Modeling a Hood in Rhino

File: hood.3dm

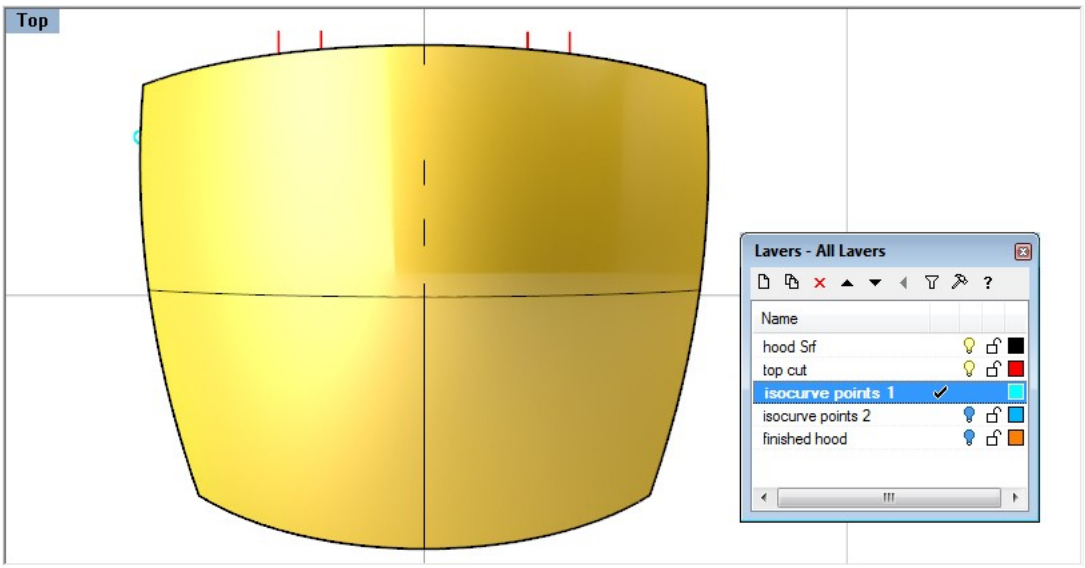
www.pivot.no

In this tutorial you will learn how to model two different types of shapes that flow smoothly into another surface, similar to the image at the front page; The result is not a finished object, it's not even necessarily a car hood. The goal is to show in principle how such shapes can be made. Underlying surfaces, point structure and isocurves are concepts you will also get some experience with in this tutorial.

If you are new to NURBS modeling, it is recommended that you read the compendium “Rhino Basics” before going through the tutorial. “Rhino Basics” can be downloaded from www.pivot.no.

We assume you are already familiar with Rhinos interface. To save paper, we will just write the **commands** with bold letters. We don't show their whereabouts in the list menus and the icon menus. This will make you learn to use the command line if you are not already accustomed to that.

1 Open the file hood.3dm. and set the working layer to **isocurve points 1.**
From Top View it should look something like this:

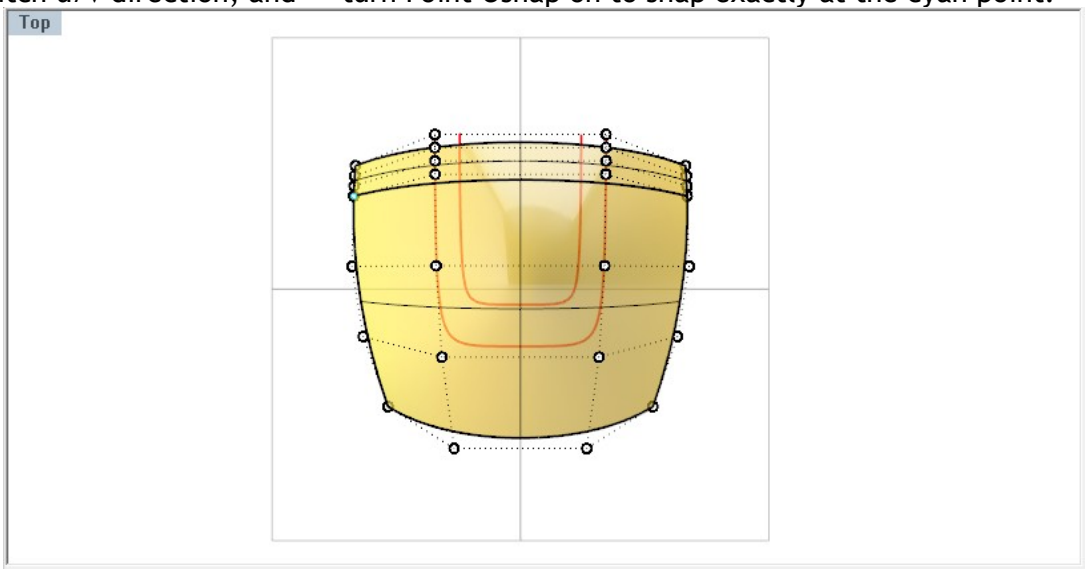


Turn the points on with **POn,** and of again with **POff** when you have seen the point structure.

2 *This is Important!*
Use **Copy** and **Paste** to make a copy of the surface, then use **Hide** to hide it for now.

3 *Goal for this step: Create a new and smaller surface inside of the hood surface that has identical curvature. We will later tweak this smaller surface to create the downward bump.*

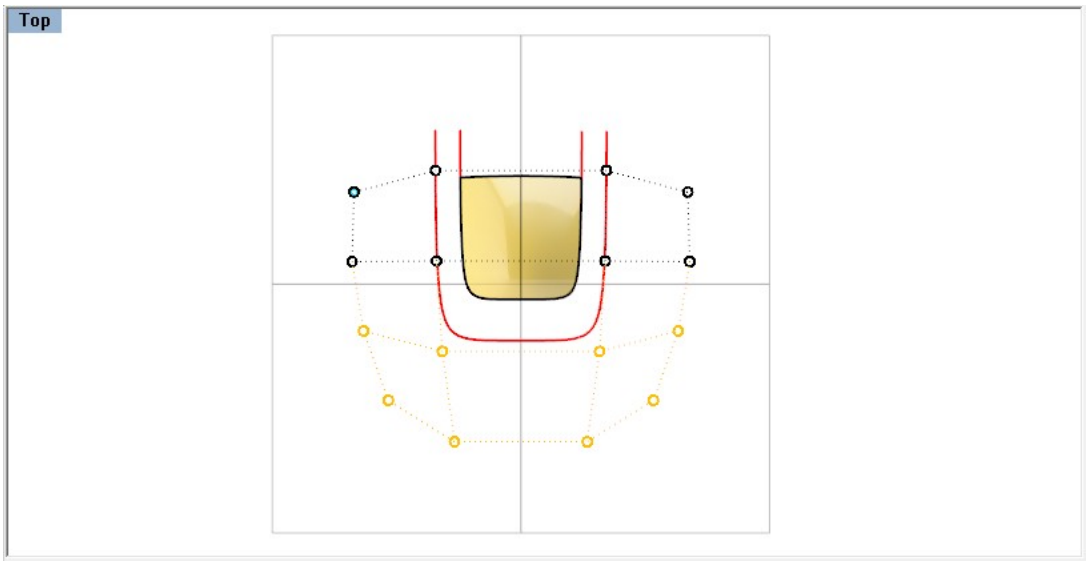
Split the surface as shown below, using the **Isocurve** option in the command.
Make sure the shrink option is set to **Shrink=Yes**. Use the **Toggle(t)** if it is necessary to switch u/v direction, and turn Point Osnap on to snap exactly at the cyan point.



You can see that the point structure is changed by turning the control points on.

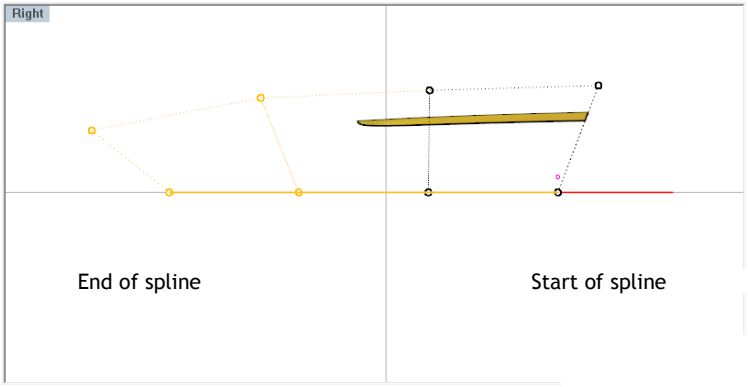
Splitting the surface in two with Shrink=Yes shrinks the underlying surfaces and changes the point structure and still preserves the exact same shape on the visible part of the surface.

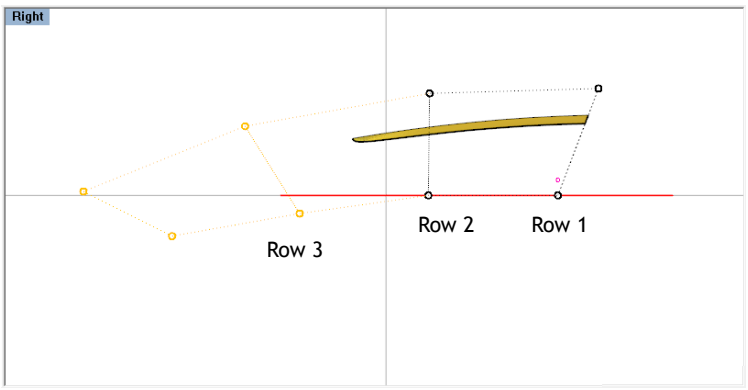
Delete the upper strip and **Trim** away the outer part of the large surface with the inner curve.
Turn the **Control points On** for the remaining interior surface.
Drag-Select the two first control point rows:



4 *Goal for this step: Tweak the curvature of the small surface so it bends downwards in one side but maintains tangency smoothness with the large surface on the other side.*

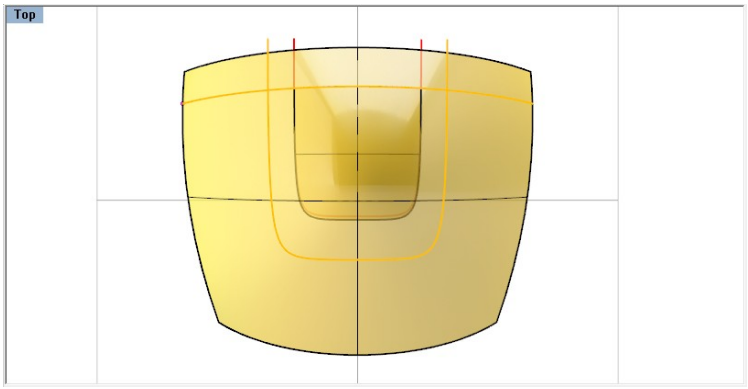
Keep the control points on and go to the Right Viewport. Make sure Project is on.
Run the **Bend** command and set the spline as shown below. Then set the options like this:
Copy=No Rigid=No Angle=12 Symmetric=No PreserveStructure=Yes



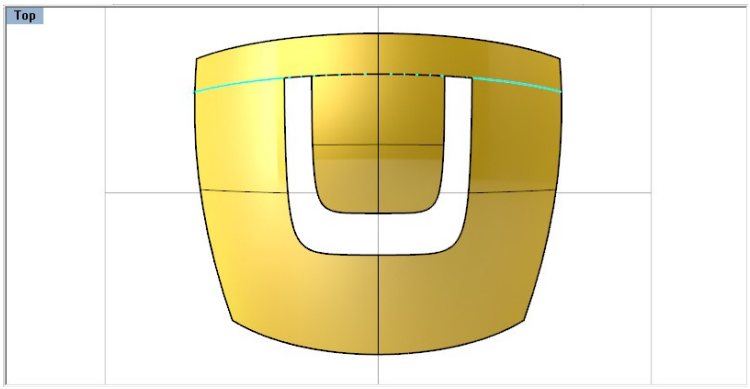


5 Use **ShowSelected** to show the surface we hid.
Then run **ExtractIsocurve** to extract an isocurve at the same place as the initial split.
Snap to the same cyan point with Point Osnap on.

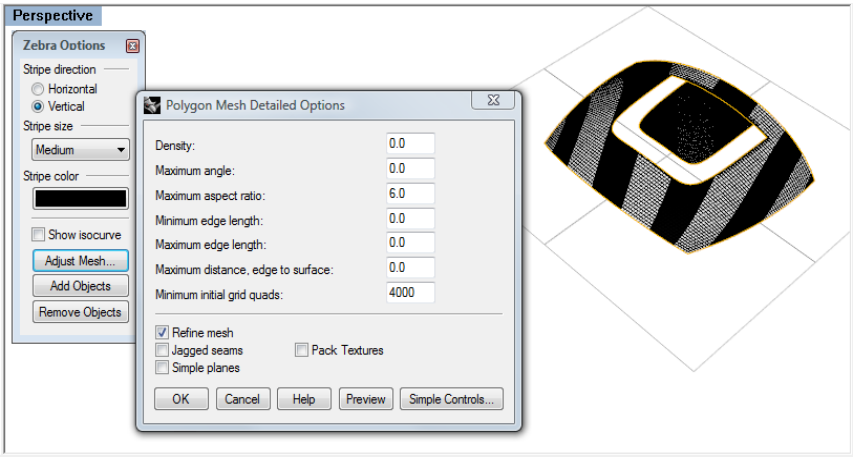
Select the Isocurve you just extracted and the outer trim curve and **Trim** away the interior from of the large surface. Do it from the the top view, with trim options set to:
ExtendLines=No ApparentIntersections=No



Now it looks like this

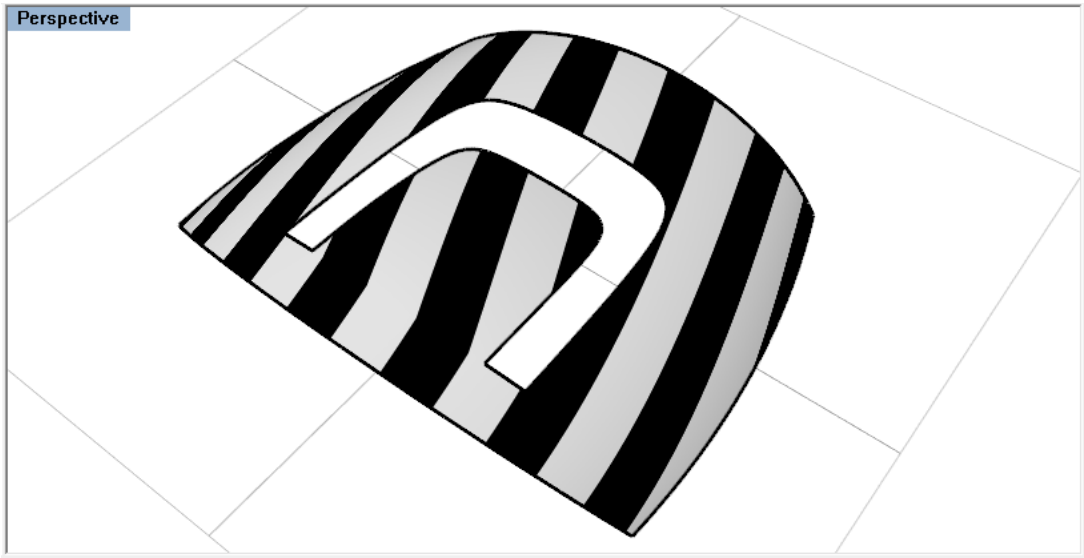


6 If everything went well it should be possible to join the two surfaces with a smooth transition. **Join** them and use **Zebra** to see if its smooth. Set the mesh in Zebra like in the image below:



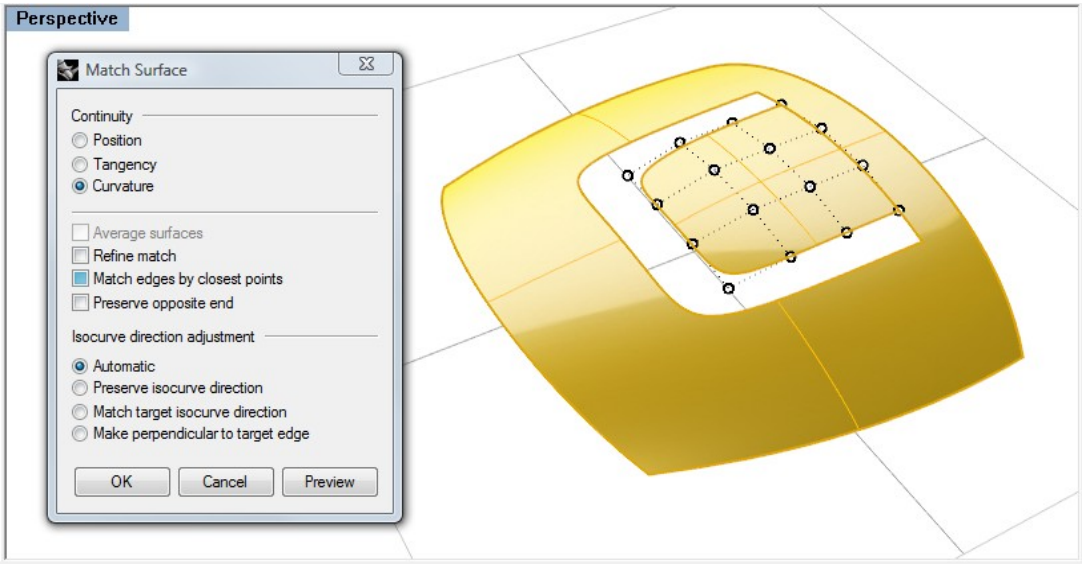
We see from the Zebra stripes that the transition is smooth, but the Zebra stripes shift slightly in direction.

Reason: The transition we see no lognger curvature continous (G2), it is only tangency continous (G1).
This is because the third row was altered during the Bend operation.
In order to maintain G2 tangency at the transition, the third row of control points would also need to maintain position.



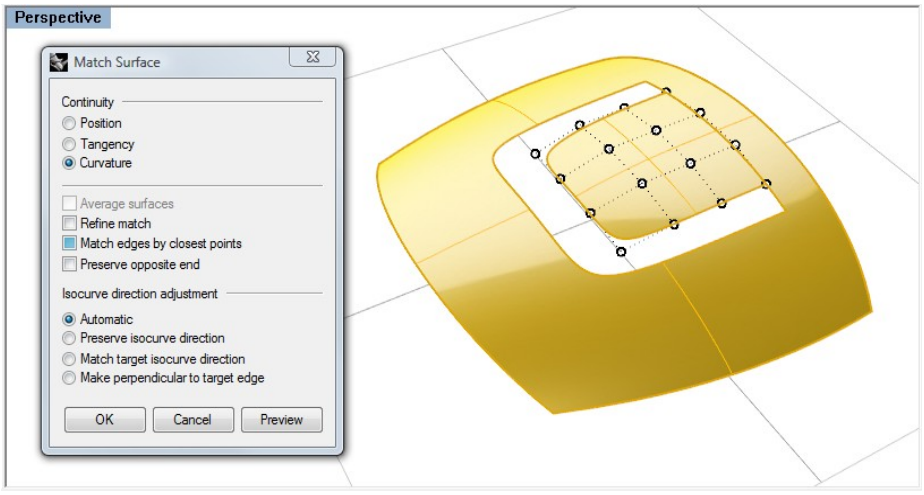
The following steps will establish curvature continuity at the transition

7 **Explode** the two surfaces and use **ShrinkTrimmedToEdge** at the interior, bent, surface to shrink its underlying point structure. Turn points on, **POn**, to see what has happened to the point structure. Shrinking rebuilds the surface so that it's underlying surface

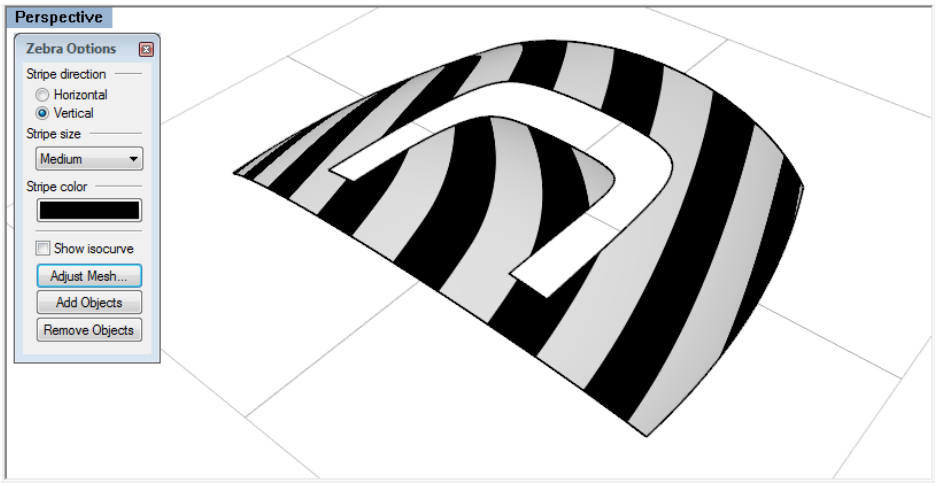


On th edge that coincides with the larger surface, the point row does not extend beyond the actual edge. This means we can match this edge of the surface to the large surface. In the next step we will do that, using curvature continuity.

8 Use **MatchSrf.** Try some different settings and use the preview button to see what happens. Notice how the third row of control points off from the edge adjusts when using curvature match. Then finish with the settings shown below:

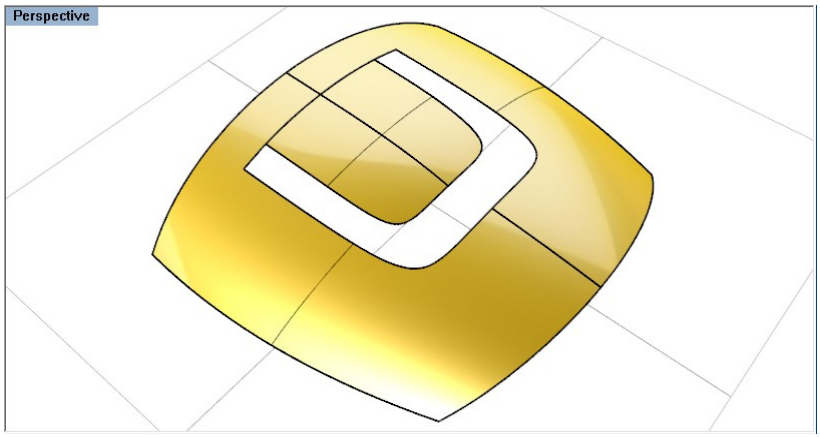


Now the Zebra stripes do not shift.



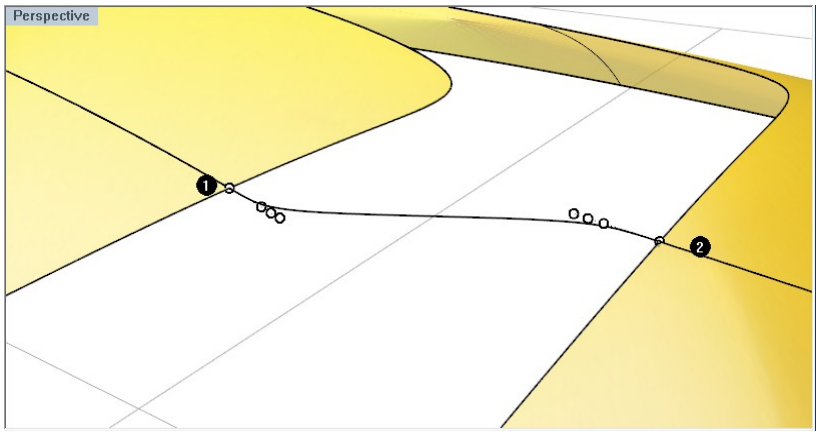
9 *Goal for this step: Create a shape controlling profile and use Sweep2 to create a smooth filling surface.*

Set the working layer to “hood Srf”, and turn of the “isocurve points 1” layer.
Extract an Isocurve in the middle of the small surface an the large surface like the image below shows.

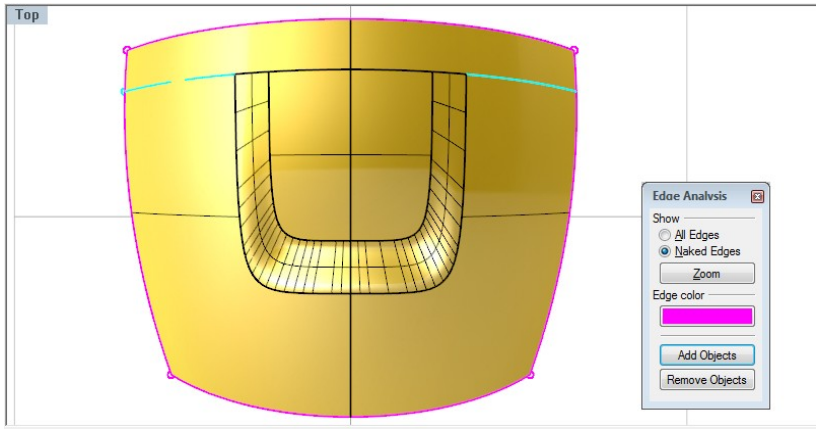


Create a blend curve between these two using **the BlendCrv** command. Have the options set to **Continuity_1=G3 Continuity_2=G3.**

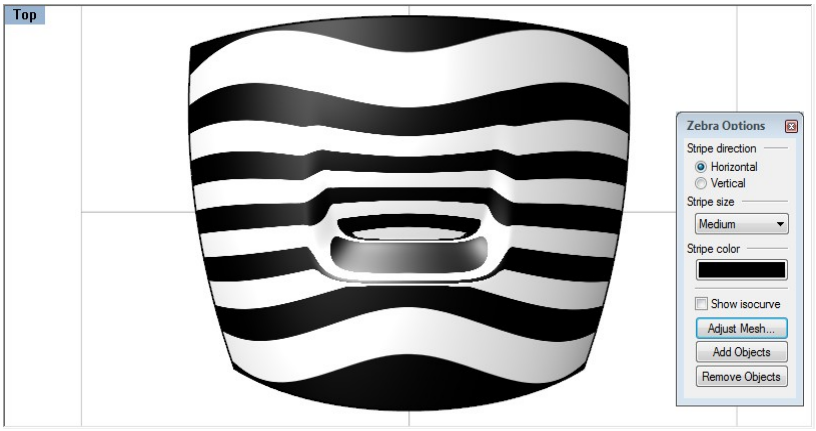
Compress the control points on both sides of the blend; Moving them while holding in Shift will move the points on both sides:



Use the **Sweep2** command. Make sure the edges are set to curvature G2. **Join** the surfaces and check for naked edges with the **ShowEdges** Command. There should not be any naked edges inside the hood.



It should also look smooth with **Zebra** stripes on.



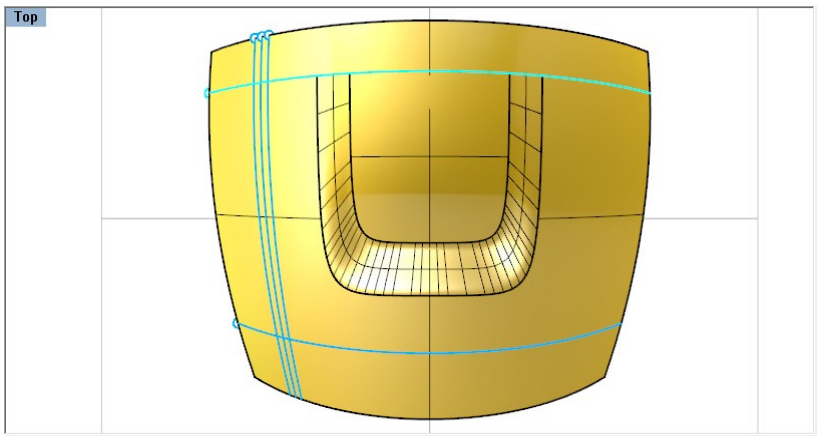
In the next section, we will go on to make the fin shapes protruding out of the surface.

Goals for the next steps, 10-13

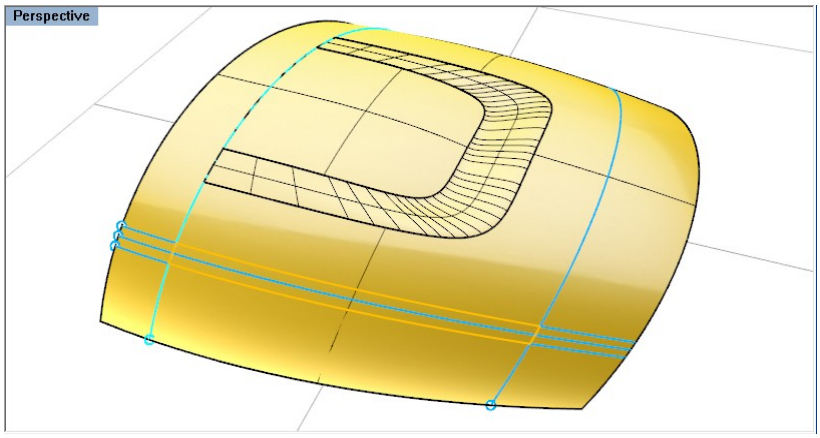
- *Create a closed trimming boundary for the rib surfaces*
- *To create a temporary surface perpendicularly for the surface so we can use it to control the side profile of the fin.*

10 - Set working layer to “hood Srf”. Turn on the “top cut” layer if it's not already on, and turn on the layer “isocurve points” 2.

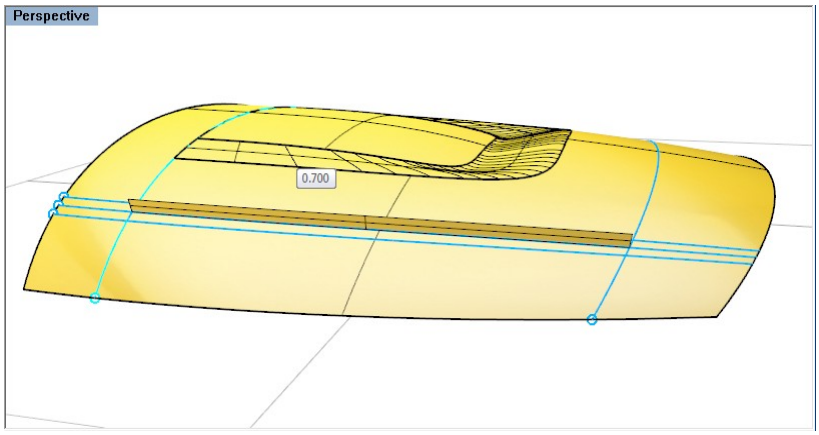
Take out a isocurves using **ExtractIsocurve** using Point **Object snap** to snap to the points on the “isocurve points 2” layer. It should look roughly as in the image below:



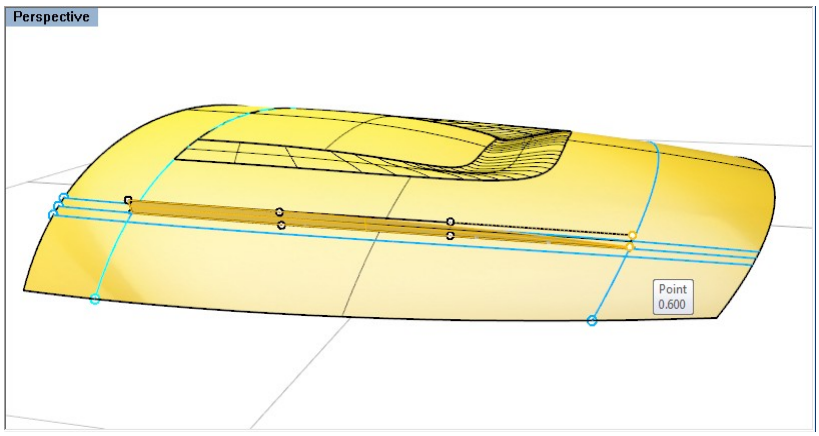
Use split to split all of the extracted isocurves against each other.
Then join up the trim boundary:



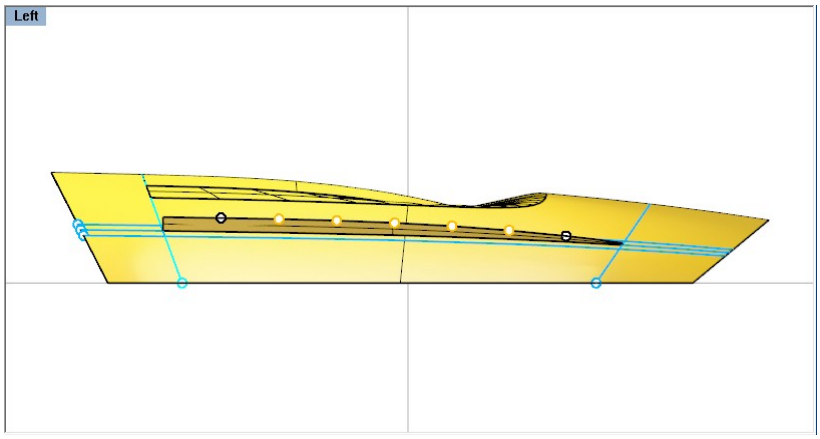
Run the **Fin** command, and extrude a fin **.7** units with the curve inside the trim boundary curve like this:



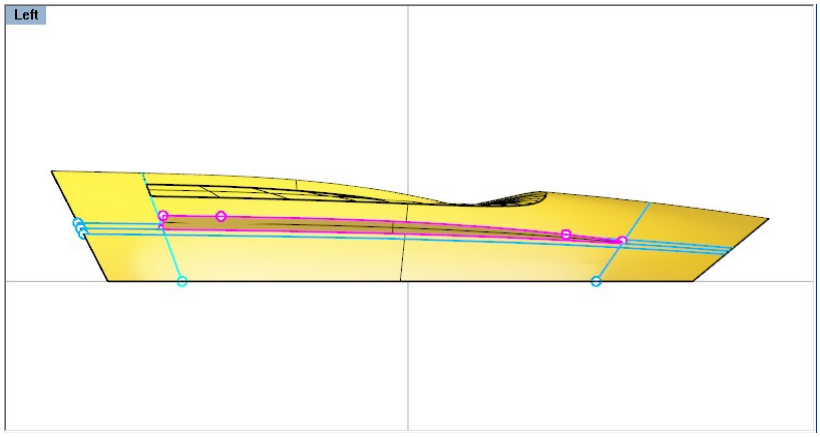
11 Now we are going to modify the fin to get a more curved profile. Turn the Fins points on, **POn.** Make sure that ProjectOsnap is off.
Drag the "First" point **.6** units perpendicularly towards the lower point. Use Point Osnap to make it go straight towards the lower point like on the image.



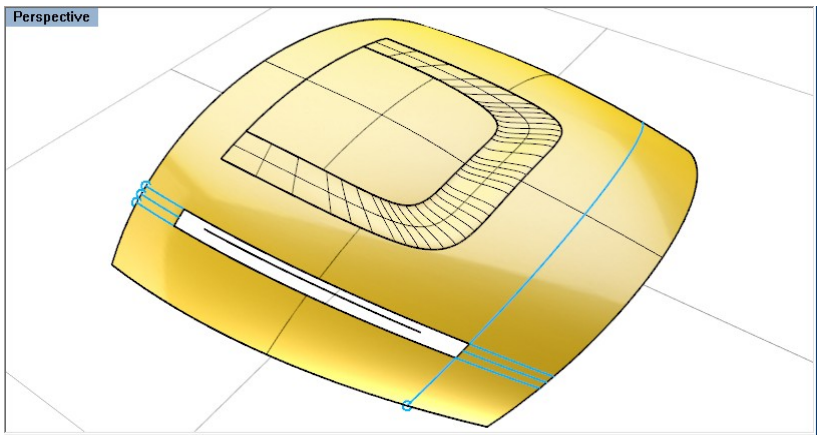
12 **Divide (MarkEnds=No)** the top profile of the fin into **8**. Use **SelLast** to select the points you just made and delete all of them except the first and last one.



13 Use **ShowEdges** and select the fin. Use **SplitEdge** to split the edge at the points. Use **DupEdge** to duplicate the middle edge, thats the one we are interested in.



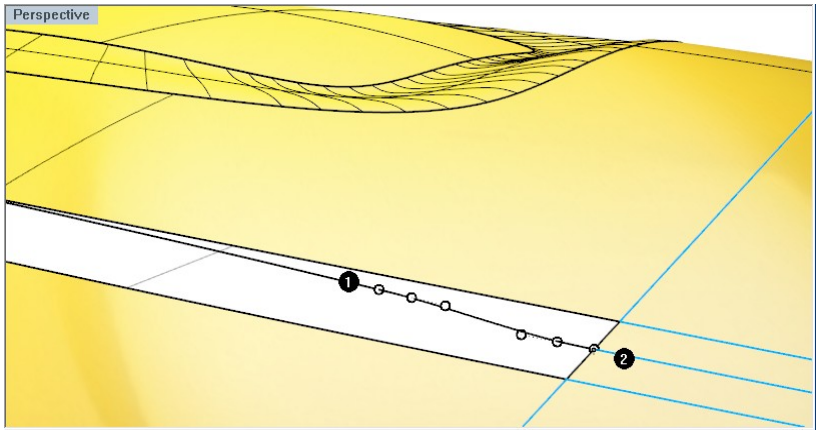
Delete the fin and the two points.
Trim away the interior using the trim boundary we made previously.



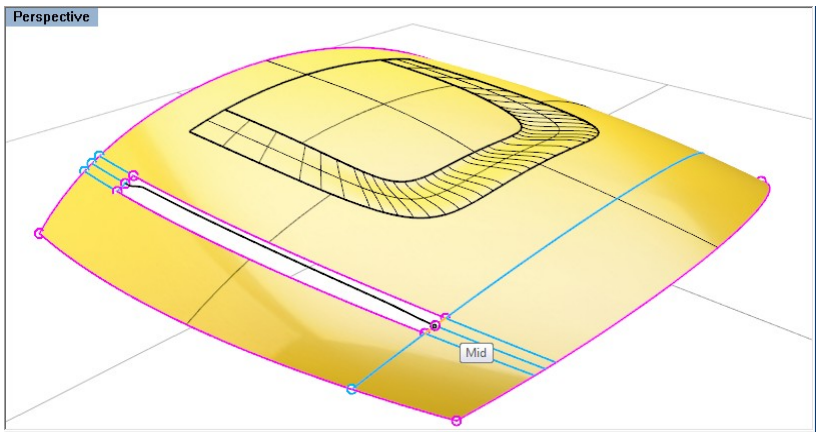
The goals for the last steps:

- *create a smooth rail curve that defines the top of the rib*
- *Sweep the two sides of the rib along this rail and the edges*
- *Curvature Match the two sides with each other and all other edges they coincide with*

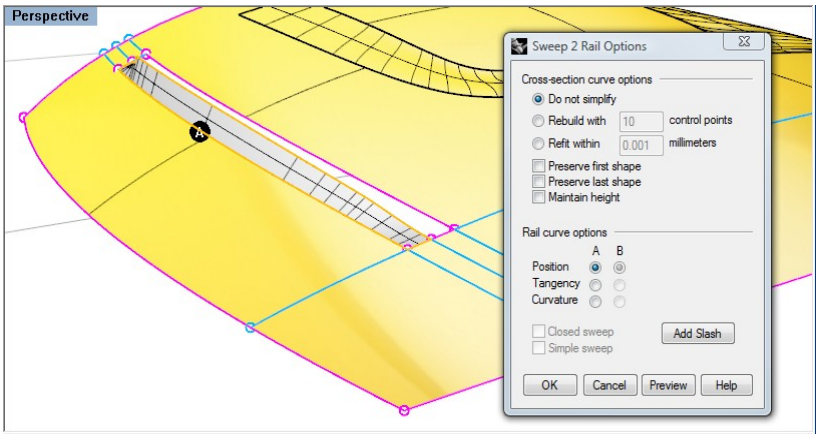
14 Use **BlendCrv Continuity_1=G2 Continuity_2=G2** to create the curves between the rib profile and the isocurves.



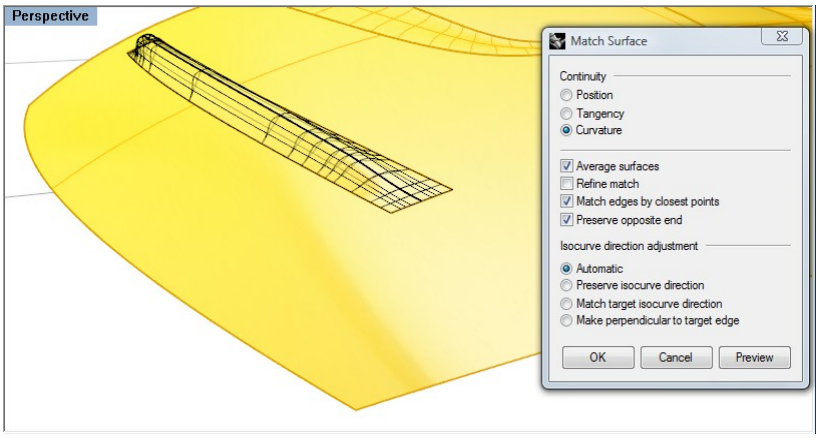
SplitEdge the short edges at the ends of the blend curves. Use **End Osnap.**



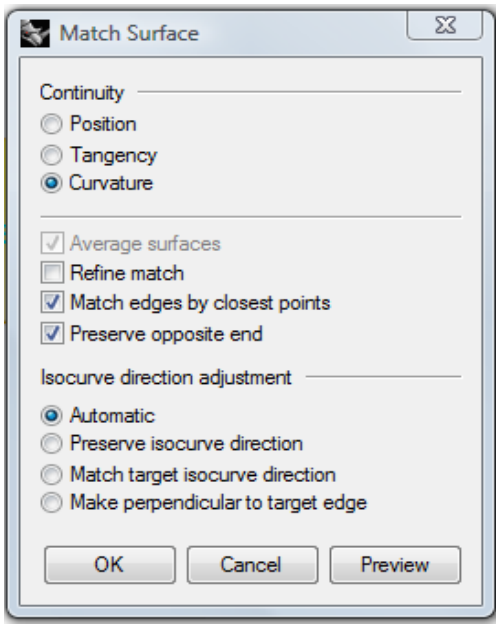
15 Join the top profile and the two blend curves, and use **Sweep2** with this curve and one of the edges. Do this for both sides.



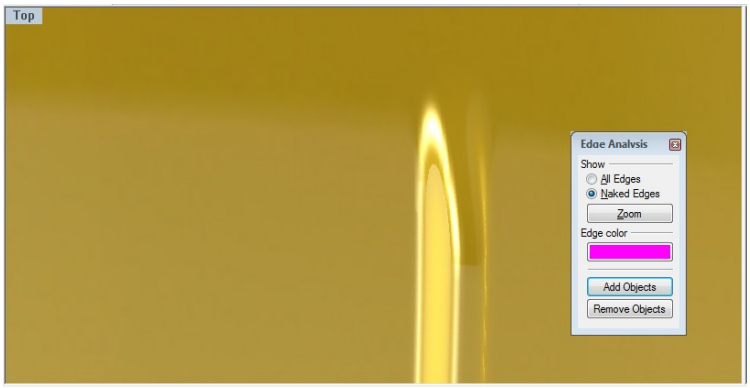
16 Use **MatchSrf** set to **Curvature** and Average **Surface** on the two surfaces to as shown below.



17 Use **MatchSrf** set to **Curvature** with **MultipleMatches** and match both of the rib surfaces to all coinciding edges. Using the settings below:



18 Join the two rib surfaces and Mirror them, then Split the hood surface with the mirrored polysurface. Join everything and check with **ShowEdges** that there are no naked edges inside the hood. Run **Zebra** and check the smoothness. Adjust the mesh if needed.



Congratulations!