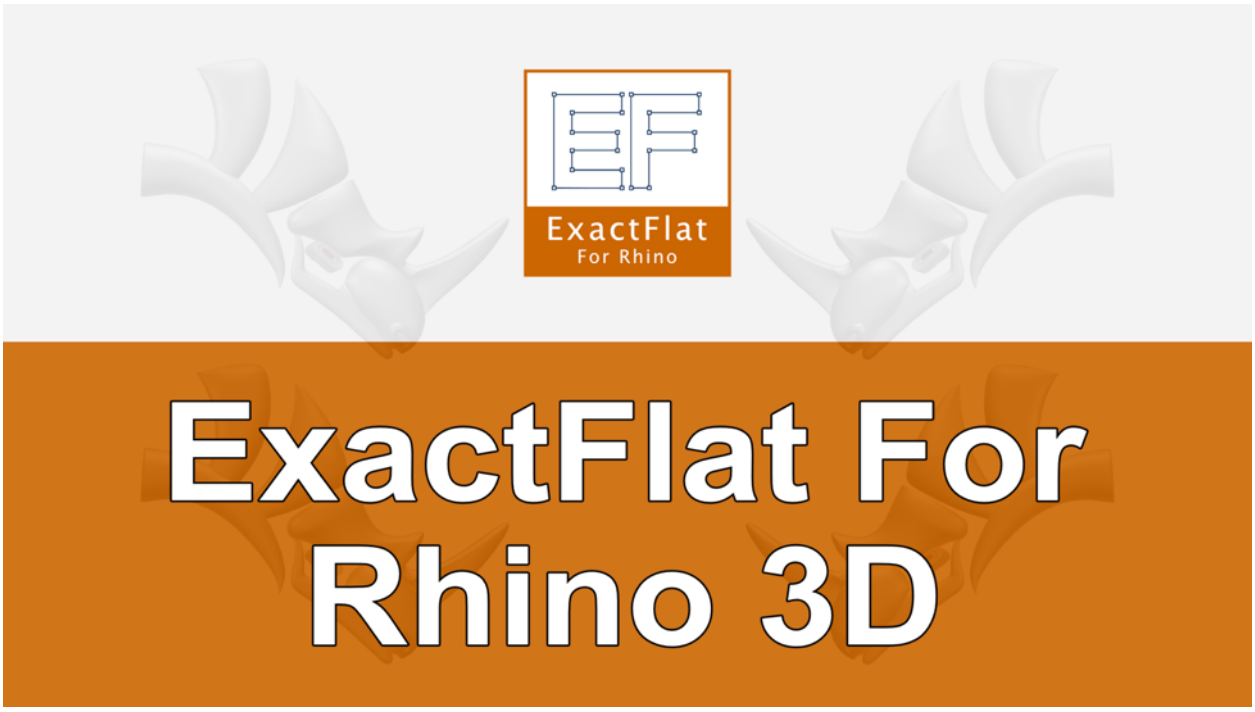

QuickStart Video Companion Guide

For 3D to 2D Digital Pattern Making

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To access the companion video for this. document please visit:

https://youtu.be/HaoreSDepdo

To talk to an expert, please call

+1 705-999-0901

To book a demo, please visit

https://www.exactflat.com/webdemo

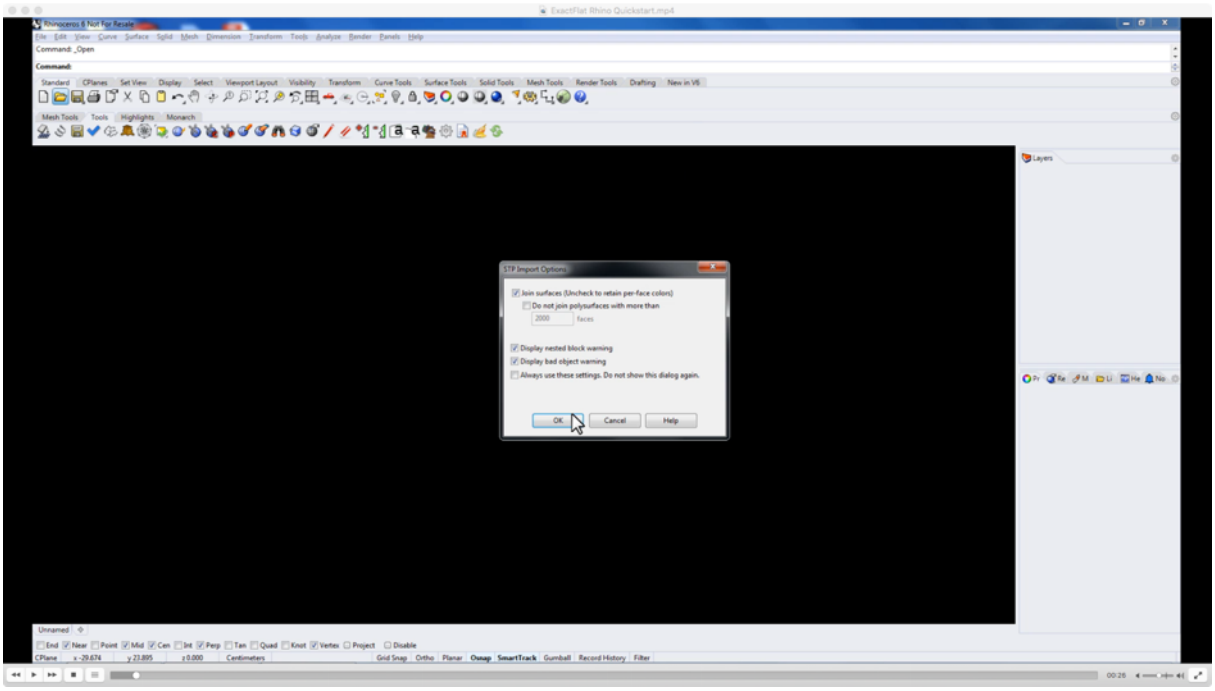
Video Time Code: 00:00

SPEAKER 1: Welcome to the ExactFlat for Rhino QuickStart video.

1. Importing A File

Video Time Code: 00:04

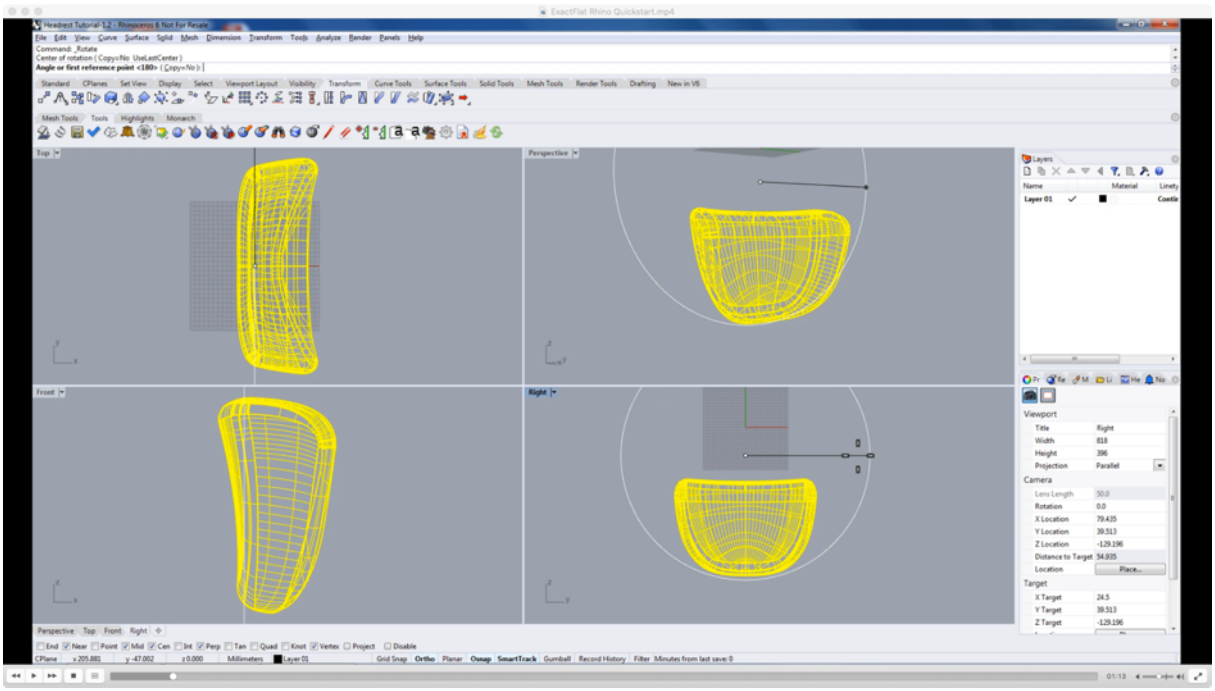
SPEAKER 1: In this video, we will be opening an automotive headrest and flattening with the ExactFlat for Rhino. ExactFlat is capable of reading many different geometry types. For this video, we are going to import a STEP-file, that was originally created in SolidWorks. We will begin by clicking the open button and selecting our headrest model, then clicking the open icon to open the model. We're going to accept the default options and just click Okay.



2. Correcting Model Orientation

Video Time Code: 00:46

SPEAKER 1: The first thing we noticed about the model is that it's coming in upside down. If we rotate perspective view around, we can see that the headrest is upside down. To correct this, we can use either the mirror command, or the rotate command. So, we will start by selecting the mesh. We're going to go to the transform tool bar and we will use the rotate command to rotate this to the correct orientation.



3. Setting Up The Workspace

We will click an arbitrary spot for our center of rotation and our first reference angle is going to be the horizontal X-axis. So we will hold shift on the keyboard to snap our second selection point to be on the horizontal X-axis.

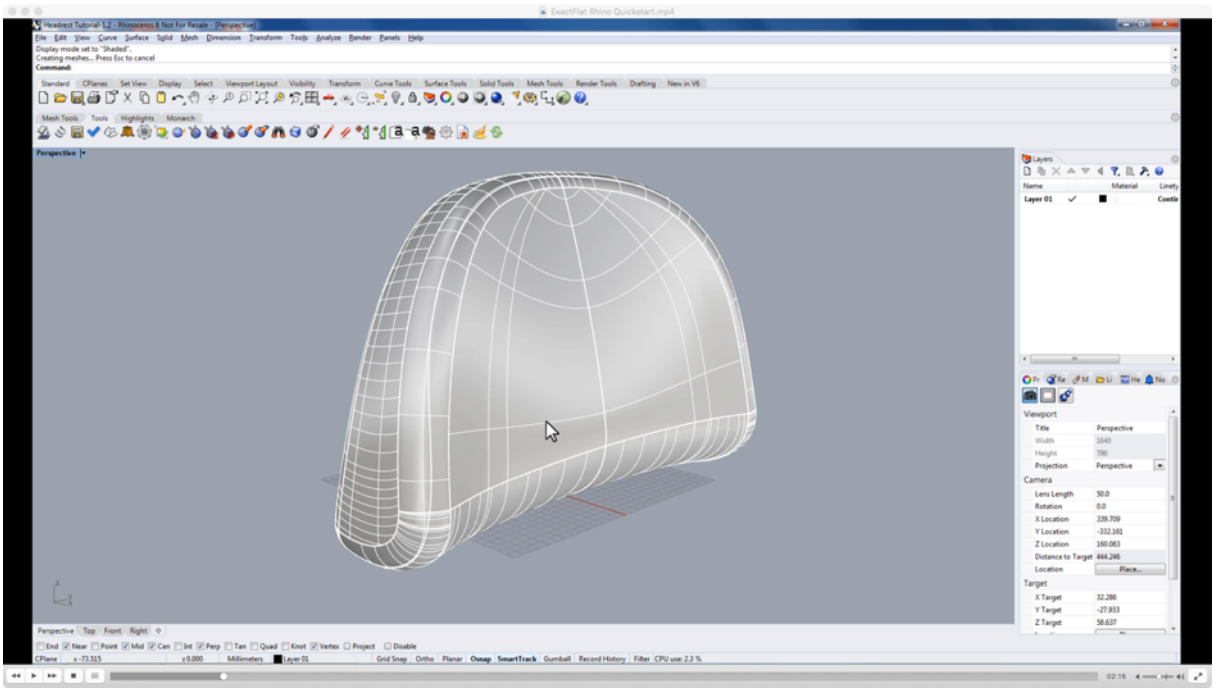
Video Time Code: 01:24

SPEAKER 1: We will rotate our second reference, angle 180 degrees, and again, holding shift on the keyboard we will snap our second point to the horizontal X-axis. Our object has now been rotated to the correct orientation. We will now proceed by maximizing the perspective viewport. We will do this by double clicking the viewport title, in the top corner here. Now, our viewport has been maximized giving us the greatest viewing area for working with our model. Our next step is, we're just going to zoom to extend, so we can see the most of our model as possible.

4. Changing the Viewing Mode

Video Time Code: 02:01

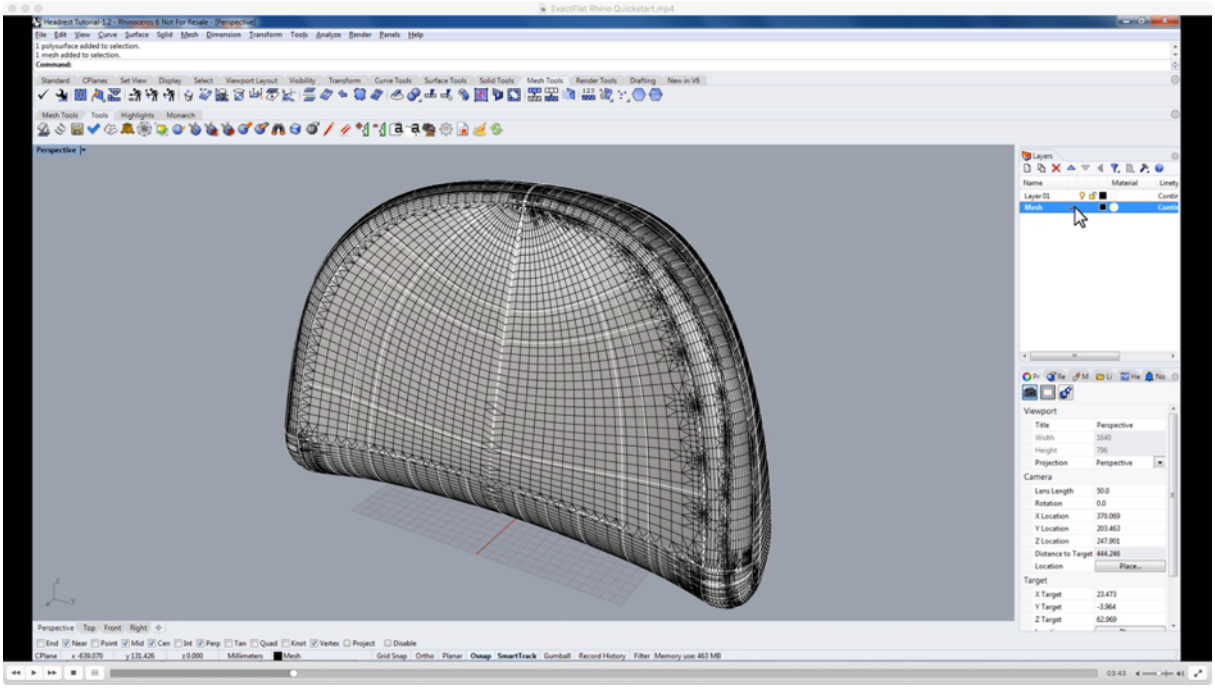
SPEAKER 1: Before we proceed, trying to work with this object in wireframe mode is a little difficult and it doesn't give us a very good sense of the curvature of the object. So we're going to change our viewing mode from wireframe. We're going to right click on the viewport title to bring up our menu, and we're going to change our render mode from wireframe to shaded. This allows us to see the curvature of the model a little better.



5. Creating the Initial Mesh

Video Time Code: 02:26

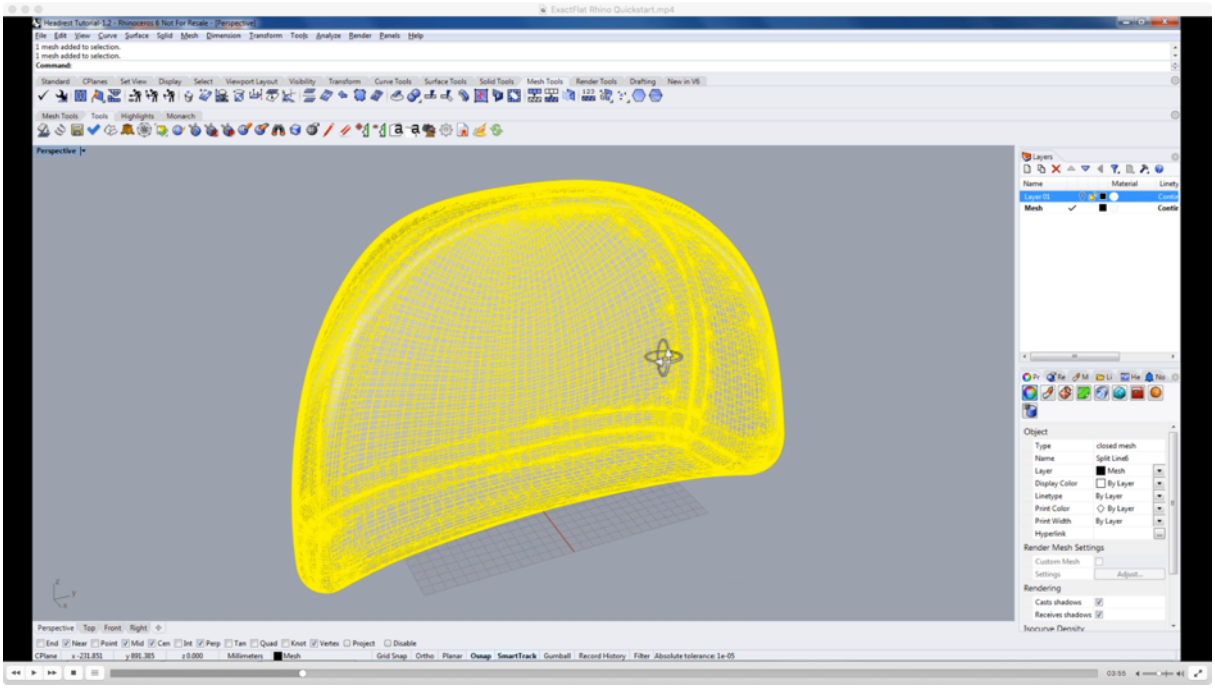
SPEAKER 1: Now, when this model came in, it came in as a single polysurface object. Although ExactFlat is perfectly capable of flattening polysurface and surface objects, it's preferable to flatten a mesh object. And this is because meshes give us the greatest degree of control, and gives us access to our suite of pre-processing tools such as the adaptive and uniform re-mesher. As such, we're going to first create a mesh from this object. So, we will begin by selecting the object, we'll go to our mesh tools toolbar, and we'll use the mesh command to create a mesh. For simplicity sake, we're going to use simple controls, and we're just going to create the most polygons possible. When done, we'll click the Okay button, and soon we have a mesh.



6. Setting Up Layers

Video Time Code: 03:07

SPEAKER 1: To keep the model document clean, we're going to separate all the different geometry on to different layers. So instead of just creating, keeping that geometry in one layer, we're going to create a new layer. We'll do this by going to the layers tab and we're going to right click in the white space and select new layer. And we're going to give our layer a name of mesh. Next we're going to select a mesh and using the object properties dialog, we're going to change the layer... Layer one to mesh. We are also going to change the display color from white to bilayer, that way the mesh inherits the color of the layer and not just a white mesh. Now we can make the mesh layer the default layer by adding a check mark, beside the layer name, and we can click the light bulb icon to turn off the polysurface name.



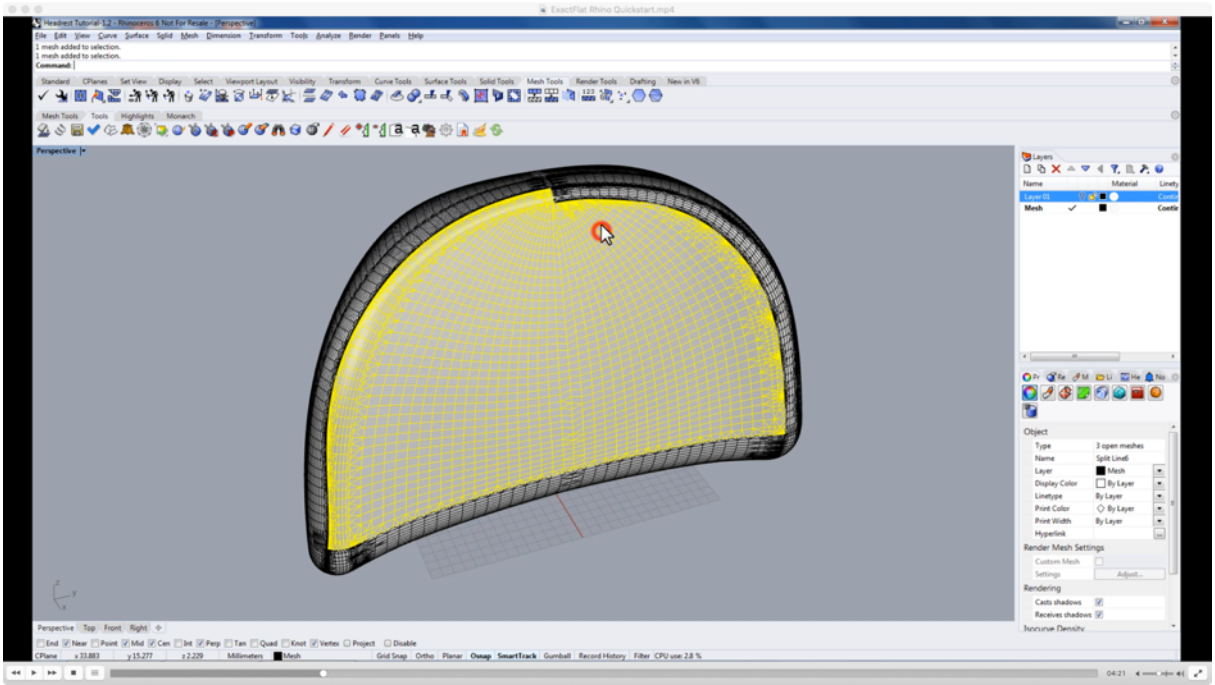
7. Defining the Pattern Pieces (Join, Invert, Weld)

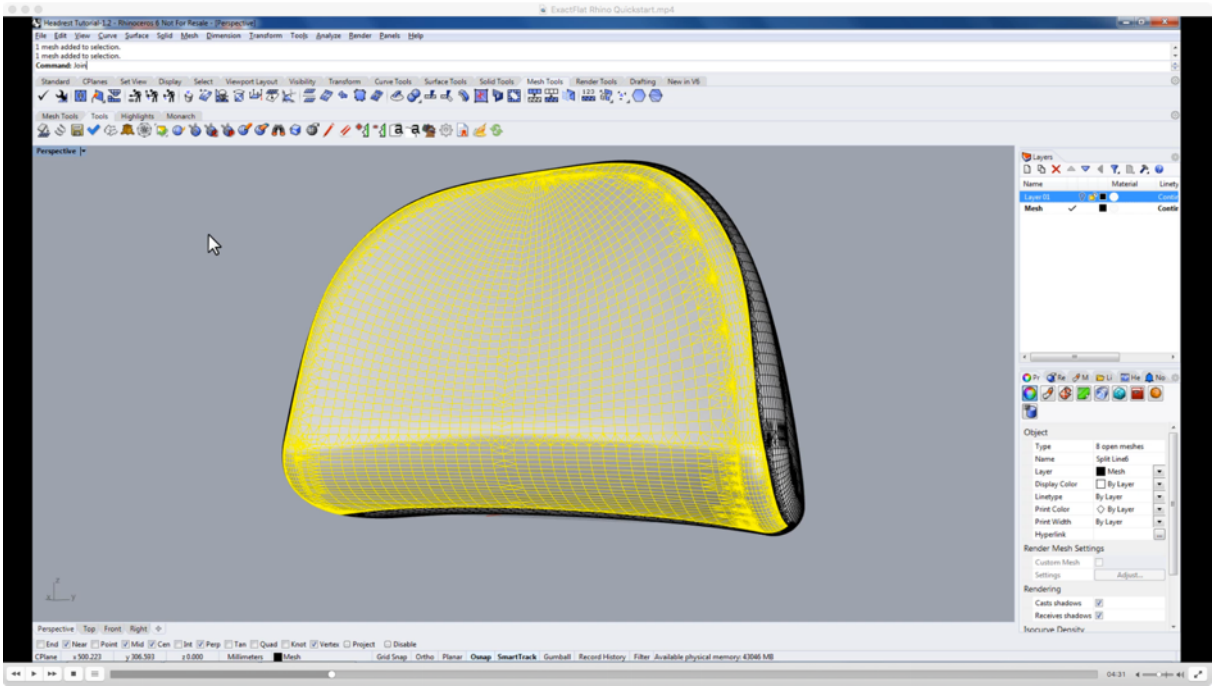
Video Time Code: 03:58

SPEAKER 1: At this point, we have one single mesh representing all pieces. For this flattening job, we're going to create four different pattern pieces out of this mesh. So we will begin by first **exploding the mesh**, and to do this, we can use the Rhino **explode command**, or we can just type explode into the command line. So, we will type in explode to explode this mesh. And it has exploded into 34 different meshes.

Video Time Code: 04:17

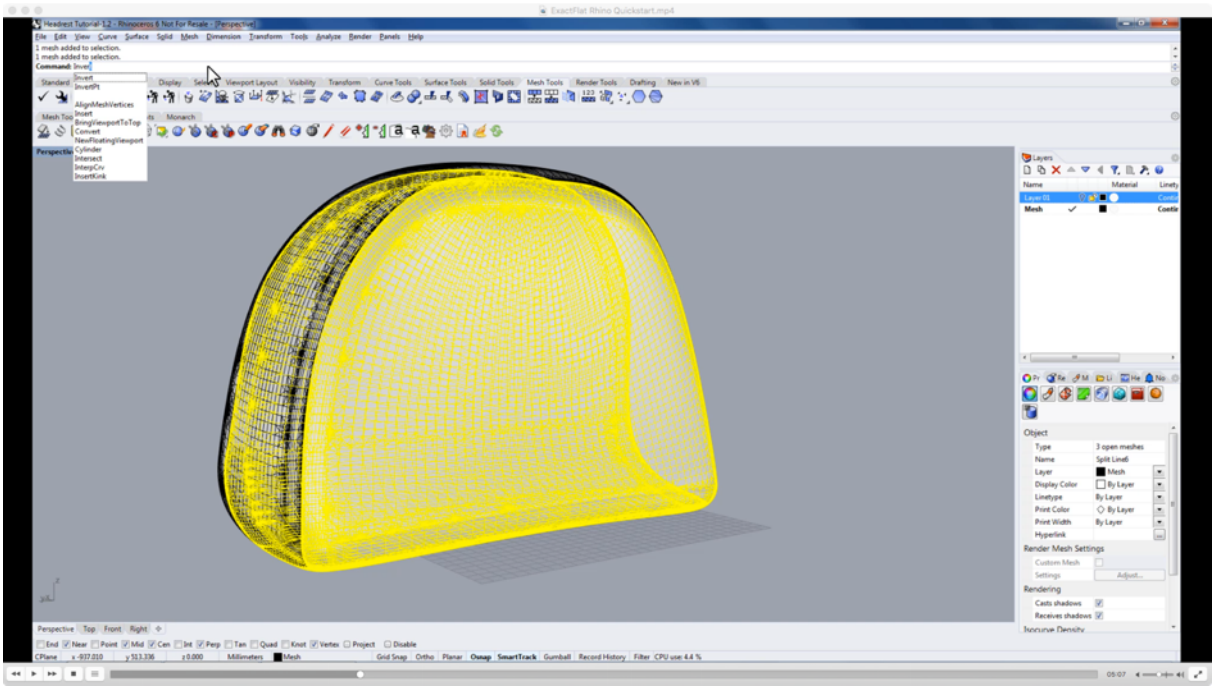
SPEAKER 1: From here, we can start to form **logical pattern pieces** by simply selecting them using the mouse, by holding shift I can select multiple pieces, multiple meshes at the same time. And then we're just going to use the **Rhino join command**. So, I will type join into the command line and press enter to join the meshes. We will repeat this process for all desired pieces. So, I've selected all my faces and now I am going to type join into the command line and join them together. And you will repeat the process for the back. By holding shift, I can select multiple meshes and then type join into the command line, and join them together.



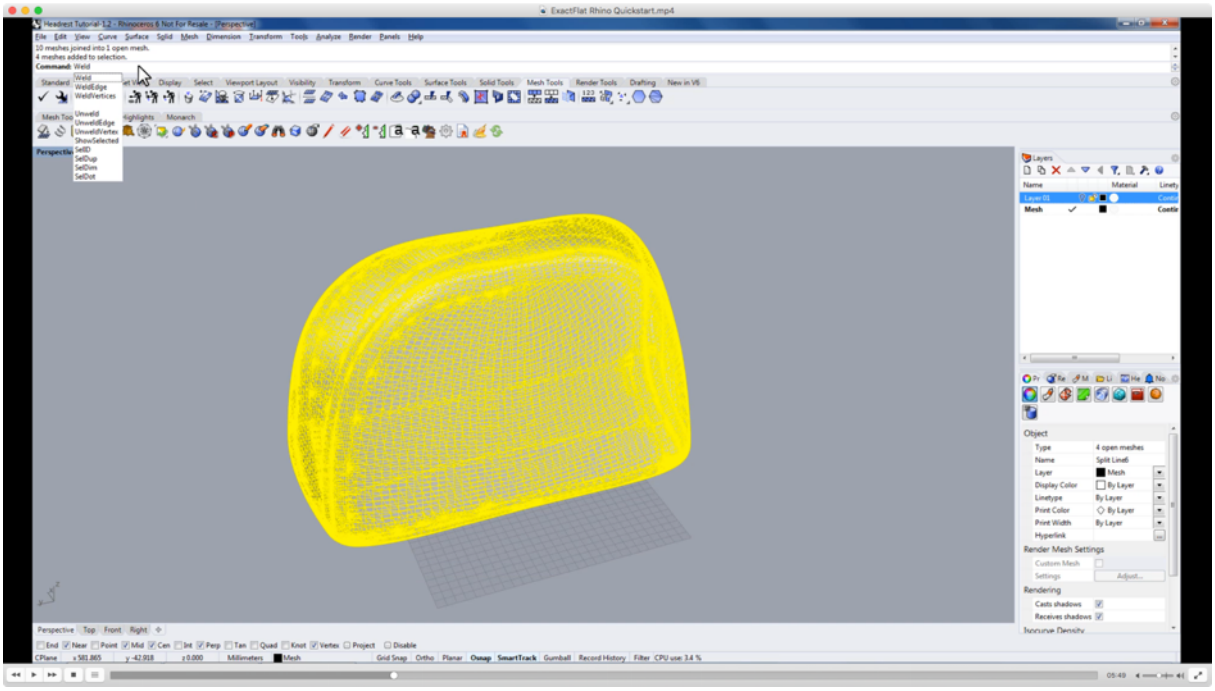


Video Time Code: 05:00

SPEAKER 1: For the last piece, instead of selecting all the faces, I'm going to select the three faces that I have already joined. So now I'm going to type **invert** into the command line to invert my selection.



And now I can type and join, to join these faces together. By joining these faces together, we have created a single mesh that is comprised of many different sub-meshes. If we were to flatten this with ExactFlat, ExactFlat would recognize the sub-meshes and it would explode them for us back into our component meshes. To prevent this from happening we are going to use the **weld command**, to weld all the vertices together, and basically reduce the coincident vertex count to zero.



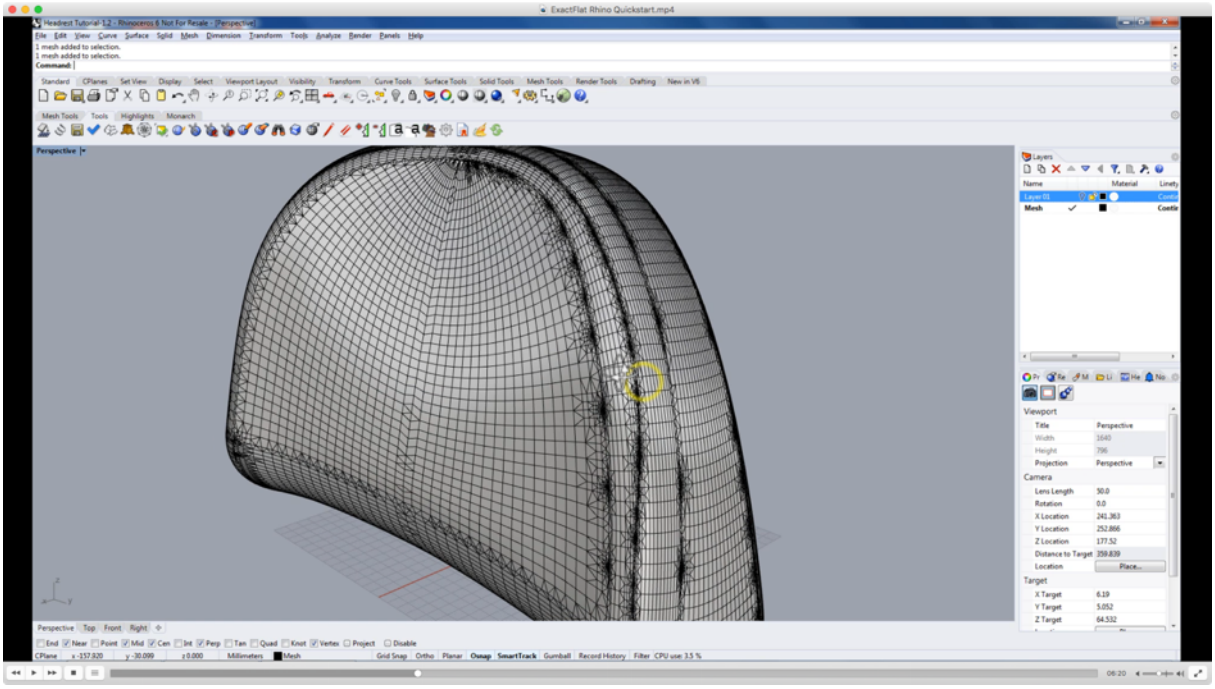
Video Time Code: 05:45

SPEAKER 1: So, we will start by selecting all the meshes. And we will type in weld into the command line, to weld them together. We're going to use a weld pant tolerance of 180 degrees and pressing enter finishes the command. Now we have four mesh objects that we will flatten with ExactFlat.

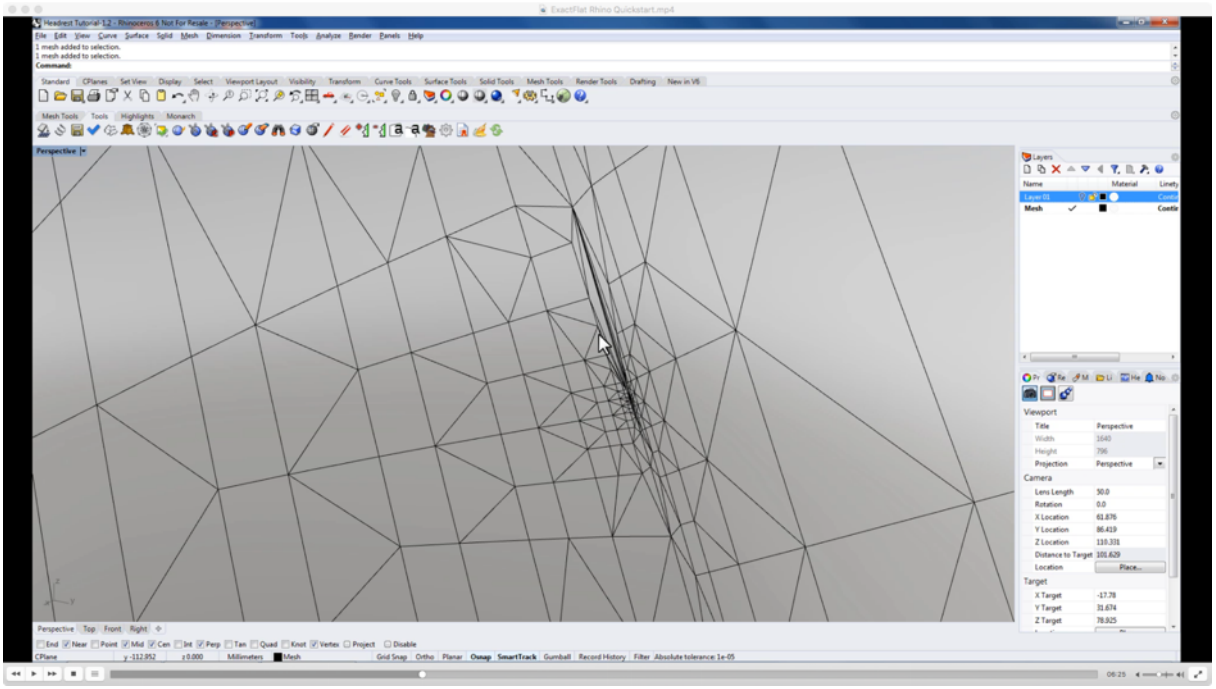
8. Creating A New Mesh For Flattening (Adaptive Re-mesher)

Video Time Code: 06:28

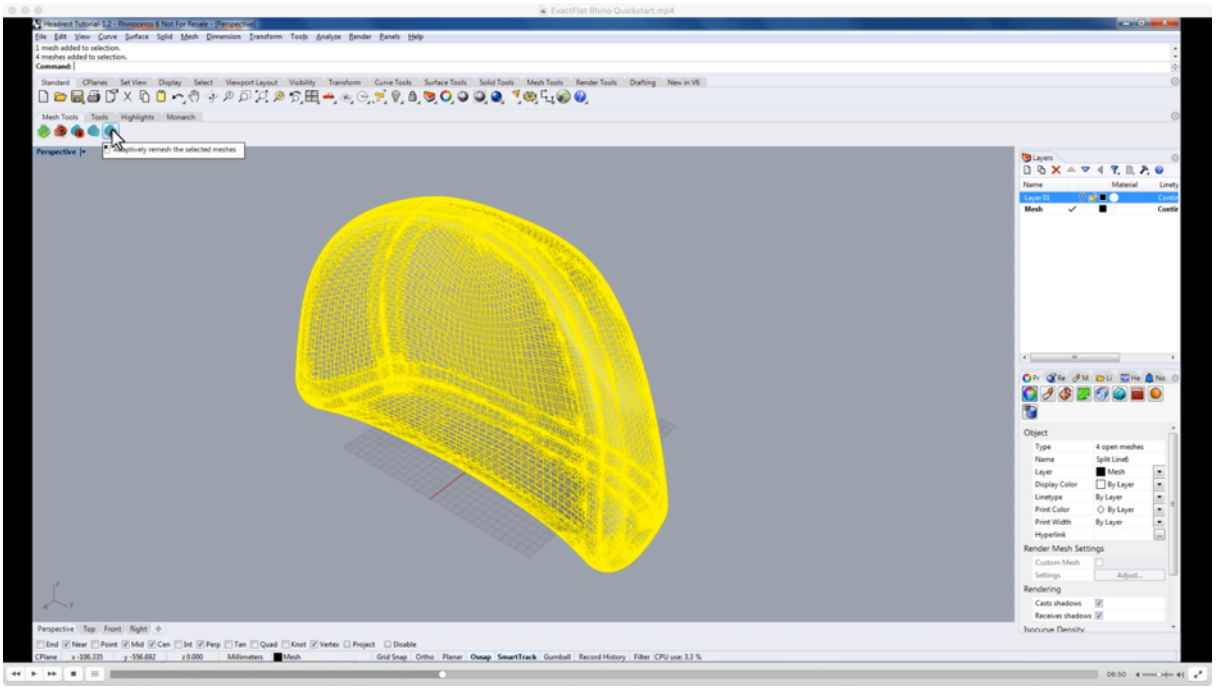
Before we flatten with ExactFlat, we're going to use ExactFlat's mesh pre processing tools to reduce the number of vertices of this mesh. As we look at the mesh we can see we have a wide variety of triangle and quad sizes, ranging from fairly large...



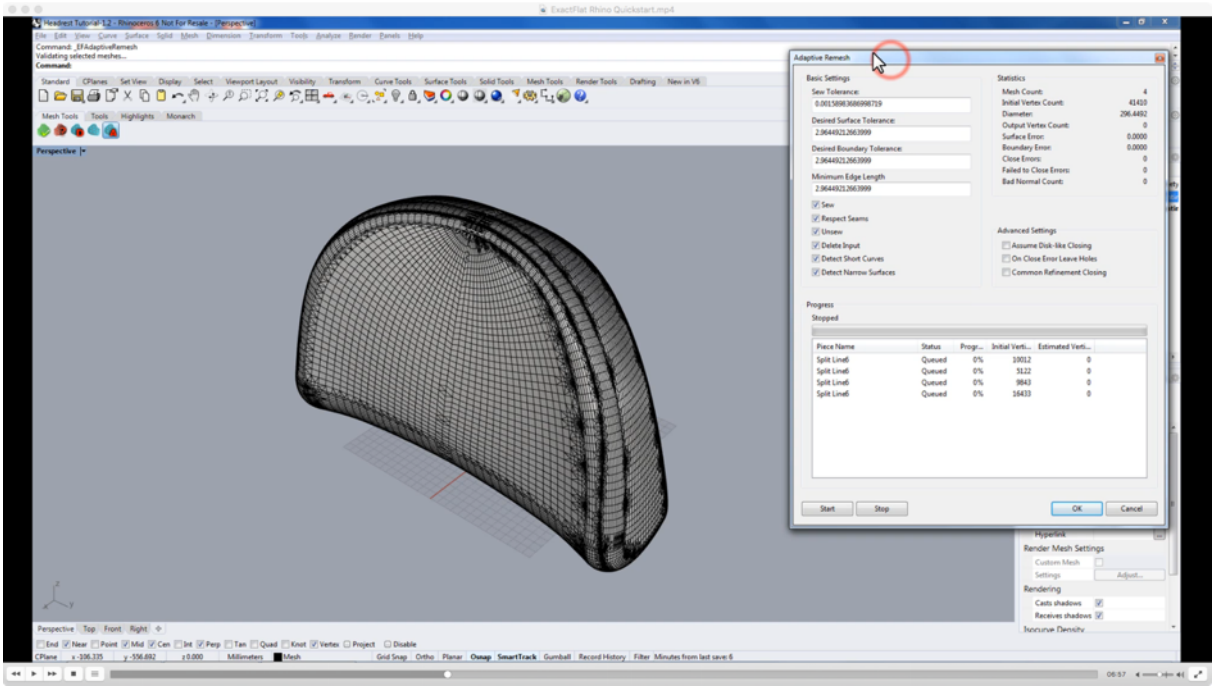
If we zoom in, we can see some very, very small triangles here. We can also see what I refer to as high aspect ratio triangles and these are triangles that have very, very small angles at one end mixed with very, very large angles at another vertex.



Although ExactFlat can flatten these, they're not ideal for ExactFlat. And as such, we have a couple different tools for pre-processing and conditioning these meshes. The most important of which is our **adaptive re-mesher**.



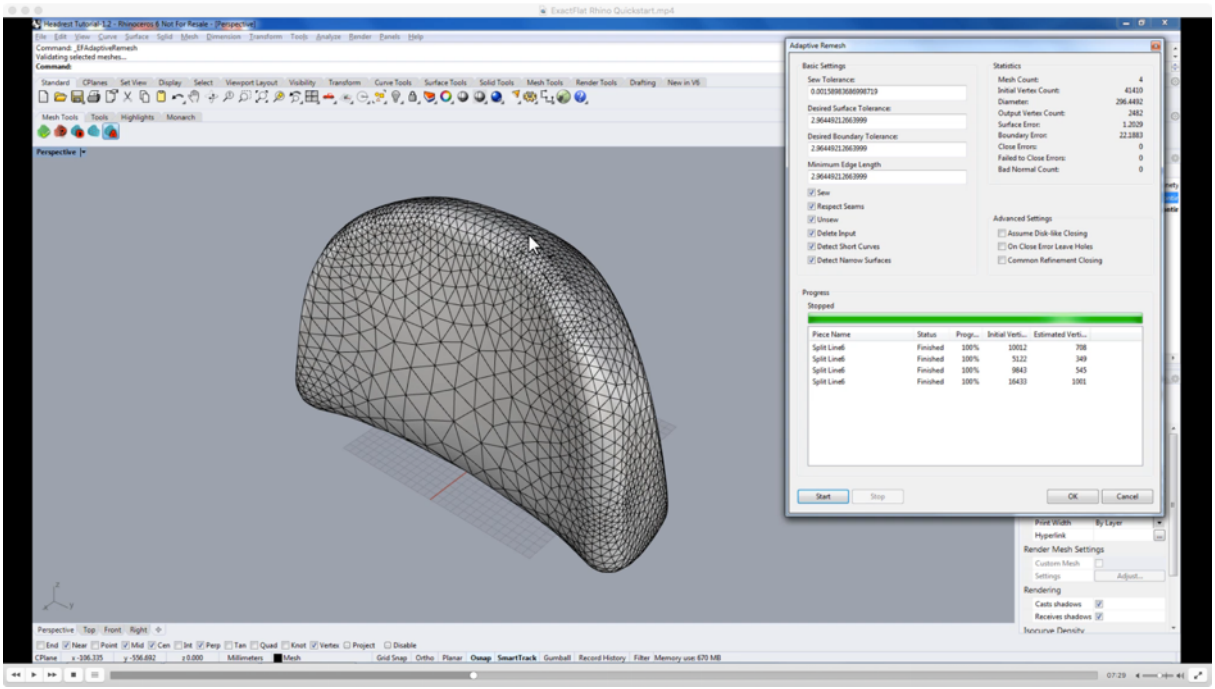
So we will select all the meshes and we will click the adaptive re-mesher icon to start the adaptive re-mesher.



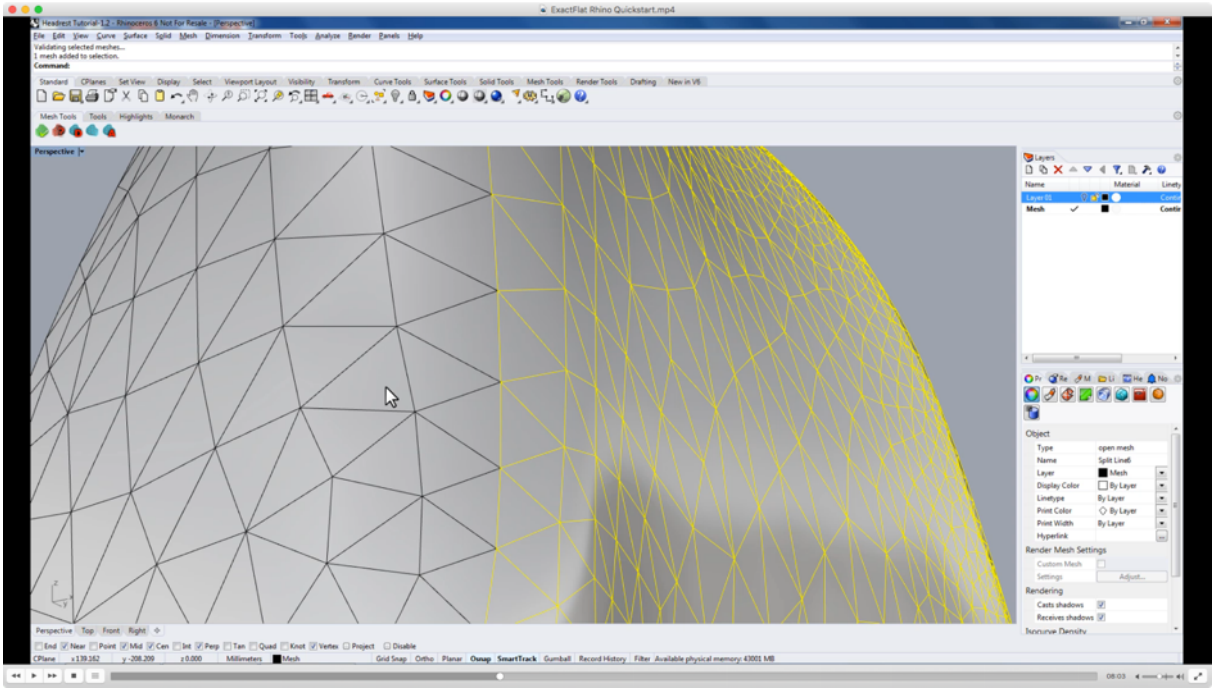
9. The Adaptive Re-Mesher

Video Time Code: 07:06

SPEAKER 1: The adaptive re-mesher will automatically compute reasonable tolerances for selling tolerance desired surface boundary and minimum edge length as well as use the most appropriate options. So we're going to simply click the start button and very soon we're going to start to see a new mesh created over top of the original. We're going to click, "yes" to the high vertex count, we've got a high vertex count over 1000 vertices, which is acceptable for ExactFlat when using the adaptive re-mesher and very soon we're going to see a new mesh being created over top of the original.



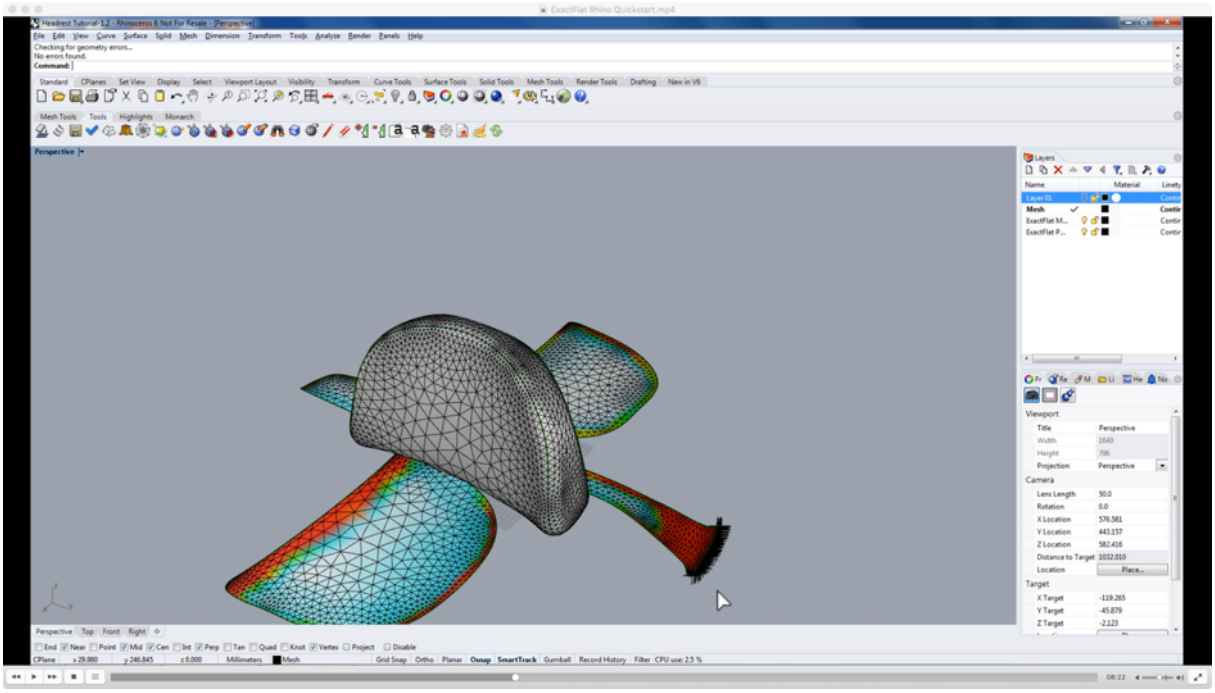
A couple of the characteristics of this mesh are that all the triangles are more or less equilateral and when there's a change in size of triangle, the change in size, occurs gradually over a large distance. We can also see that the edge tessellation has been preserved. So, as we look at seams we can see that both sides of the seam share the same tessellation, and that is, there's a single set of vertices along the edge of both right and left hand side share.


ExactFlat Rhino Quickstart.mp4
Perspective
Layers
Object
Render Mesh Settings
Rendering

10. The Initial Flat Pattern

Video Time Code: 08:11

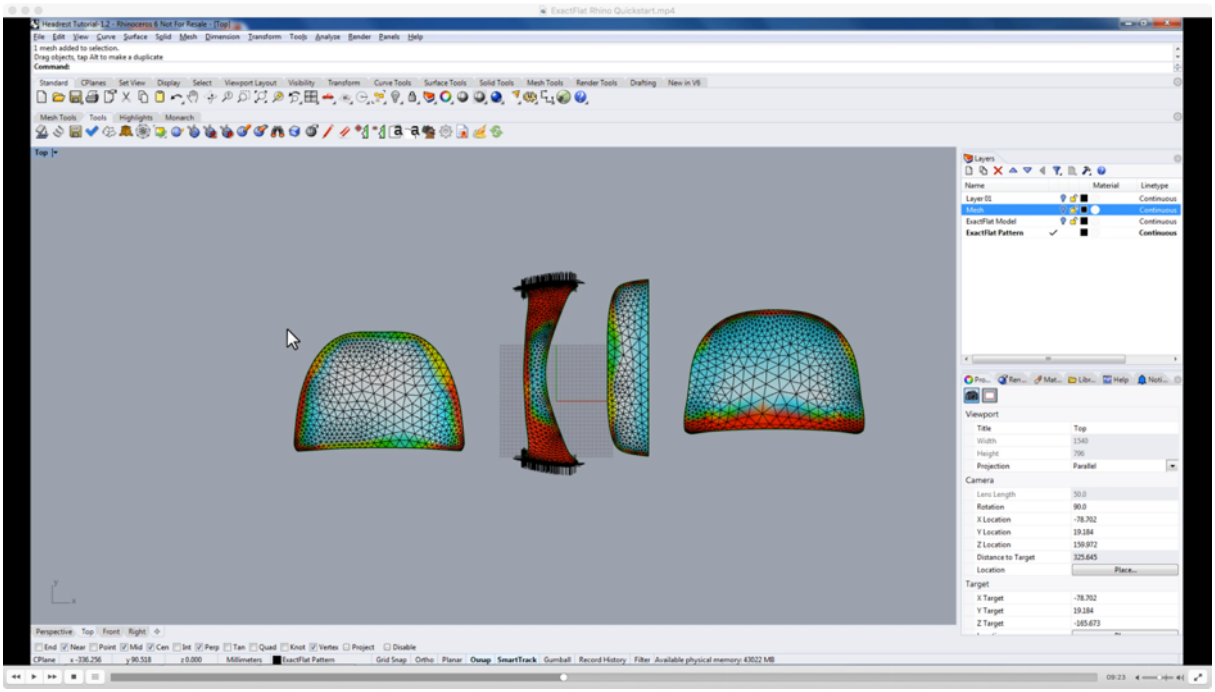
SPEAKER 1: All of these characteristics of the mesh make this a very well, very suitable mesh for ExactFlat to flatten. After we've finished re-meshing we will change over to the ExactFlat toolbar we will start to flatten these using the flatten command. We will simply rectangle select all the meshes and press enter on the keyboard, to accept the selection. And very quickly, we can see our flat pattern.



11. Preparing Your View And Layers To Optimize

Video Time Code: 08:43

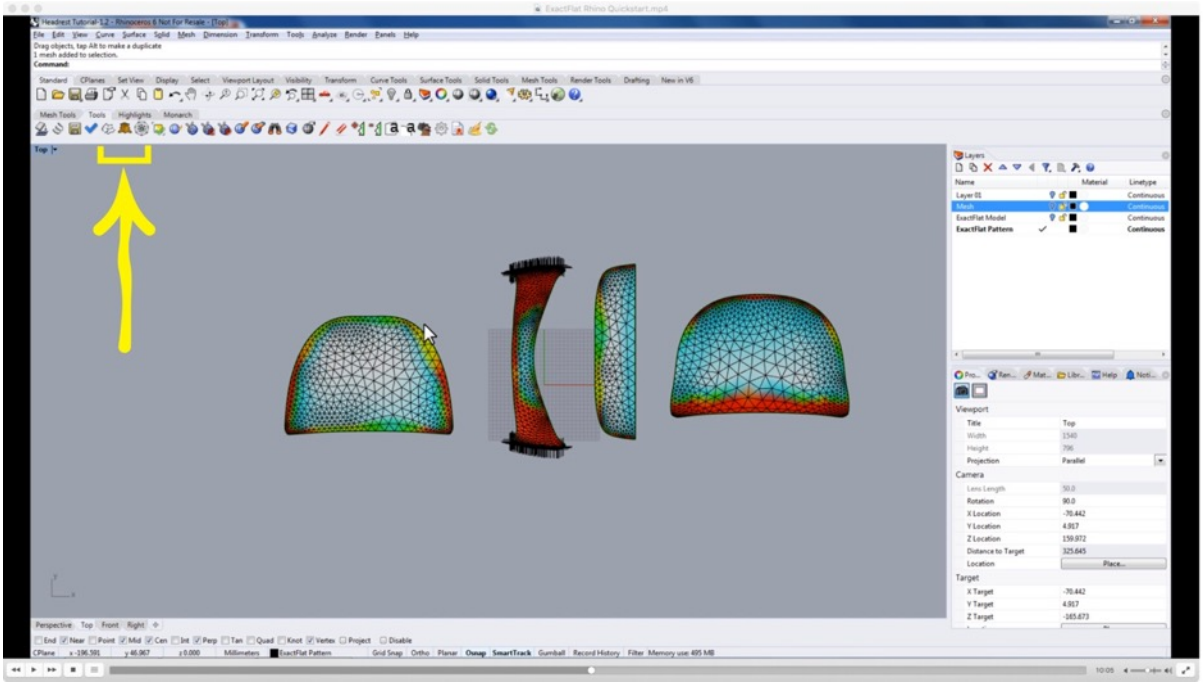
For our next step, we're going to minimize the perspective view port by clicking on the **prospective title**, and we are going to maximize our top view port by double clicking on the **top view port title**. We're going to switch from a wire frame mode by right clicking on the top view port title and selecting shaded. And now after flattening we have two new layers created. One is the ExactFlat model layer, and the other is the ExactFlat pattern layer. We're going to make the pattern layer our active layer, and we are going to turn off the model and the mesh layer. It's important to know if that ExactFlat is a two stage flattener and that means that ExactFlat does its flattening in two steps. The first step is what we are looking at now. And these are, are flattened using what are called pre-flatteners.



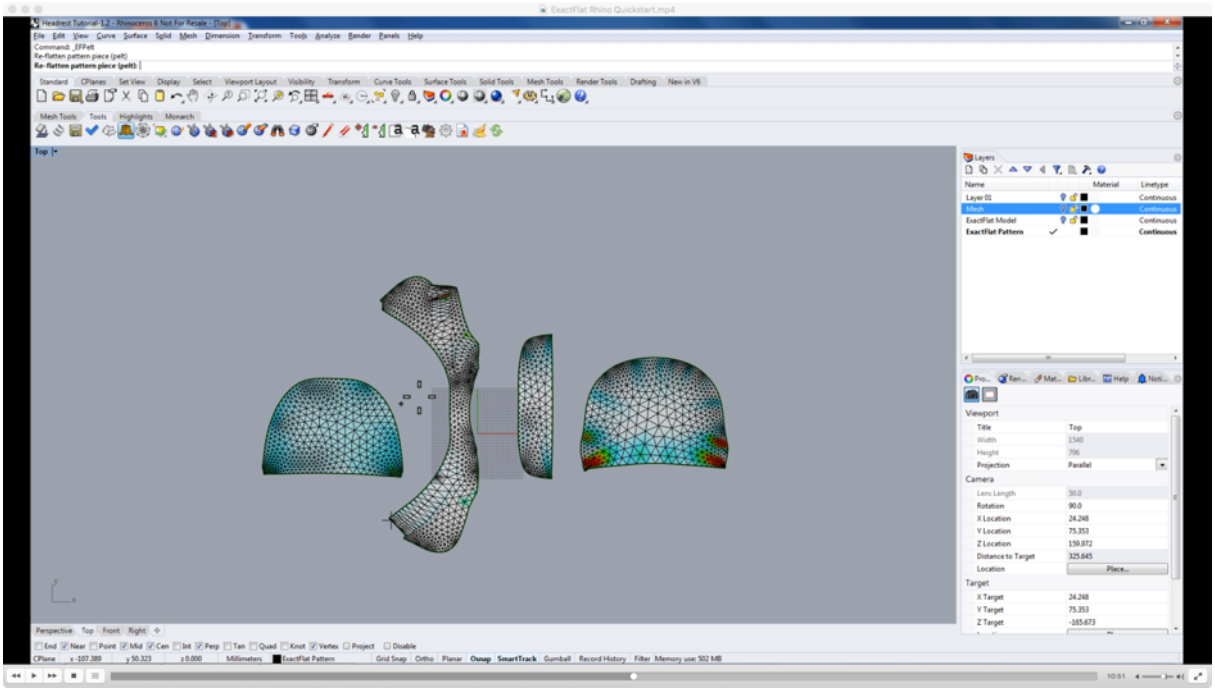
12. ExactFlat For Rhino Pre-Flatteners

Video Time Code: 09:28

SPEAKER 1: So our pre-flatteners are a collection of different mesh flatteners that are very, very quick but they produce meshes that are not optimized. In the case of this one, we have quite a bit of strain around the perimeter for this piece here, we have quite a bit of strain and the meshes folded in on itself. This is the result of a **projection flattening**. And we have very similar results for the remaining meshes as well. ExactFlat has a number of pre-flatteners including our **fracture** pre-flattener. We have our **pelt** pre-flattener. And we have a collection of **convex combination** pre-flatteners as well as a number of pre-flatteners, that are not actually featured in our toolbar yet.



If we select a fracture pre-flattener we can select any edge on a mesh to act as a starting point for a new fracture. We can see the results of this fracture has both, reduced the strain on the surface as well as expanded the pattern perimeter, and eliminated a lot of the **strain** on this piece.



When used on the second piece here, we can see that we've eliminated the vast majority of the strain. However, if you look at the corner over here, we can see a cross highlight, which indicates the presence of flip triangles or folds or wrinkles in the pattern.

Video Time Code: 10:39

SPEAKER 1: We'll use the fracture command, on the remaining pieces and our primary goal here is to eliminate a lot of the excess strain that's in the pattern. We can try the pelt command on some of the pieces, and we can see that we end up with a slightly different starting pattern although and is still unoptimized in the case of this piece we got this better starting position, without the flipped triangles, but this starting point has more strain in it. The important thing to understand is that **any of the pre-flatteners can be used at any point in time and you can use them as many times as you want**. This is just a result of the first stage flattening and the second stage is always going to be optimized.

Video Time Code: 11:18

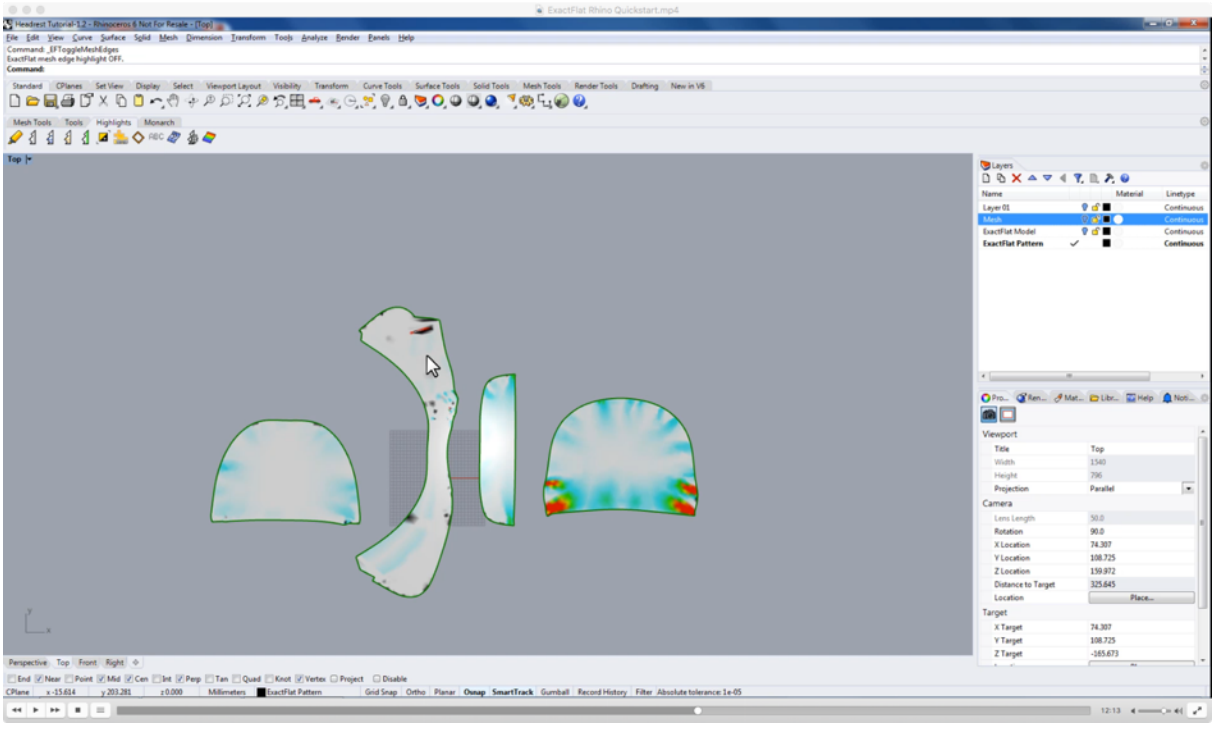
SPEAKER 1: And the optimizer is what's going to give us our final flat pattern. The goals of using the pre-flatteners are to achieve a decent starting point for the optimizer, that has minimal strain such as this piece and no flip triangles. In the case of this piece, we can't optimize this piece yet, because it has a flip triangle. The best way to correct flip

triangles are to either try a different pre-flattener or in the case of fracture, we can try fracturing from different starting locations and depending on the starting location we end up with a different initial flat pattern that may or may not have flip triangles. We can also try using ExactFlat's automated flip triangle removal process, to remove the flip triangles for us. And in this case, the process was successful and we no longer have any flipped triangles on this pattern piece.

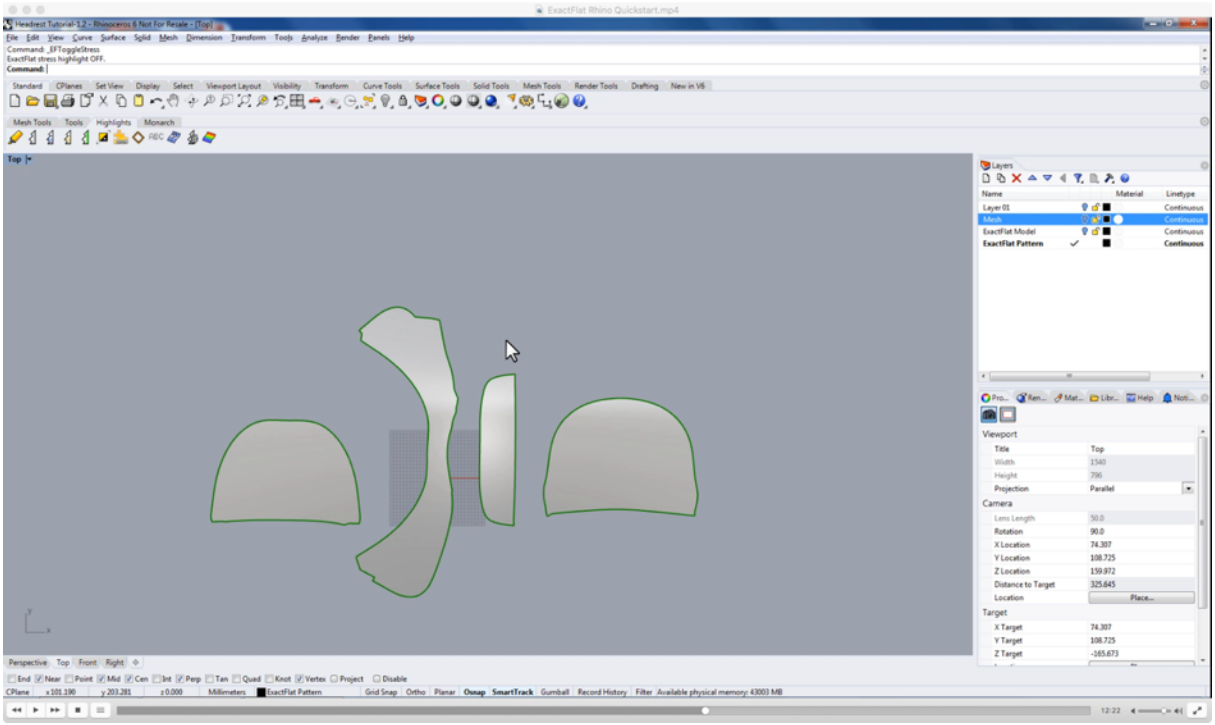
13. Edge Highlights & Strain Analysis

Video Time Code: 12:15

SPEAKER 1: It may be beneficial to turn off the ExactFlat **edge highlight**, and this will remove the triangulated mesh from the pattern piece, and we may also turn off the **strain analysis**.



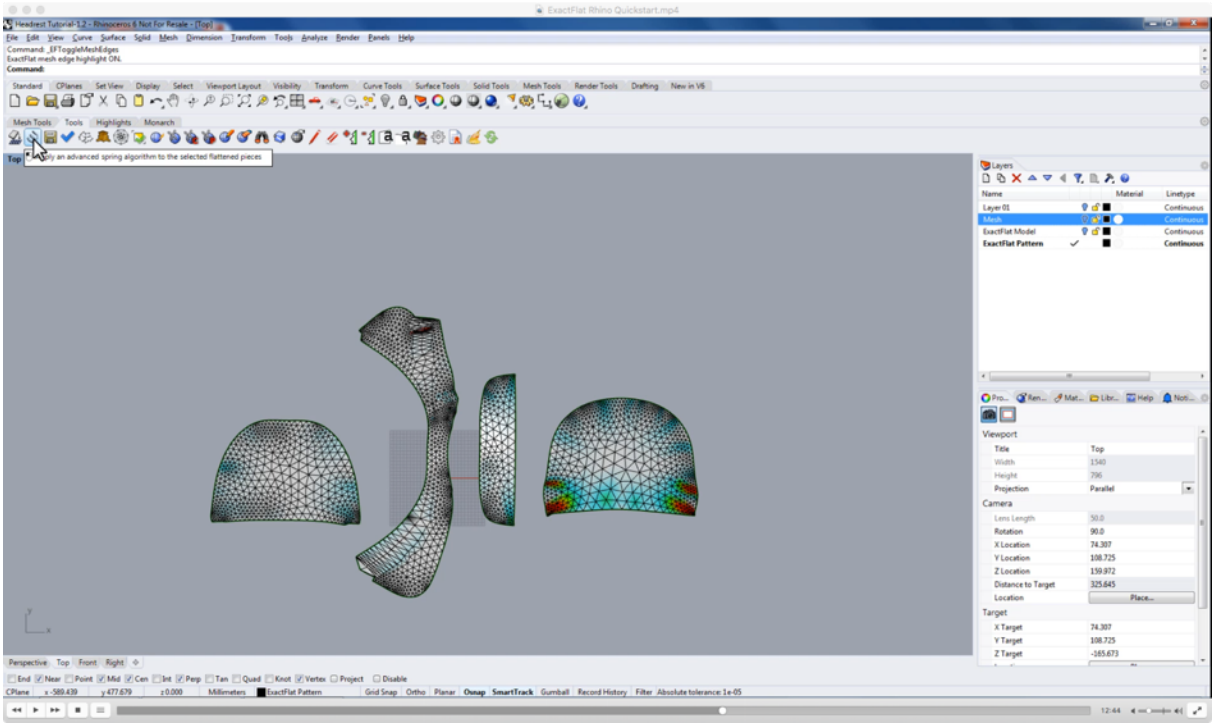
In the case of rendered textured objects turning off the strain analysis will also allow us to see the texture of the object when in rendered mode. If the strain analysis is turned on even if we are in rendered mode we will only see the straining highlight. We will turn our strain highlight and try it back on and go back to the tools toolbar.



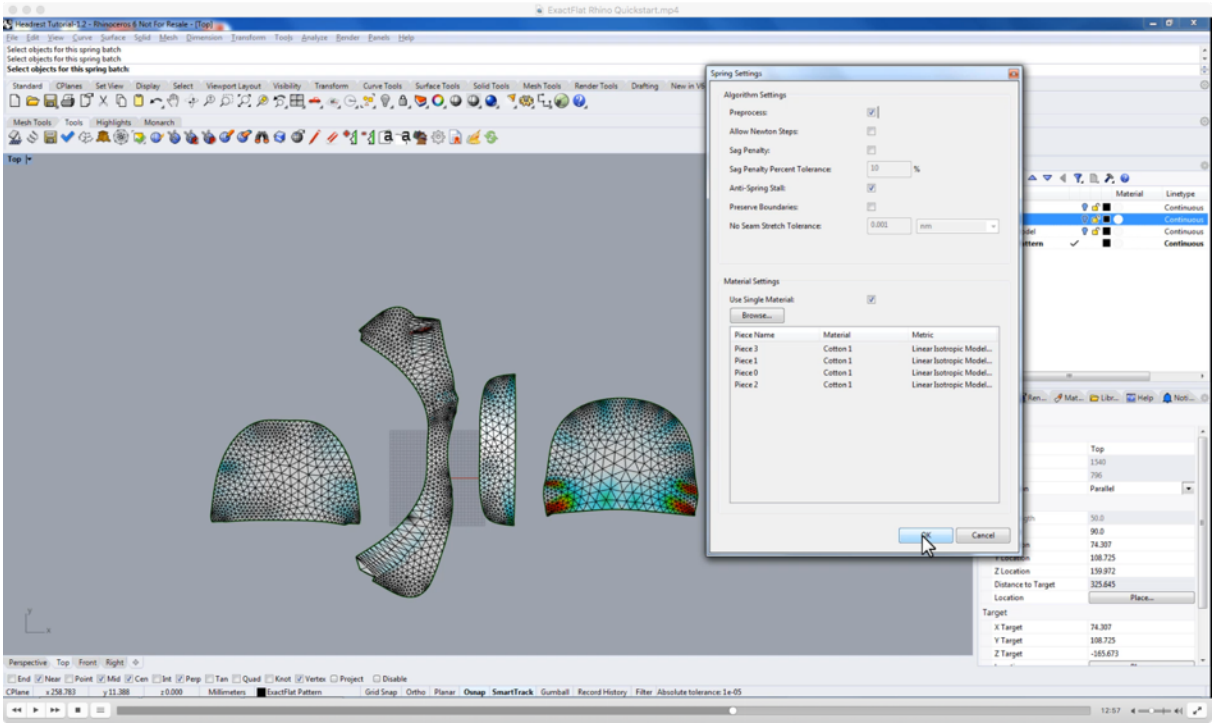
Optimizing Pattern Fit

Video Time Code: 12:53

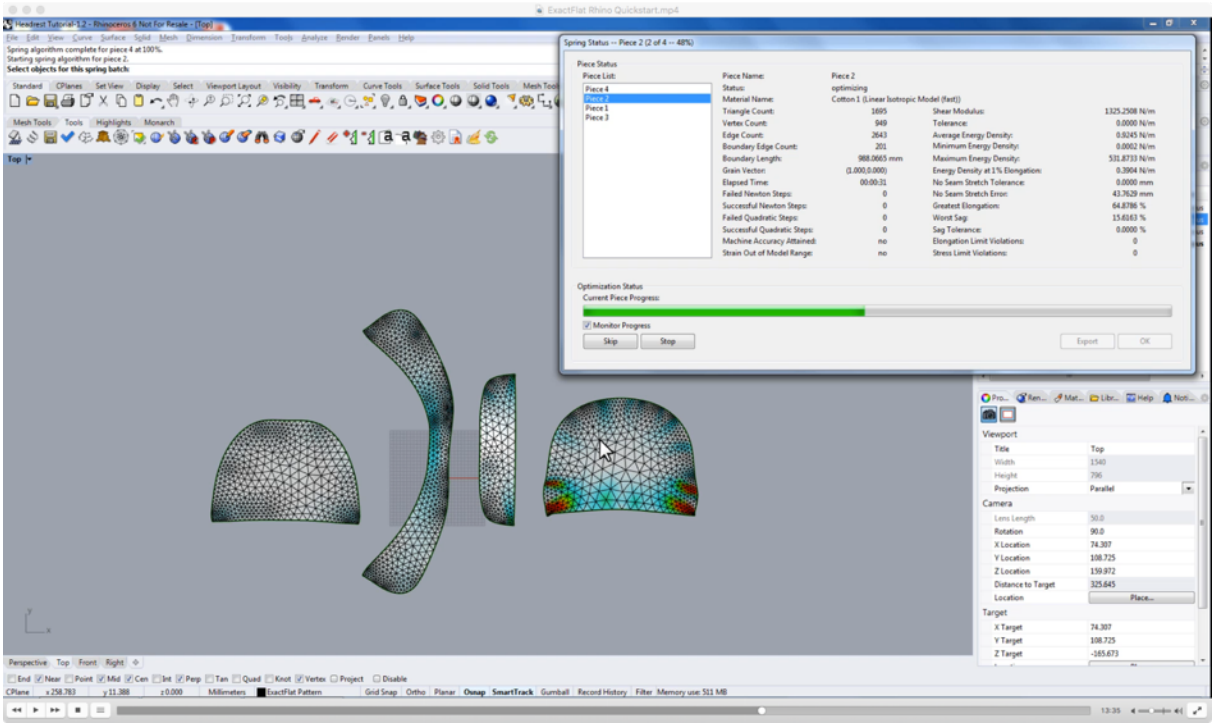
SPEAKER 1: Once we have decent starting point for our flat patterns we will use the ExactFlat optimizer to reduce the strain and sag to as close to zero as possible.



For this demo we're going to use a simple cotton model and we're going to turn pre-process on to reduce our optimization time.



Very quickly the optimizer starts **minimizing strain and sag** and optimizing the pattern piece. As the optimizer runs, we can see the shape is changing to better…



Video Time Code: 13:12

SPEAKER 1: So the pattern piece better fits over top of the original 3D model. You can also see this strain highlight changing indicating the strain throughout the pattern piece is changing. For most pattern pieces this shift is going to be from red and green colors down towards white and cyan. As with most parts of ExactFlat, **the strain legend** is very configurable through the **ExactFlat options panel**. By default the strain analysis is configured, so white represents 0% strain, cyan is about 5% strain, green is 10% strain, yellow is 15 and red is 20% or more.

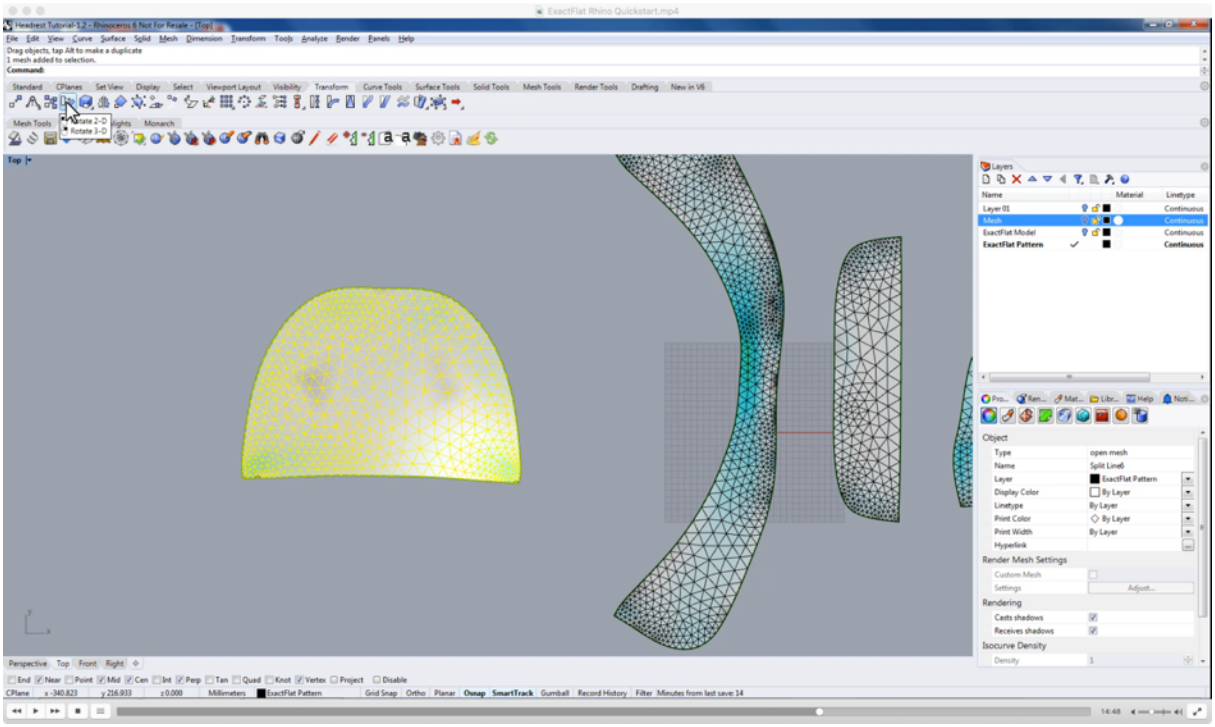
Video Time Code: 13:56

SPEAKER 1: If at any point in time the optimizer reaches a point where the pattern is good enough and you just want to continue, we can click either **the skip button** to skip the current piece, or we can click the **stop button** to stop optimizing all together. In this case, we click the skip button to skip optimizing this piece, so we can proceed on to the next pieces.

14. Finding and Arranging Pattern Pieces

Video Time Code: 14:37

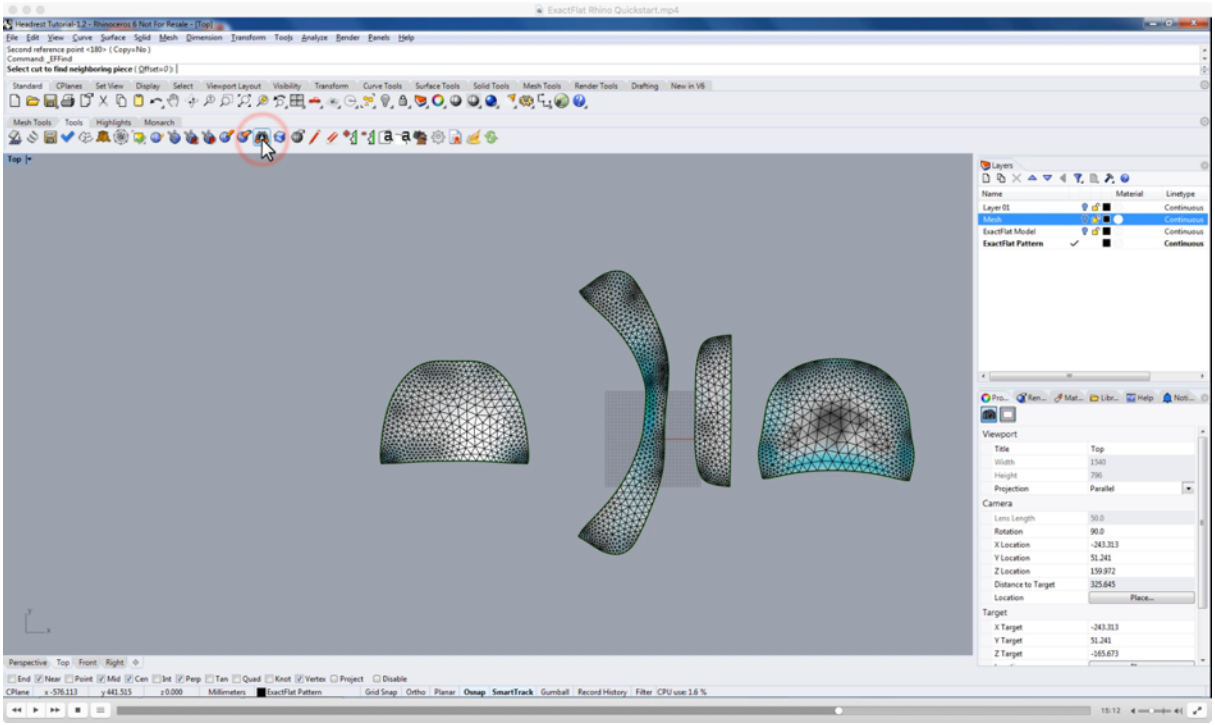
SPEAKER 1: After the optimization is complete, we can click the okay button, close the **spring status dialog**. And now we are ready to do our patterning with these pattern pieces. To begin we're going to **rotate** this pattern piece so the bottom edge is perfectly horizontal and to do this we will then use the Rhino **rotate command**, so we'll click the rotate icon on the toolbar, we're going to select the bottom edge as a starting reference point, we will select, the other corner is our first reference point and just holding the shift key on the keyboard we're going to snap this to the horizontal X-axis.

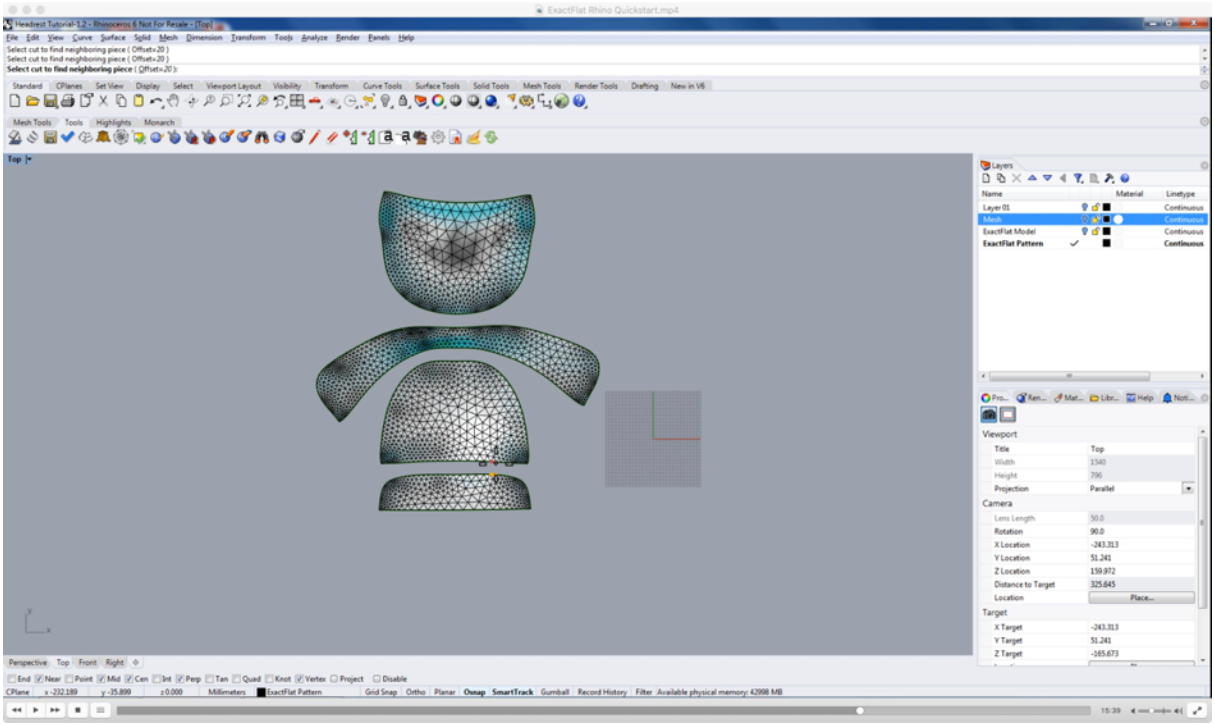


Video Time Code: 15:06

SPEAKER 1: We are now going to use the ExactFlat **find command** by clicking the binoculars icon in the ExactFlat tools toolbar and we're going to set a find **offset** of about 20 millimeters. Now, as we click on edges, as we highlight over one of the edges, we can see the **neighboring edge** is also being highlighted on the piece to the right and when we click on an edge, we're going to see that our neighbouring piece is automatically translated and rotated to match the orientation of the selected edge. Using this tool we can very quickly rearrange the pattern pieces so they are much easier to

work with an ExactFlat. This allows us to easily place notches on our pattern pieces as well as identify any meshing or flattening errors that have occurred.

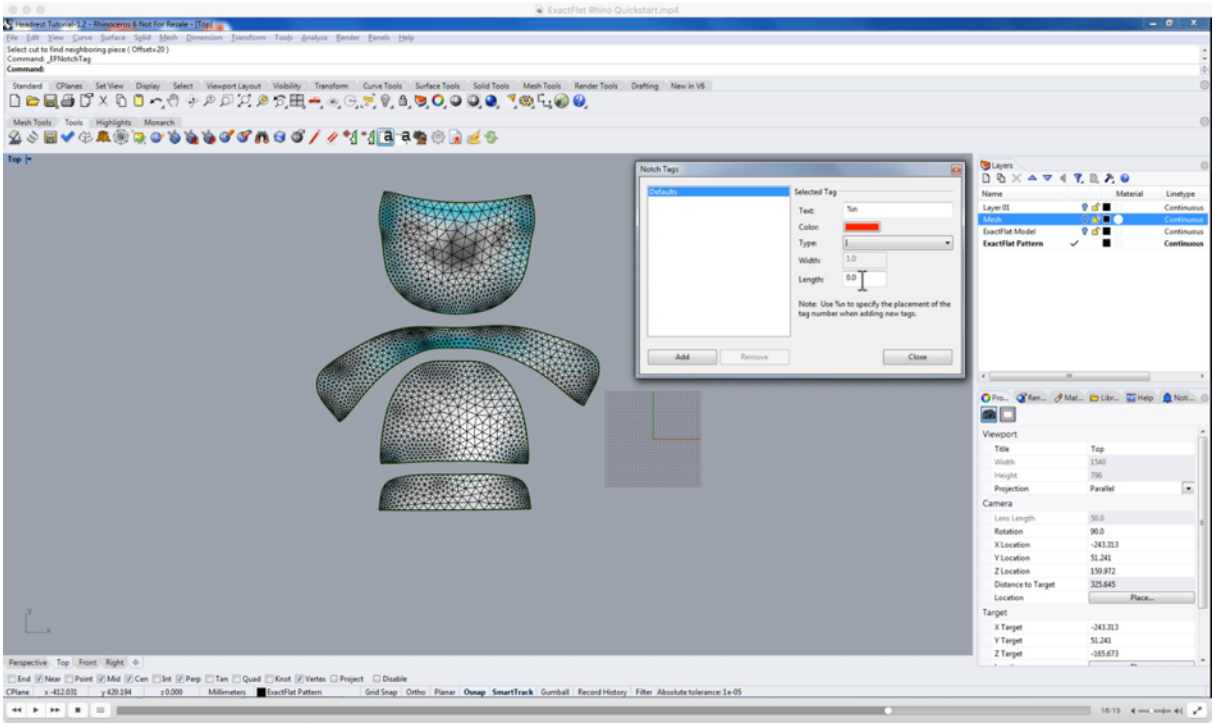




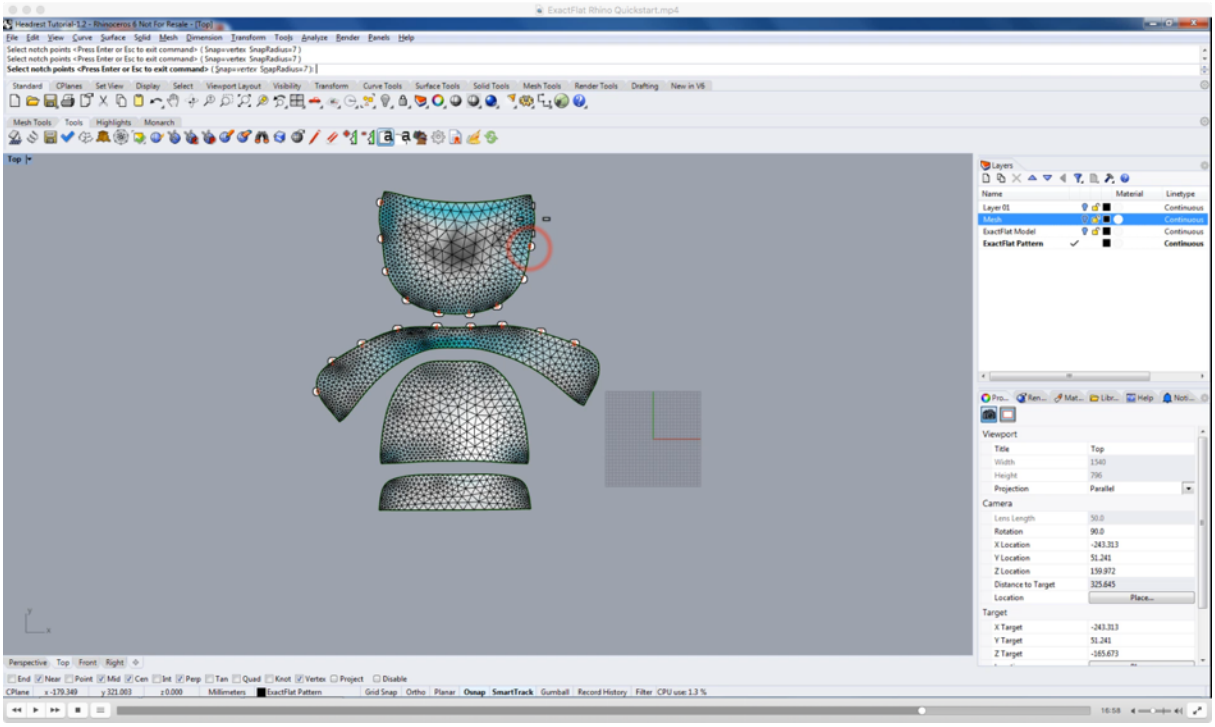
15. Adding Alignment Notches

Video Time Code: 16:02

SPEAKER 1: Our next step is to add **notches** to the pattern and notches are a combination of a **text tag** as well as either a **slit notch** or a **V notch**. Notches can be configured. We can change the color of the notch, and we can change the type of the notch between I and V notch and we can also manually adjust the width and length of the notch.



When the length is set to zero, the length is going to automatically be the length of the **seam allowance** added to our pattern piece. If we manually specify the length and the length is always going to be the length entered and the unit system of the document is currently used. In this case we're going to specify our slit notch to be 5 millimeters in length. We'll click the add button to start adding notches to this part. As I select edges on the pattern piece, we can see that the notches are showing up on the neighboring pattern piece as well.



16. Adding Notches to the 3D Model

Video Time Code: 16:02

We can also add notches to the reference model by simply switching back to our model, we'll make the model layer the active layer, we'll hide the pattern.

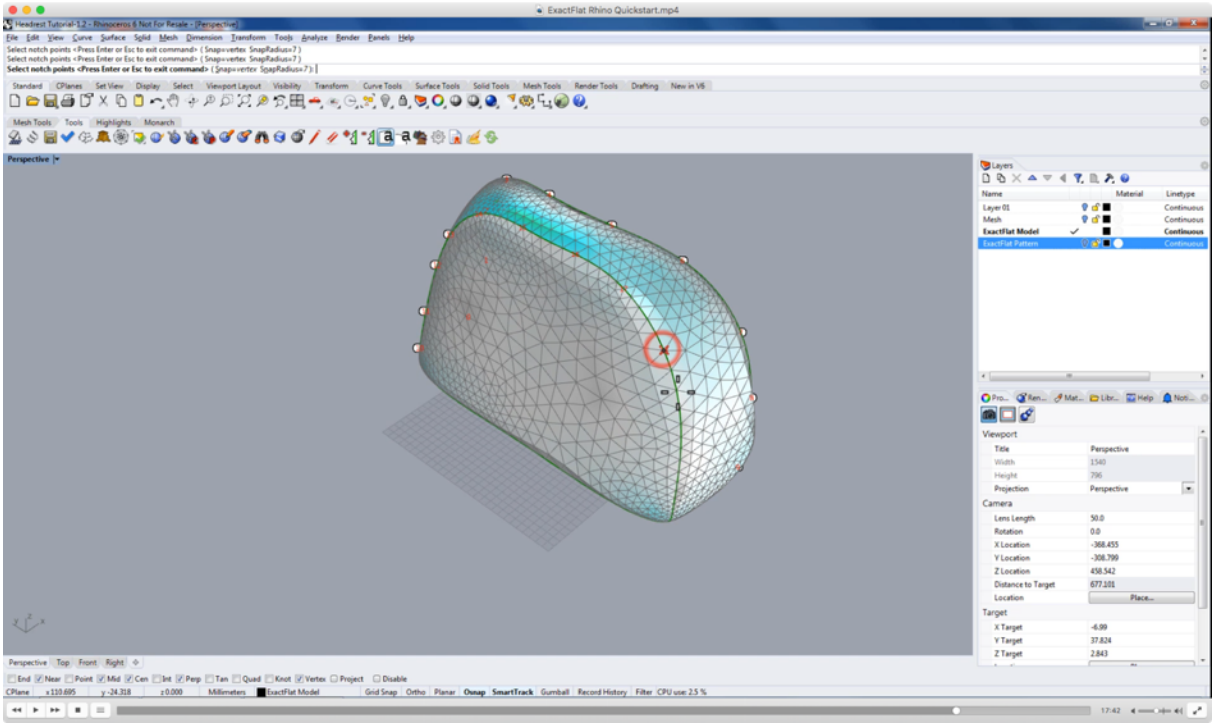
Video Time Code: 17:06

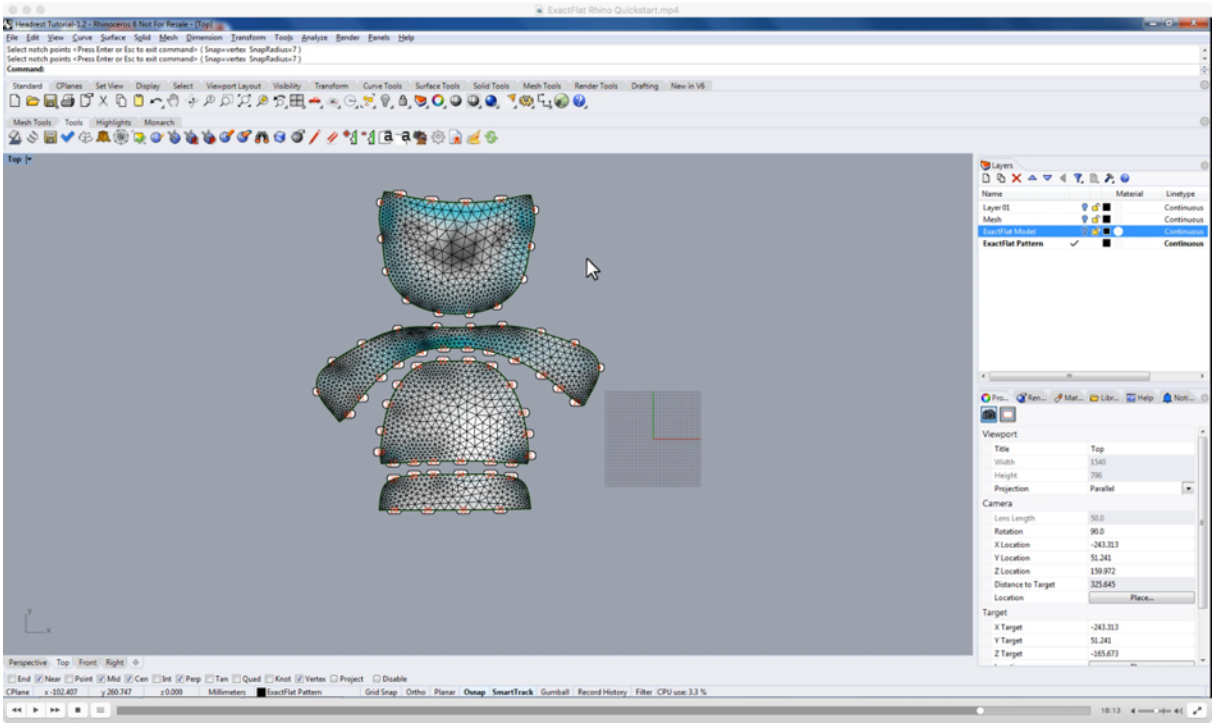
SPEAKER 1: We're going to minimize the top view port by double clicking on the top label. We'll maximize the perspective view current port by double clicking on perspective and now we can rotate our model around and we can start adding notches to the 3D model. We will again open up our notch tag dialog and we'll click **Add** to start adding notches again.

Video Time Code: 17:26

SPEAKER 1: So as we select our edges we can see that our notches are showing up where we select. And if we were to view our pattern again we would see that the notches are being added to the pattern, as well as the 3D model. The 3D reference model always represents the exact same changes made to the pattern and vice versa. So any change

made to the model will be represented in the pattern and any change made to the pattern will also show up on the 3D reference model.

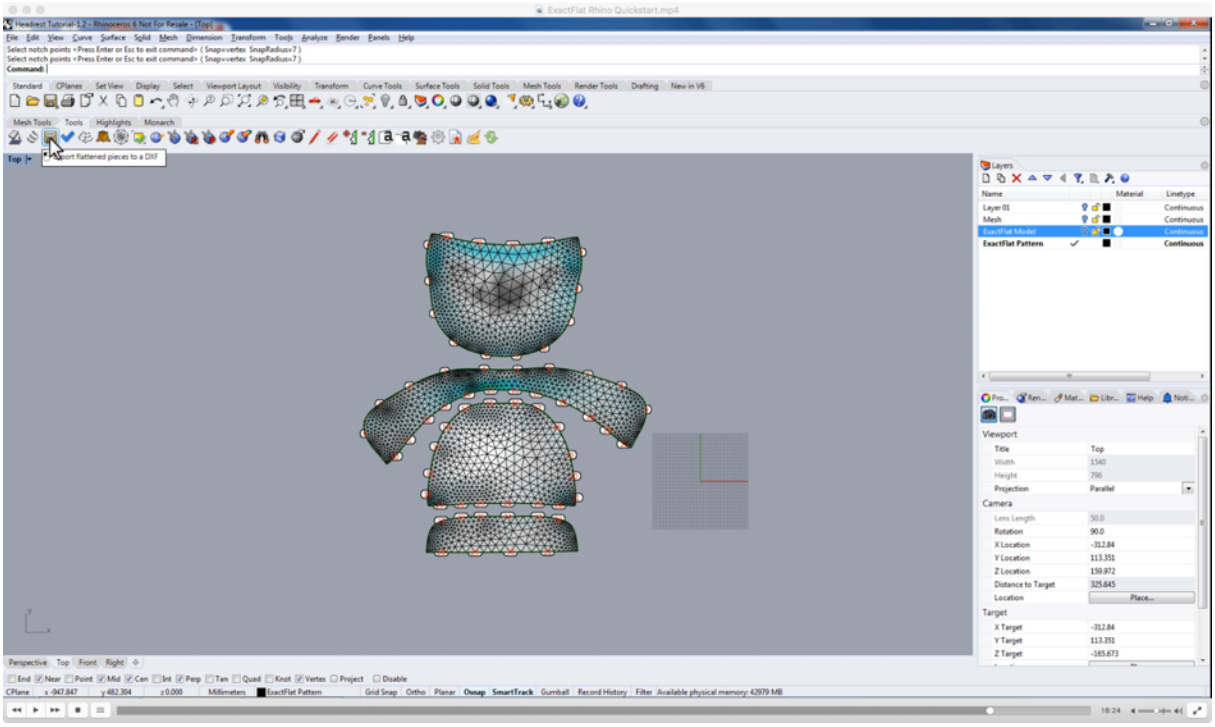




17. Creating A DXF

Video Time Code: 18:25

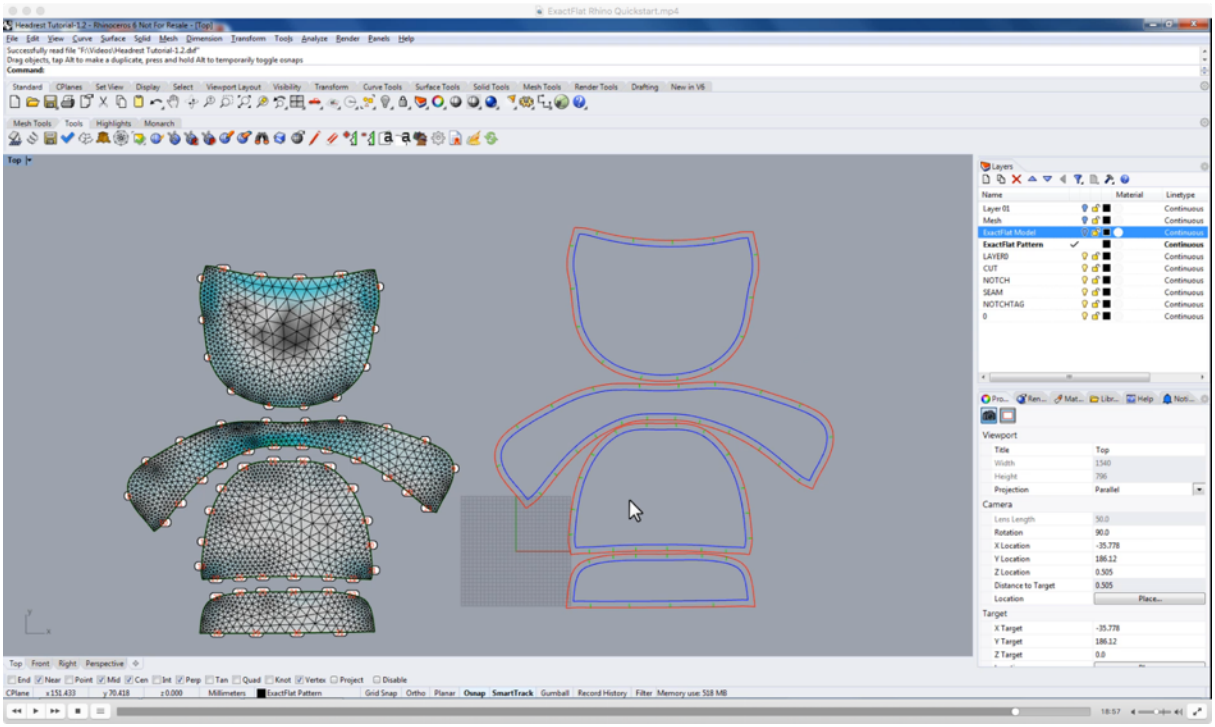
SPEAKER 1: Once all our notches have been added, we are ready to start creating a **DXF**. To do this, we will click the DXF icon in the ExactFlat tools toolbar and we will specify a DXF name.



18. Viewing and Checking the DXF File Including Layers

Video Time Code: 18:53

SPEAKER 1: We can use the import command to import the DXF into the current document so we can have a look at the structure of the DXF.



As we zoom in, we can see that all the notches have been created where we specified them. We can also see that each notch has a tag added to it. And when we start looking at the structure of the pattern, we can see we have a **blue seam line**, which represents the perimeter of the pattern piece, as well as a **red cut line** which is the pattern piece plus an optional **seam allowance**. The optional seam allowance is configured in the **ExactFlat options** panel. And if we move this pattern piece over the top of the original mesh, we can see that the blue seam line matches the perimeter of the mesh.

Video Time Code: 19:36

SPEAKER 1: Furthermore, if we start looking at the layer structure, we can see that all the cut lines have been created on a cut layer and we can turn that layer on and off. All the seam lines have been created on a separate **seam layer**. All the notches have been created on a separate **notch layer** and the tags themselves have been created on separate **tag layer**. So, if you zoom in and turn the tag layer off, we can see the text disappearing. This is important because when we bring this to over to a cutting table, we can change the layer names and we can also turn the individual layers on and off and this allows us to very easily assign different tools, whether it's a cutting tool or a pen tool to the different layers.

This has been a very quick overview of the basic functionality of ExactFlat for Rhino. I hope this video has been helpful and have a wonderful day.