Learning Objectives

After completing this tutorial, you will be able to:
- Use the new 3D Modeling tools in AutoCAD 2007.

Required Competencies

Before starting this tutorial, you should have been able to:
- Use the 3D Modeling tools available in previous releases of AutoCAD
- Use AutoCAD at an intermediate to advanced level
- Manipulate the UCS

The new 3D modeling tools in AutoCAD 2007 allow you to model complex freeform shapes that previously were not possible to model in AutoCAD. This tutorial assumes that the user is completely familiar with creating precise 2D sketches of arcs, lines, polylines, and splines in any location as well as the 3D tools from previous releases.
1. The first thing I would do is turn off the grid. In almost 20 years of doing CAD I have not had anyone give me a convincing reason for using a grid except for a few narrowly defined cases. I consider the use of a grid the mark of an amateur. Notice that there is a new tool in the tray marked DUCS. The Dynamic User Coordinate System will allow you to sketch on planar faces of solids without having to manually change the UCS.

I would also turn on the LWT lineweight and experiment with the Settings display scale to get a thickness you can easily see.

2. You may need to experiment with background settings to see you sketch linework.
3. In the upper right hand corner of the screen you will find the new **Dashboard**.

![Figure 3](image-url)

**3D Make control panel**

**3D Navigate control panel**

**Visual Style control panel**

**Light control panel**

**Materials control panel**

**Render control panel**

Figure 3

4. If you move the mouse to the gray bar in each of the control panels a down pointing chevron will appear that will reveal more tools if you click on it.

![Figure 4](image-url)

Figure 4
5. Right Mouse Button (RMB) click in one of the control panels of the Dashboard and set the visibility of the control panels as shown. Expand the 3D Make control panel. This will give you access to both the 2D Draw and the 3D Make tools.

Figure 5
6. In the lower right corner of the screen you will find the Tool Pallets. I prefer to have the Modify tab selected. (You should know how to customize the Tool Pallets from previous releases.) I prefer to have the tool description text turned off and I have added a few tools that I use often, particularly Shell, which were left off of the Dashboard. Unfortunately, the Dashboard cannot be modified.

Figure 6
7. Open the file named Tutorial 1. Turn off all layers except the Polysolid layer and make the Polysolid layer the active layer. I have set the delobj = 0 that all entities will be preserved. Set the Visual Style to Realistic.

- Select the Polysolid tool and RMB Select Object and click on the wireframe sketch.

Undo and then experiment with different settings for Justify, Width, and Height.

- Select the Polysolid tool and RMB Select Width, experiment with the settings.
- Select the Polysolid tool and RMB Select Height, experiment with the settings.
- Select the Polysolid tool and RMB select Justify, experiment with the settings.

8. You should be able to figure out how to use these tools on your own. Pyramid is new.
9. Turn off all layers except the Extrude Surfaces layer and make it the active layer. Select the Extrude tool and extrude the arc, polyline, spline and line as surfaces. Surfaces in previous releases of AutoCAD were of limited value, but in AutoCAD 2007 surfaces can be used to edit solids.

![Figure 9](image)

10. Turn off all layers except the PressPull layer and make it the active layer. Do a List (li) on the entities and notice that there is a polyline, line, arc, and spline.

![Figure 10](image)
11. Select the Presspull tool (or hold Ctrl + Alt) and click inside the closed boundary and pull up a solid. In previous releases you would have had to have a closed polyline boundary to get something similar.

![Figure 11](image1.png)

**Figure 11**

12. Draw a circle on the face of the solid. (You might want to turn off osnap and set your active color to something other than the solid color. (I will assume after this that you are an experienced 3D user and not bother you with the obvious.) Notice that with the new Dynamic UCS that you did not have to reset your UCS to the top of the solid to draw a circle on that face. Try drawing another circle on one of the vertical planar faces.

![Figure 12](image2.png)

**Figure 12**
13. Select the Presspull tool again and click in the circle and move the cursor below the solid to “press” a hole through the solid. Repeat for the circle on the vertical face. In previous releases you would have had to create a solid cylinder and then subtract. If you wanted to “match machine” drill through multiple parts you can use the Presspull tool multiple times and the individual parts will remain separate parts with matching holes.

![Figure 13](image_url)

14. Turn off all layers except the Revolved Surfaces layer and make it the active layer. Revolve the spline and arc about the vertical line as surfaces.

![Figure 14](image_url)
15. Turn off all layers except the Sweep layer and make it the active layer. Start the Sweep command and select the green triangle as the object to sweep and the polyline rectangle as the path.

![Figure 15](image1.png)

16. Start the Sweep command again and select the red semi-circle as the object to sweep. Hold down the Ctrl key and select the top edge of the triangular profile solid as the sweep path. Undo this step.

![Figure 16a](image2.png) ![Figure 16b](image3.png)
17. Type in the command XEDGES and select the swept triangular profile solid. The xedges command extracts the edges of a solid. Join the extracted top edges of the solid into a polyline. Sweep the semi-circle along the joined polyline path.

![Figure 17](image1)

18. Undo back to the xedges command. Notice that right angle of the swept triangle follows the rectangular path. Delete the swept solid. Start the Sweep tool and select the red triangle as the sweep object and the rectangle as the sweep path. Change the Visual Style to 3D wireframe and notice that the rectangular path runs through the middle of the triangular profile. If the profile is not perpendicular to the path AutoCAD realigns the middle of the profile to the path. Therefore you may need to explicitly locate your sweep profile.

![Figure 18a](image2)

![Figure 18b](image3)
19. Delete the solid. Type in the command UCS with the ZAxis and Object options and click on the end of the 3D spline. Repeat the UCS with ZA and O options and click on the other end of the 3D spline. Repeat selecting different entities. In AutoCAD 2007 the new ZAxis option for setting the UCS makes it very easy to set to a line, arc, polyline or spline end. Set the UCS back to World.

![Figure 19](image1.png)

20. Sweep the red circle along the line, polyline rectangle, 2D spline, and the 3D spline. Undo and then sweep along the 3D spline using the Alignment, No options. Delete the solid.

![Figure 20](image2.png)
21. Sweep the square tube region along the line as shown.

22. Sweep the region along the 3D spline path (this one may take a few seconds to complete). Undo the sweep.
23. Sweep the region again this time using the Twist option and enter 270° as the twist angle.

![Figure 23](image1)

24. Sweep the region along the rectangular polyline path.

![Figure 24](image2)
25. Sweep the blue line as a surface along the line path, rectangular polyline, 2D polyline, and 3D polyline paths.

![Figure 25](image)

26. If you haven’t already done so, expand the 3D Make control panel to reveal the new Helix command.

![Figure 26](image)
27. Turn off all layers except the Loft layer and make it the active layer.

![Figure 27](image1)

28. Loft the line to the arc and the polyline rectangle to the circle. Experiment with the Loft Settings. After experimenting undo and Loft with the Smooth Fit surface control.

![Figure 28](image2)
29. Turn on the Loft with Guides layer and loft the polyline rectangle to the circle with the Guides option and select the 16 guides.

Figure 29

30. Examine the different results.

Figure 30
31. Turn on the Loft with Path layer and loft the circles and arcs along the arc paths.

![Figure 31](image1.png)

32. Turn off all layers except the Planar Surface layer and make it the active layer. Select the Planar Surface tool and choose the Object option and then click on the circle the polyline rectangle and all of the edges of the irregular shape comprised of a polyline, arc, and spline.

![Figure 32](image2.png)
33. If you haven’t already done so, expand the 3D Make control panel to reveal the Thicken Surface tool and use it to thicken the planar surfaces.

![Figure 33](image)

34. Draw some closed shapes on the thickened surface solids. With DUCS active you do not have to change ucs to planar faces.

![Figure 34](image)
35. In AutoCAD 2007 is no longer necessary to create a 3D solid to imprint on a planar face of another solid. Select the Imprint tool and imprint the planar closed boundaries on the planar faces. Use the Color Faces on the Solids Editing toolbar to change the face colors.

Figure 35

36. I don’t have any examples for the Section Plane and the Flatshot tools at this time. I use the solview, soldraw, or solprof commands to create 2D layout views. I guess if you wanted these views as modelspace blocks you might find these useful. I would be interested in hearing about your implementation of these tools (please include dwg files if you contact me).

Figure 36
37. Turn off the visibility of all of the layers except the Helix layer and make it the active layer.

![Figure 37](image)

38. Sweep the blue polyline rectangle along the helix and spiral paths. Experiment with the Helix tool to create various helix/spiral curves.

![Figure 38](image)
39. Turn off all layers except the Slice layer and make it the active layer. If you examine the entities you will find a solid and two lofted surfaces.

![Figure 39](image1.png)

40. Select the Slice tool and following the command prompts select the solid, then slice with Surface option, and finally the side of the solid to keep.

![Figure 40](image2.png)
41. Repeat Slice for the other side and place the surfaces on the Hidden Surfaces layer. With combinations of extruded, revolved, planar, swept, and lofted surfaces used as Split tools complex freeform solid shapes can be modeled in AutoCAD 2007.

![Figure 41](image.png)

42. I do not have any uses for the Convert to Solids or Convert to Surfaces tools at this time.

![Figure 42](image.png)
43. Turn off all layers except the Ctrl Select layers and make it the active layer. Experiment with selecting faces, edges, or vertices while holding the Ctrl key and then editing the shape.

![Figure 43](image)

44. You can also Thicken many surfaces to solids. Go back to the surfaces created earlier and try using the Thicken command. Experiment with different distances – both negative and positive.

![Figure 43](image)
45. Check the Help files for new information on the following System Variables or Commands:

- `delobj`
- `3dalign` vs `align`
- `solidhist`
- `legacyctrlpick`
- `Shift + Spacebar` cycle pick

And see the New Features Workshop for additional information.