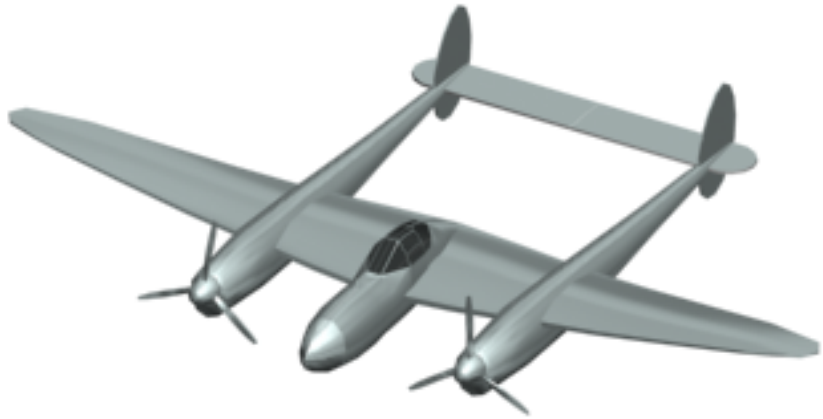# Refining the Airplane

3ds Max has modeling features that can help you build models more efficiently. These lessons describe each feature and show you practical ways you can use them when constructing models.

In this tutorial, you will learn how to:

■ Weld vertices with the Vertex Weld modifier.

■ Add detail to your model using Editable Poly tools.

■ Select scene elements using soft selection.

■ Use the HSDS modifier.

■ Use the Edit Normal modifier.

Skill level: Beginner to Intermediate

Time to complete: 2 hours (15 to 20 minutes per lesson)

Using the Vertex Weld Modifier

In this lesson, you'll work on a model that was built with an older version of 3ds Max. It's a low-poly model of an airplane that was created using the Mirror tool.
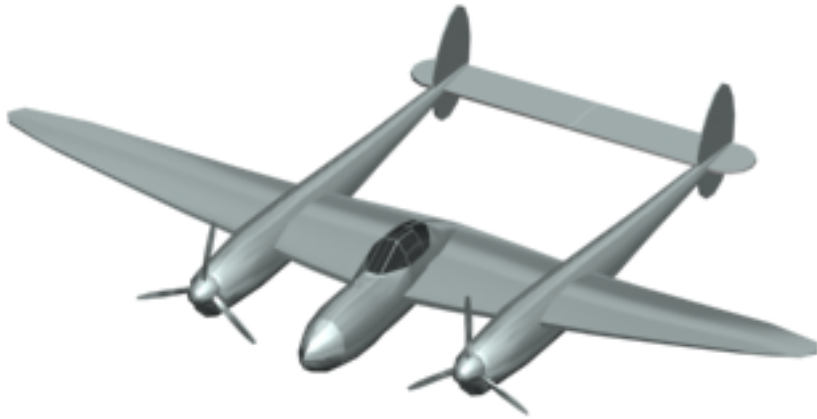
Low-poly airplane

Set up the lesson:

■ 🗁 On the Quick Access toolbar, click the Open File button, navigate to the the *\modeling\p38_lightning* folder, then open the *low_poly_p38.max* file. This scene includes an airplane named *Lightning*.

Weld the seam between the two halves:

This model was built in an earlier version of 3ds Max using the Mirror tool, so there is a seam of unwelded vertices where the two halves of the plane meet.

  1 In the Front viewport, select the airplane, *Lightning*.

  2 ⬚ Use Region Zoom to center the view on the cockpit section of the airplane.
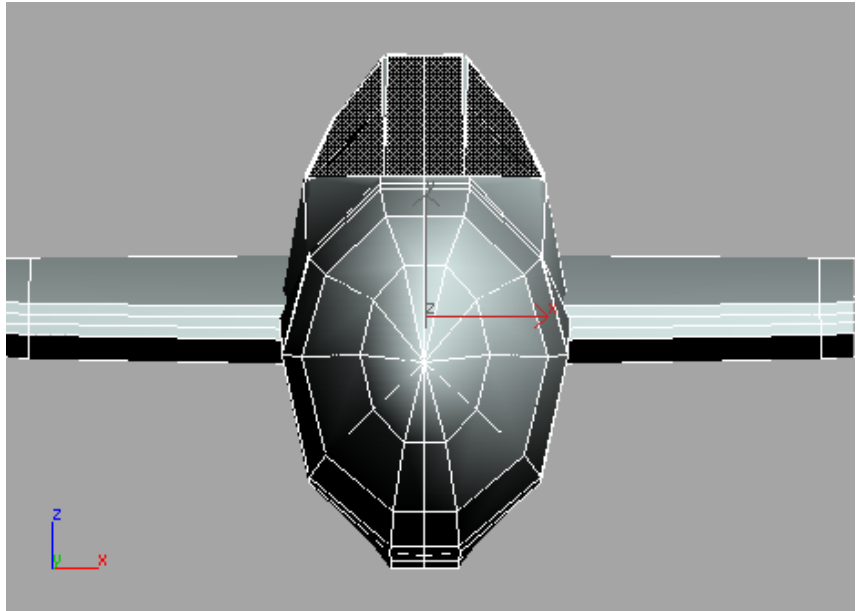
3 Choose Modifiers menu > Mesh Editing > Vertex Weld.

 You can also apply the Vertex Weld modifier from the Modify panel > Modifier list > Object-Space Modifiers > Vertex Weld.

4 In the Parameters rollout, set the Threshold value to **.75"**.

This is one way to clean up the model.

> **NOTE** Be careful not to set Threshold too high. If you do, the model will begin to degrade as more vertices get welded together.

5 Experiment a little by setting the Threshold to **1'**, then **6"**, and then **3"**.

While the Vertex Weld can be used to reduce the number of faces a model has, greater values distort the model drastically.

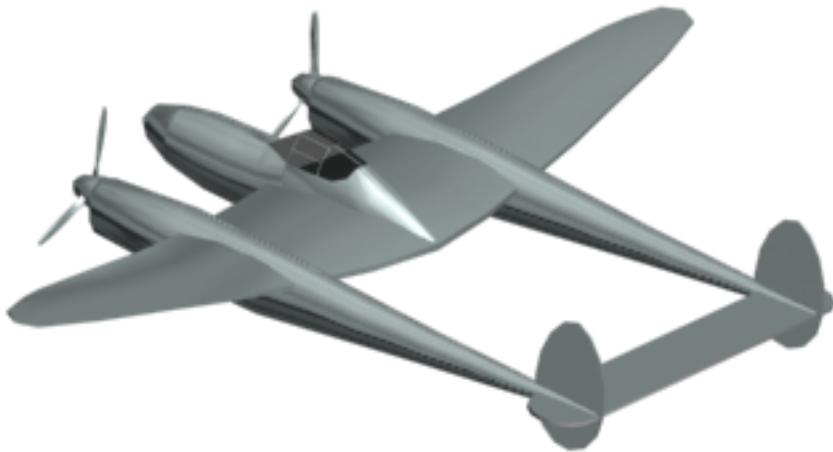**6** Set the Threshold back to **.75"** and save the scene as **welded_lightning.max**.

Using the Editable Poly Tools

3ds Max has a set of handy editable poly tools that improve the way you can clean up and add detail to your models.

This set of lessons focuses on several tools.

Set up the lesson:

■ Open *low_poly_p38_02.max* from the *\modeling\p38_lightning* folder.

Detail the air intakes:

The first detail you'll add are the air intakes on the *sponsons* of your Lightning. The sponson is the long extension between the wings and the tail section of the airplane.

1   In the Right viewport, Zoom Region around the sponson between the wing and tail.
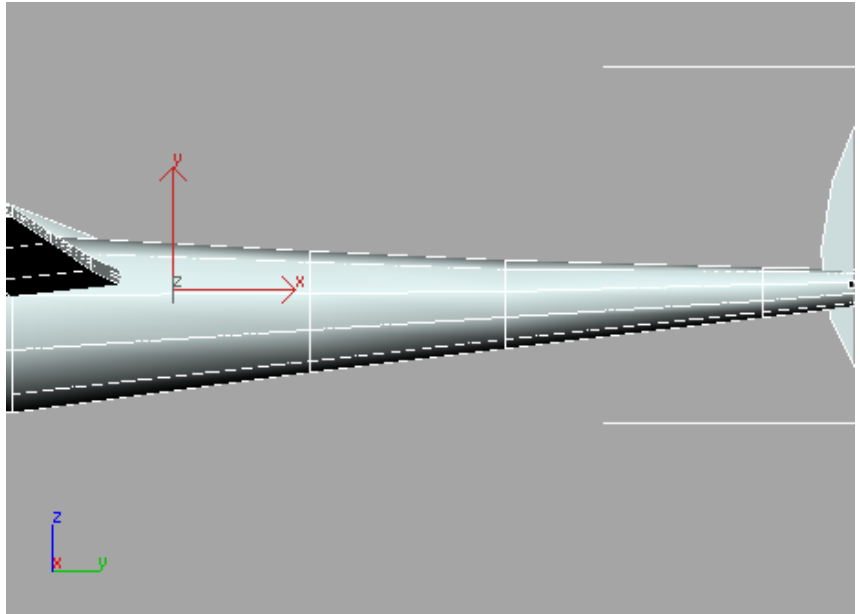
2 Select the object, *Lightning.*

3 Go to the Modify panel and click the Editable Poly entry in the modifier stack.

> **NOTE** Half of the airplane disappears because you're working at a lower level in the modifier stack.

**4** Click the Show End Result On/Off Toggle button that is located along the bottom of the modifier stack.

Turning on this toggle lets you see the results of additional modifiers all way up the modifier stack. You now see the other half of the airplane generated by the Symmetry modifier that was used in the sample file you opened for this lesson.

5 ![red square icon] On the Selection rollout, click the Polygon button and make sure Ignore Backfacing is off.

6 ![select object icon] Activate the Select Object tool and drag a window across the three polygons in the center of the sponson. Make sure the polygons at the top and bottom are not selected.
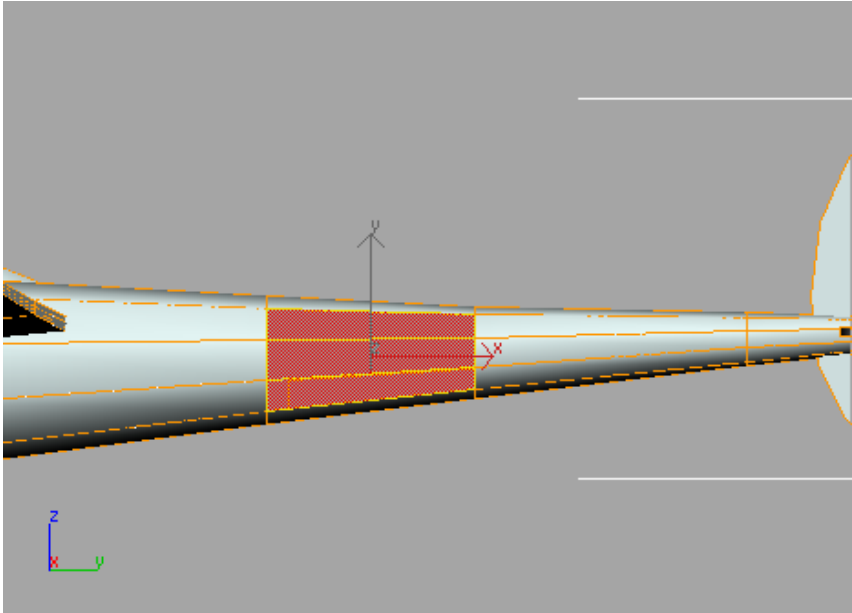
Because Ignore Backfacing is off, you've also selected the same three polygons on the other side of the sponson, for a total of six.
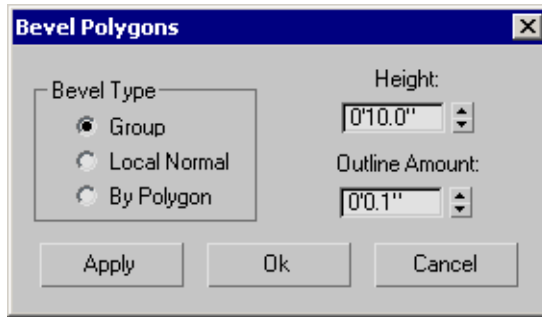
TIP To see the selected polygons displayed in red, press F2.

7 ![settings icon] On the Edit Polygons rollout, click the Settings button next to the Bevel tool.

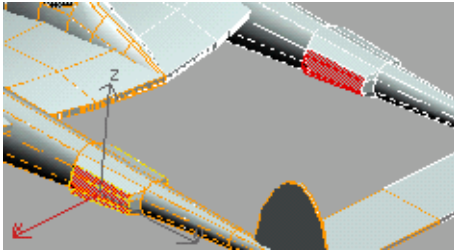The Bevel Polygons dialog appears.

8 Set the Height to **7″** and the Outline Amount to **–3.5″**. Click OK.
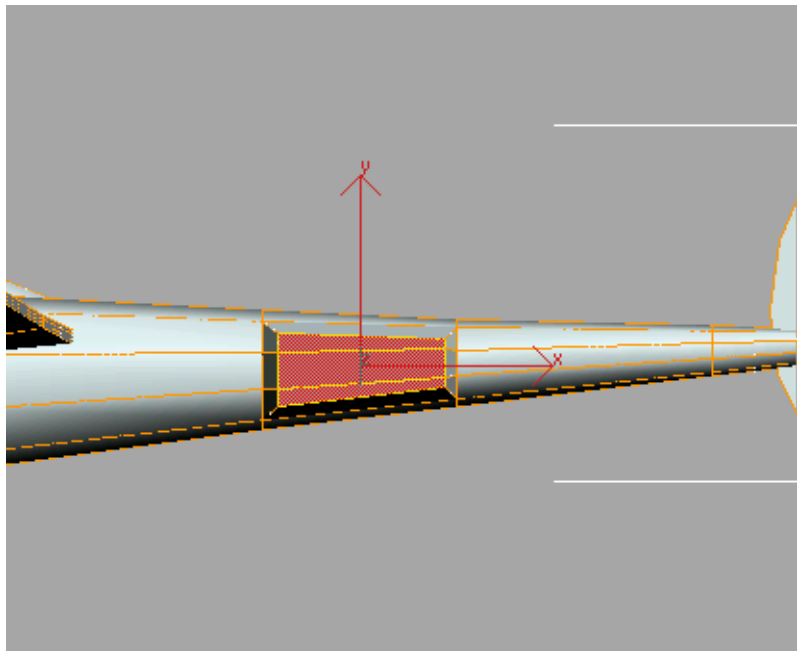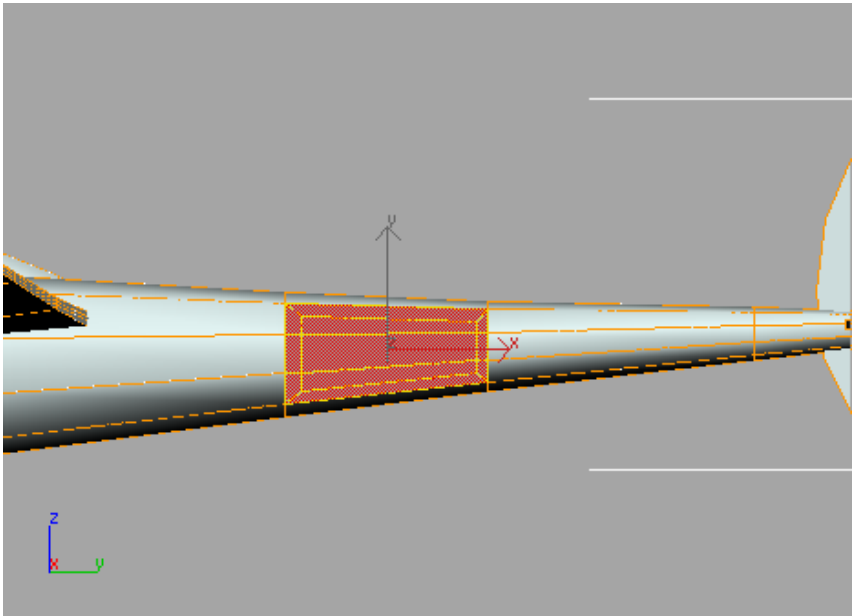

The air intake starts to take form.

Using the Symmetry modifier ensures that changes you make to the original half of the airplane are automatically reflected in the mirrored half.
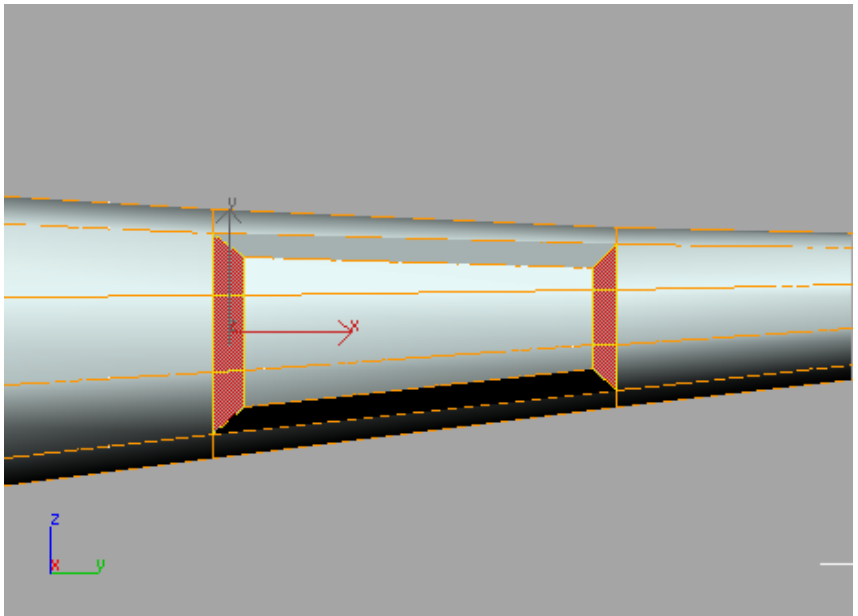
9 Make sure Select Object is still active, and then click the Grow button on the Selection rollout.

Grow increases the polygon selection to include polygons that share a common edge.

10 While holding down the Alt key, drag a window across the middle set of polygons to deselect them. Select only the polygons on the left and right, as viewed in the Right viewport.

11 ⬜ Click the Settings button next to the Inset tool in the Edit Polygons rollout.
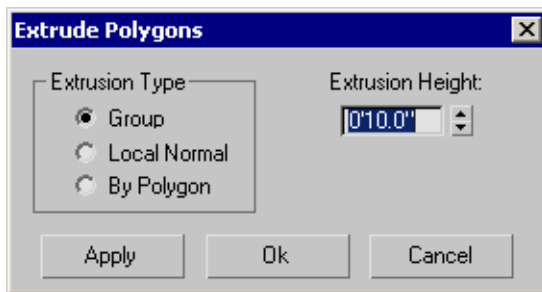
The Inset Polygons dialog appears.
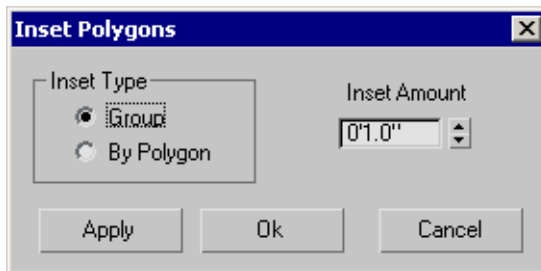
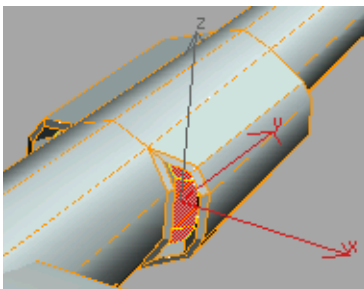**12** Set the Inset Amount to **1.5″** and click OK.
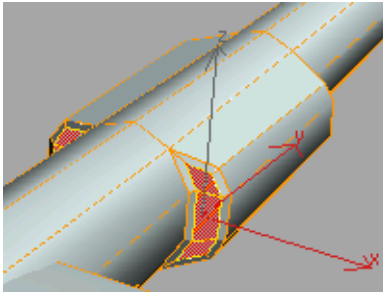
Inset creates new polygons from the current selection by offsetting their edges toward the inside.

13 Click the Settings button next to the Extrude tool in the Edit Polygons rollout.

The Extrude Polygons dialog appears.

**14** Set the Extrusion Height to **–5"** and click OK.

The air intakes are now complete. Next, you'll build some engine exhaust ports.

15 Save your scene as **mylightning02**.

Add engine exhaust ports:

Next, you'll add exhaust ports to either side of the forward section of the sponson near the propellers. Continue with the model you saved during the previous exercise, or open *low_poly_p38_03.max*. If you load this file, select the airplane, go to the Modify panel, and access the Polygon sub-object level of Editable Poly.

1 In the Top viewport, use Region Zoom to zoom into the right-side engine/propeller section.
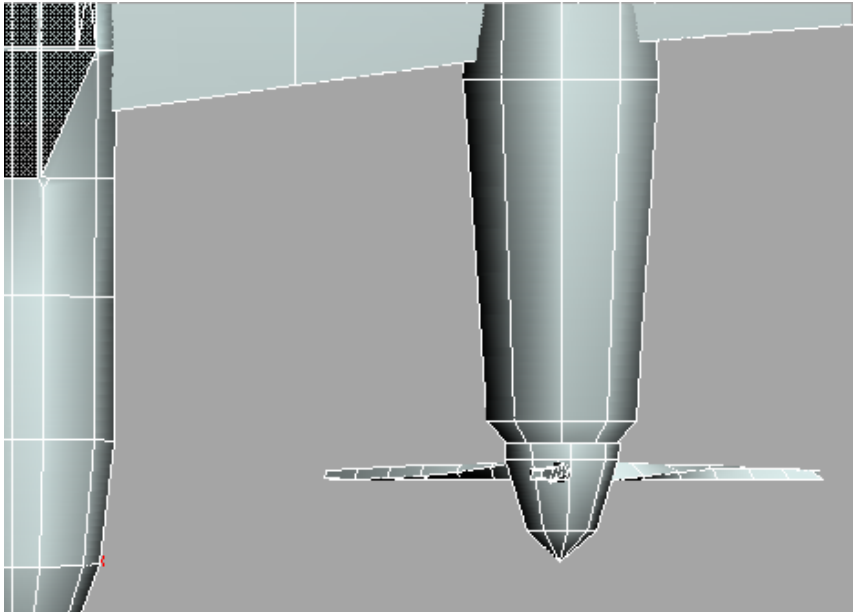

**2** Make sure the Show End Result On/Off Toggle button at the bottom of the modifier stack is on.

3 Turn on Select Object and select the polygons at the left and right sides of the engine housing. If selected polygons do not appear in red, press the F2 key on the keyboard.
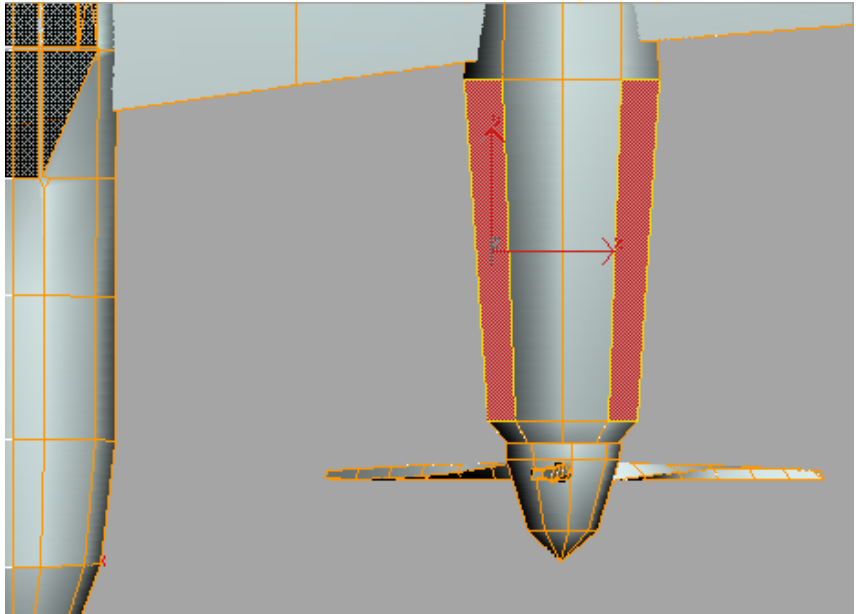
4 Activate the Right viewport and use Region Zoom to center the view around the engine section. If necessary, deselect polygons until only the topmost polygons on the engine housing are selected. Press F2 to display selected polygons in red.
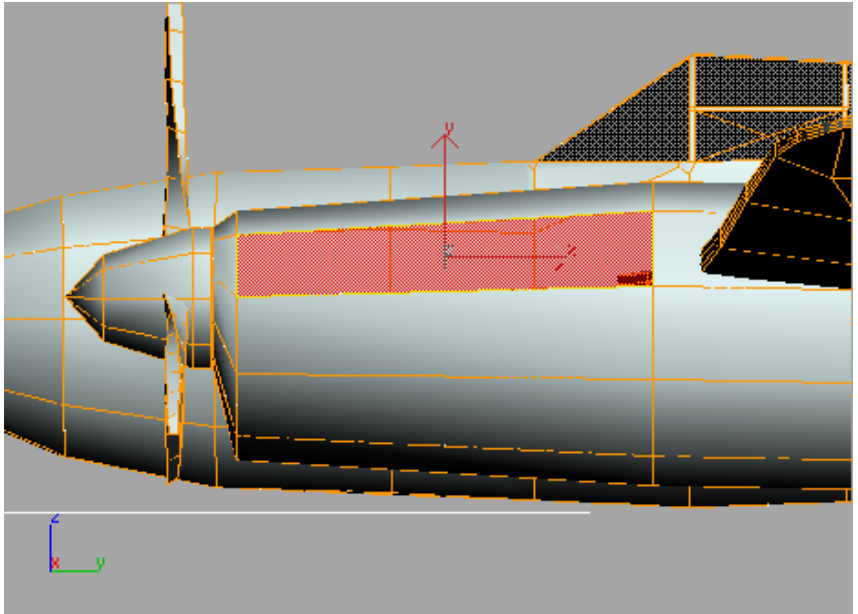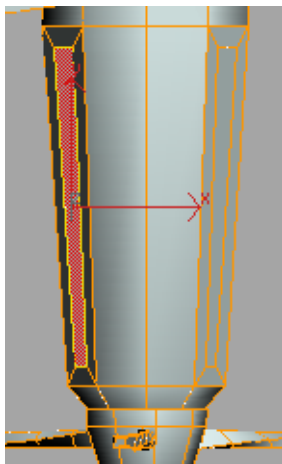
5 Click the Settings button next to the Inset tool in the Edit Polygons rollout.
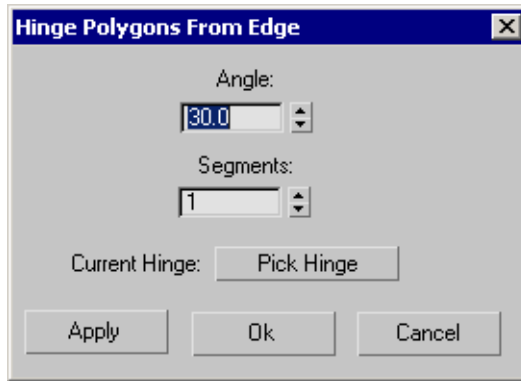
The Inset Polygons dialog appears.
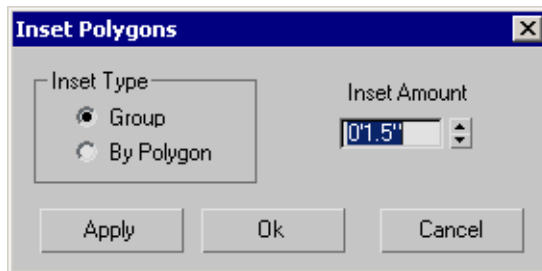
6 Set the Inset Amount to **3.5"** and click OK.
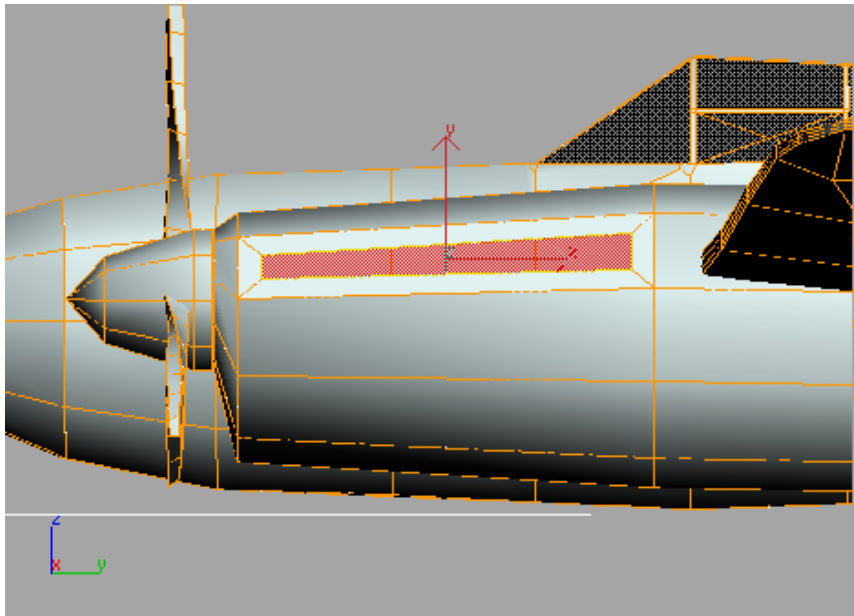
**7** In the Top viewport, select only the inside polygon, as shown in the following illustration.

8 [icon] Click the Settings button next to the Hinge From Edge tool in the Edit Polygons rollout.

Hinge Polygons From Edge

Angle:
30.0

Segments:
1

Current Hinge: Pick Hinge

Apply   Ok   Cancel

9 Click the Pick Hinge button. In the Top viewport, select the left edge of the selected polygon, as viewed from the top. From a "normal" orientation, this is the bottom edge.

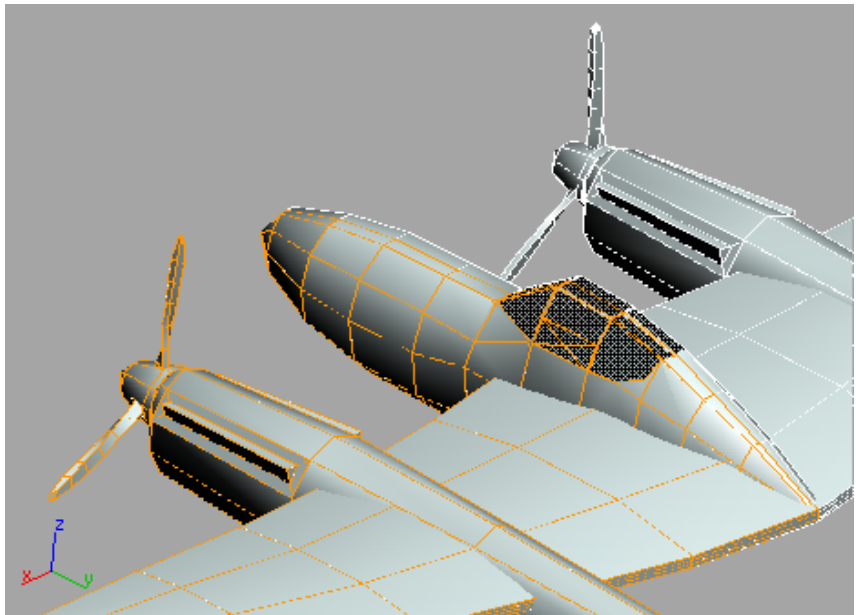The button text changes to *Edge 1051*. This will cause a hinged face to be created at this edge.

10 Set the Angle value to **45** and click OK. The hinged face is created.
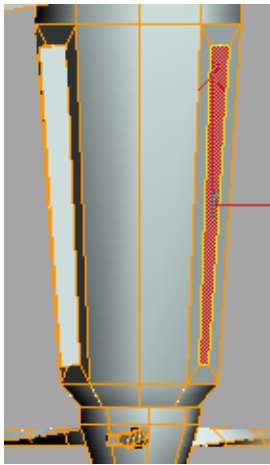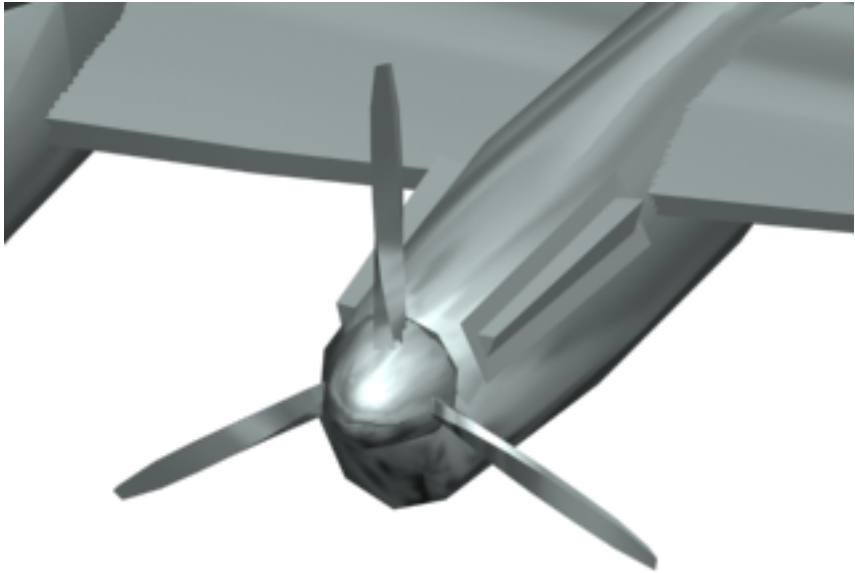

11 Select the outside polygon.

12 Repeat the Hinge procedure using the right edge, *Edge 1057*, as the hinge.

13 Save your scene as **mylightning03.max**.

View of the engine exhaust ports you've added
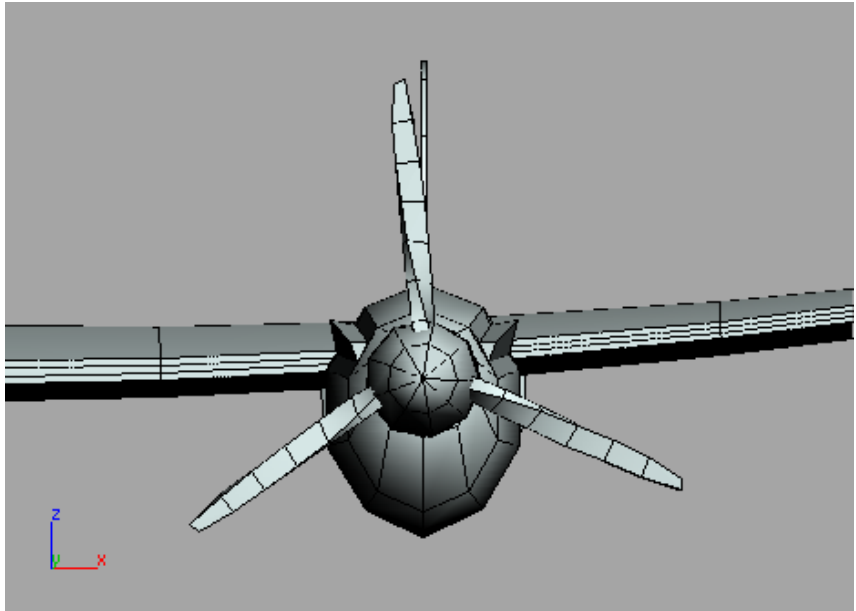
Using Soft Selection

The original propellers on this model are a little too clunky-looking. In this lesson, you'll remove the existing propeller blades and replace them with new blades.

Set up the lesson:

■ Open *low_poly_p38_04.max*.

Change the propellers:

1   In the Front viewport, use Zoom Region to center the view around the port engine of the airplane.

**2** Select the *Lightning*.

3 Go to the Modify panel and pick the Editable Poly entry in the modifier stack.

4 Click the Show End Result On/Off Toggle button that is located along the bottom of the modifier stack.

5 From the Selection rollout, turn on the Element button and make sure Ignore Backfacing is on.

**6** While holding down the Ctrl key, select each of the propeller blades.
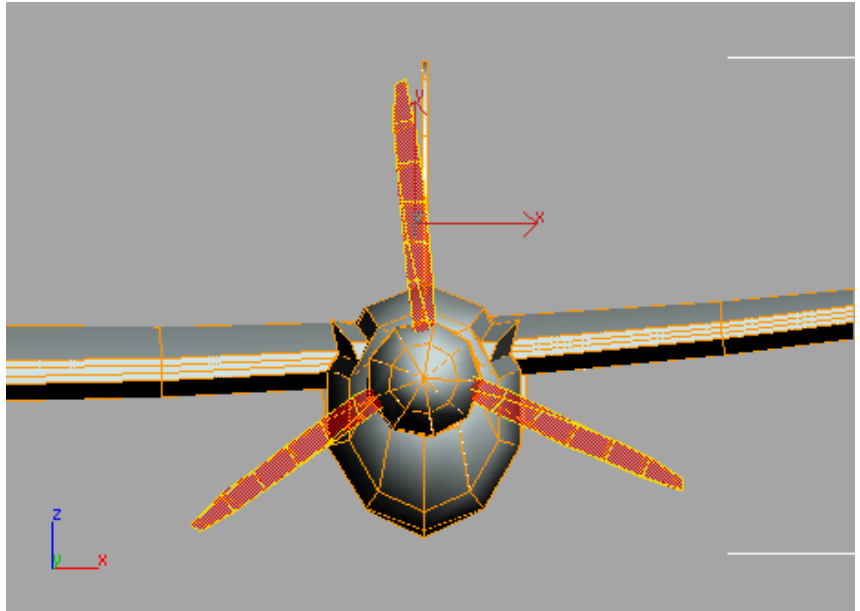
7 Click the Detach button on the Edit Geometry rollout and then click OK on the Detach dialog.

NOTE When you detach the propellers, they disappear from the opposite side of the airplane. This is because they are no longer part of the editable poly that has the Symmetry modifier applied to it.

---

8 Click the Editable Poly entry in the modifier stack to exit the sub-object level and then select the propellers.

**9** Press the Delete key to remove the propellers you just detached.
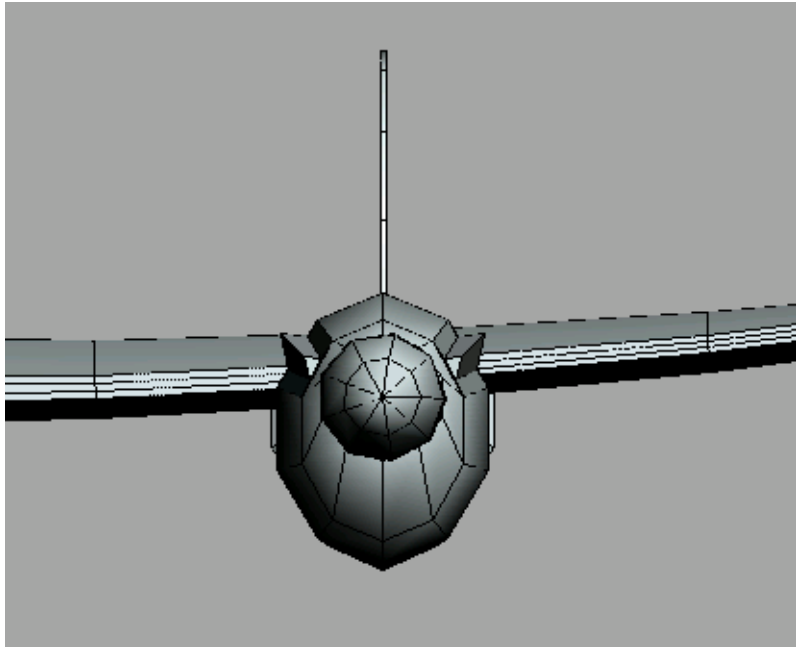
The Lightning has no propellers now.

Add the new propeller blades:

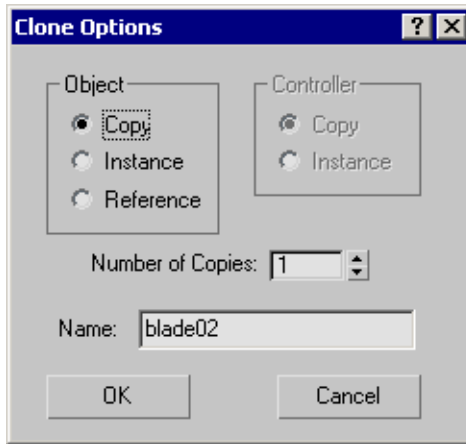You'll use the Merge command to add a new propeller blade to your model.

1 From the Application menu, choose Import > Merge.

The Merge File dialog appears.

2 Browse to the *\modeling\p38_lightning* folder and double-click the file *newprops.max*.

The Merge – newprops.max dialog appears.

3 Select the *Blade01* object and click OK.
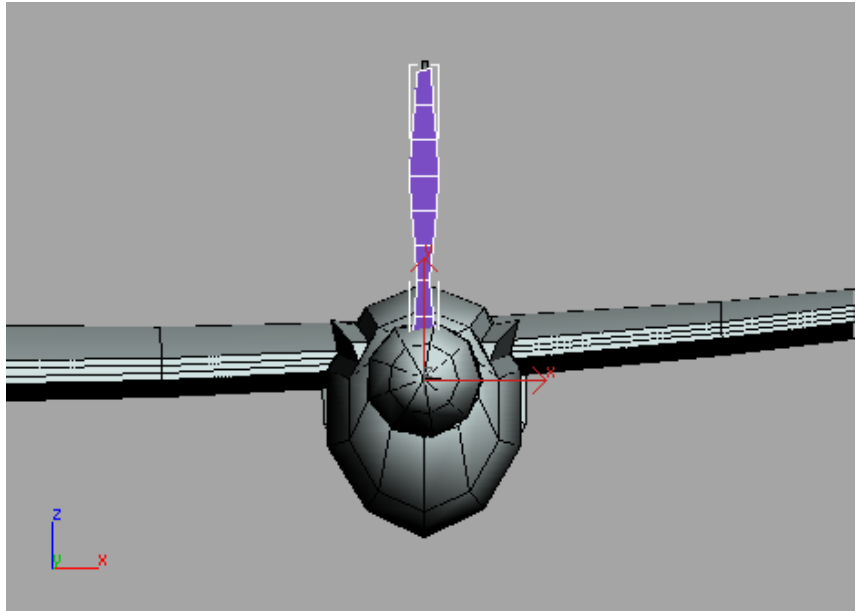
The new propeller blade appears in your scene.

4 ⟳ Activate the Front viewport and then turn on Select And Rotate.

5 While holding down the Shift key, rotate the *Blade01* object around the
   Z axis to approximately **120** degrees.

   The Clone Options dialog appears when you release the mouse button.

Clone Options

Object
- ● Copy
- ○ Instance
- ○ Reference

Controller
- ● Copy
- ○ Instance

Number of Copies: 1

Name: blade02

OK   Cancel

6 Set the Number Of Copies to **2** and in the Object group choose Instance. Click OK.

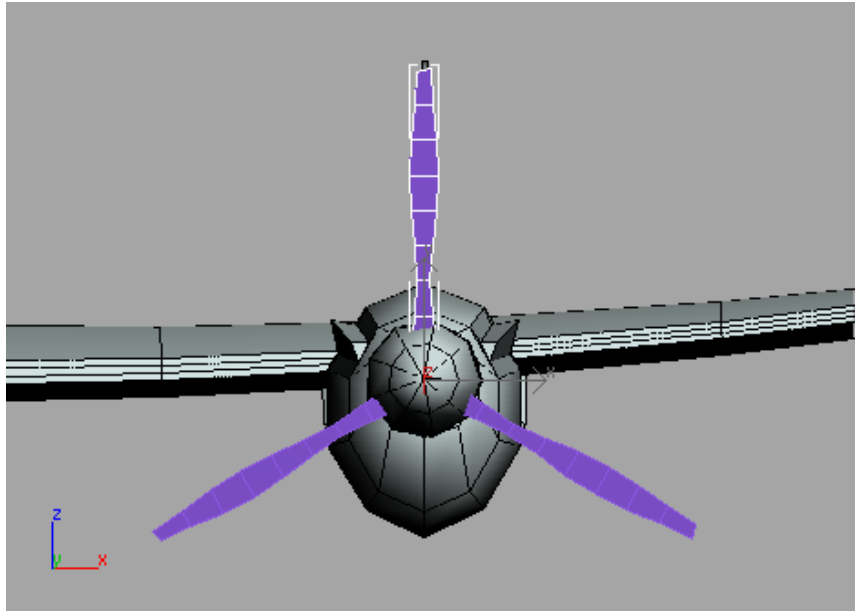**NOTE** Using the Instance option is important, as you'll soon see.

Add a final touch for realistic propeller blades

Now that the new blades are in the scene, you'll twist the blades to make them look realistic. You'll use the Soft Selection feature to accomplish this.
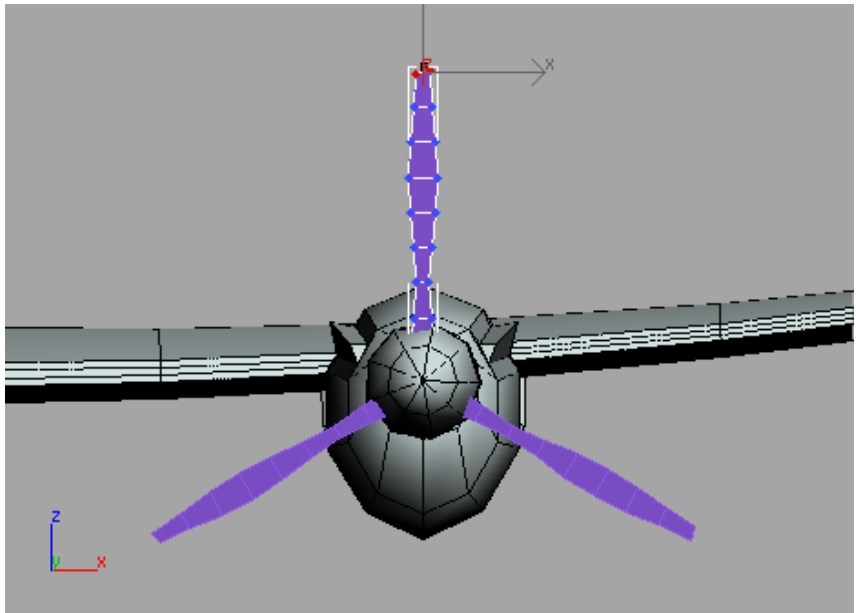
Twist the blades:

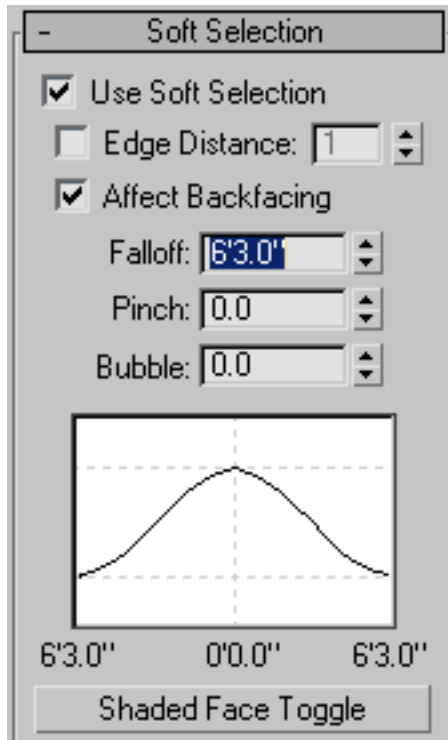**1** Turn on Select Object. In the Front viewport, select the top propeller blade.

2 On the Modify panel, click the Vertex button in the Selection rollout.

3 Drag a window around the top set of vertices at the tip of the propeller blade.

4 Open the Soft Selection rollout and turn on Use Soft Selection.

5 Drag or set the Falloff setting to **6'3"**.

Soft Selection

☑ Use Soft Selection
☐ Edge Distance: 1
☑ Affect Backfacing

Falloff: 6'3.0"
Pinch: 0.0
Bubble: 0.0

6'3.0"   0'0.0"   6'3.0"

Shaded Face Toggle

Notice what happens to the adjacent vertices as you increase the falloff. Vertices closest to the top will be affected more than the vertices that are further away.
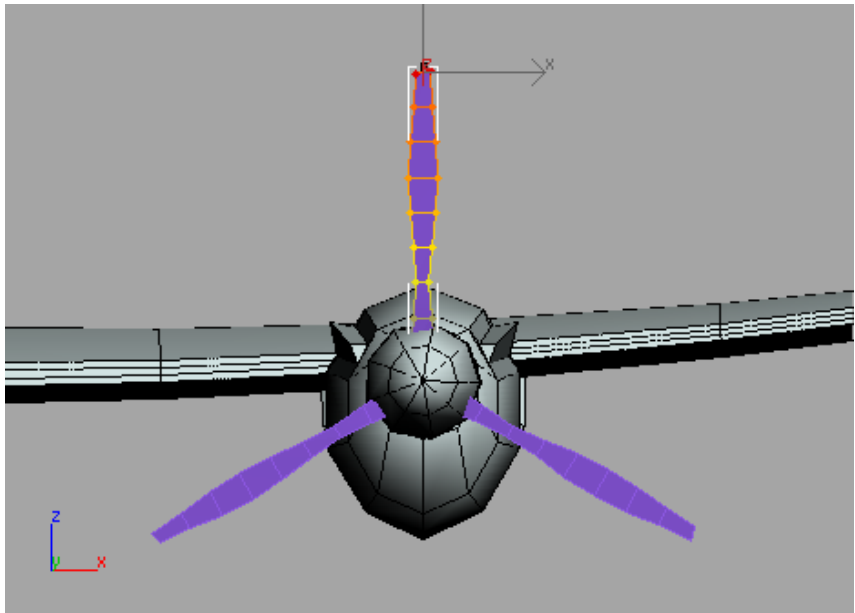
6 ![rotate icon] Turn on the Select And Rotate button and rotate the selected vertices around the Y axis to **–35** degrees.

Because the second and third blade are instances of the first, any change you make to the first blade affects the other two.
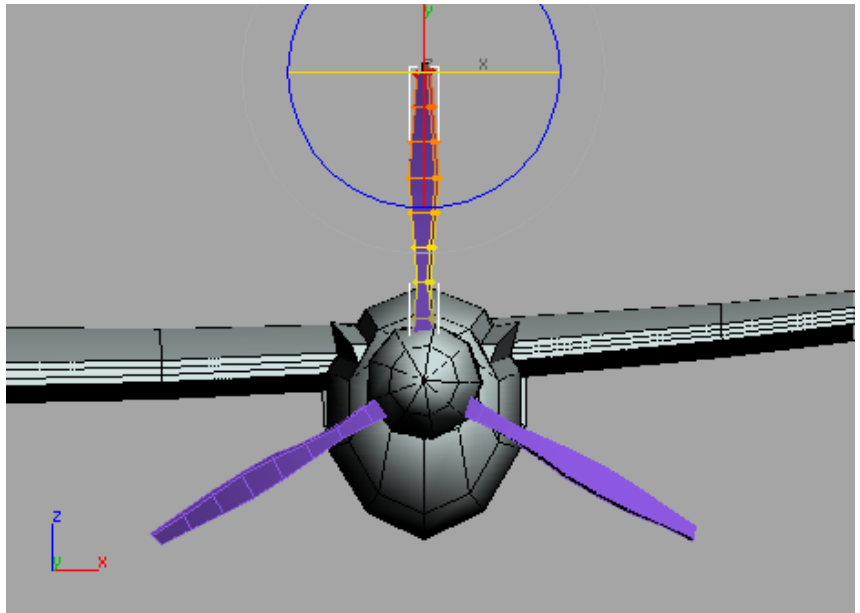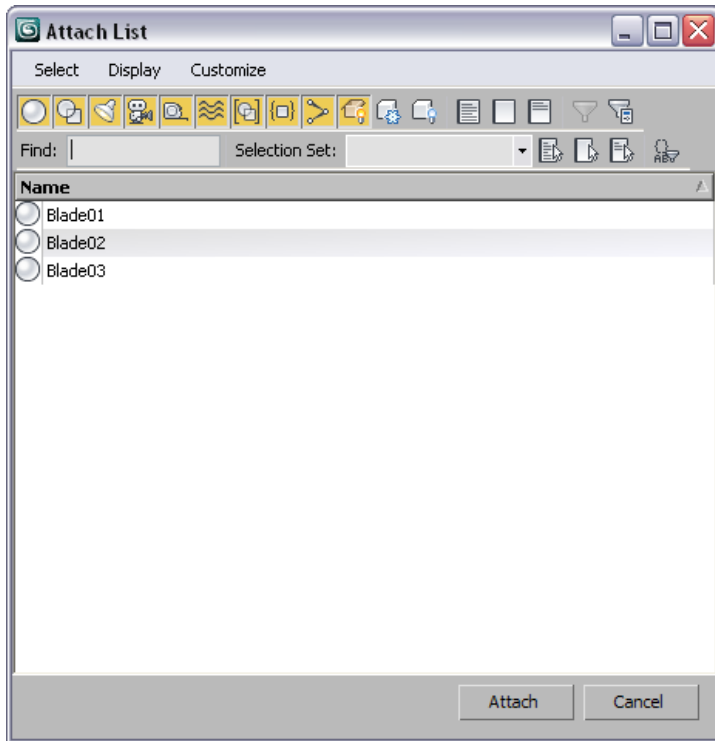
7 Click the Vertex button in the Selection rollout to exit Vertex sub-object level.

8 [icon] Turn on Select Object and select the *Lightning*.

9 [icon] Select the Editable Poly entry in the modifier stack and click the Attach List button, next to the Attach tool, in the Edit Geometry rollout.

The Attach List dialog opens showing you the three propeller blades.

10 Click the Select All button on the Selection Set portion of the toolbar. Ctrl+click to deselect Scene root, and then click Attach.
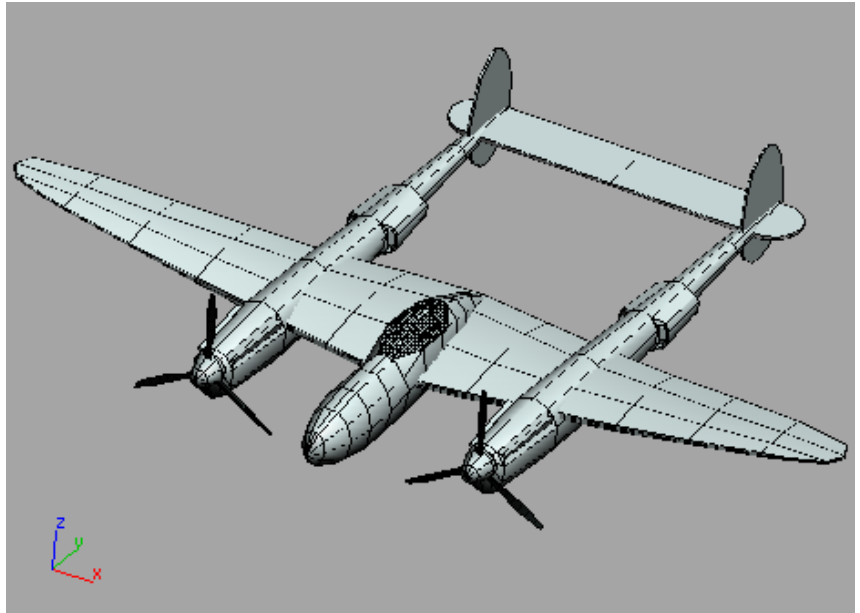
The blades are now attached to the rest of the airplane, and they are automatically added to the opposite half due to the Symmetry modifier.

11 Save your scene as **mylightning04.max**.

Using the HSDS Modifier

The HSDS (Hierarchical SubDivision Surface) modifier is a finishing tool rather than a modeling tool. It gives you the best result when working on low-polygon models, like the P-38 Lightning.

This lesson will give you a better understanding of HSDS modifier's use. You'll use the modifier on the tail of the airplane to give it a couple of levels of detail.

Set up the lesson:

■ Continue with the model you saved during the previous exercise, or open *low_poly_p38_05.max* in the *\modeling\p38_lightning* folder.

Refine the rudder:

1 [icon] In the Right viewport, use Zoom Region to center the view around the rudder of the airplane.
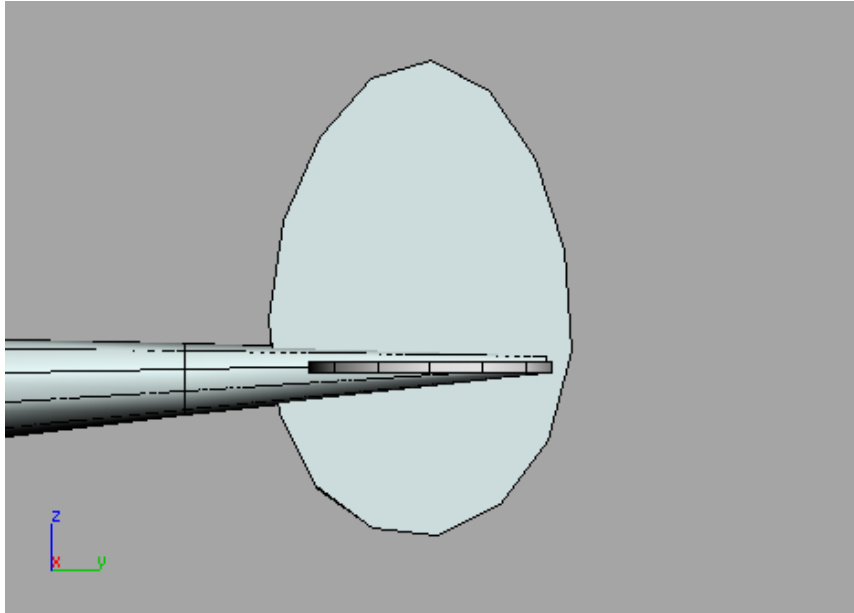
**2** Select the *Lightning*.

3 [icon] Go to the Modify panel and pick the Editable Poly entry in the Modifier stack.

4 [icon] Click the Show End Result On/Off Toggle button that is located along the bottom of the modifier stack.
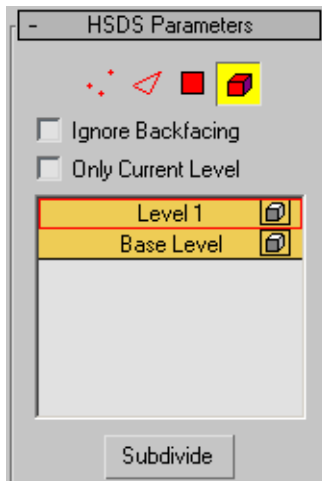
5 From the Modifiers menu, choose Subdivision Surfaces > HSDS Modifier

6 [icon] From the HSDS Parameters rollout, turn on the Element button. You'll see half of the airplane displayed in a yellow mesh.
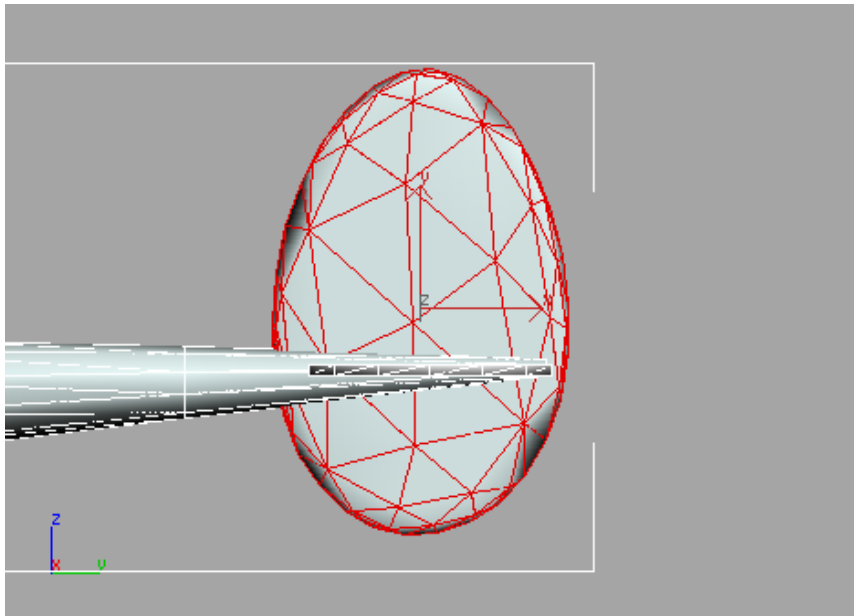
7 Select the rudder element.
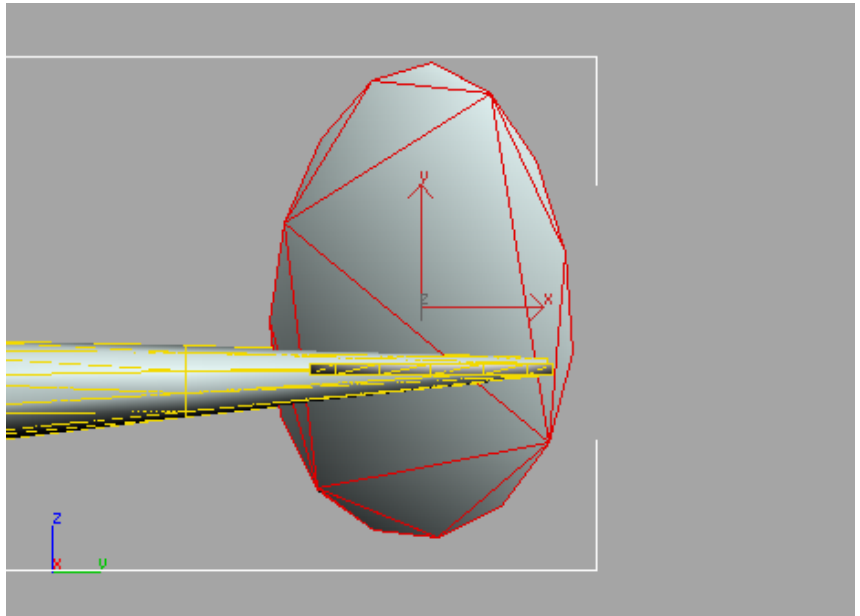
**8** Click the Subdivide button under the level-of-detail display.
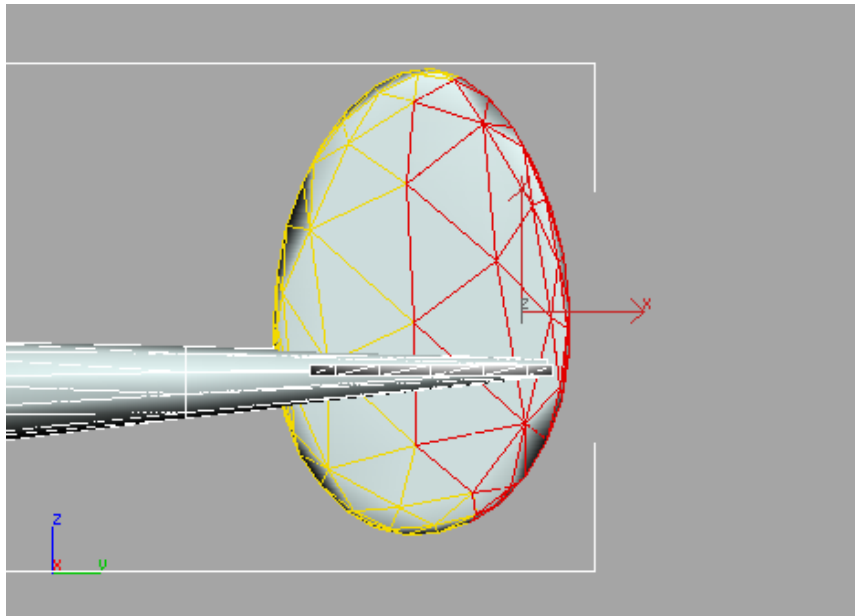

The rudder becomes more refined and the edges are much smoother. A level of detail, Level 1 is added to the level of detail list.

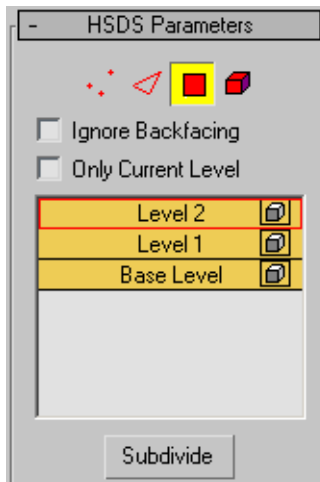**HSDS allows you increase the mesh resolution of specific parts of the model instead of the entire model**
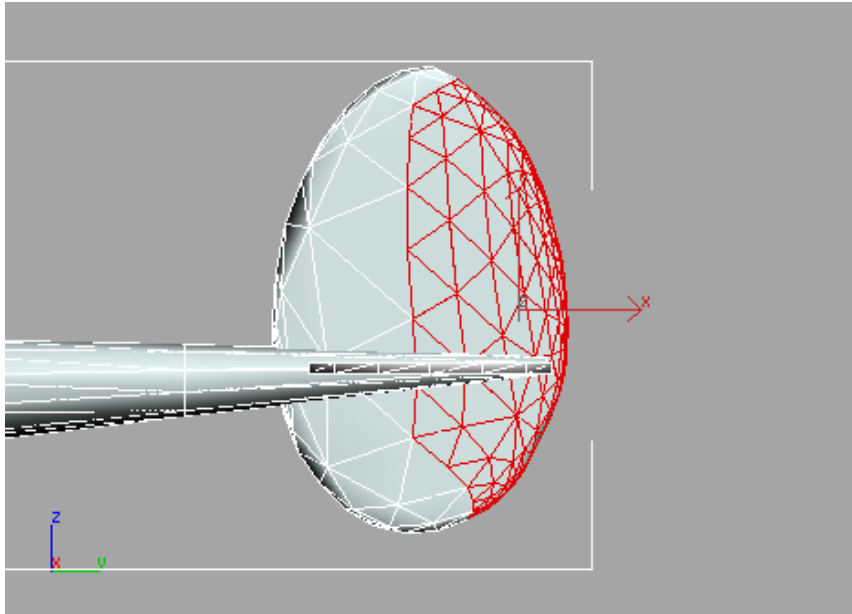
9 On the HSDS Parameters rollout, turn on the Polygon button, then drag a selection window over the rear polygons on the rudder.

10 Click the Subdivide button again.

A second level of detail is added to the level of detail list and the rear part of the rudder is even more refined.

11 Click the display button next to the Base Level.

Level 1 and 2 are turned off and you see the original polygons you started with.

Using the Edit Normal Modifier

The Edit Normal modifier in 3ds Max was developed with game developers in mind. Now that many game engines and graphics hardware use pixel and vertex shaders, demand has increased to give modelers the ability to adjust normals interactively when looking at the result of a pixel vertex shader.

NOTE In order to see the results of using the Edit Normal modifier, 3ds Max should be configured for DirectX.

Set up the lesson:

■ Continue with the model you saved during the previous exercise or open *low_poly_p38_06.max* in the *\modeling\p38_lightning* folder.

If you use the sample scene, some of the plane's components have been hidden for better performance. It's also been maximized to the Perspective viewport.
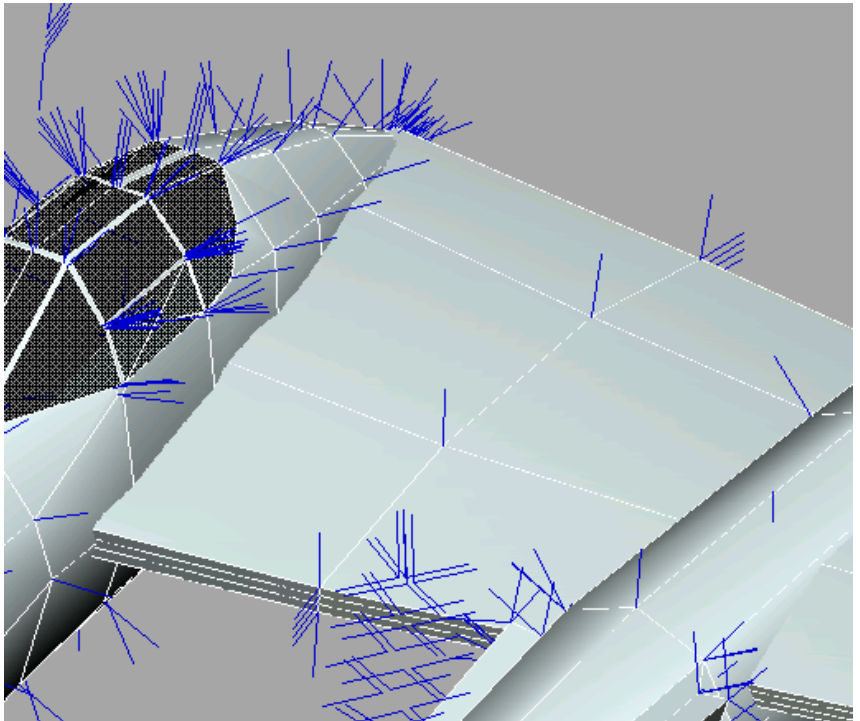
Adjust the normals on the wing:

1 Select the *Lightning.*

2 Open the Modify panel and unroll the Modifier List.

3 Click Edit Normals.

The normals are indicated by the blue lines that suddenly sprout from the model. The dark blue color tells you the normals are Unspecified and are calculated based on the smoothing groups of surrounding faces.


4 Select Normal 194.

This normal is in the middle of the wing between the cockpit and sponson.

You can also see which normal you've picked by looking at the display at the bottom of the Parameters rollout.
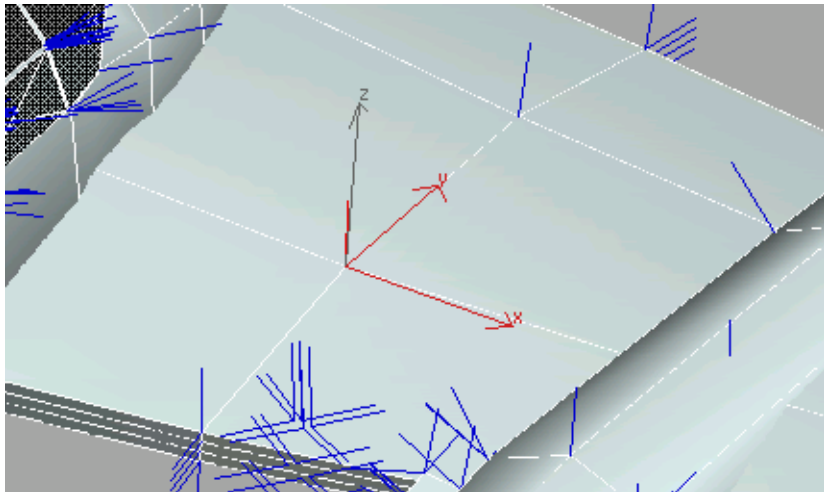
5   Rotate the normal. Notice the effect different rotations have on the surface of the airplane.

The surrounding surfaces get lighter or darker depending on how you rotate the normal.
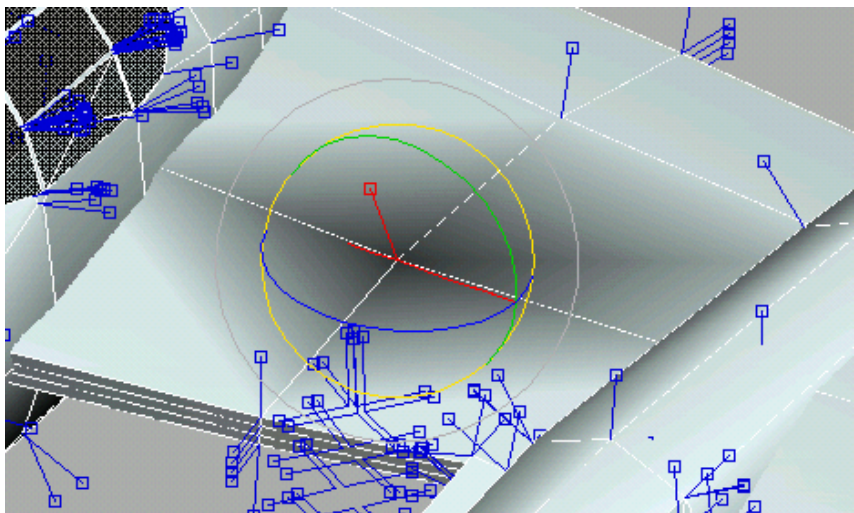
> **NOTE** Once you make a manual change to the original orientation of the normal, the normal changes to a green color, signifying that it's now an Explicit normal.

6 Experiment by selecting some of the other normals, or try working with groups of normals to see how they respond.

Summary

You have learned about several powerful features that will improve your modeling skills. The Editable Poly object is very versatile, and works with many modifiers to help you shape an object exactly as you like.