Constructing a Headlight Nose Piece

Preface

In this lesson, you will construct a headlight nose piece using TrueSurf Master. The completed part should look similar to Figure 1 below.

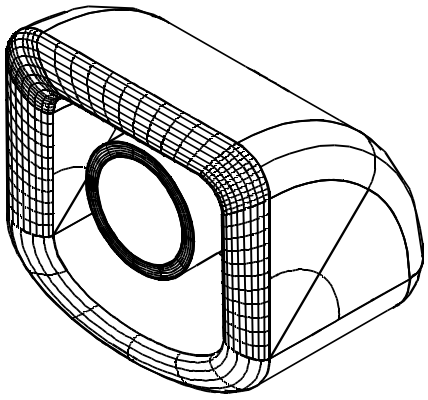

Figure 1:

Defining the Basic Shape

First, you are going to define the basic shape of the nose piece. The next few drawings will be created in the front view.

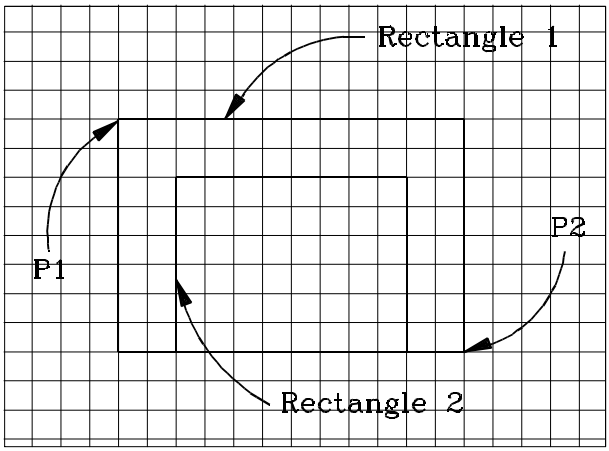

Figure 2:

1. Load the drawing HEADLITE.CXD.
2. Click on **Draw > Rectangle > Two Corners**.
3. Set the -Rectangle Plane ? modifier to “view” to ensure that the rectangle will be horizontal to the specified front view.
4. In the front view, draw a rectangle starting at point P1 and ending at point P2. Use the grid already established to help find your points.
5. In the same view, draw a rectangle about two units smaller than the first, but with the bottom of the second rectangle in line with that of the

first.

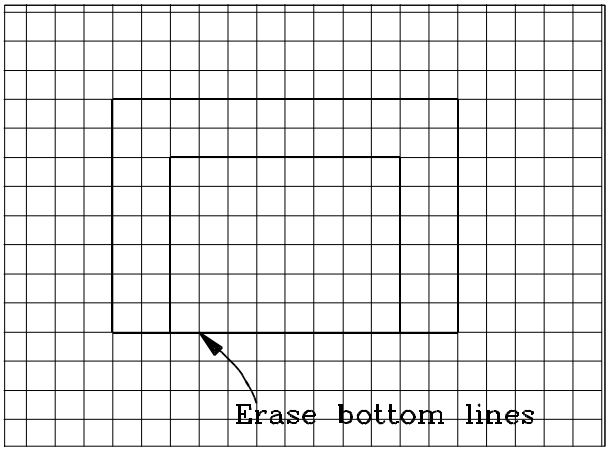

Figure 3:

6. Click on **Modify > Erase Element** and remove the lines along the bottoms of the rectangles by clicking on the bottom lines two times.

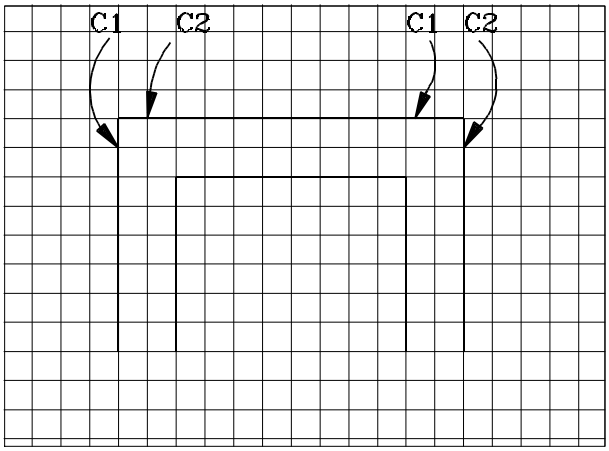

Figure 4:

7. Click on **Modify > Corner > Fillet Curve.**

8. Set the modifiers as follows:

   -Trim ? to “both”
   -Circle Part ? to “fillet”
   -Radius ? to 3

9. Click on points C1 and C2 as demonstrated in the figure at left, to create fillets on the corners.

10. Repeat Step 8 for the corners of the smaller rectangle, setting the -Radius ? modifier to 2. Your results should be the same as Figure 5.

Creating the Outer and Inner Walls

In the next series of steps you will rotate the profile 90 degrees to create the inner and outer walls of the headlight nose piece as shown in Figure 6.

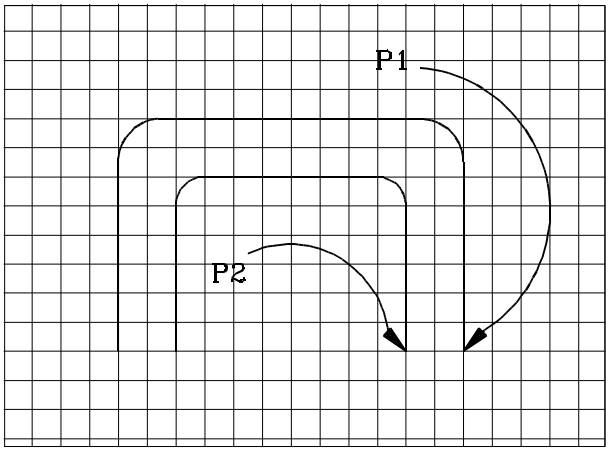

Figure 5:

11. Click on **Select > Select All In** and select the entire drawing using a rubberband box.

12. Click on **Draw > Surface > Rotation**.

13. Set the -Angle ? modifier to 90.

14. Click on points P1 and P2 as indicated. The order in which you pick the points determines the direction of the rotation. The points that you pick should be at the ends of the lines as shown.

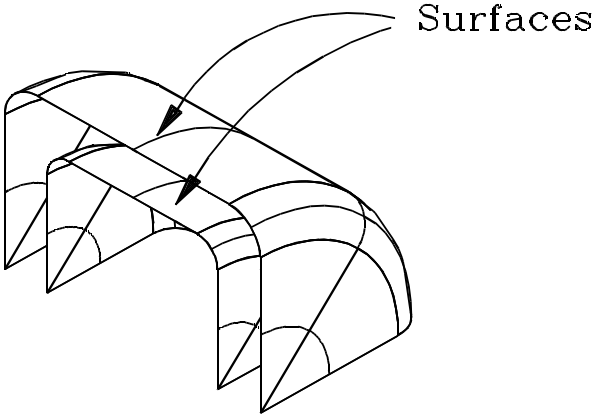

Figure 6:

Figure 6 shows the surfaces that are generated after steps 11-14.

Blending Surfaces Between the Inner and Outer Walls

A blend surface is a surface that joins previously built surfaces. The edges of the blend surface are guaranteed to be tangent to the edges of the surfaces to which it connects. In this section, you are going to do a series of blends between the inner and outer walls of the nose piece. You will do this by first picking the surface edges of the surfaces that you wish to blend, and by then clicking anywhere within the Work Area to generate the blend surface.

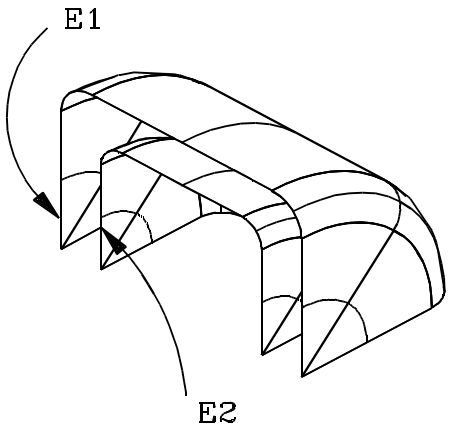

Figure 7:

15. Click on **Draw > Surface > Blend > 2 Surfaces**.

16. Set the -Flow lines: modifier as follows:

    #U to 10
    #V to 10
    Surface Edge to Single Boundary

    You can change these values later if you wish.

17. Click on E1 and E2 in the locations as shown, then click anywhere in the Work Area to accept the specified surface edges, and to generate the blend surface between them.

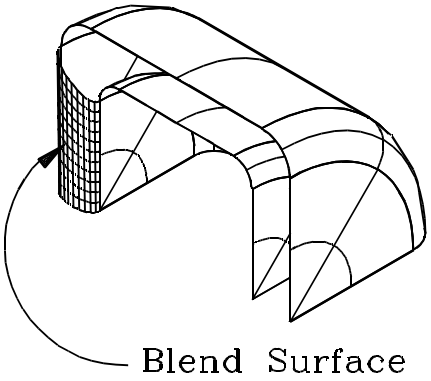

Figure 8:

Where you click on the surface edges determines the blend. Therefore, pick your points in the same location on both surface edges. For example, either pick both points towards the tops of the edges, or otherwise, pick both points towards the bottoms of the edges, as shown in Figure 7.

Clicking on the surface edges and then clicking anywhere within the Work Area gives you the opportunity to change your mind before the blend surface is created.

When you click on a surface edge, that edge becomes highlighted in red. If the edge that you pick belongs to more than one surface and the wrong surface is highlighted, click on OTHER-SURFACE to pick the other surface shared by that edge.

If you click on the wrong side of a surface edge or on the wrong edge, click on BACKUP to go back to your previous point. You must use the OTHER-SURFACE and BACKUP functions **before** clicking in the Work Area to generate the blend surface.

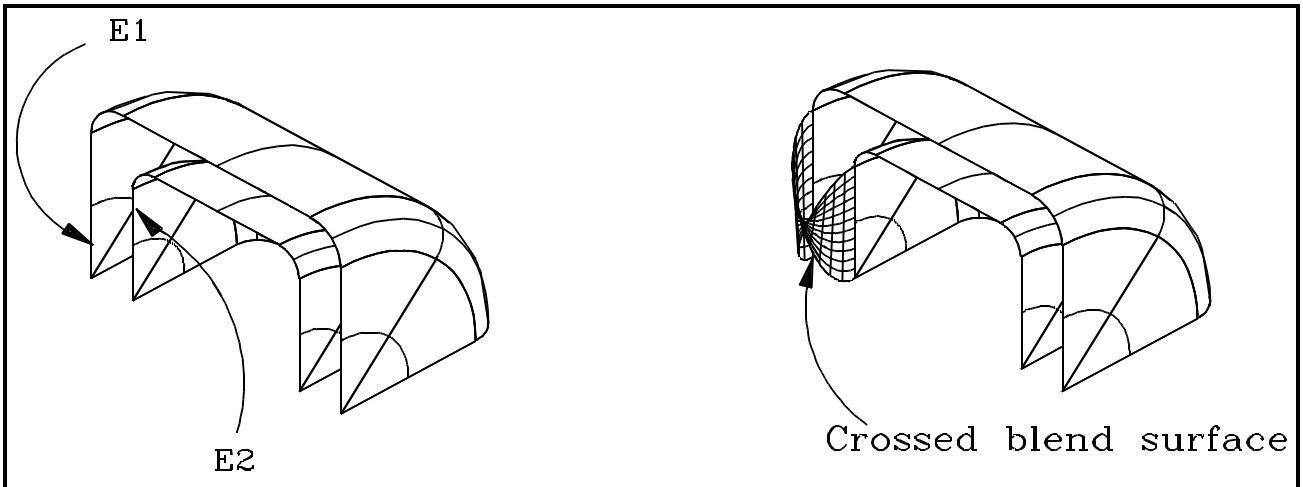

Figure 9: CROSS BLENDED SURFACES

If you pick one point near the top of one surface edge and the other point near the bottom of the corresponding surface edge, the blend will cross, as demonstrated in this figure. To undo a crossed blend surface, click on BACKSPACE three times to remove the surface and two geometry elements.

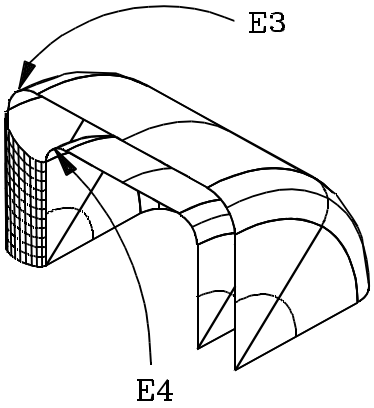

Figure 10:

18. Click on E3 and E4 to pick your second set of surface edges.

19. Click anywhere within the Work Area to generate the blend surface.

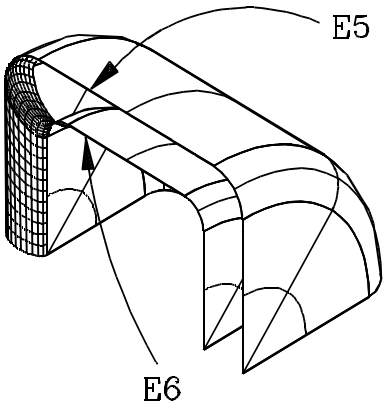

Figure 11:

20. Click on E5 and E6 to pick your third set of surface edges.

21. Click anywhere within the Work Area to generate the blend surface.

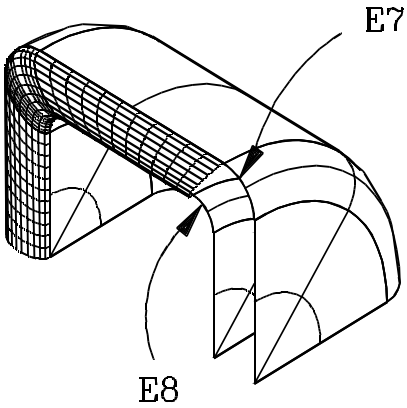

Figure 12:

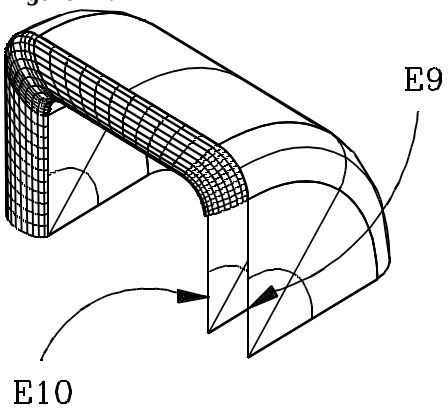

Figure 13:

22. Click on E7 and E8 to pick your fourth set of surface edges.

23. Click anywhere within the Work Area to generate the blend surface.

24. Click on E9 and E10 to pick your fifth set of surface edges.

25. Click anywhere within the Work Area to generate the blend surface.

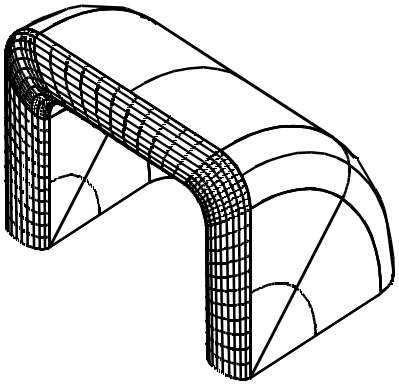

Figure 14:

At this point, your part should look like this one in Figure 14.

Making the Cylindrical Opening

Now, you are going to make the cylindrical opening of the nose piece. To do this, you will place two circles in the front view of the object, and then sweep them through the inner and outer walls of the part.

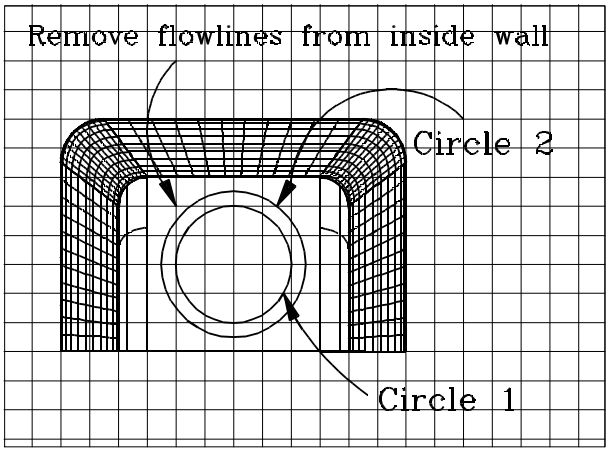

Figure 15:

26. Click on **Draw > Circle > Center Radius.**

27. Set the modifiers as follows:

    -Radius ? to 4
    -Arc Plane ? to “view”

28. Using the grid as a snap aid, place a circle in the middle of the inside wall.

29. Reset the -Radius ? modifier to 5.

30. Press **Enter** to place the new circle at the same location as the first circle.

In the next few steps, you will extrude the circles through the walls of the nose piece, thereby creating two cylinders.

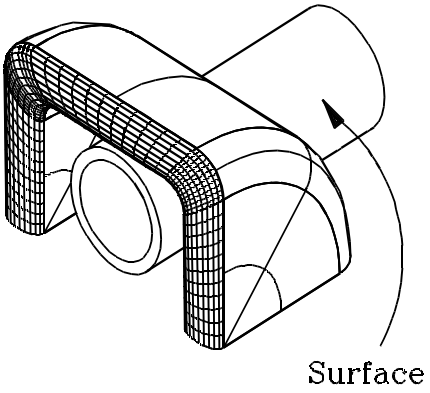

Figure 16:

31. Click on **Select > Select Element** and click on both of the circles in any view.

32. Click on **Modify > Sweep > Linear, Surfaces**.

33. Click anywhere in the drawing to place a pick up point.

34. Type Ctrl+ <Page Down> 25, then press **Enter** to extrude the circles a distance of 25 in the -z direction.

Intersecting and Cutting the Opening and the Inside Wall

Next, you are going cut the inside wall of the part at the place where it intersects with the cylindrical opening. You are also going to cut the opening itself, at the place where it meets with the inside wall. CADMAX will automatically generate any intersecting geometry where the cylindrical opening and the wall intersects.

NOTE: The front and side surfaces of the drawings have been removed in the following two sections to better show you the result of each action taken.

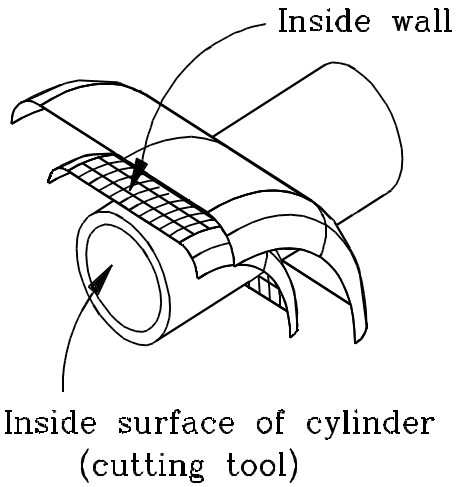

Figure 17:

In the next series of steps, you will cut the smaller cylinder where it intersects the inside wall and then cut the inside wall where it intersects the cylinder. You will then remove the portion of the cylinder that extends beyond the inside wall, and the portion of the inside wall within the cylinder, thereby creating a hole in the inside wall.

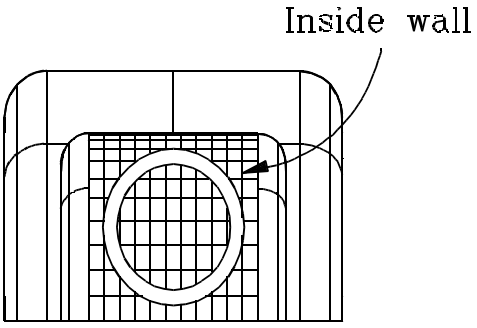

Figure 18:

35. Click on **Select > Select > Surface**.

36. Click on the inside wall in the front view to select it. Make sure that no other geometry elements are within the cursor when you click.

NOTE: You will notice that flow lines have been added to Figure 18. This is to better show you the results after **Intersect+cut**.

37. Click on the surface of the smaller cylinder (in the isometric view) to select it, making sure that no geometry elements are within the cursor.

38. Click on **Modify > Edit Surface > Intersect & Cut**.

39. Click on either the smaller cylinder or the inside wall to identify it as your cutting tool.

The cutting tool does not have to be a selected surface. When you use **Intersect & Cut**, all selected surfaces will be acted upon where they intersect with the cutting tool. In this case, since you need to cut both the cylinder and the inside wall, both surfaces need to be selected. If you only wanted to cut the cylinder, then you would only select the cylinder, and the inside wall would be your cutting tool.

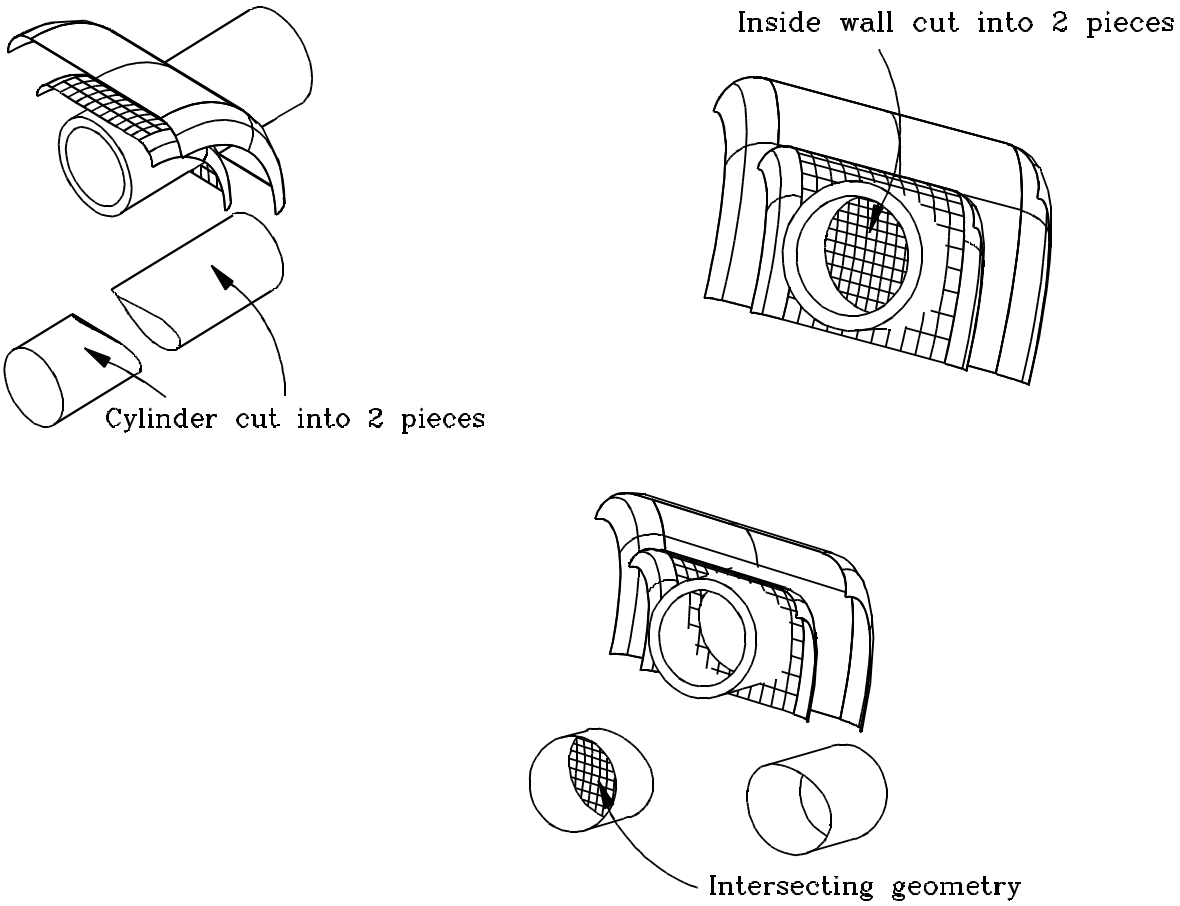

Figure 19:

As you can see from Figure 19, CADMAX cuts the inside surface of the cylinder into two pieces where it intersects with the inside wall, and cuts the inside wall into two pieces where it intersects with the cylinder. CADMAX also generates the intersecting geometry where the cylinder and the selected surface (inside wall) intersect.

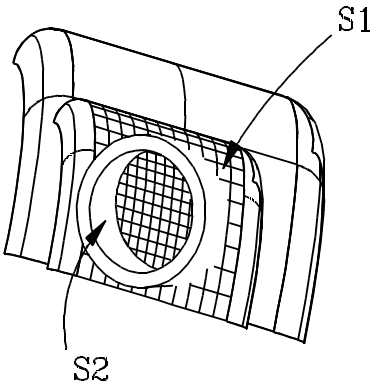

Figure 20:

40. Click on **Select > Unselect Element**.

41. Click on surfaces S1 (in the front view) and S2 (in the isometric view) as shown, to unselect the cylinder and the inside wall. These are the parts that you want to keep.

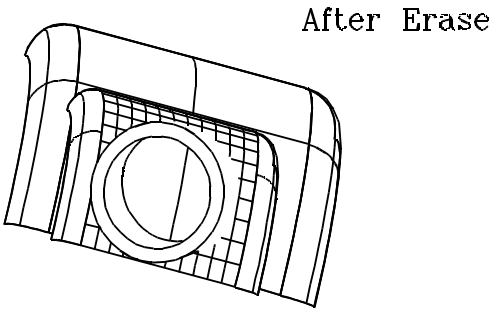

Figure 21:

42. Click on **Modify > Erase Element** to remove the smaller cylinder where it extends beyond the inside wall, and to remove the portion of the inside wall within the cylinder.

43. Click on **Select > Clear**.

Intersecting and Cutting the Opening, Inside and Outside Walls

In the previous section, you cut the inside surface of the cylinder and the inside wall. In this section, you will cut the larger cylinder to the inside wall. You will also create a hole in the outside wall where the larger cylinder would have intersected with that wall. Again, CADMAX automatically generates the intersecting geometry at the places where the cutting tool and any selected surfaces intersect.

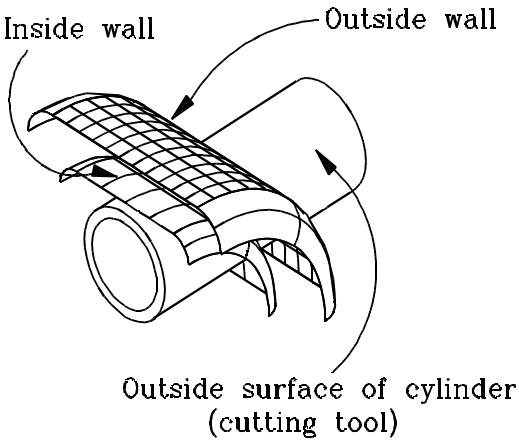

Figure 22:

44. Click on **Select > Select Element**.
45. Click on the outside wall to select the surface.
46. Click on the surface of the larger cylinder to select it.
47. Click on the inside wall of the nose piece to select it.
48. Click on **Modify > Edit Surface > Intersect & Cut**.
49. Click on the surface of the larger cylinder to identify it as your cutting tool.

Unlike the previous case, the selection of the cutting tool is very important here. In this instance, the cutting tool must be the cylinder. The cylinder is the only surface that intersects with the inside and outside walls of the nose piece. If you were to select one of the walls of the nose piece as the cutting tool, you could not generate the intersection with the other wall, since the two walls do not intersect.

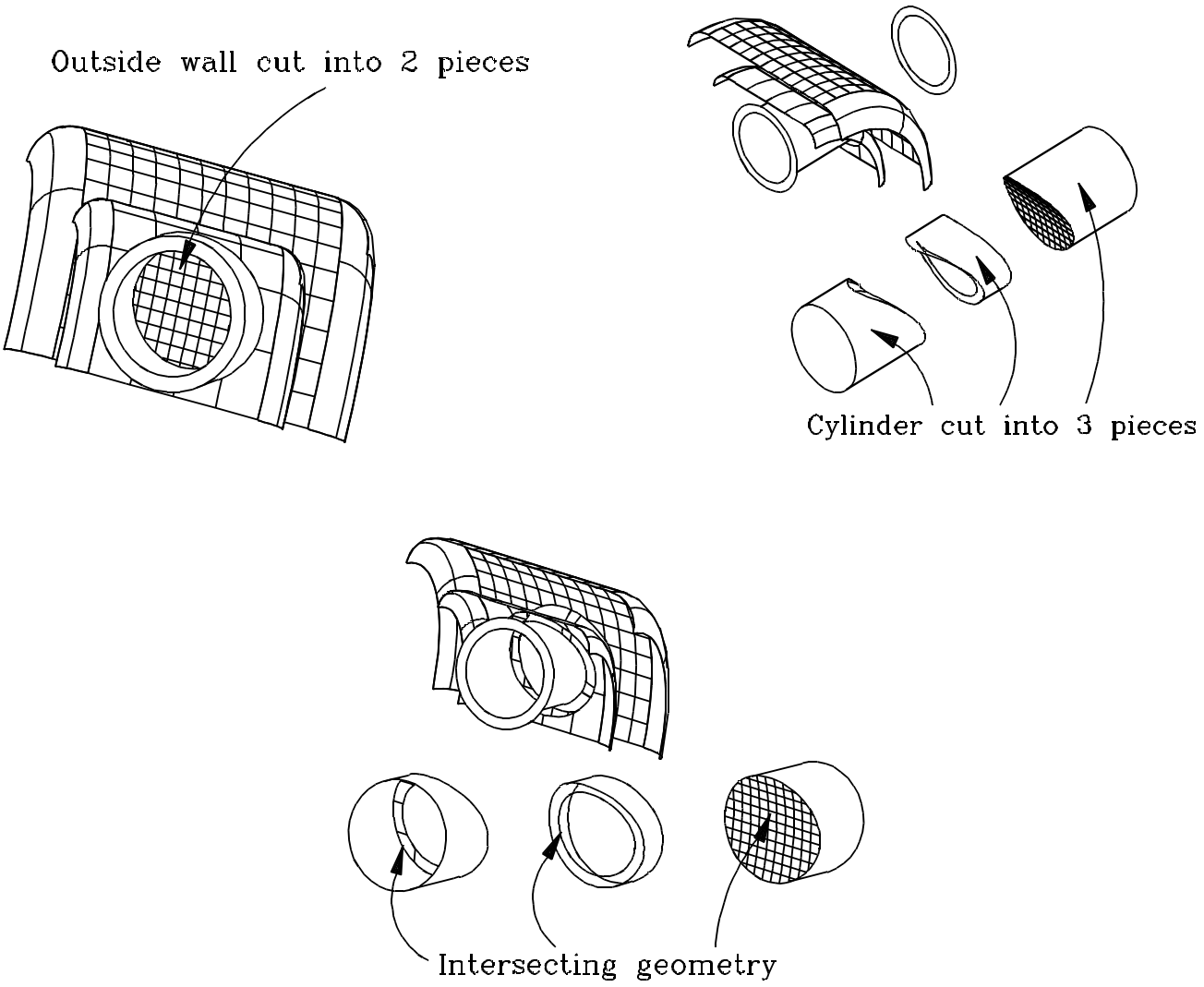

Figure 23:

In Figure 23, you can see that the cylinder is cut into three pieces where it intersects with the two walls, and the walls are cut into two pieces where they intersect with the cylinder. You can also see that CADMAX generates the intersecting geometry where any selected surfaces (the walls) intersect with the cutting tool (the cylinder).

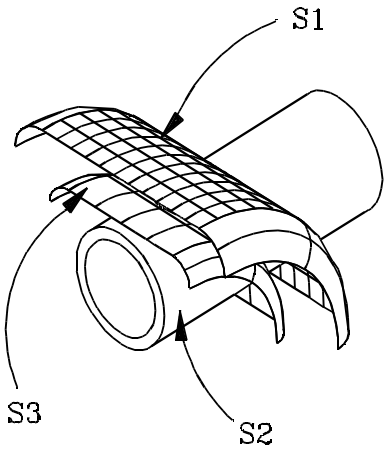

Figure 24:

50. Click on **Select > Unselect Element**.

51. Click on surfaces S1, S2, and S3 as shown in Figure 24, to unselect the outside surface of the cylinder, the inside wall, and the outside wall. These are the parts that you want to keep.

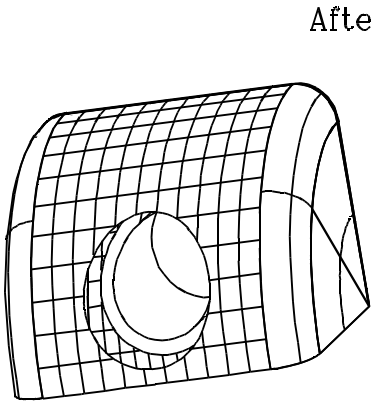

Figure 25:

52. Click on **Modify > Erase Element** to remove the cylinder from beyond the inside wall, and to remove the wall section where the cylinder lies.

53. Click on **Select > Clear**.

Blending the Inside and Outside Walls

If you look at the previous drawing, you can see the separation of the inside and outside walls. We are going to place a blend surface between the two walls, thereby joining them.

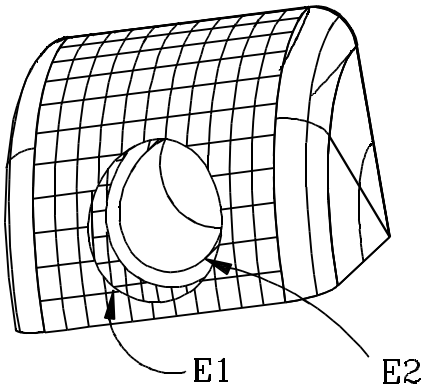

Figure 26:

54. Click on **Draw > Surface > Blend > 2 Surfaces**.

55. Click on E1 and E2 as shown to pick your surface edges.

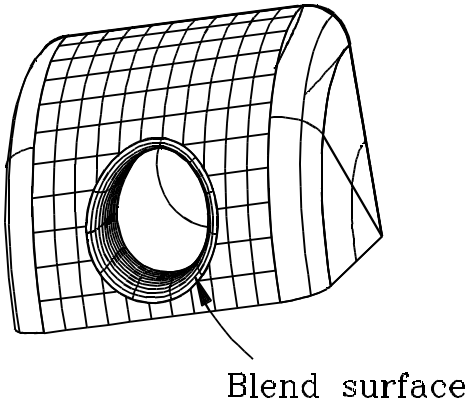

Figure 27:

56. Click anywhere within the Work Area to generate the blend surface.

Rounding the Front Edges of the Cylinder

Here, you will make a simple blend between the inside and outside surfaces of the cylinder.

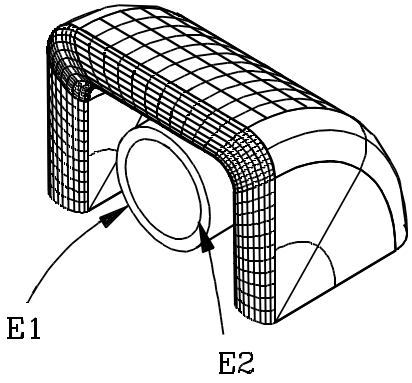

Figure 28:

57. Click on **Draw > Surface > Blend > 2 Surfaces**.

58. Click on E1 and E2 as shown to pick your surface edges.

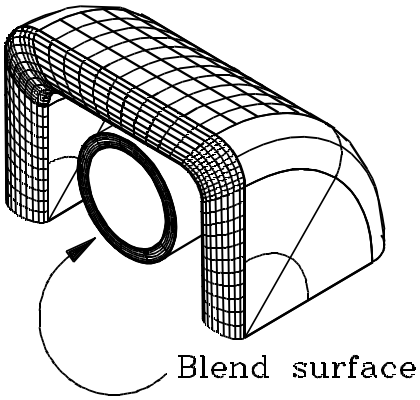

Figure 29:

59. Click anywhere within the Work Area to generate the blend surface.

Creating the Floor of the Piece

In this section, we will create the "floor" of the nose piece. To do this, we need to generate a blend surface between the two bottom, inside edges of the piece, and then another blend between the two bottom, outside edges of the piece. Then, we need to make a final blend between these two, new surfaces.

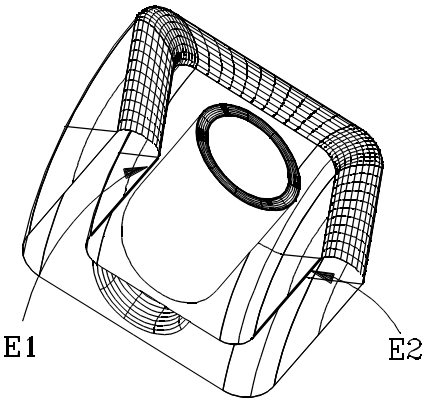

Figure 30:

60. Click on **3D View > Dynamics > Roll.**

61. Click twice on any view and roll it so that you can see the bottom edges of the part.

62. Click on **Draw > Surface > Blend > 2 Surfaces**.

63. Set the -Surface Edge ? modifier to "single boundary".

64. Click on E1 and E2 to pick your first set of surface edges.

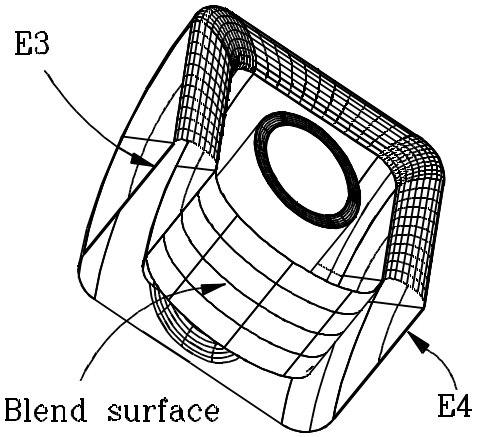

Figure 31:

65. Click anywhere within the Work Area to generate the blend surface.

66. Click on E3 and E4 to pick your second set of surface edges.

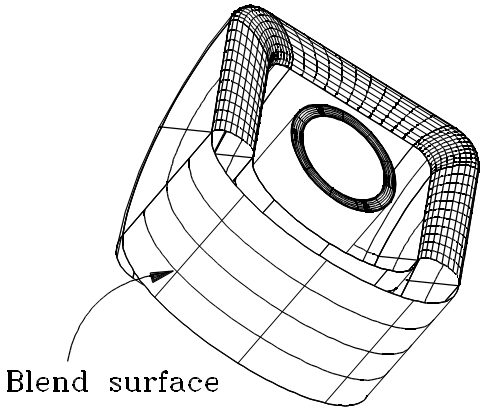

Figure 32:

67. Click anywhere within the Work Area to generate the blend surface.

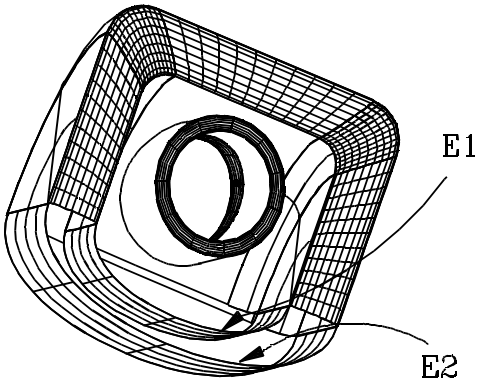

Figure 33:

68. Click on E1 and E2 to pick your surface edges.

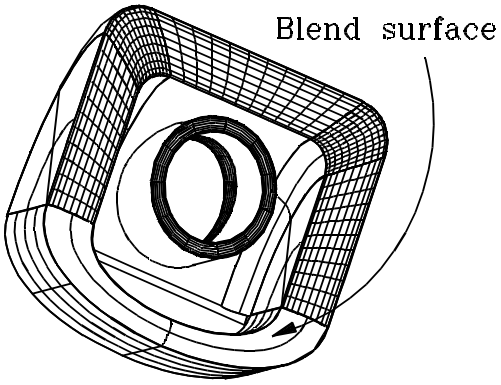

Figure 34:

69. Click anywhere within the Work Area to generate the blend surface.

Finishing Up

Now that you've constructed the nose piece, there's only one thing left to do: finish up! If you roll your nose piece so that you can see the bottom of the back of it, you will notice that there is a hole in both walls. You're going to close the hole, and the nose piece will be complete!

To do that, you're going to do more surface blending, but using a new function.

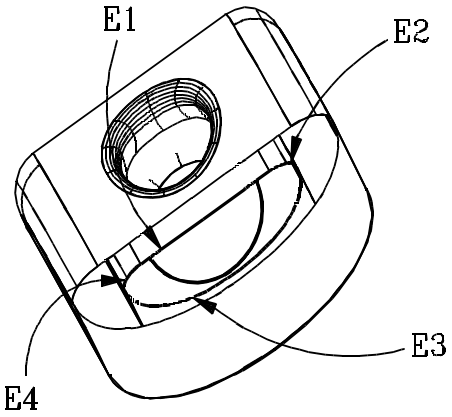

Figure 35:

70. Click on **3D View > Dynamics > Roll**.

71. Click twice on any view and roll it so that you can see the bottom of the back of the piece.

NOTE: You will notice that the opening is bounded by the edges of four surfaces. To close the opening, you will create a blended surface between the four edges.

72. Click on **Draw > Surface > Blend > 4 Surfaces**.

73. Set the -Surface Edge ? modifier to "whole side".

74. Click on E1, E2, E3, and E4, in any order, to pick your first set of surface edges.

75. Click anywhere within the Work Area to generate the blend surface.

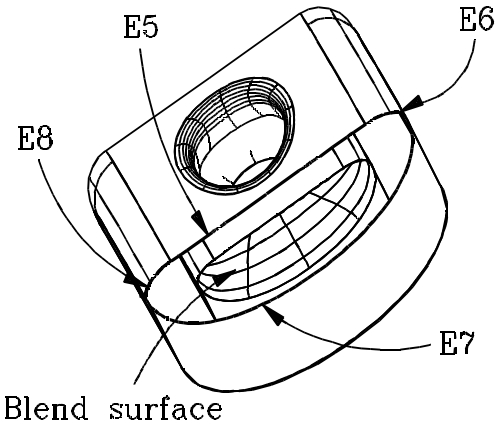

Figure 36:

76. Click on E5, E6, E7, and E8, in any order, to pick your second set of surface edges.

77. Click anywhere within the Work Area to generate the blend surface.

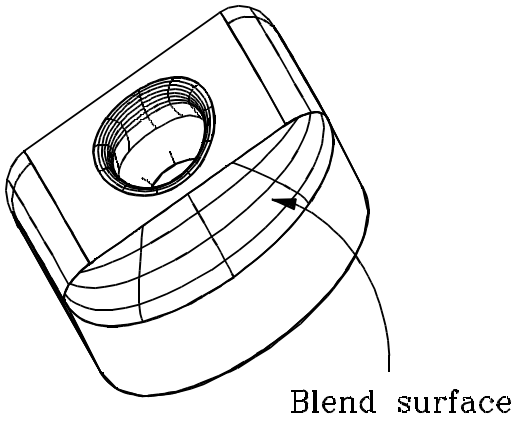

Figure 37 shows the resulting blend surface.

Figure 37:

That's it! You're done! Your headlight nose piece should look something like this:

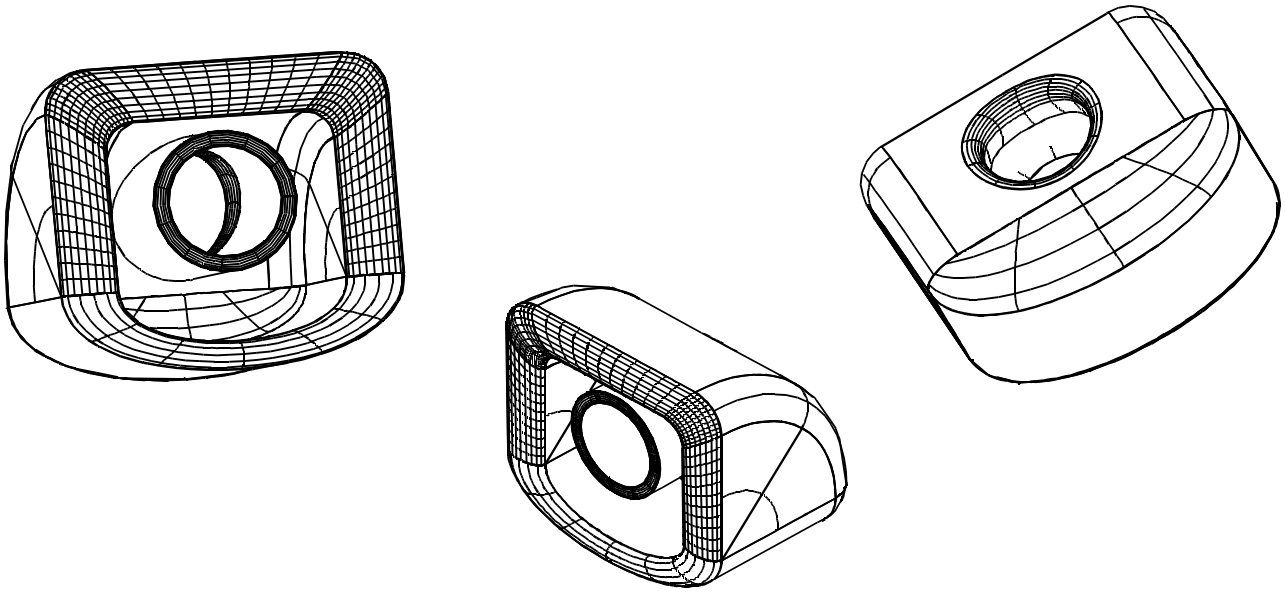

Figure 38: