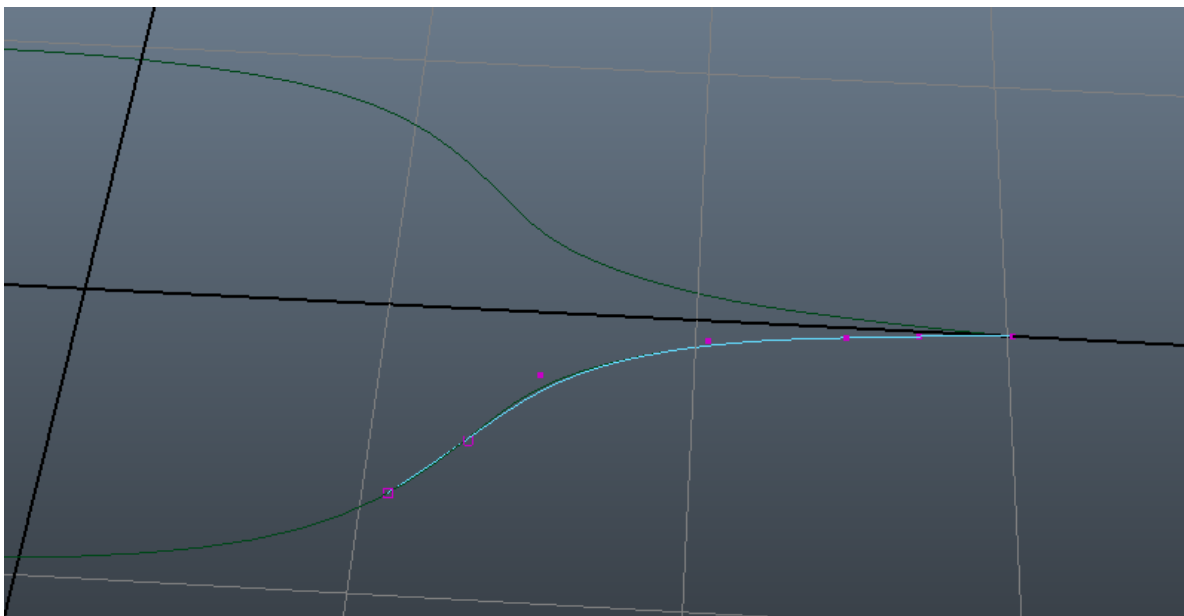
- In the f**ront and side views**, **draw** three additional curves to define the front, side and top profile curves for the cabin, as seen below, Make sure to line up the endpoints so the curves define one solid surface:
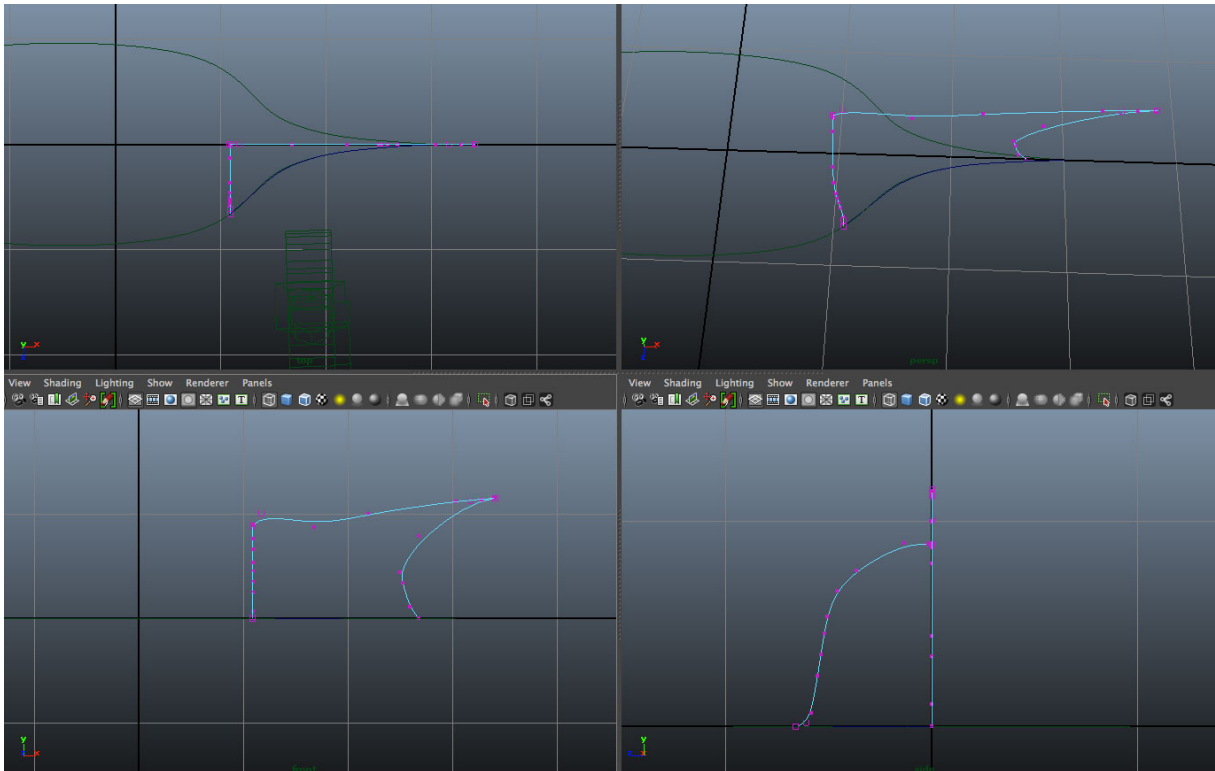


- With the curves in **Object** selection mode (**Right Click/Object Mode**), **select** the four curves in a **counter clockwise** direction in the **Perspective** view. Go to **Surfaces/Boundary** (with all default settings) to create a **boundary surface** defined by our four curves.
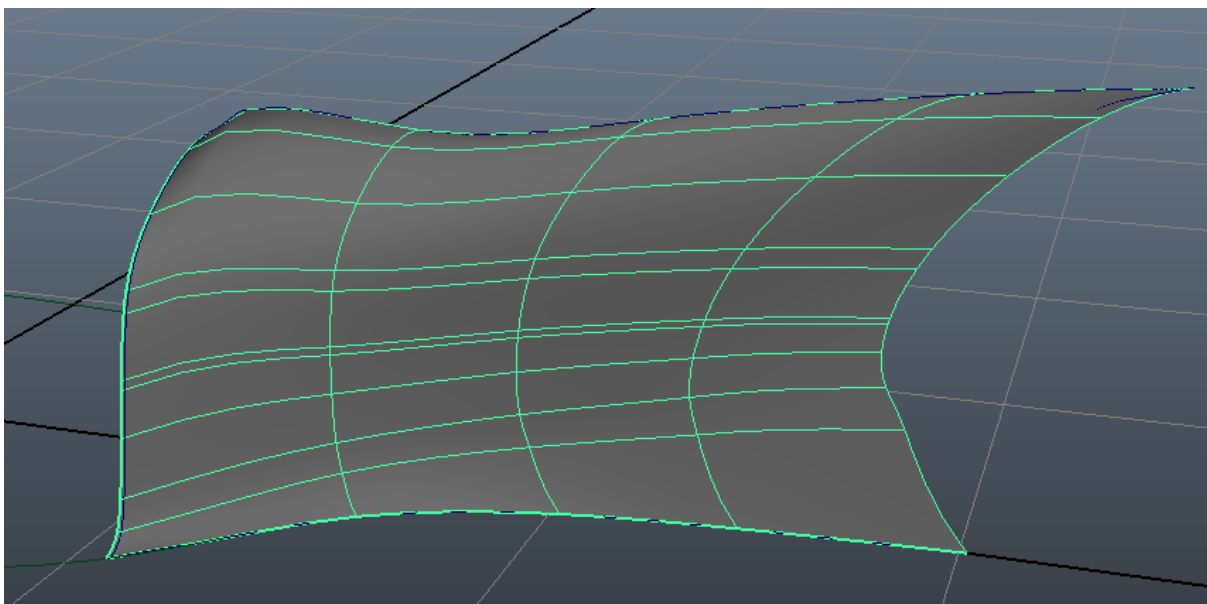


- With the main surface of our boundary defined, let's cut out some windows so we can actually see out of it!
- Looking down the front of our airship, go to **Create/NURBS Primitives/Square** and **position** it

in front of the cabin. **Reshape** the square CVs in Control Vertex mode as you see fit.
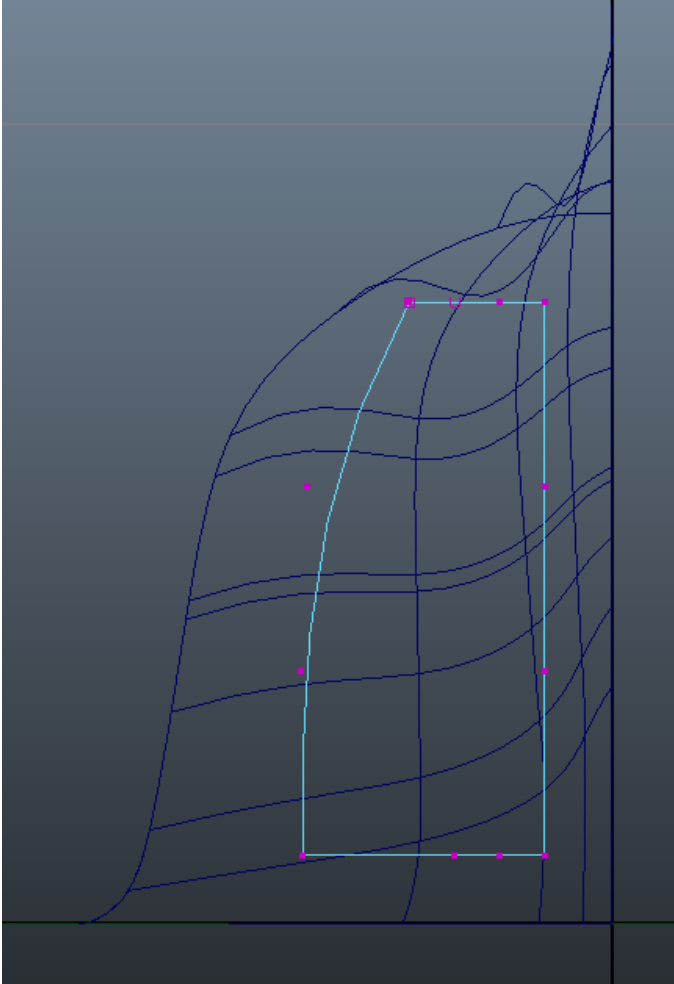


- **Select** the curve and **THEN** the boundary surface in the perspective view. Switch back to looking down the front of the airship, as seen in the above screenshot. With the curve and surface selected, go to **Edit NURBS/Project Curve on Surface** to add the curve of the window to the boundary surface. We can now cut that window out of our boundary curve!
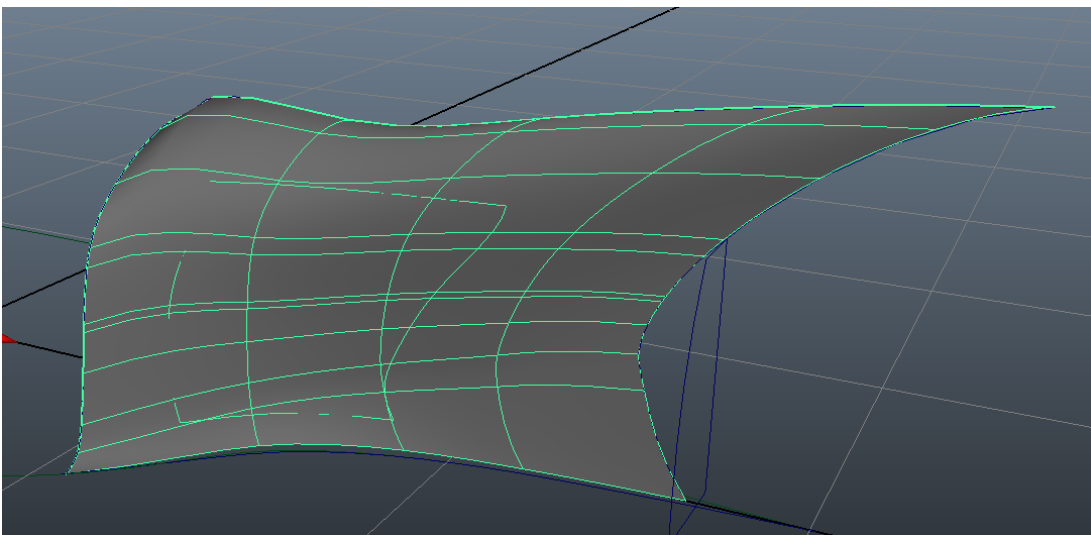


- With the boundary surface selected, go to **Edit NURBS/Trim Tool**. This tool allows us to define

which surfaces we want to "**keep**" and which ones to "**trim**", like cutting out with a pair of scissors. **Click on the cabin surface** to keep it and a yellow dot will appear, indicating that you would like to keep that surface.
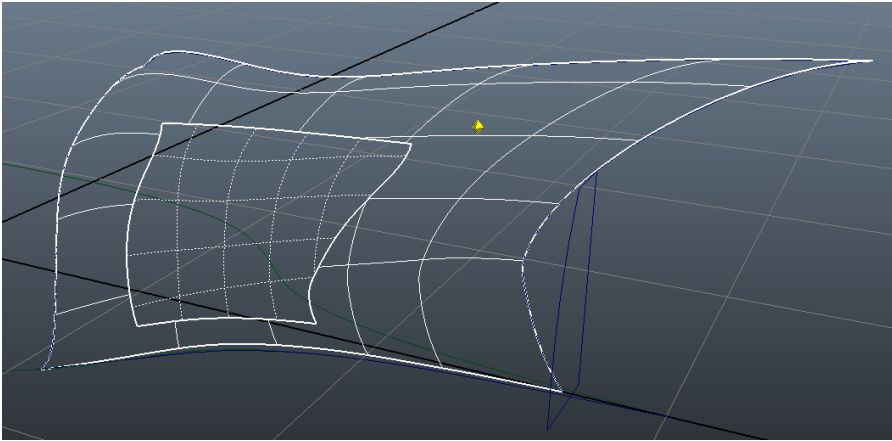


- **Press enter** to perform the trim and remove the window from the cabin surface!
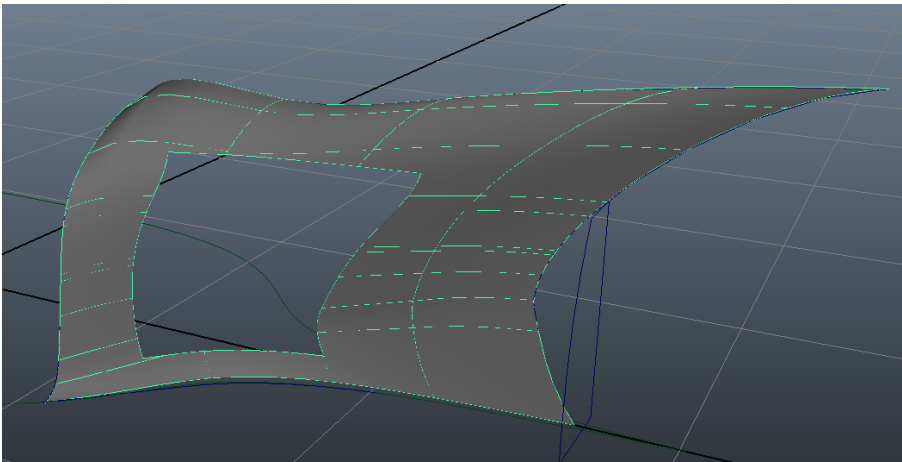


      - Bear in mind that since both the projected curve and trim are still active, we can move and reshape our window curve to change the window shape.

- Now, let's add a bevel to our window to give it some depth!

- **Right click** on our surface and switch to **Trim Edge** mode. **Shift+select** our trim edges in a **clockwise** manner and then go to **Surfaces/Bevel** to add a **Bevel** to our window. Set the **Width** to 0 and adjust the **Depth** and **Extrude Depth** to your liking.
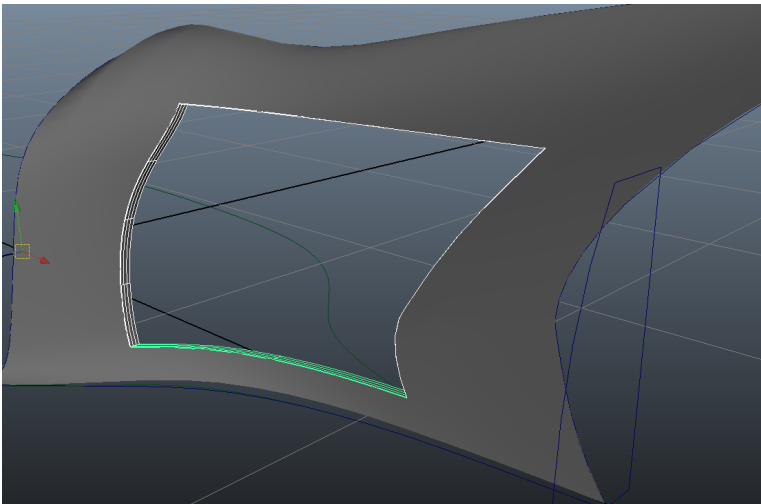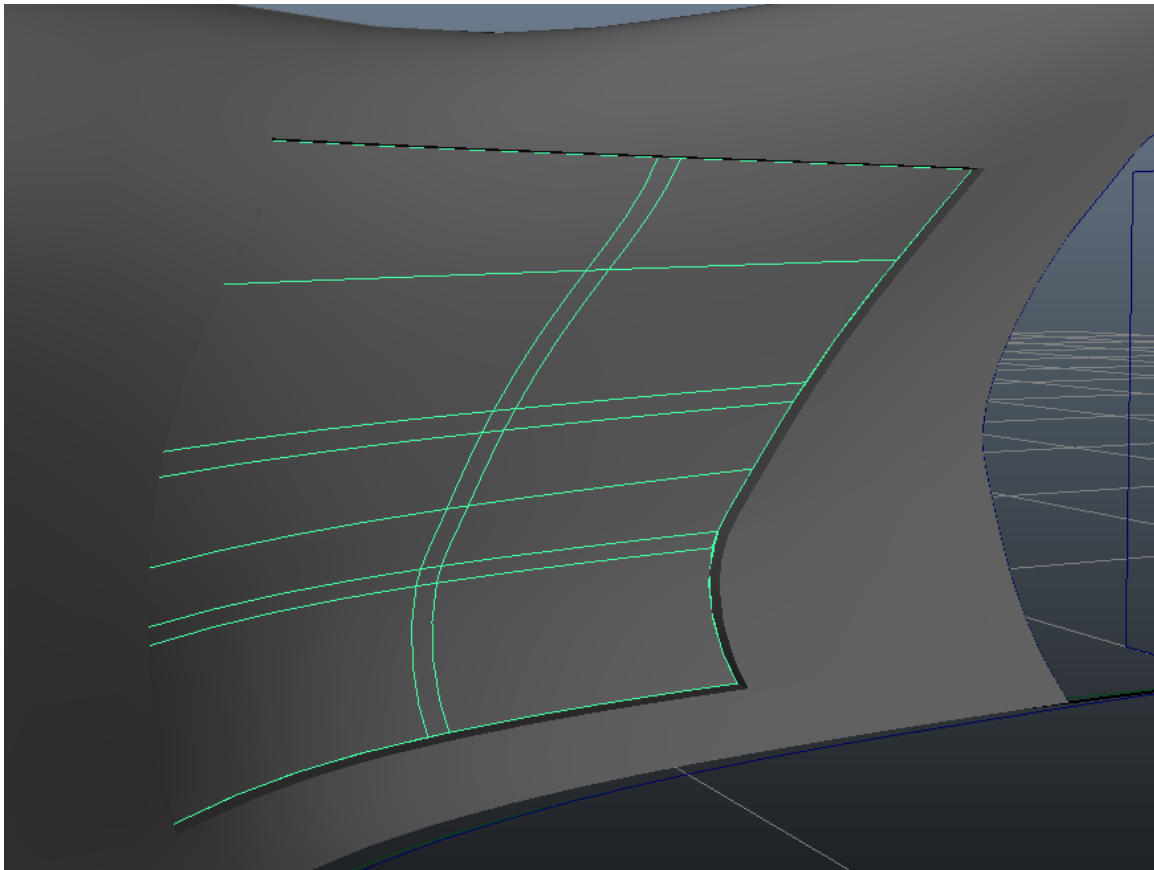
- **Right click** on each of the newly created beveled surfaces and switch to **Trim Edge selection mode**.
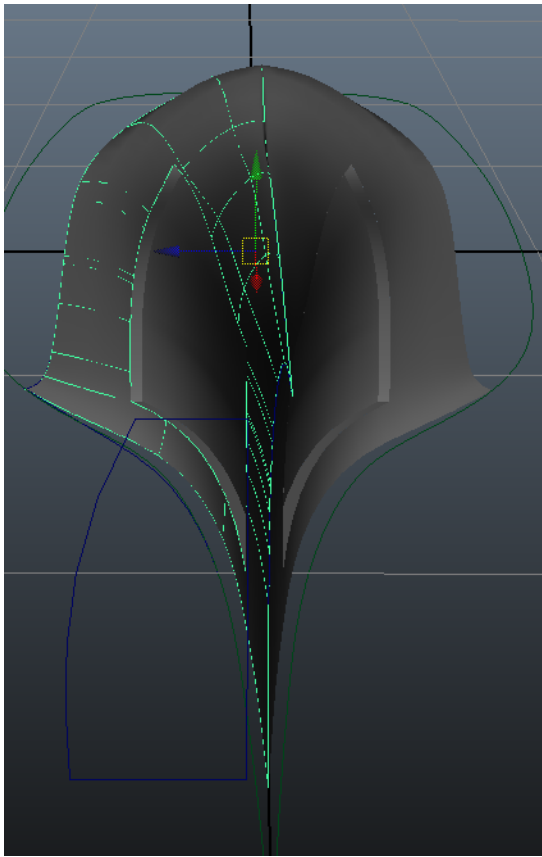- Select the interior trim edges in a **counter-clockwise** direction
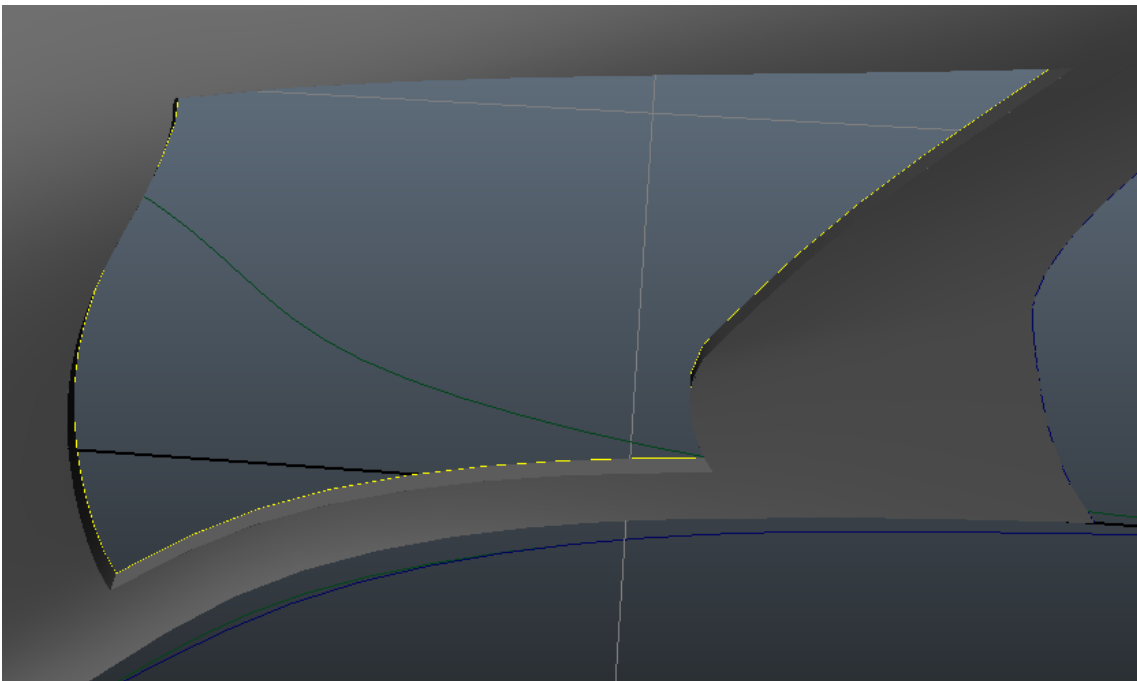


- Go to **Surfaces/Boundary** to create the window surface.

- **Select** all of the newly created cabin surfaces, **group** them together and name the group "l_cabinGroup"
- **Duplicate** the group and change its **Scale Z** to -1 to mirror it across the Z axis. Rename it "r_cabinGroup"
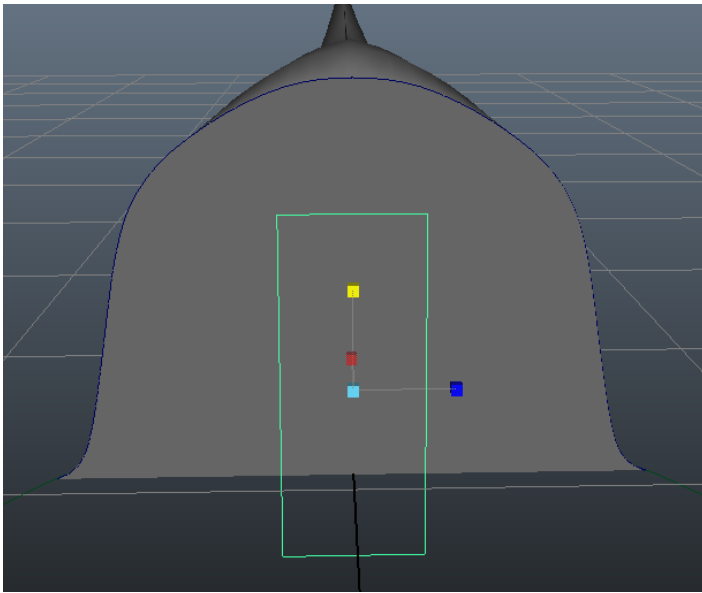
- Almost done with the cabin! Let's create a rear door for the cabin using the same techniques as before:
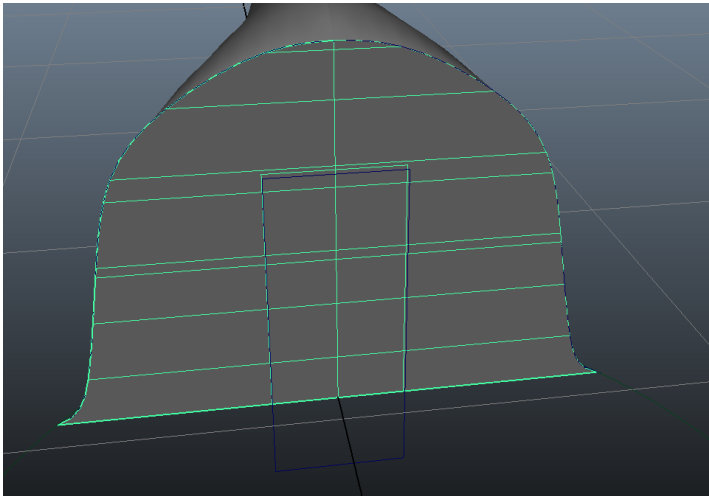
    - **Select** and **duplicate** the rear curve used to make the back of the cabin, **scale** it across the Z axis to **mirror** it and create a flat **Lofted** surface.
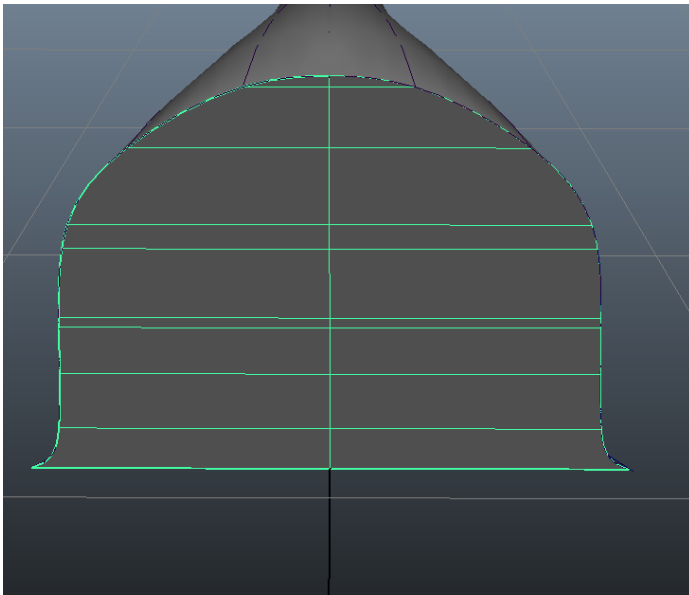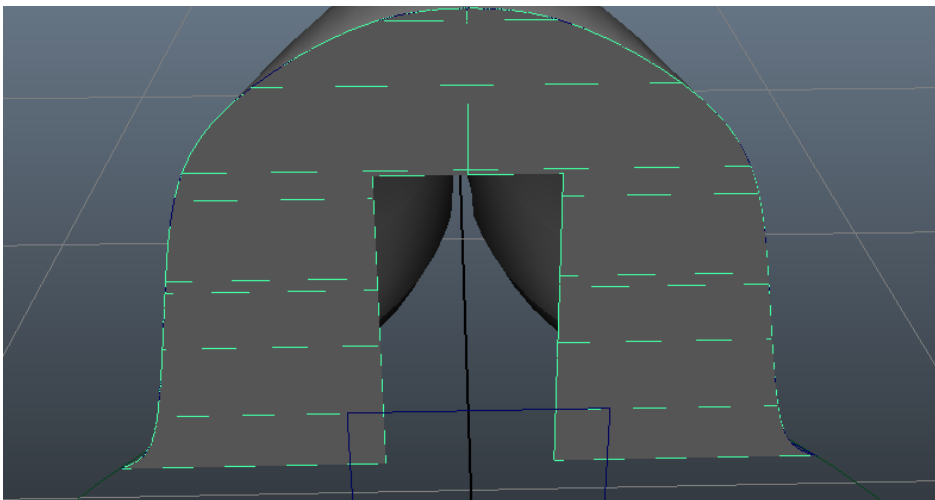


    - **Create** a square NURBS primivite and **scale/position** it to where you would like to cut out the door.
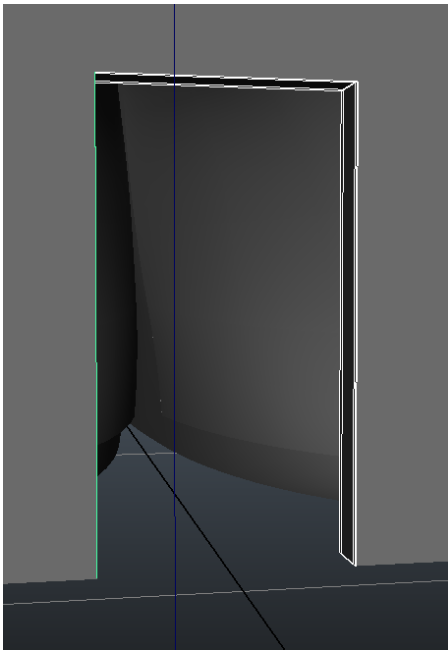
- In the **Front** view, use **Project Curve on Surface** to cut out the door frame.
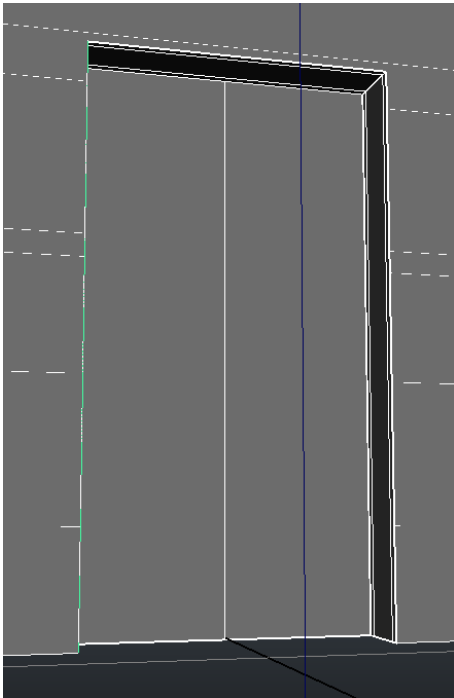


- Use the **Trim tool** to cut out the door frame



- **Select** the Trim edges of the opening and perform a **Bevel** to give the door frame some depth

- **Select** the Isoparms on either side of the beveled door opening and **Loft** them together to create the door surface.



Congratulations, we have completed our airship! Feel free to add many more details and decorations to make yours special and unique!