Chapter 6. Creating More Complex Man-made Materials

In this chapter, we will cover the following recipes:

- Creating cloth materials with procedurals
- Creating a leather material with procedurals
- Creating a synthetic sponge material with procedurals
- Creating a spaceship hull shader

Introduction

In this chapter, we will see some more complex artificial materials, starting with the relatively simpler materials. Remember that the procedure is basically the same as that for all the materials we have seen so far—the generic shader followed by the color pattern or the bump effect (one or more), depending on the preponderance of the different components.

The only difference is the level of complexity they can reach (for example, look at the *Creating a spaceship hull shade* recipe at the end of this chapter).

Creating cloth materials with procedurals

In this recipe, we will create a generic cloth material, as shown in the following screenshot:

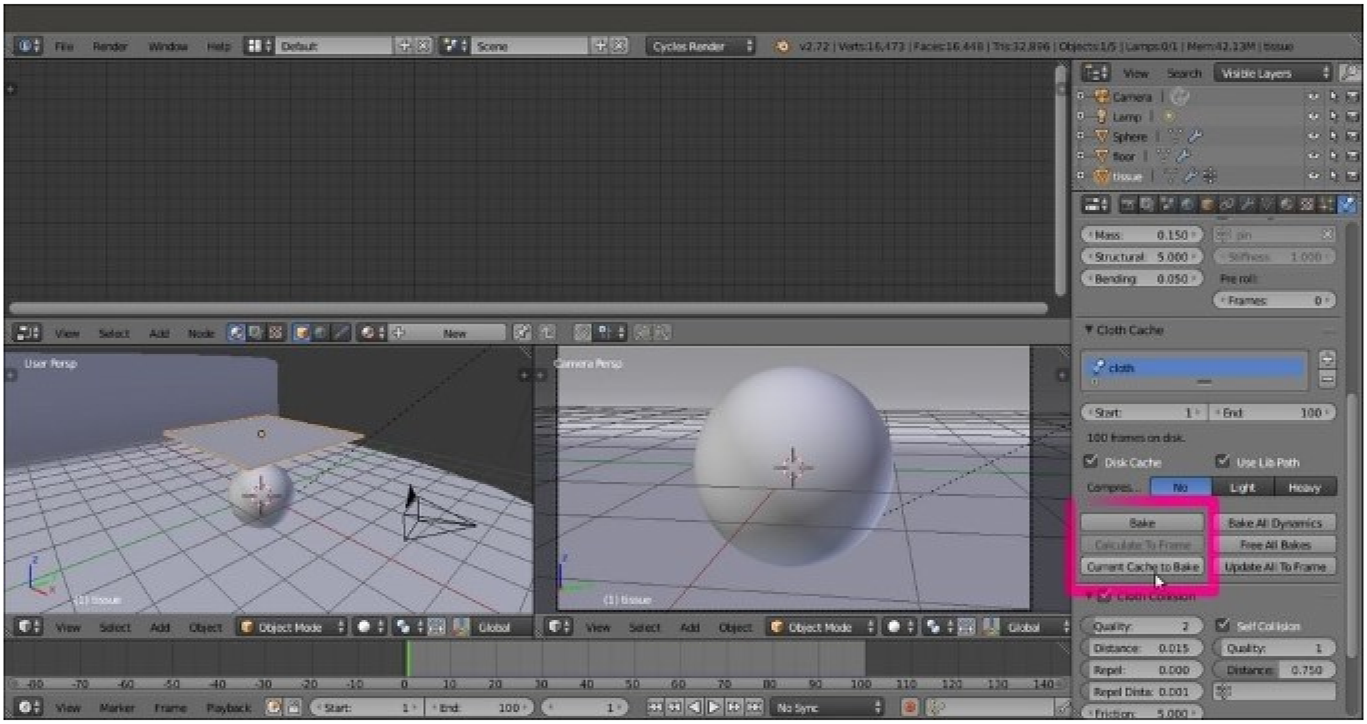
The cloth material as it appears in the final rendering

Getting ready

Before we start creating the material, let's set up the scene by performing the following steps:

1. Start Blender and load the `9931OS_cloth_start.blend` file. In the scene, there is already a cloth simulation.
2. Click on the **Play animation** button in the **Timeline** toolbar (or press *Alt* + *A*) to see the simulation running and being cached in real time. It consists of a Plane (our fabric) draped on a UV Sphere leaning on a bigger Plane (the floor).
3. After the simulation has been totally cached (a total of 100 frames), in the **Physics** window (the last tab to the right) under the **Cloth Cache** tab, press the **Current Cache to Bake** button to save the simulation. The 100-frame simulation is now cached and saved inside a folder (unless differently specified), named as a blend file, and stored on your hard drive in the same directory as the blend file.

From now on, there is no need to perform calculations about the simulation anymore. Blender will read the simulation data from that cache folder, so it will be possible to quickly scroll through the **Timeline** bar and immediately reach any frame inside the cached range.



The cloth simulation scene with the Cloth Cache subpanel to the right

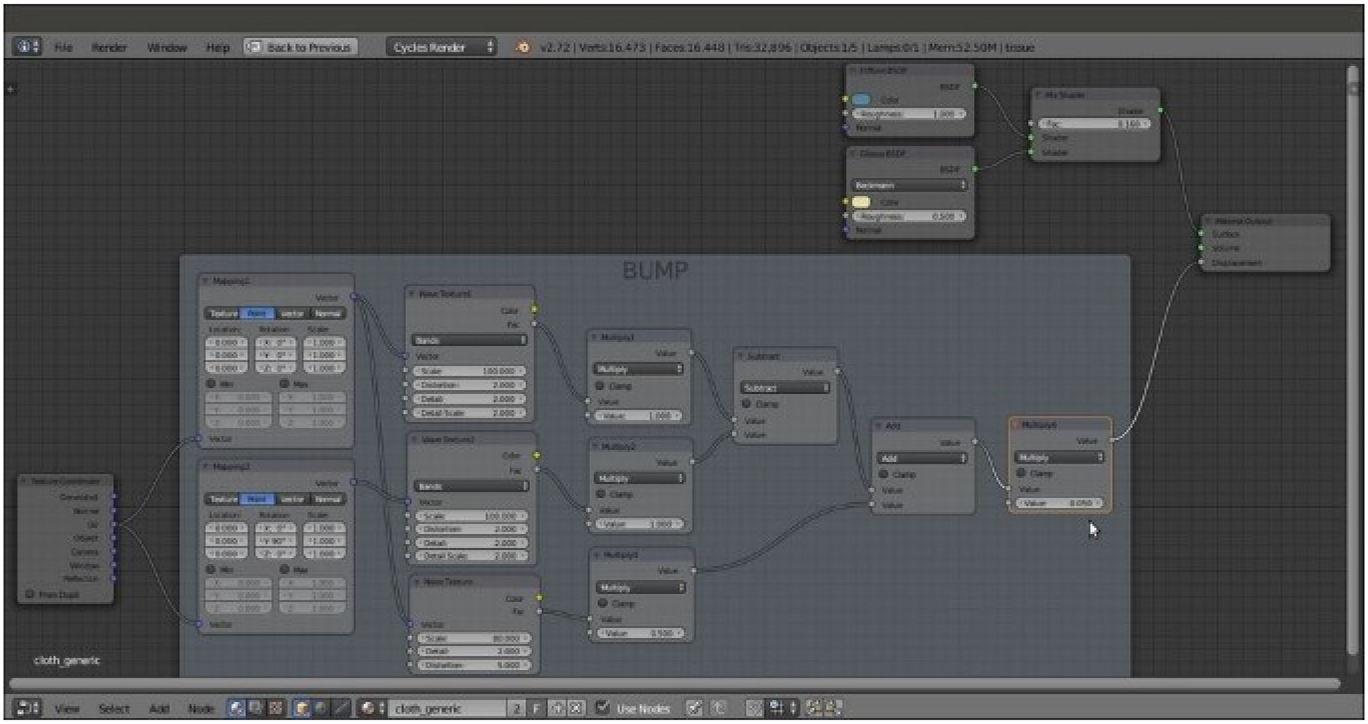
How to do it...

Now we are going to create the material on the fabric Plane, which has been first unwrapped by assigning a basic UV layer (**Object data** | **UV Maps**) and later subdivided by the **Specials** menu. This is done before the cloth simulation by performing the following steps:

1. Go to the **100** frame.
2. Make sure you have the **fabric** Plane selected. Click on **New** in the **Material** window under the main **Properties** panel or in the **Node Editor** window. Rename the new material `cloth_generic`.
3. In the **Material** window, switch the **Diffuse BSDF** node with a **Mix Shader** node. In the first **Shader** slot, select a **Diffuse BSDF** node, and in the second **Shader** slot, select a **Glossy BSDF** shader node.
4. Set the **Diffuse BSDF** node's **Roughness** value to `1.000`. Set the **Glossy BSDF** node's **Roughness** value to `0.500`. Change the **Glossy BSDF** node's **Color** values of **R** to `0.800`, **G** to `0.730`, and **B** to `0.369`. Set the **Fac** value of the **Mix Shader** node to `0.160`.
5. Add one **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**) and two **Mapping** nodes (press *Shift* + *A* and navigate to **Vector** | **Mapping**). In the **Properties** panel (press *N*) of the **Node Editor** window, label the two **Mapping** nodes as `Mapping1` and `Mapping2`. Then connect the UV output of the **Texture Coordinate** node to the **Vector** input sockets of both the **Mapping** nodes.
6. Now add two **Wave Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Wave Texture**) and a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**). Label the

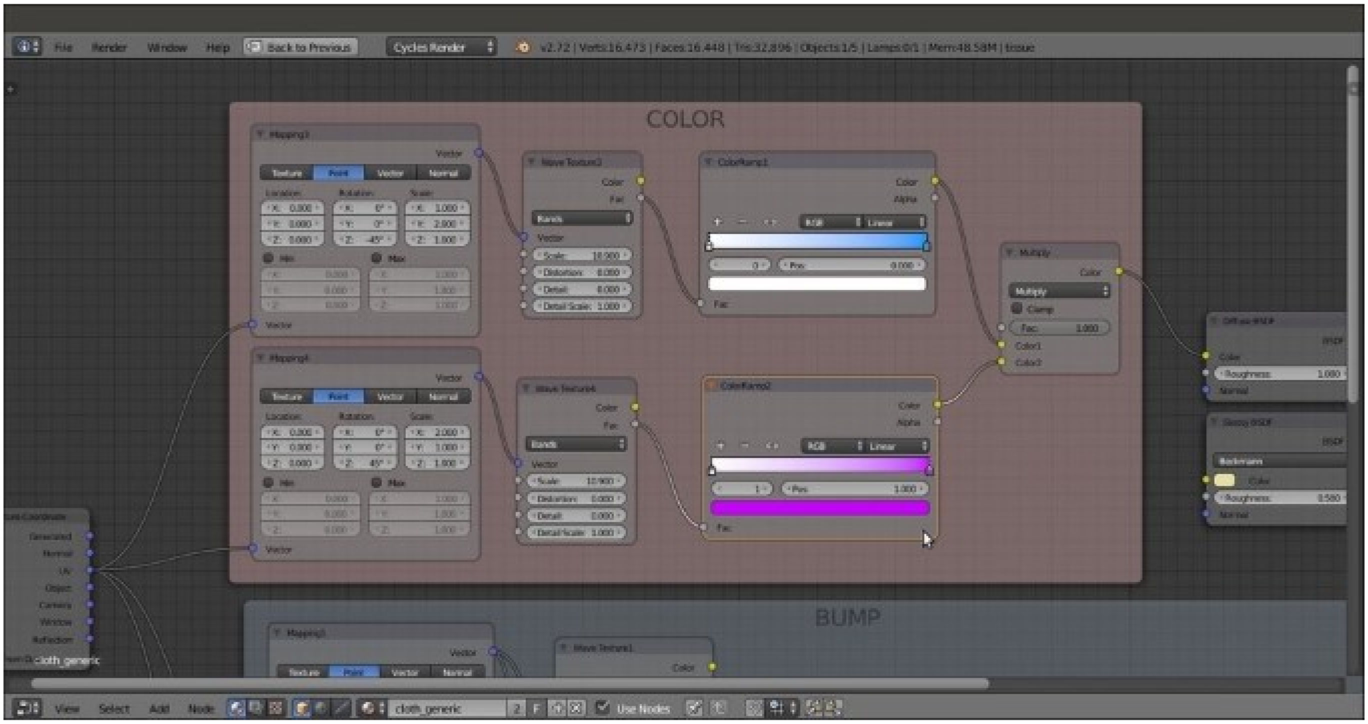
first two nodes as `Wave Texture1` and `Wave Texture2`. Connect the output of the **Mapping1** node to the **Vector** input sockets of the **Wave Texture1** node and the **Noise Texture** node. Connect the output of the **Mapping2** node to the **Vector** input of the **Wave Texture2** node.

7. Add three **Math** nodes (press *Shift* + *A* and navigate to **Converter** | **Math**), one for each texture node. Set their **Operation** mode to **Multiply** and label them as `Multiply1`, `Multiply2` and `Multiply3`. Then connect the **Fac** output of the **Wave Texture1** node to the first **Value** input socket of the **Multiply1** node, the **Wave Texture2** node to the **Multiply2** node, and the **Noise Texture** node to the **Multiply3** node. Set the second **Value** input socket of the **Multiply1** and **Multiply2** nodes to `1.000`, and leave the **Multiply3** node as `0.500`.
8. Go to the **Mapping2** node and set the **Rotation** value of **Y** to `90°`. Go to the **Wave Texture** nodes, and for both of them, set the **Scale** value to `100.000`, **Distortion** to `2.000`, and **Detail Scale** to `2.000`. For the **Noise Texture** node, set the **Scale** value to `80.000` and the **Distortion** value to `5.000`.
9. Add a new **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**) and set **Operation** to **Subtract**. Connect the output of the **Multiply1** and **Multiply2** nodes to the first and the second **Value** input sockets, respectively.
10. Press *Shift* + *D* to duplicate the last **Math** node. Set the **Operation** mode to **Add**. Connect the output of the **Subtract** node to its first **Value** socket and the output of the **Multiply3** node to the second **Value** input socket.
11. Press *Shift* + *D* to duplicate a **Multiply** node, label it as `Multiply4`, and connect the output of the **Add** node to the first **Value** input socket. Set the second **Value** input socket to `0.050`. Connect the last **Multiply** node's output to the **Displacement** input socket of the **Material Output** node.
12. Add a **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Press *Shift* and select the two **Mapping** nodes, the three textures, all the **Math** nodes, and then the **Frame**. Press *Ctrl* + *P* to parent them. Label the frame as `BUMP`, as shown in the following screenshot:



The shader and the network for the fabric bump pattern

13. Add two new **Mapping** nodes (press *Shift* + *A* and navigate to **Vector** | **Mapping**). Label them as `Mapping3` and `Mapping4`. Then add two **Wave Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Wave Texture**). Label them as `Wave Texture3` and `Wave Texture4`. As before, connect the **UV** output of the **Texture Coordinate** node to both the **Mapping3** and **Mapping4** nodes, and the output sockets of the latter to the new **Wave Texture** nodes.
14. Go to the **Mapping3** node. Set the **Rotation** value of **Z** to `-45°` and the **Scale** value of **Y** to `2.000`. In the **Mapping4** node, set the **Rotation** value of **Z** to `45°` and the **Scale** value of **X** to `2.000`. Go to the two **Wave Texture** nodes to set the **Scale** value to `10.900` and the **Detail** value to `0.000`.
15. Add two **ColorRamp** nodes (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**) and label them as `ColorRamp1` and `ColorRamp2`. Connect the **Fac** output of the **Wave Texture3** to the **Fac** input socket of the **ColorRamp1** node, and the **Fac** output of the **Wave Texture4** node to the **Fac** input socket of the **ColorRamp2** node.
16. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Connect the **Color** output of the two **ColorRamp** nodes to the **Color1** and **Color2** input sockets of the **MixRGB** node. Set **Blend Type** to **Multiply** and the **Fac** value to `1.000`.
17. Connect the **Color** output of the **Multiply-MixRGB** node to the **Color** input socket of the **Diffuse BSDF** shader node.
18. Add a **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Press *Shift* and select the new nodes and then the **Frame**. Press *Ctrl* + *P* to parent them. Rename the **Frame** `COLOR`, as shown in the following screenshot:



The COLOR frame

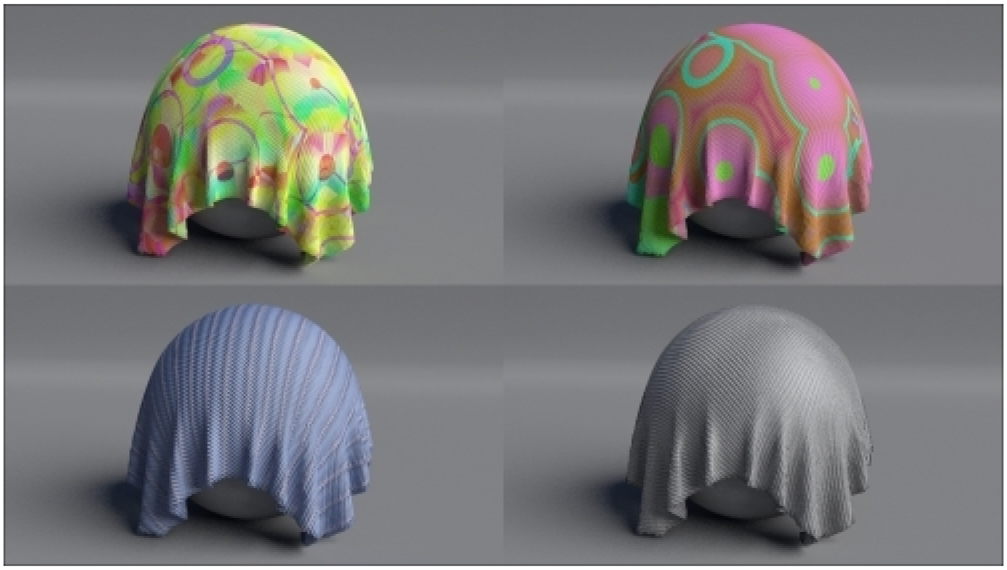
19. At this point, we can change the colors inside the two **ColorRamp** gradients to obtain colored patterns. In my example, I set the **ColorRamp1** colors ranging from pure white going to a light blue, and violet for the **ColorRamp2** node.

How it works...

- From steps 1 to 3, we just made the basic shader by mixing a rough **Diffues BSDF** shader (**Roughness** to `1.000`) with a light glossy shader (the low **Fac** value of the **Mix Shader** node shows a lot more of the diffuse component than the glossy component)
- From steps 4 to 10, we built the bump texture of the fabric by mixing two **Wave Texture** nodes in different orientations and by adding a bit of noise
- From steps 11 to 18, we built a simple cross-color pattern

There's more...

A lot of variations can be obtained by setting different values for the bump and using different texture nodes and combinations for the color pattern, as shown in the following screenshot:



Different color patterns of the cloth material

Tip

All of these examples are included in the `9931OS_06_cloth.blend` file provided with this module.

See also

To learn more about Blender cloth simulation, you can take a look at the online Blender documentation at http://wiki.blender.org/index.php/Doc:2.6/Manual/Physics/Cloth.

Creating a leather material with procedurals

In this recipe, we will create a leather-like material, as shown in the following screenshot:

The leather-like material assigned to Suzanne and three wallet-like, simple objects

Start Blender and load the `9931OS_06_start.blend` file, where there is already an unwrapped Suzanne mesh.

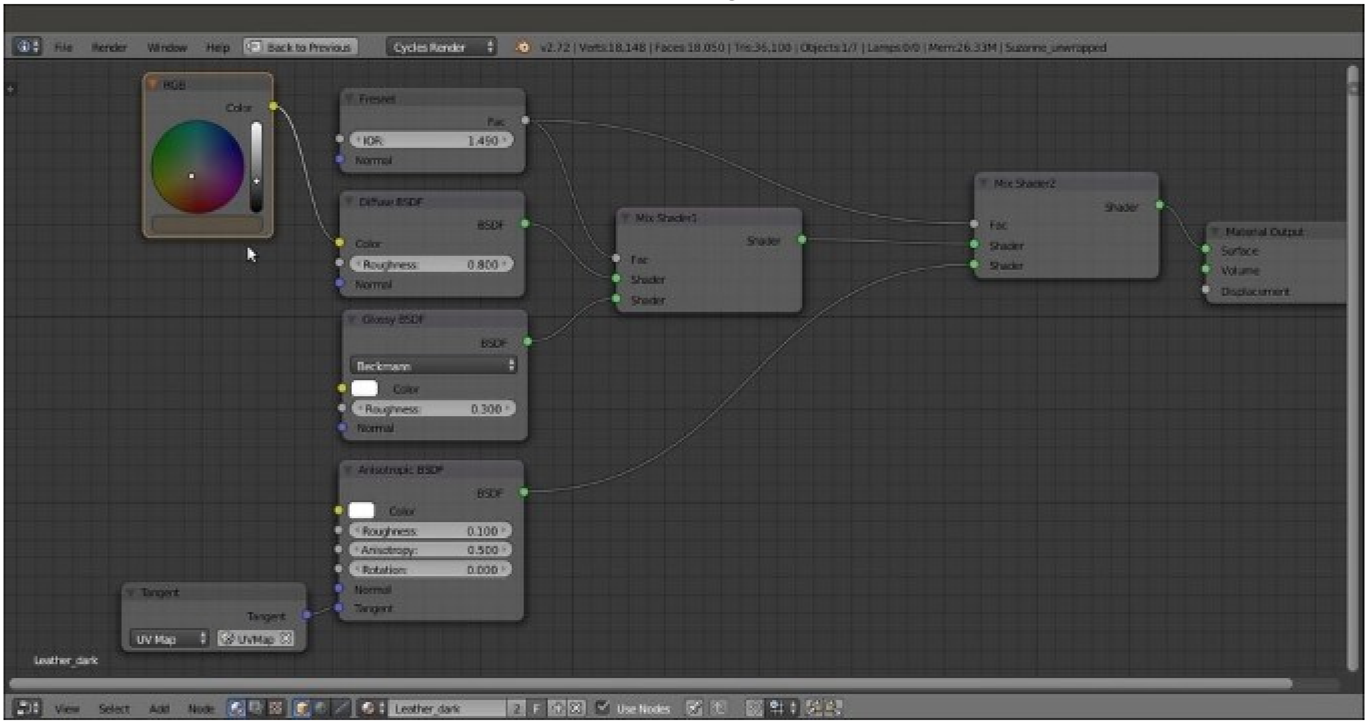
How to do it...

Now we are going to create the material by performing the following steps:

1. Click on **New** in the **Material** window under the main **Properties** panel or in the **Node Editor** toolbar. Rename the new material `Leather_dark`.
2. In the **Material** window, switch the **Diffuse BSDF** node with a **Mix Shader** node (label it as `Mix Shader2`). In its first **Shader** slot, select a **Mix Shader** node again (label it as `Mix Shader1`), and in the second slot, load an **Anisotropic BSDF** shader node.
3. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and connect it to the **Fac** input sockets of both the **Mix Shader** nodes. Set the **IOR** value to `1.490`.
4. Set the **Anisotropic BSDF** node's color to pure white and the **Roughness** value to `0.100`. Add a **Tangent** node (press *Shift* + *A* and navigate to **Input** | **Tangent**). Connect it to the **Tangent** input socket of the **Anisotropic BSDF** shader, and in its **Method to use for the Tangent** slot, select the **UV Map** item. Optionally, click on the blank slot to the right to select the name of the UV layer to be used (this is useful if the mesh has two or more UV layers).
5. Add a **Diffuse BSDF** shader (press *Shift* + *A* and navigate to **Shader** | **Diffuse BSDF**) and a **Glossy BSDF** shader node (press *Shift* + *A* and navigate to **Shader** | **Glossy BSDF**). Connect the **Diffuse BSDF** node to the first **Shader** input socket of the **Mix Shader1** node and the **Glossy BSDF** node to the second **Shader** input socket. Set the **Diffuse BSDF** node's

Roughness value to `0.800`. Set the **Glossy BSDF** distribution to **Beckmann**, **Color** to pure white, and its **Roughness** value to `0.300`.

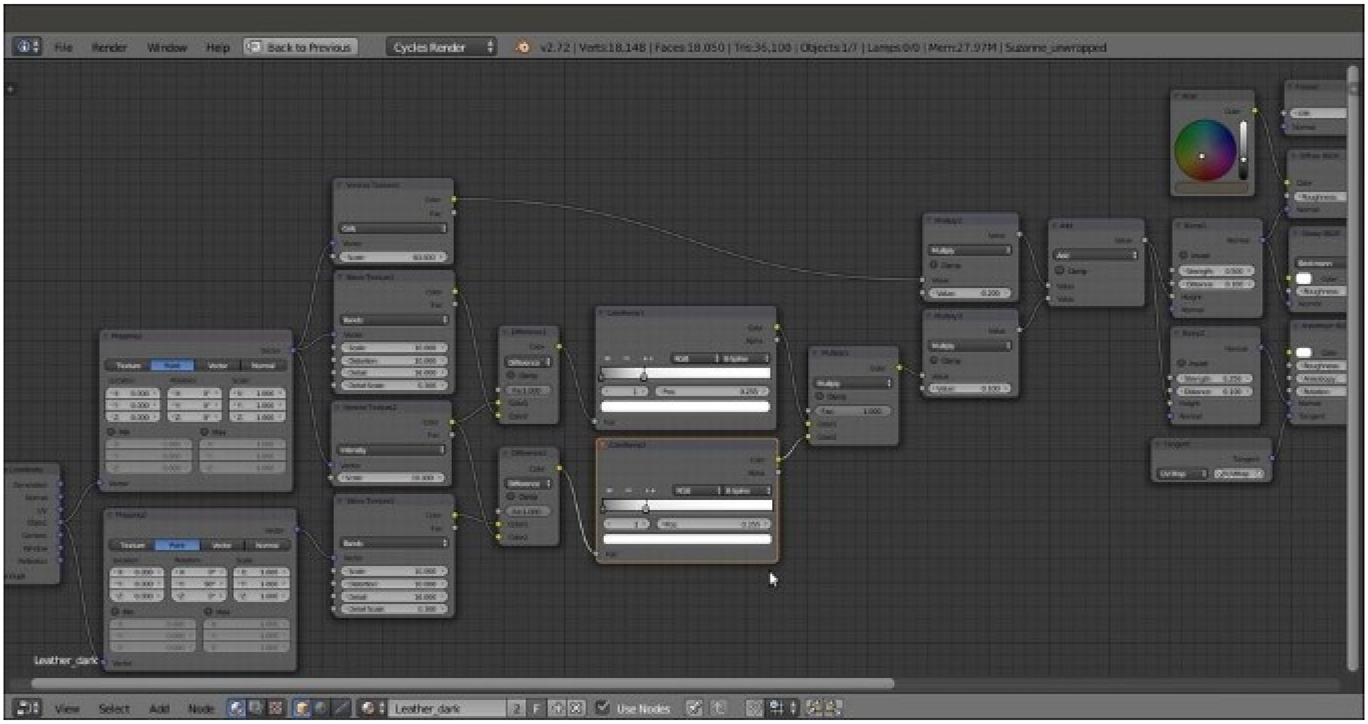
6. Add an **RGB** node (press *Shift* + *A* and navigate to **Input** | **RGB**) and connect its **Color** output to the **Color** input socket of the **Diffuse BSDF** node. Change the **Color** values of **R** to `0.100`, **G** to `0.080`, and **B** to `0.058`, as shown in the following screenshot:



The shader part of the material

7. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**) and two **Mapping** nodes (press *Shift* + *A* and navigate to **Vector** | **Mapping**). Connect the **Object** output of the **Texture Coordinate** node to the **Vector** input sockets of both the **Mapping** nodes (label them as `Mapping1` and `Mapping2`). Then in the **Mapping2** node, change the **Rotation** value of **Y** value to `90°`.
8. Add two **Voronoi Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Voronoi Texture**) and two **Wave Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Wave Texture**). Place them in a column next to the **Mapping** nodes in this order from top to bottom: **Voronoi Texture1**, **Wave Texture1**, **Voronoi Texture2**, and **Wave Texture2**.
9. Set the **Voronoi Texture1** node's **Coloring** to **Cells** and the **Scale** value to `60.000`. Go to the **Wave Texture1** node and set the **Scale** value to `10.000`, the **Distortion** value to `10.000`, **Detail** to `16.000`, and **Detail Scale** to `0.300`. Set the **Scale** value of the **Voronoi Texture2** node to `10.000`, and copy and paste the values from the **Wave Texture1** node to the **Wave Texture2** node.
10. Now connect the **Mapping1** node output to the **Vector** input sockets of the two **Voronoi Texture** nodes and the **Wave Texture1** node. Connect the output of the **Mapping2** node to the **Vector** input socket of the **Wave Texture2** node.

11. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Set the **Blend Type** to **Difference** and the **Fac** value to `1.000`. Connect the **Color** output of the **Wave Texture1** node to the **Color2** input socket of the **Difference** node, and the **Color** output of the second **Voronoi Texture2** node to its **Color1** input socket.
12. Label the **Difference** node as **Difference1**. Then press *Shift* + *D* to duplicate it. Label the duplicate as `Difference2` and connect the **Color** output of the **Voronoi Texture2** node to its **Color2** input socket. Connect the **Color** output of the **Wave Texture2** node to the **Color1** input socket of the **Difference2** node.
13. Press *Shift* + *D* to duplicate the **Difference** node again, change its **Blend Type** to **Multiply** and label it as `Multiply1`. Connect the output of the **Difference1** node to the **Color1** input socket of the **Multiply1** node. Then connect the output of the **Difference2** node to the **Color2** input socket of the **Multiply1** node.
14. Add a **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**), label it as **Multiply3**, and connect the output of the **Multiply1** node to the first **Value** input socket. Set the second **Value** input socket to `0.100`.
15. Press *Shift* + *D* to duplicate the **Multiply3** node, label it as `Multiply2`, and connect the **Color** output of the **Voronoi Texture1** node to the first **Value** input socket. Set the second **Value** input socket to `-0.200`.
16. Press *Shift* + *D* to duplicate the **Multiply2** node, label it as `Add`, and change **Operation** to **Add** as well. Connect the output of the **Multiply2** and **Multiply3** nodes to the two **Value** input sockets.
17. Add two **Bump** nodes (press *Shift* + *A* and navigate to **Vector** | **Bump**). Label them as `Bump1` and `Bump2`. Then connect the **Bump1** to the **Normal** input sockets of both the **Diffuse BSDF** and **Glossy BSDF** shader nodes. Connect the **Bump2** node to the **Normal** input of the **Anisotropic BSDF** shader. Set the **Strength** value of the **Bump1** node to `0.500` and the **Strength** value of the **Bump2** node to `0.250`. Connect the output of the **Add** node to the **Height** input sockets of both the **Bump** nodes.
18. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**). Paste it between the first **Difference1** node and the **Multiply1** node. Set **Interpolation** to **B-Spline** and move the white color stop to the `0.255` position. Label it as `ColorRamp1`.
19. Press *Shift* + *D* to duplicate the **ColorRamp1** node, label it as `ColorRamp2`, and paste it between the **Difference2** node and the **Multiply1** node, as shown in the following screenshot:



The completed network with the added bump pattern

How it works...

- From steps 1 to 6, we built the basic shader for the leather material.
- From steps 7 to 19, we built the bump pattern for the leather. We used two different **Bump** nodes with different values for the **Diffuse BSDF** and **Glossy BSDF** nodes and for the **Anisotropic BSDF** shader, to have slightly different light reflections on the surface.

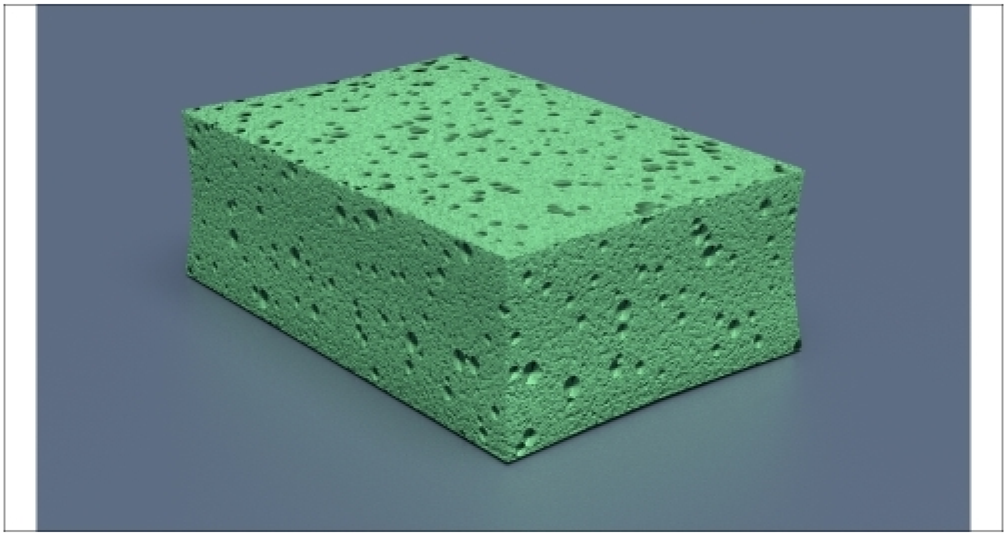
Note

Note that we used the **UV Map** layer information of the mesh for the **Tangent** node to be connected to the **Anisotropic BSDF** shader, and the **Object** mapping node for the bump textures instead.

Actually, we could have used the **UV** mapping output for the texture nodes too, because the mesh had already been unwrapped. However, the scale values for all the nodes in that case would have been double and the flow of the textures on the polygons would have been different (based on the flow of the unwrapped faces in the **UV** window).

Creating a synthetic sponge material with procedurals

In this recipe, we will create a polyurethane sponge material (the type that you usually find in kitchens), as shown in the following screenshot:



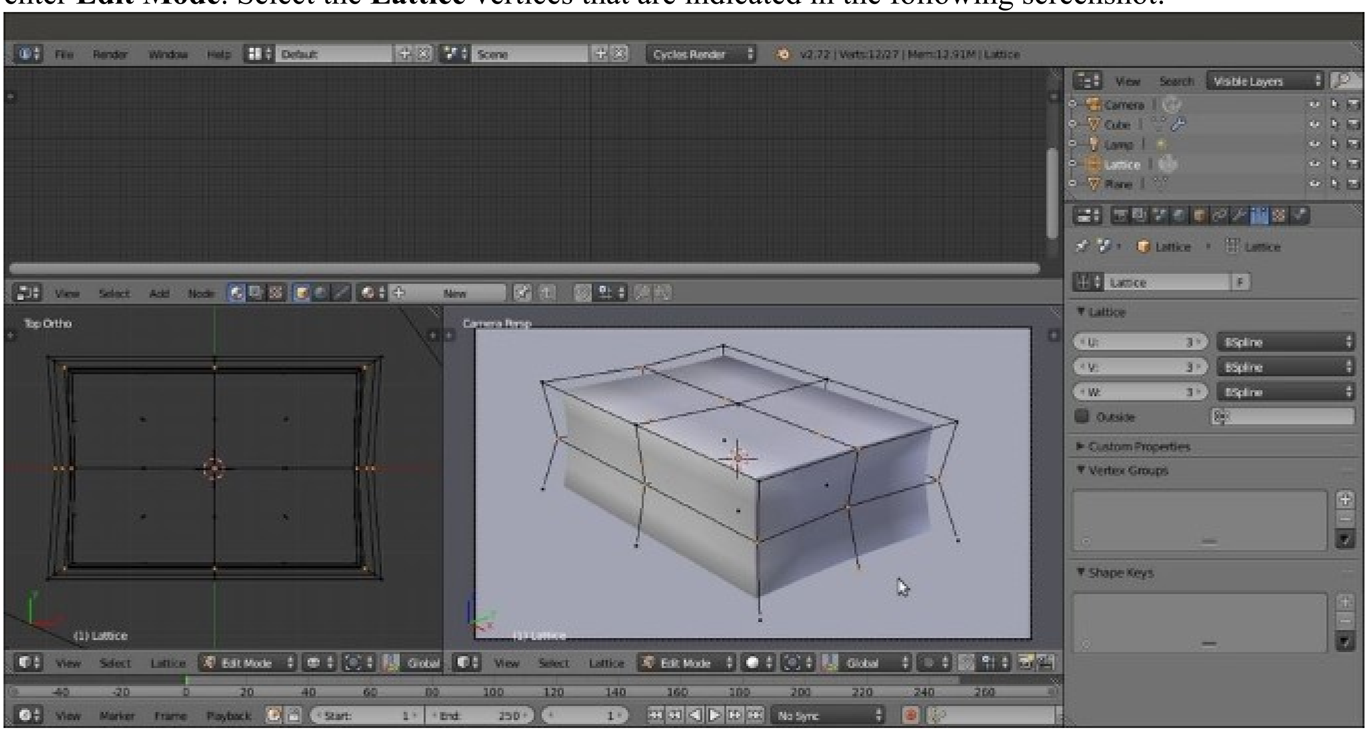
The synthetic sponge material when rendered

Getting ready

Follow these steps to create a synthetic sponge material with procedurals:

1. Start Blender and switch to the **Cycles Render** engine.
2. Select the default Cube, and in the **Transform** subpanel to the right of the 3D viewport (under **Dimensions**), change the values of **X** to `0.350`, **Y** to `0.235`, and **Z** to `0.116`. Press *Ctrl* + *A* to apply the scale.
3. With the mouse arrow in the 3D viewport, add a Plane to the scene (press *Shift* + *A* and navigate to **Mesh** | **Plane**). Exit **Edit Mode**, and in the **Transform** subpanel (the **Dimensions** item), set the values of **X** to `20.000` and **Y** to `20.000`. Press *Ctrl* + *A* to apply the scale. Move the Plane down (press *G*, then press *Z*, enter `-0.05958`, and then press *Enter*) to act as the floor for the sponge.
4. Select the **Lamp** item. In the **Object data** window, click on the **Use Nodes** button and change the type to **Sun**. Set the **Size** to `0.500`, **Color** to pure white, and the **Strength** value to `5.000`. In the **Transform** panel, set the values of **Rotation** value of **X** to `15°`, **Y** to `0°`, and **Z** to `76°`.
5. Select the **Camera** item, and in the **Object data** window under the **Lens** subpanel, change the **Focal Length** value to `60.000`. In the **Transform** subpanel, set the values of the **Location** value of **X** to `0.82385`, **Y** to `-0.64613`, and **Z** to `0.39382`. Change the **Rotation** values of **X** to `68°`, **Y** to `0°`, and **Z** to `51°`.

6. Go to the **World** window and click on the **Use Nodes** button under the **Surface** subpanel. Click on the little square with a dot on the right side of the color slot, and from the menu, select **Sky Texture**. Change **Sky Type** to **Preetham** and set the **Strength** value to `0.100`.
7. Go to the **Render** window, and under the **Sampling** subpanel, set the **Clamp Direct** and **Clamp Indirect** values to `1.00`. Set **Samples** for **Render** and **Preview** to `50`.
8. Split the 3D viewport into two rows. Convert the upper row to a **Node Editor** window. Split the bottom view into two parts and convert the left part to another 3D viewport. With the mouse arrow in the left 3D view, press `0` on the numeric keypad to go to the **Camera** view.
9. Select the **Cube**, and with the mouse arrow in the **Camera** view, press *Shift* + *S*. Navigate to **Cursor to Selected** to place the cursor on the pivot of the Cube (if it's elsewhere). Add **Lattice** to the scene (press *Shift* + *A* and select **Lattice**). Press *Tab* to exit **Edit Mode**. In the **Transform** subpanel, under **Scale**, set the values of **X** to `0.396`, **Y** to `0.264`, and **Z** to `0.129`. Go to the **Object data** window, and in the **Lattice** subpanel set the **U**, **V**, and **W** values to `3`.
10. Reselect the **Cube** and go to the **Object modifiers** window. Assign a **Subdivision Surface** modifier, switch the type of subdivision algorithm from **Catmull-Clark** to **Simple**, and set the **Subdivisions** value to `2` for both **View** and **Render**.
11. Assign a **Bevel** modifier and set the **Width** value to `0.0010`. Assign a **Lattice** modifier, and in the empty **Object** field, select the **Lattice** name. Reselect the **Lattice** object and press *Tab* to enter **Edit Mode**. Select the **Lattice** vertices that are indicated in the following screenshot:



The setup for the sponge scene in Solid viewport shading mode

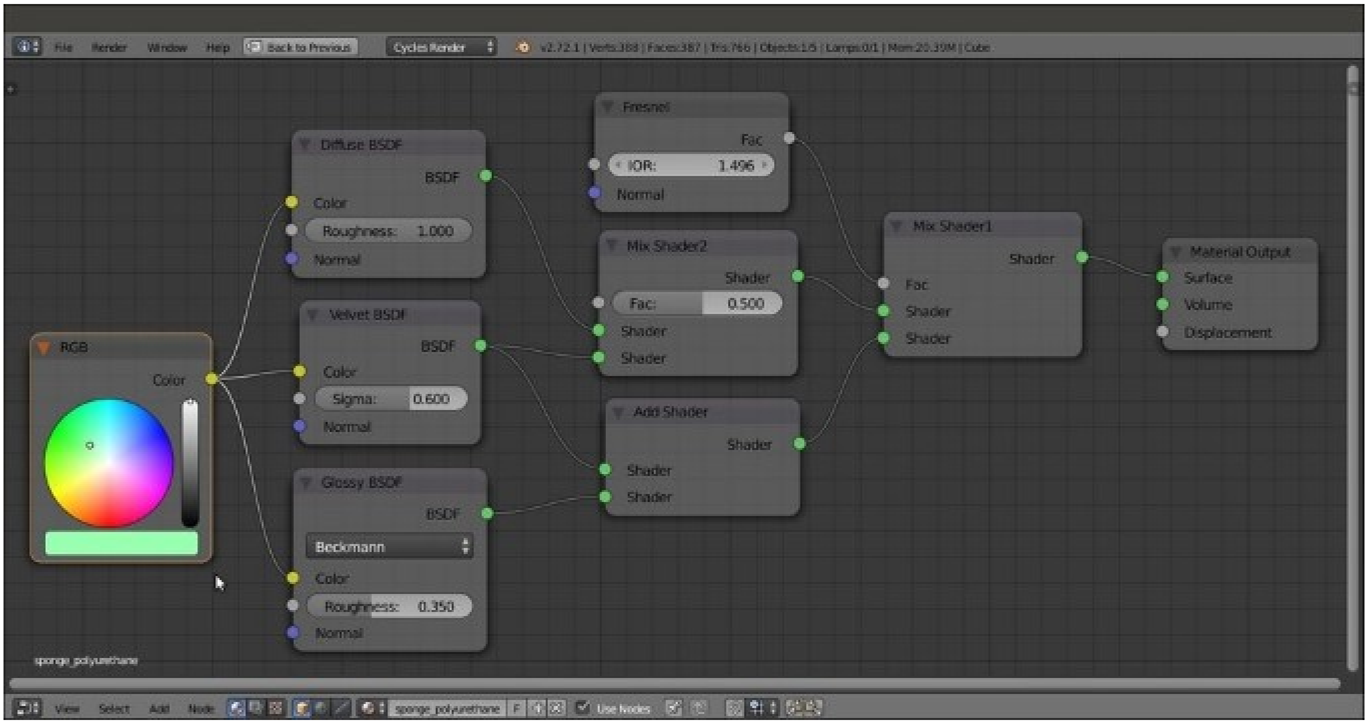
12. Scale the selected vertices on the *x* and *y* axes to slightly smaller values (press *S*, then press *Shift* + *Z*, enter digit *.9*, and press *Enter*). Then scale only the upper vertices to slightly smaller values, and similarly scale other vertices to obtain a shape similar to a kitchen sponge. Then exit **Edit Mode** (press *Tab*).

13. Reselect the **Cube**, navigate to **Tool Shelf** | **Tools** | **Shading**, and select **Smooth**. With the mouse arrow in the 3D view, press *N* and *T* to close the **Transform** and **Tool Shelf** panels. Go to the **Material** window.

How to do it...

Now let's create the material by performing the following steps:

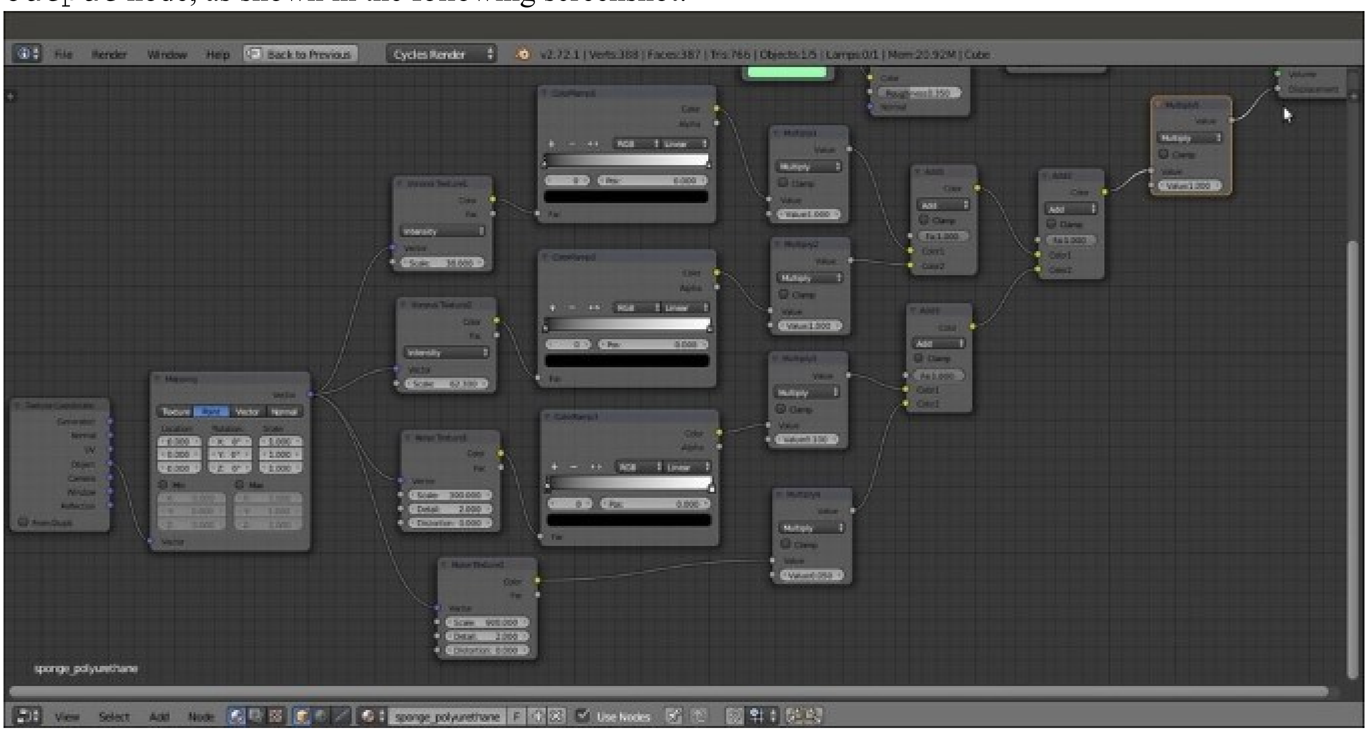
1. First, select the **Plane** and click on **New** in the **Material** window under the main **Properties** panel or in the **Node Editor** toolbar. In the **Material** window, switch the **Diffuse BSDF** node with a **Mix Shader** node. In the first **Shader** slot, select a **Diffuse BSDF** node, and in the second **Shader** slot, select a **Glossy BSDF** shader node. Set **Distribution** of the **Glossy BSDF** shader to **Beckmann**, the **Fac** value of the **Mix Shader** to `0.400`, and the **Diffuse BSDF** node's **Color** to a shade of blue (in my case, **R** to `0.110`, **G** to `0.147`, and **B** to `0.209`).
2. Now select the **Cube** object and click on **Use Nodes** in the **Material** window under the main **Properties** panel or in the **Node Editor** window's toolbar. Rename the new material `sponge_polyurethane`.
3. In the **Material** window, switch the **Diffuse BSDF** node with a **Mix Shader** node. In the **Label** slot in the **Node** subpanel under the **Properties** panel of the **Node Editor** window (if this is not present, press the *N* key to make it appear), label it as `Mix Shader1`. Go to the **Material** window, and in the **Mix Shader1** node's first **Shader** slot, select a **Mix Shader** node again. Label it as `Mix Shader2`. In the second **Shader** slot, select an **Add Shader** node.
4. In the first **Shader** slot of the **Mix Shader2** node, select a **Diffuse BSDF** shader node, and in the second slot, a **Velvet BSDF** node. Set the **Diffuse BSDF** node's **Roughness** value to `1.000` and the **Velvet** node's **Sigma** value to `0.600`.
5. Connect the output of the **Velvet** shader to the first **Shader** input of the **Add Shader** node. In its second **Shader** input, load a **Glossy BSDF** shader and set the **Roughness** value to `0.350`.
6. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and connect it to the **Fac** input socket of the **Mix Shader1** node. Set the **IOR** value to `1.496`. Add an **RGB** node (press *Shift* + *A* and navigate to **Input** | **RGB**) and connect its output to the **Color** input sockets of the **Diffuse BSDF**, **Velvet**, and **Glossy BSDF** shader nodes. Set the **RGB** node's **Color** of **R** to `0.319`, **G** to `1.000`, and **B** to `0.435` (any other color is also fine), as shown in the following screenshot:



The basic shader component

7. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**), a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**), two **Voronoi Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Voronoi Texture**), and two **Noise Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**). Label the textures as `Voronoi Texture1`, `Voronoi Texture2`, `Noise Texture1`, and `Noise Texture2`.
8. Place the four textures in a row. Then connect the **Object** output of the **Texture Coordinate** node to the **Vector** input socket of the **Mapping** node, and the **Vector** output of this node to the **Vector** input sockets of the four texture nodes.
9. Set the **Scale** value of the **Voronoi Texture1** node to `38.000`, the **Voronoi Texture2** node to `62.300`, the **Noise Texture1** node to `300.000`, and the **Noise Texture2** node to `900.000`.
10. Add three **ColorRamp** nodes (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**). Label them as `ColorRamp1`, `ColorRamp2`, and `ColorRamp3`. Connect the **Color** output of the **Voronoi Texture1** node to the **Fac** input socket of the **ColorRamp1** node, the **Color** output of the **Voronoi Texture2** node to the **Fac** input socket of the **ColorRamp2** node, and the **Color** output of the **Noise Texture1** node to the **Fac** input socket of the **ColorRamp3** node.
11. Add four **Math** nodes (press *Shift* + *A* and navigate to **Converter** | **Math**). Set **Operation** to **Multiply** and label them as `Multiply1`, `Multiply2`, `Multiply3`, and `Multiply4`. Connect the **Color** output of the three **ColorRamp** nodes to the first **Value** input socket of the first three **Multiply-Math** nodes, and the **Color** output of the **Noise Texture2** node to the first **Value** input socket of the **Multiply4** node. Set the second **Value** input socket of the **Multiply1** and **Multiply2** nodes to `1.000`, the second **Value** input socket of the **Multiply3** node to `0.100`, and the second **Value** input socket of the **Multiply4** node to `0.050`.

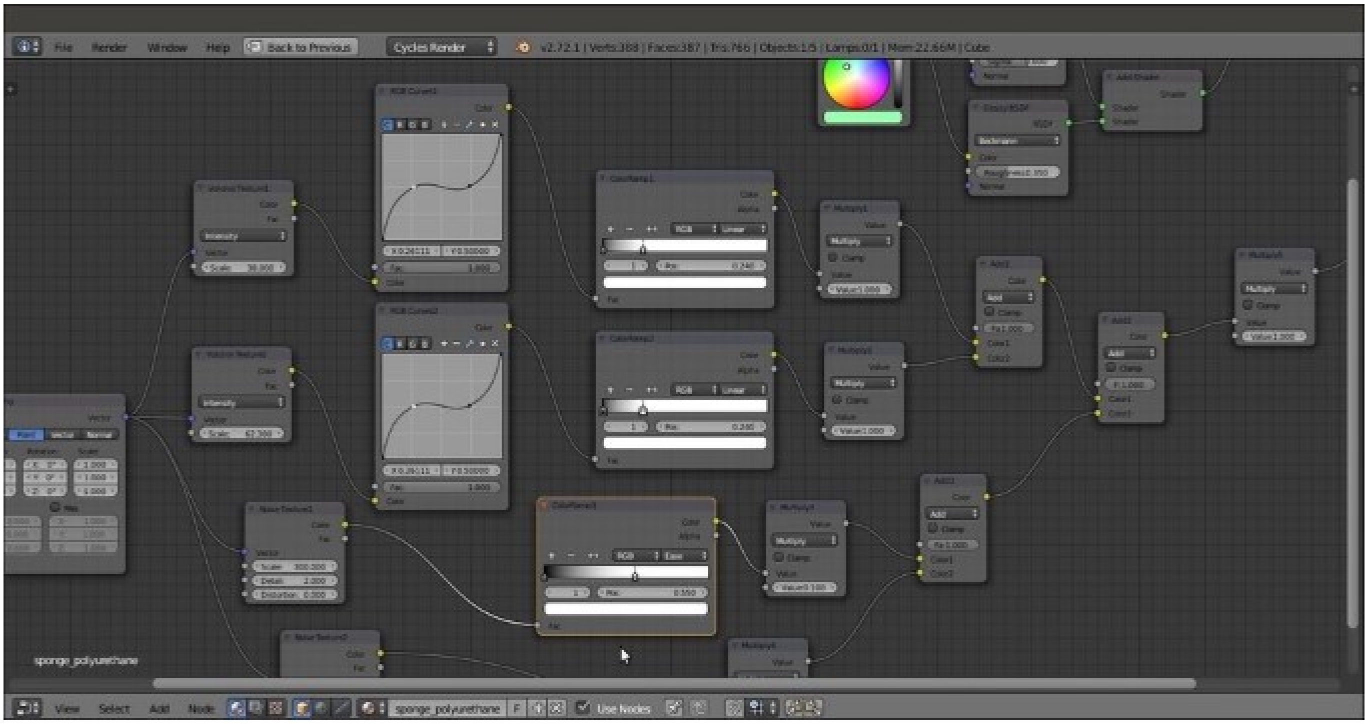
12. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Connect the output of the **Multiply1** node to the **Color1** input socket and the output of the **Multiply2** node to the **Color2** input socket. Change **Blend Type** to **Add** and the **Fac** value to `1.000`. Label the **Add-MixRGB** node as `Add1`.
13. Press *Shift* + *D* to duplicate the **Add1** node, and label it as `Add2`. Connect the output of the **Add1** node to the **Color1** input socket. Then connect the output of the **Multiply3** node to the **Color2** input socket of the **Add2** node.
14. Press *Shift* + *D* to duplicate the **Add2** node, and label it as `Add3`. Paste it between the **Multiply3** and **Add2** nodes, and connect the output of the **Multiply4** node to the **Color2** input socket of the **Add3** node.
15. Add a new **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**), set **Operation** to **Multiply**, and label it as `Multiply5`. Connect the output of the **Add2** node to the first **Value** input socket of the **Multiply5** node, and set the second **Value** input socket to `1.000`.
16. Connect the output of the **Multiply5** node to the **Displacement** input socket of the `Material Output` node, as shown in the following screenshot:



The bump pattern

17. Now box-select (press the *B* key and then click and drag the selection to enclose the objects) the **ColorRamp1**, **ColorRamp2**, **Multiply1**, **Multiply2**, **Add1**, **Add2**, and **Multiply5** nodes. Press *G* and move them to the right to make room for new nodes on the left side.
18. Add an **RGB Curves** node (press *Shift* + *A* and navigate to **Color** | **RGB Curves**) and paste it between the **Voronoi Texture1** node and the **ColorRamp1** node. Label it as `RGB Curves1`. Click on the curve to add a control point, and in the coordinate slots below the node window, set the **X** value to `0.26111` and the **Y** value to `0.50000`. Click to add a second control point. Set **X** to `0.73889` and **Y** to `0.51111`.

19. Press *Shift* + *D* to duplicate the **RGB Curves1** node. Paste it between the **Voronoi Texture2** and **ColorRamp2** nodes. Label it as `RGB Curves2`.
20. Go to the **ColorRamp1** node and move the white color stop to the `0.240` position. Then go to the **ColorRamp2** node and repeat this step. Next, go to the **ColorRamp3** node, move the white color stop to the `0.550` position, and set **Interpolation** to **Ease**, as shown in the following screenshot:



Tweaking the bump pattern

How it works...

- From steps 2 to 6, we built the basic shader for the sponge material and the color. As you can see in the **Rendered** camera view, without the bump pattern, there is a visible artifact in the more distant side of the mesh. This is due to the **Smooth** shading we set in step 13 of the *Getting ready* section. Setting the shading to **Flat** again would remove the artifact, but would also show the blocky faces of the deformed sponge mesh. In this case, because of the bump pattern and the fact that the mesh is subdivided, this is not a major issue, and both solutions (smooth but with artifacts or flat but blocky) are fine.
- From steps 7 to 20, we built the sponge bump pattern by mixing **Voronoi Texture** nodes at different sizes, with increased contrast due to the **ColorRamp** nodes. Then we add some noise to avoid a highly smoothed surface.

Creating a spaceship hull shader

In this recipe, we will create a spaceship hull material. We will add random, tiny light windows based on the values of procedural textures, and the spaceship's logo as if it were painted in red on the hull, as shown in the following screenshot:

The final, rendered spaceship hull material assigned to a displaced Torus primitive

Getting ready

To start creating this spaceship hull, we need the spaceship and space first. Follow these steps to build a quick and easy model and set up the scene:

1. Start Blender and switch to the **Cycles Render** engine. Select the default **Cube** and delete it.
2. With the mouse arrow in the 3D view, press *Shift* + *A* and add a **Torus** primitive (press *Shift* + *A* and navigate to **Mesh** | **Torus**). In **Edit Mode**, scale it to at least twice its current size (press *A* to select all the vertices, then type *S*, enter *2*, and press *Enter*).
3. Exit **Edit Mode**, and in **Outliner**, select the **Lamp** object. In the **Object data** window, change it to **Sun**. Then set the **Size** value to `0.050`. Click on the **Use Nodes** button and set the **Strength** value to `10.000`. Change the **Color** value of **RGB** to `0.800`.
4. Go to the **World** window and click on the **Use Nodes** button under the **Surface** subpanel. Click on the little square with a dot to the right of the **Color** slot. From the menu, select **Sky Texture**. Set the **Strength** to `0.100`.
5. Select the **Camera**, and in the **Transform** panel, set the **Location** values of **X** to `6.10677`, **Y** to `-0.91141`, and **Z** to `-2.16840`. Set the **Rotation** values of **X** to `112.778°`, **Y** to `-0.003°`, and **Z** to `81.888°`.
6. Go to the **Render** window, and under the **Sampling** subpanel, set the **Samples** to `25` for **Preview** and `100` for **Render**. Then set the **Clamp Indirect** value to `1.00`, but let the **Clamp**

Direct value remain as `0.00`. Go to the **Film** subpanel and check the **Transparent** item. Then set the output **File Format** to **RGBA**.

7. Under the **Light Paths** subpanel, disable both the **Reflective** and **Refractive Caustics** items. Set **Filter Glossy** value to `1.00`. Under the **Performance** subpanel, set the **Viewport BVH Type** to **Static BVH** (this should speed up the rendering a bit, considering the fact that the model is static and doesn't change shape). Check the **Persistent Images** and **Use Spatial Splits** items.
8. Press *N* with the mouse arrow in the 3D view to close the **Properties** panel. Then press *T* to get rid of the **Tool Shelf** panel. Split the 3D view into two rows. Convert the upper row to a **Node Editor** window.
9. Split the bottom window into two parts. Convert the left part to a **UV/Image Editor** window. Select **Torus** and press *Tab* to go to **Edit Mode**. In the window toolbar, change the selection mode to **Face select**. Select only one face on the mesh (whichever you prefer). Press the *A* key twice to select all the faces, and keep the first face selected as the active face. Then press the *U* key. In the **UV Mapping** pop-up menu, select the **Follow Active Quads** item, and then in the next pop-up menu set **Even** as **Edge Length Mode**. Click on the **OK** button.
10. With the mouse arrow in the **UV/Image Editor** window, press *A* to select all the vertices of the UV islands. Then scale them to one-third of their current size (press *S*, enter digit *.3*, and press *Enter*). Press *Tab* to exit **Edit Mode**, and change **UV/Image Editor** to **3D View**. Convert the right 3D viewport to a **Camera** view by pressing the *0* key on the numeric keypad (with the mouse arrow in the 3D view).
11. Go to the **Object modifiers** window and assign a **Subdivision Surface** modifier to **Torus**. Set the **Subdivisions** level to `4` for both **View** and **Render**. Set the **Camera** view mode to **Rendered** and go to the **Material** window.

How to do it...

Now let's start creating the material. The steps to create a basic hull shader are as follows:

1. Click on **New** in the **Material** window under the main **Properties** panel or in the **Node Editor** toolbar. Rename the new material `spacehull`.
2. In the **Material** window, switch the **Diffuse BSDF** node with a **Mix Shader** node. Label it as `Mix Shader1`. In the first **Shader** slot, select a new **Mix Shader** node (label it as `Mix Shader2`), and in the second slot, select an **Anisotropic BSDF** node.
3. In the first **Shader** slot of the **Mix Shader2** node, select a **Diffuse BSDF** node, and in the second slot, select a **Glossy BSDF** node. Set the **Distribution** of both the **Glossy BSDF** and **Anisotropic BSDF** nodes to **Ashikmin-Shirley**.
4. In the **Anisotropic BSDF** shader node, set the **Rotation** value to `0.250`. In the **Diffuse BSDF** node, set the **Roughness** value to `0.500`.
5. Add a new `Mix Shader` node (press *Shift* + *A* and navigate to **Shader** | **Mix Shader**) and paste it between the **Mix Shader1** and the **Material Output** nodes. Label it as `Mix Shader_Spec_Amount` and connect the output of the **Diffuse BSDF** node to the first **Shader** input socket (so that the link from the **Mix Shader2** node automatically switches to the second socket). Set the **Fac** value to `0.300`.

6. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**). Connect its output to the **Fac** input sockets of the **Mix Shader1** and **Mix Shader2** nodes. Set the **IOR** value to `100.000`.
7. Add a **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Press *Shift* and select all the nodes except the **Material Output** node. Then select the **Frame** and press *Ctrl* + *P* to parent all of them. Label the frame as `SHADER`, as shown in the following screenshot:

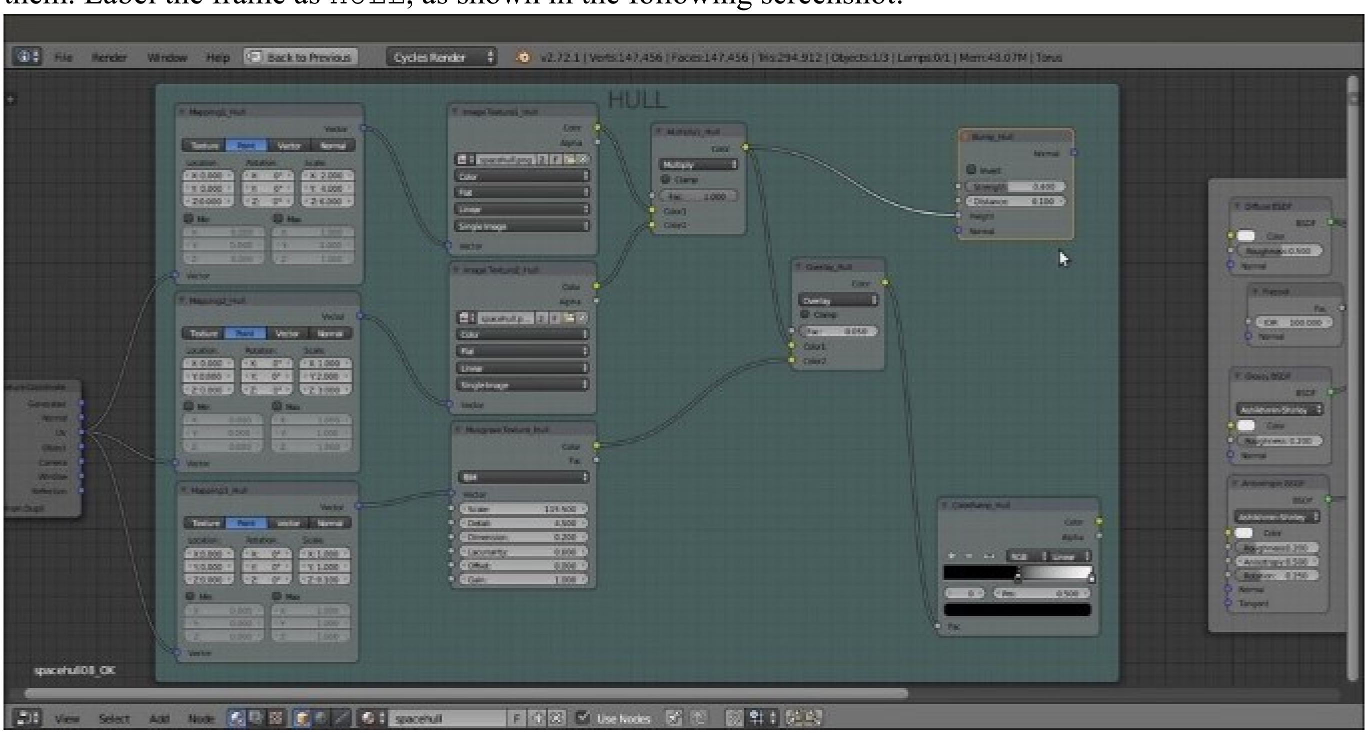
The SHADER frame

The steps to create hull's panels are as follows:

8. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**), a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**), two **Image Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Image Texture**), and one **Musgrave Texture** node (press *Shift* + *A* and navigate to **Texture** | **Musgrave Texture**).
9. Label the textures as `Image Texture1_Hull`, `Image Texture2_Hull`, and `Musgrave Texture_Hull`. Place them in a column.
10. Press *Shift* + *D* to duplicate the **Mapping** node twice. Label the nodes as `Mapping1_Hull`, `Mapping2_Hull`, and `Mapping3_Hull`. Place them in a column to the left of the texture nodes. Connect the UV output of the **Texture Coordinate** node to the **Vector** input sockets of the three **Mapping** nodes. Connect the **Vector** output of each of the **Mapping** nodes to the **Vector** input socket of each of the texture nodes.
11. Click on the **Open** button in the **Image Texture1_Hull** node to load `image spacehull.png`. Then click on the little arrows to the left of the **Open** button in the **Image Texture2_Hull** node to select the same image texture. Go to the **Musgrave Texture** node and

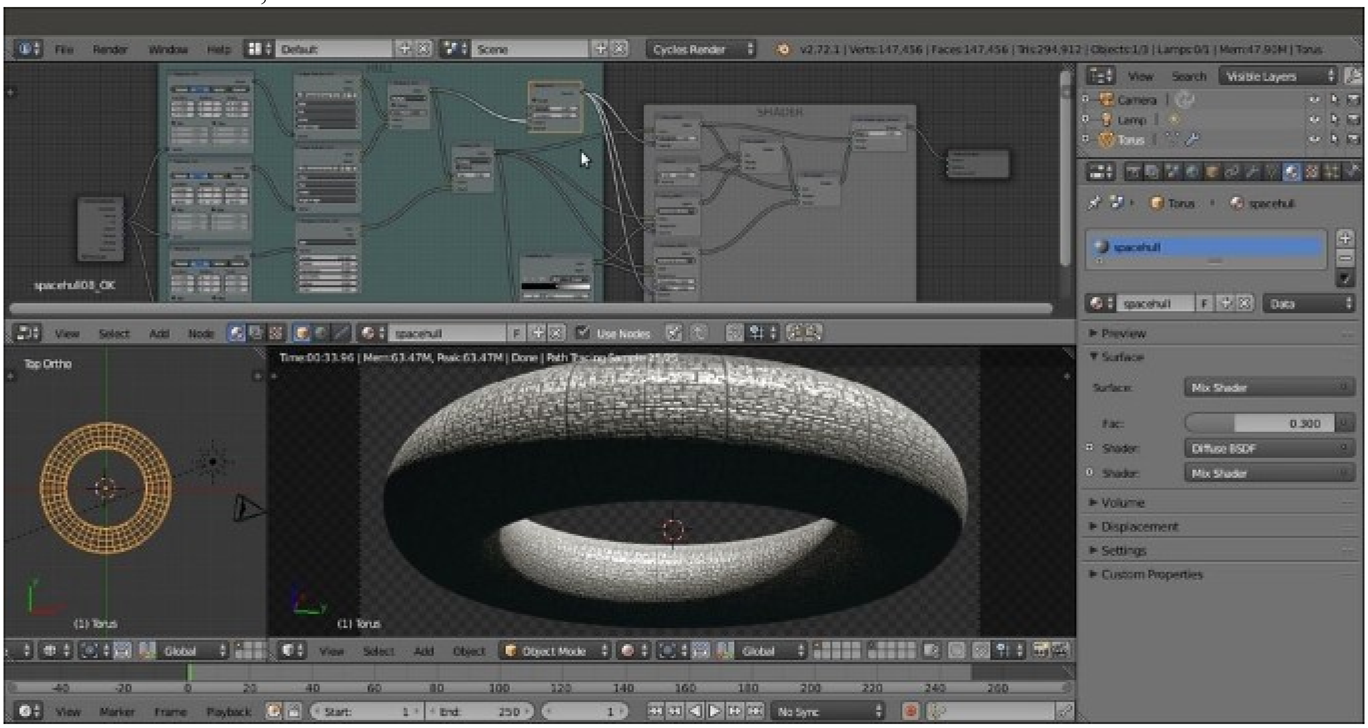
set the **Scale** value to `115.500`, the **Detail** value to `4.500`, the **Dimension** value to `0.200`, and the **Lacunarity** value to `0.600`.

12. Go to the **Mapping1_Hull** node and set the **Scale** value of **X** to `2.000`, **Y** to `4.000`, and **Z** to `6.000`. Then go to the **Mapping2_Hull** node and set the **Scale** value of **Y** to `2.000` and **Z** to `3.000`. Next, go to the **Mapping3_Hull** node and set the **Scale** value of **Z** to `0.100`.
13. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Set **Blend Type** to **Multiply** and the **Fac** value to `1.000`. Label it as `Multiply1_Hull`. Then connect the **Color** output of the **Image Texture1_Hull** node to the **Color1** input socket and the **Color** output of the **Image Texture2_Hull** node to the **Color2** input socket.
14. Press *Shift* + *D* to duplicate the **Multiply1_Hull** node, change **Blend Type** to **Overlay**, and label it as `Overlay_Hull`. Set the **Fac** value to `0.050`. Connect the output of the **Multiply1_Hull** node to the **Color1** input socket and the **Color** output of the **Musgrave Texture** node to the **Color2** input socket.
15. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), label it as `ColorRamp_Hull`, and connect the output of the **Overlay_Hull** node to its **Fac** input socket. Move the black color stop to the `0.500` position.
16. Add a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**), label it as `Bump_Hull`, and connect the output of the **Multiply1_Hull** node to the **Height** input socket. Set the **Strength** value to `0.400`.
17. Add a **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Press *Shift* and select the three **Mapping** nodes, the two **Image Texture** nodes, the **Musgrave Texture** node, the **Bump** node, the **ColorRamp** node, the two **MixRGB** nodes, and then the **Frame**. Press *Ctrl* + *P* to parent them. Label the frame as `HULL`, as shown in the following screenshot:



The HULL frame

18. Connect the **Normal** output of the **Bump_Hull** node to the **Normal** input sockets of the **Diffuse BSDF**, **Glossy BSDF**, and **Anisotropic BSDF** nodes inside the **SHADER** frame. Then connect the output of the **Overlay_Hull** node to the **Color** input sockets of the same **Diffuse BSDF**, **Glossy BSDF**, and **Anisotropic BSDF** nodes. Next, connect the **Color** output of the **ColorRamp_Hull** node to the **Roughness** input sockets of the **Glossy BSDF** and **Anisotropic BSDF** shader nodes, as shown in this screenshot:



The output of the HULL frame connected to the SHADER frame nodes

The steps to create hull's logo are as follows:

19. Add a new **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**) and a new **Image Texture** node (press *Shift* + *A* and navigate to **Texture** | **Image Texture**). Label them as `Mapping4_Name` and `Image Texture3_Name`, respectively. Connect the UV output of the **Texture Coordinate** node to the **Mapping4_Name** node, and the output of this node to the **Vector** input socket of the **Image Texture_Name** node.
20. Click on the **Open** button of the **Image Texture** node and load the `spacehull_name.png` image, an image texture of the ARGUS logo with a transparent background (alpha channel).
21. Go to the **HULL** frame and add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Label it as `Mix_Hull_Name` and paste it between the **Overlay_Hull** node and the **Diffuse BSDF** shader node. Then connect its **Color** output to the **Color** input socket of the **Glossy BSDF** and **Anisotropic BSDF** shader nodes.
22. Connect the **Color** output of the **Image Texture_Name** node to the **Color2** input socket of the **Mix_Hull_Name** node. Then connect the **Alpha** output of the **Image Texture_Name** node to the **Fac** input socket of the **Mix_Hull_Name** node.

23. Go to the **Mapping4_Name** node and check both the **Min** and **Max** items. Then set the **Location** value of **X** to `-3.300` and **Y** to `1.000`. Set the **Scale** value of **Y** to `2.500`. (These values depend on the scale and location you want for your logo on the spaceship; just experiment looking at the real-time-rendered preview.)
24. Add a **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Press *Shift* and select the **Mapping4_Name** node, the **Image Texture3_Name** node, and then the **Frame**. Press *Ctrl* + *P* to parent them. Label the frame as `NAME`, as shown in the following screenshot:

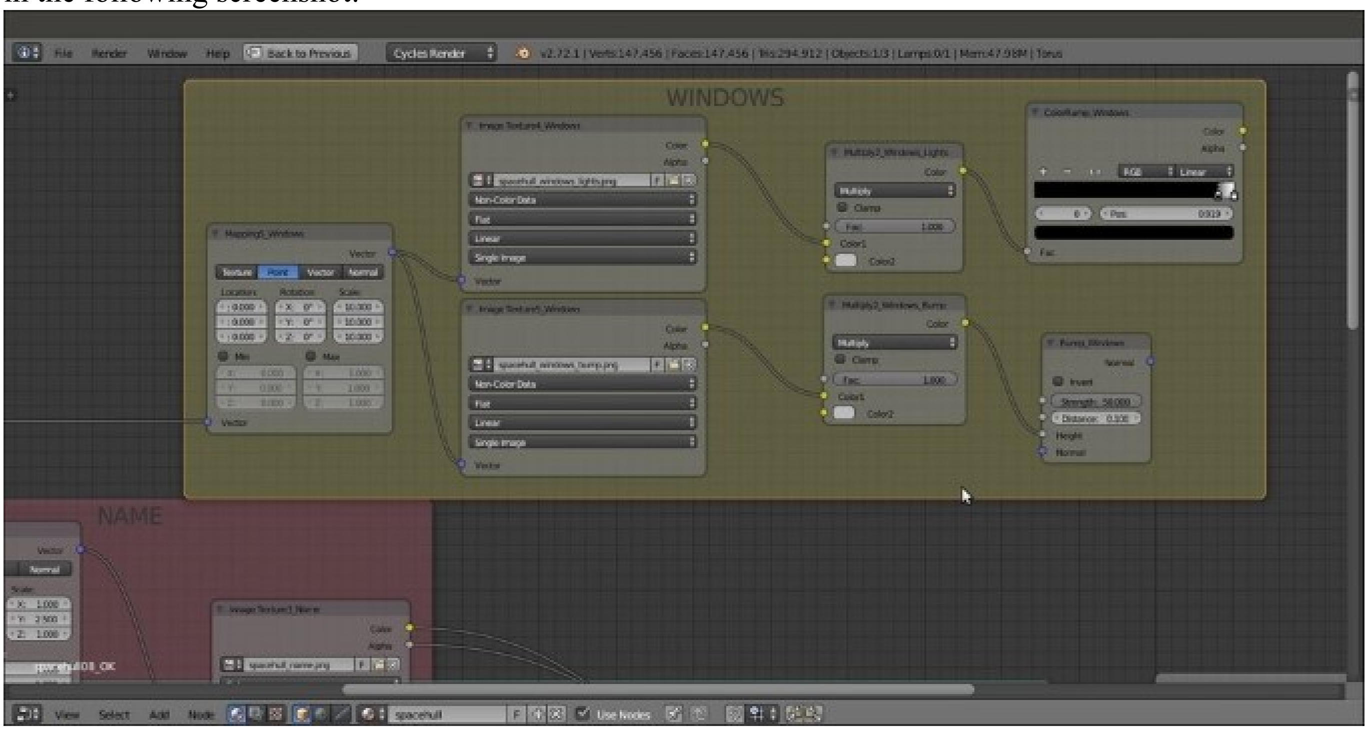
The ARGUS logo on the hull

The steps to create the windows are as follows:

25. Add a new **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**) and two **Image Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Image Texture**). Label them as `Mapping5_Windows`, `Image Texture4_Windows`, and `Image Texture5_Windows`. Connect the **Texture Coordinate** node's **UV** output and the **Mapping** node's output to the **Image Texture** nodes as usual. Then set the **Mapping** node's **Scale** values to `10.000` for the three axes.
26. Click on the **Open** button of the **Image Texture4_Windows** node and load the `spacehull_windows_lights.png` image. Then click on the **Open** button of the **Image Texture5_Windows** node and load the `spacehull_windows_bump.png` image. Set **Color Space** for both the image nodes to **Non-Color Data**.
27. Add two **MixRGB** nodes (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Set **Blend Type** to **Multiply** and **Fac** values to `1.000`. for both the nodes Label them as `Multiply2_Windows_Light` and `Multiply2_Windows_Bump`. Connect the output of the **Image Texture4_Windows** node to the **Color1** input socket of the

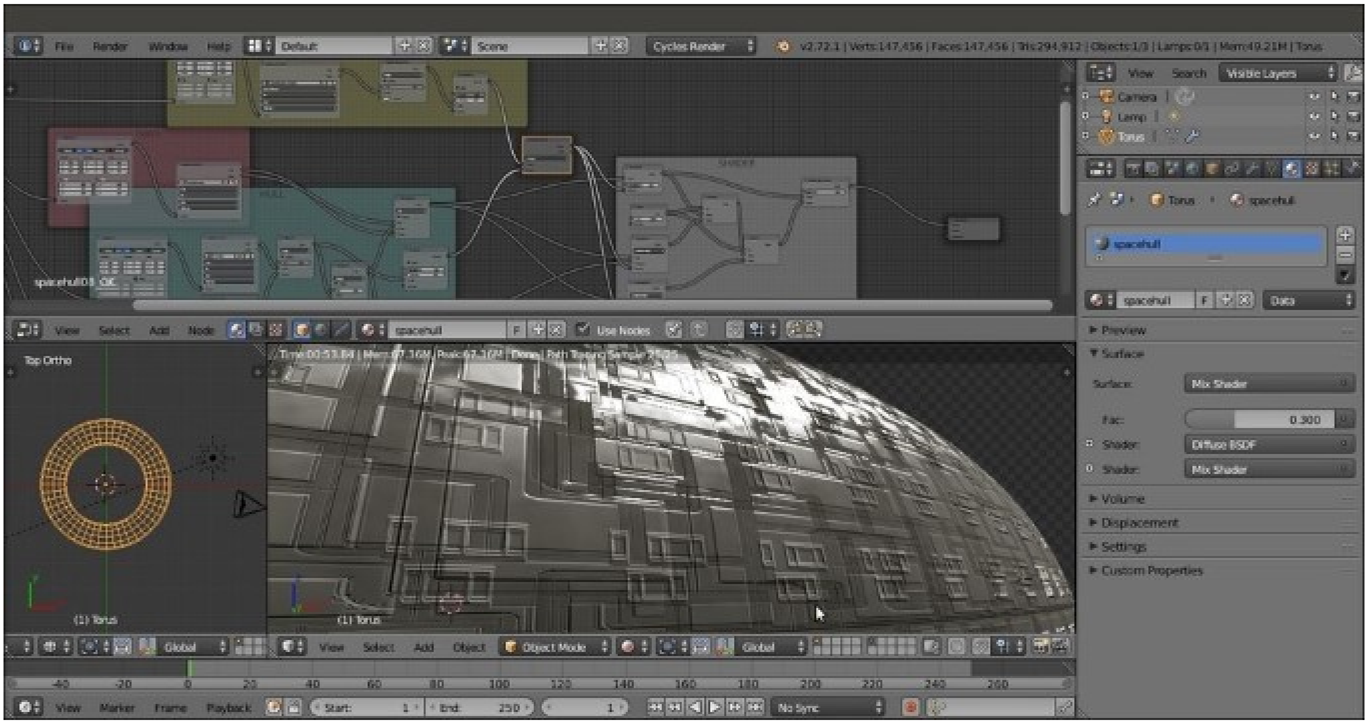
Multiply2_Windows_Light node, and the output of the **Image Texture5_Windows** node to the **Color1** input socket of the **Multiply2_Windows_Bump** node.

28. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), label it as `ColorRamp_Windows`, and move the black color stop to the `0.919` position. Connect the output of the **Multiply2_Windows_Light** node to its **Fac** input socket.
29. Add a new **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**), label it as `Bump_Windows`, and connect the output of the **Multiply2_Windows_Bump** node to the **Height** input socket. Set the **Strength** value to `50.000`.
30. Add a **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Press *Shift* and select the **Mapping5_Windows** node, the **Image Texture4_Windows** and **Image Texture5_Windows** nodes, the two **MixRGB** nodes, the **ColorRamp_Windows** and the **Bump_Windows** nodes, and then the **Frame**. Press *Ctrl* + *P* to parent them. Label the frame as **WINDOWS**, as shown in the following screenshot:



The WINDOWS frame

31. Add a **Vector Math** node (press *Shift* + *A* and navigate to **Converter** | **Vector Math**) and set **Operation** to **Average**. Connect the **Normal** output of the **Bump_Windows** node inside the **WINDOWS** frame to the first **Vector** input socket, and the **Normal** output of the **Bump_Hull** node inside the **HULL** frame to the second **Vector** input socket. Then connect the **Normal** output of the **Average Bump_Hull** node to the **Normal** input sockets of the **Diffuse BSDF**, **Glossy BSDF**, and **Anisotropic BSDF** shader nodes, as shown in this screenshot:

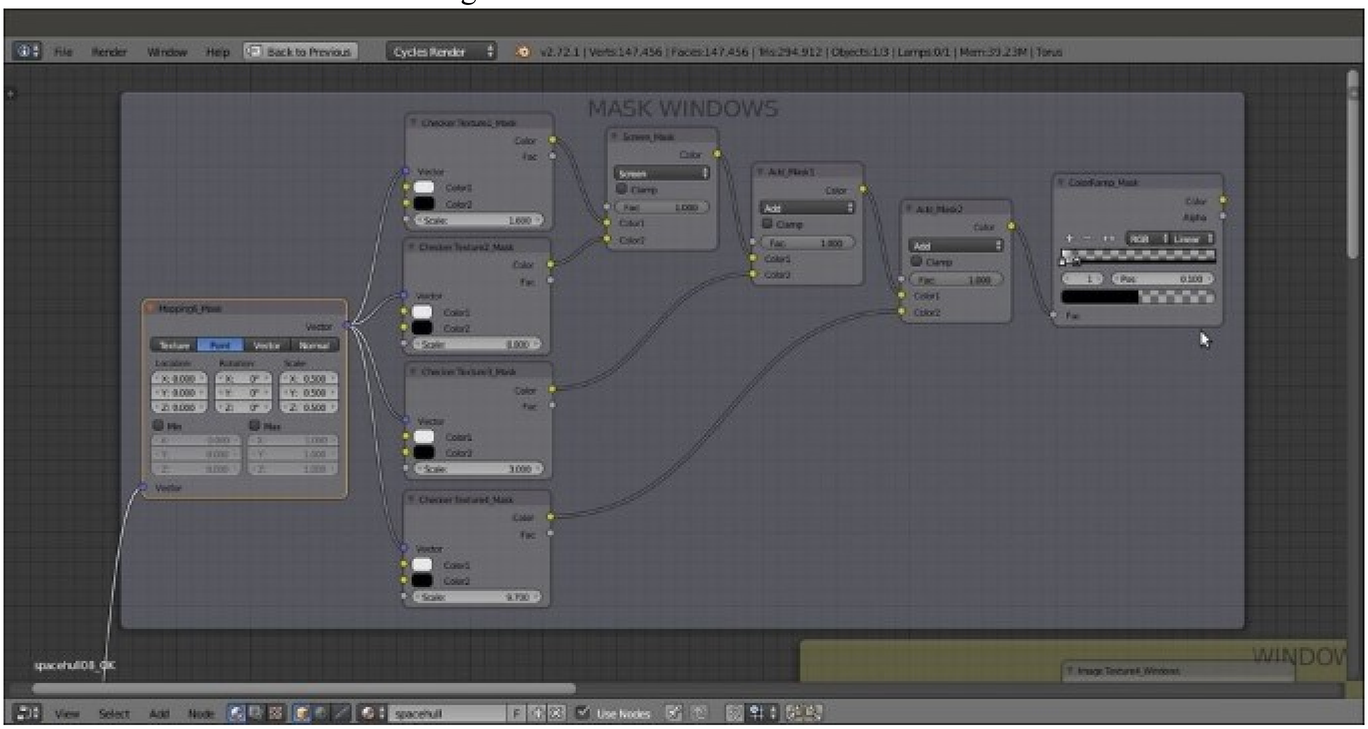


The windows bump visible on the hull

The steps to create the location mask for the windows are as follows:

32. Add one more **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**) and four **Checker Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Checker Texture**). Connect the **Texture Coordinate** node and the nodes as usual. Then label them as `Mapping6_Mask`, `Checker Texture1_Mask`, `Checker Texture2_Mask`, `Checker Texture3_Mask`, and `Checker Texture4_Mask`. In all, the four **Checker Texture** nodes change **Color2** to pure black.
33. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**), set **Blend Type** to **Screen** and **Fac** value to `1.000`, and label it as `Screen_Mask`. Connect the **Color** output of the **Checker Texture1_Mask** node to the **Color1** input socket of the **Screen_Mask** node, and the **Color** output of the **Checker Texture2_Mask** node to the **Color2** input socket.
34. Press *Shift* + *D* to duplicate the **MixRGB** node, change the duplicate node's **Blend Type** to **Add**, and label it as `Add_Mask1`. Connect the output of the **Screen_Mask** node to the **Color1** input socket. Then connect the **Color** output of the **Checker Texture3_Mask** node to the **Color2** input socket.
35. Press *Shift* + *D* to duplicate the **Add_Mask1** node, and label the duplicate as `Add_Mask2`. Connect the output of the **Add_Mask1** node to the **Color1** input socket. Then connect the **Color** output of the **Checker Texture4_Mask** node to the **Color2** input socket.
36. Add a **ColorRamp** node and label it as `ColorRamp_Mask`. Connect the output of the **Add_Mask2** node to its **Fac** input socket. Then move the black color stop to the `0.100` position and the white color stop to the `0.000` position. Set **Alpha** of the black color stop to `0.000`.

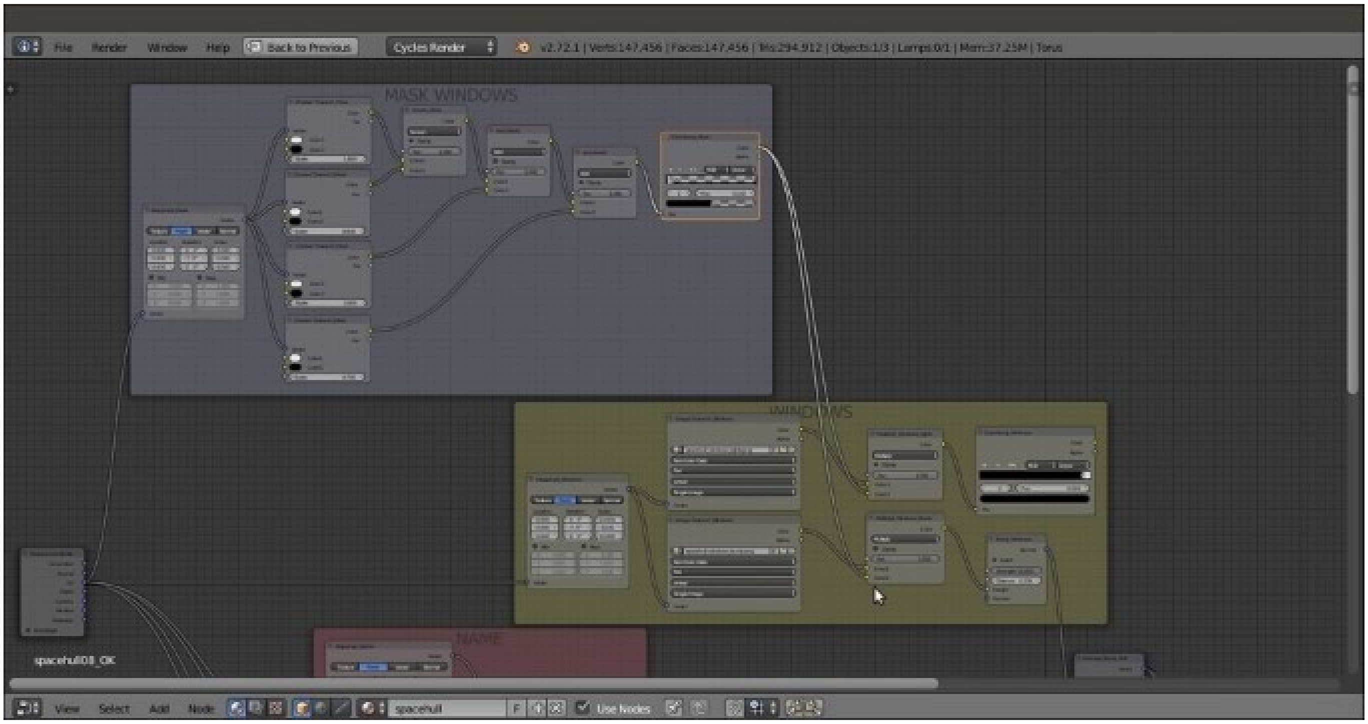
37. Go to the **Checker Texture** nodes. Set the **Scale** value for the **Checker Texture1_Mask** node to `1.600`, the **Checker Texture2_Mask** node to `8.800`, the **Checker Texture3_Mask** node to `3.000`, and the **Checker Texture4_Mask** node to `9.700`. Go to the **Mapping6_Mask** node and set the **Scale** values to `0.500` for all the three axes.
38. Add a **Frame** (press *Shift* + *A* and navigate to **Layout** | **Frame**). Press *Shift* to select the recently added nodes and then the **Frame**. Press *Ctrl* + *P* to parent them. Rename the frame as `MASK WINDOWS` as shown in the following screenshot:



The MASK WINDOWS frame

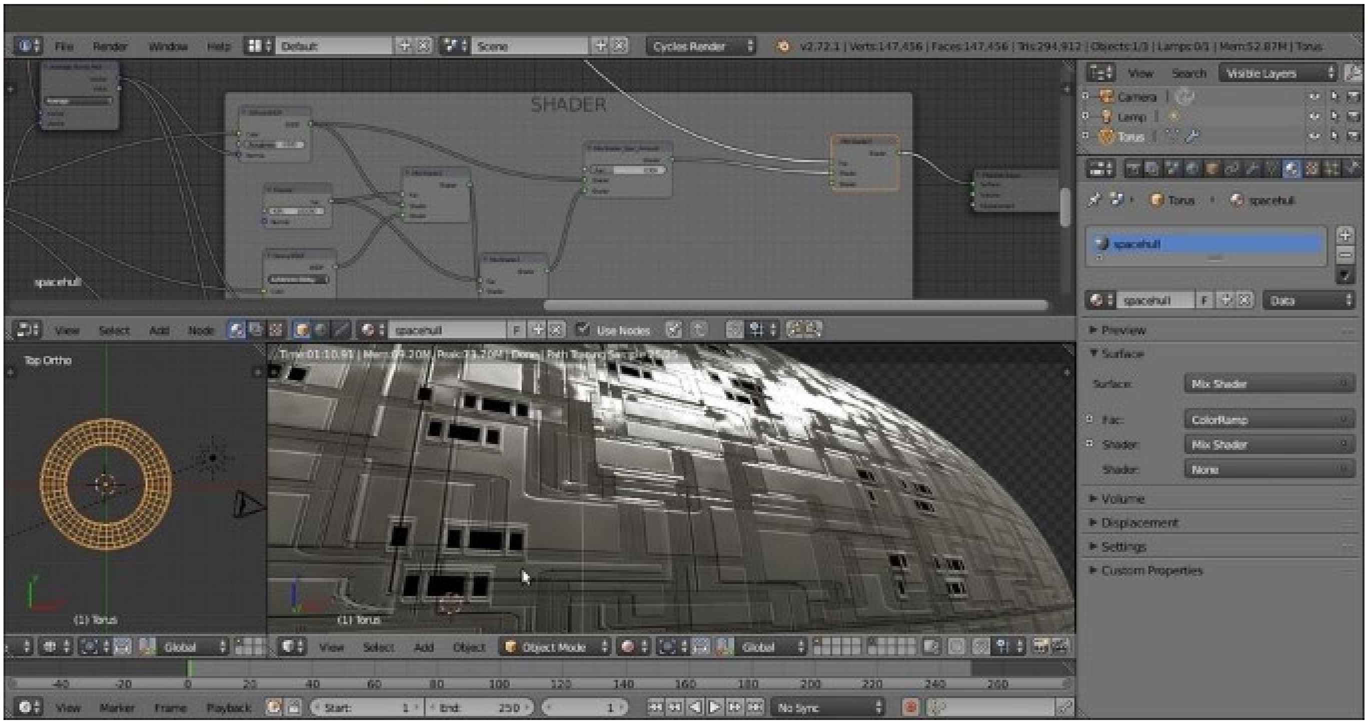
The steps to create the final connections are as follows:

39. Connect the **Color** output of the **ColorRamp_Mask** node to the **Color2** input sockets of both the **Multiply2_Windows_Lights** and **Multiply2_Windows_Bump** nodes, as shown in this screenshot:



The MASK WINDOWS frame output connected to the WINDOWS frame nodes

40. Go to the **SHADER** frame and add a **Mix Shader** node (press *Shift* + *A* and navigate to **Shader** | **Mix Shader**). Label it as `Mix Shader3` and paste it between the **Mix Shader_Spec_Amount** and the **Material Output** nodes.
41. Connect the **Color** output of the **ColorRamp_Windows** node inside the **WINDOWS** frame to the **Fac** input socket of the **Mix Shader3** node, as shown in the following screenshot:



The output of the WINDOWS frame connected to the SHADER frames nodes and the result in the Rendered preview

The steps to create the light emitter for the windows are as follows:

42. Inside the **SHADER** frame, add an **Emission** shader node (press *Shift* + *A* and navigate to **Shader** | **Emission**), a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), and an **Object Info** node (press *Shift* + *A* and navigate to **Input** | **Object Info**). Label the **ColorRamp** node as `ColorRamp_Lights_Colors`, change **Interpolation** to **Constant**, and add six more color stops (eight total). Change the color values alternatively of **R** to `0.800`, **G** to `0.517`, **B** to `0.122`; and **R** to `0.800`, **G** to `0.198`, and **B** to `0.040` (or any other color you prefer).
43. Connect the **Random** output of the **Object Info** node to the **Fac** input socket of the **ColorRamp** node, and the output of this node to the **Color** input socket of the **Emission** node.
44. Connect the **Emission** node's output to the second **Shader** input socket of the **Mix Shader3** node. Then set **Strength** to `3.000`, as shown in the following screenshot:

The windows on the hull getting illuminated by the ColorRamp_Lights_Colors node and an Emission node output connected to the SHADER output

How it works...

- From step 1 to step 7, we built the general shader for the metallic hull, which is similar to the metal node group we saw in Chapter 4, *Creating Man-made Materials in Cycles*. This was achieved by mixing **Diffuse BSDF** and **Glossy BSDF** shaders with an **Anisotropic BSDF** node on a ground with a quite high **IOR** value (`100.000`), and through the usual **Mix Shader** nodes. We added one more **Mix Shader** node (**Mix Shader_Spec_Amount**) to include the possibility of setting more specularity than anisotropy, and vice versa.
- From step 8 to step 18, we built the **HULL** frame group by superimposing two differently scaled versions of the same image. Then they could be used for the color, bump, and specular components. These components were obtained by contrasting the paneling through a **ColorRamp** node and then going straight to the **Glossy BSDF** shader's roughness and the **Anisotropic BSDF** shader, to add a metallic look. The mixture of both **Glossy BSDF** and **Anisotropic BSDF** is made on the ground of a **Fresnel** node set to `100.000`. A very high value like this is needed because the specularity is then mixed again with the **Diffuse BSDF** component to the purpose to obtain a slider to tweak the effect.
- From step 19 to step 24, we added the red hull's logo, ARGUS, using its own alpha channel to overimpose it on the hull surface's panels..
- From step 25 to step 30, we built the **WINDOWS** frame group.
- In step 31, we merged (averaged) the bump effect of the windows with the bump effect of the hull's panels.

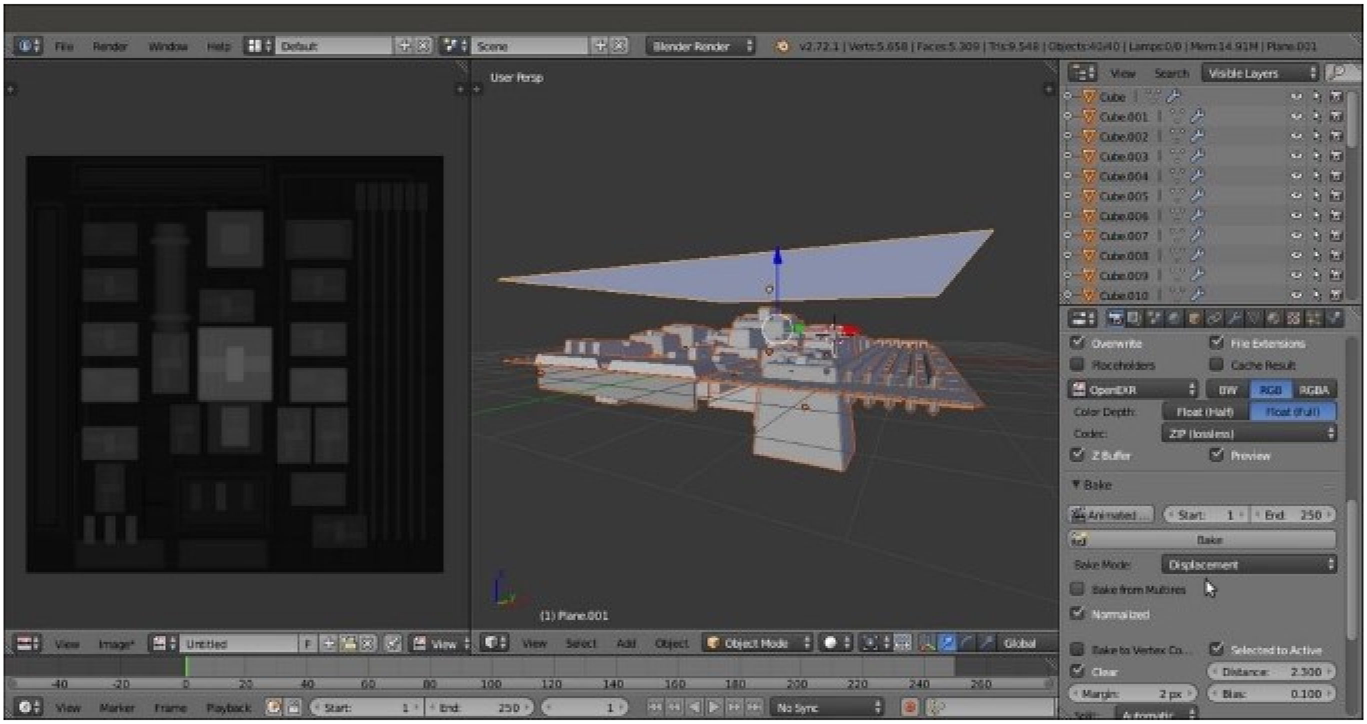
- From step 32 to step 38, we made the masking for the windows to give them a random appearance.
- From step 39 to step 41, we simply connected the various frames' output.
- From step 42 to step 44, we created the light-emitting material for the windows. Note that the **WINDOWS_ MASK** frame group provides the masking for the windows' positions. The **WINDOW** frame group provides the whiteness values for the windows, the bump, and the last nodes added to the **SHADER** frame the light emission based on the output of the previous frame groups.

There's more...

The appearance of the hull can be improved even further using some displacement to add geometric details to the spaceship surface, which (at the moment) is a bit too smooth:

1. Go to the **Object modifiers** window and assign a second **Subdivision Surface** modifier to **Torus**. Set the **Subdivisions** levels to `2` for both **View** and **Render**.
2. Assign a **Displace** modifier. Then click on the **Show texture in texture tab** button on the right side of the **Texture** slot. In the **Textures** window, click on the **New** button. Then replace the default **Clouds** texture with an **Image or Movie** texture.
3. Click on the **Open** button and load the `spacehull_displ.exr` texture.
4. Go back to the **Object modifiers** window and set the displacement's **Strength** value to `0.200`. In the **Texture Coordinates** slot, select **UV**.

This way, the displacement features get mixed with the hull bump panels of the shader, giving a nice result. The `spacehull_displ.exr` texture is a 32-bit float displacement map created and stored in the **Blender Internal** engine. I modeled the Planes and scaled Cubes a simple **greeble** panel, then I baked the displacement on a different and unwrapped Plane, as shown in the following screenshot:

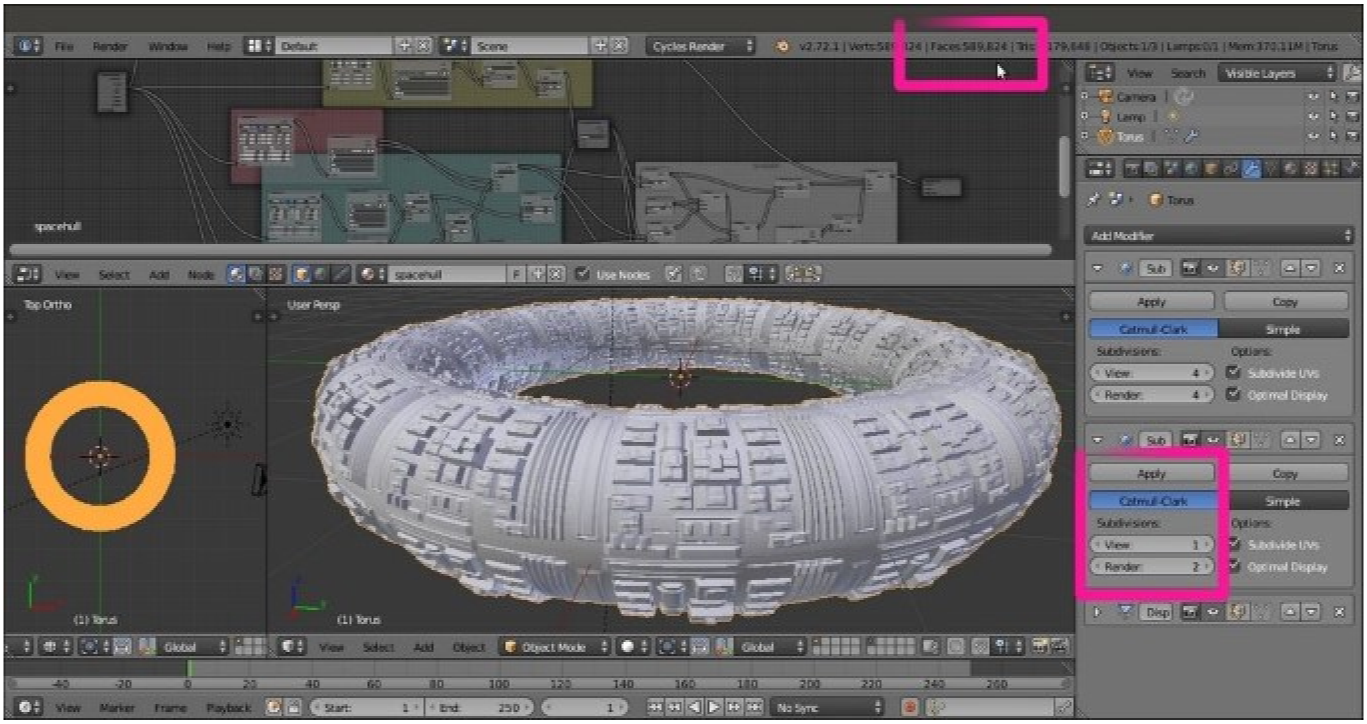


The greeble scene ready for the baking

Tip

If you want to take a look at the baking scene, open the `9931OS_06_greeble.blend` file.

Finally, we can try to set the first **Subdivision Surface** modifier level to `4` and lower the second **Subdivision Surface** modifier's level to `1`. Then, starting from the top one, apply all the modifiers. You will inevitably lose the details but will obtain a much lighter mesh—589,824 faces against the initial 2,359,296—and considering the fact that most of the details come from the texturing, the result looks pretty good (at least from a distance). It also looks good if the shading is set to **Flat** instead of **Smooth**.



The Torus spaceship with the applied modifiers

See also

- The displacement technique on the Blender Artists forum, at http://blenderartists.org/forum/showthread.php?273033-Sculpting-with-UVs-and-displacements.

Chapter 7. Subsurface Scattering in Cycles

In this chapter, we will cover the following recipes:

- Using the Subsurface Scattering shader node
- Simulating Subsurface Scattering in Cycles using the Translucent shader
- Simulating Subsurface Scattering in Cycles using the Vertex Color tool
- Simulating Subsurface Scattering in Cycles using the Ray Length output in the Light Path node
- Creating a fake Subsurface Scattering node group

Introduction

Subsurface Scattering is the effect of light not getting directly reflected by a surface but penetrating it and bouncing internally before getting absorbed or leaving the surface at a nearby point. In short, light is *scattered*.

The RGB channels of a surface color can have different scattering values, depending on the material; for example, for human skin the red component is more scattered (as a rough approximation, you could say that the values for the three channels are blue = 1, green = 2, and red = 4).

In Cycles, a true Subsurface Scattering node has been introduced in Blender 2.67. Since Version 2.72, it also works with the GPU (only in the Experimental feature set).

But sadly, it still has the common big Cycles problem—it takes a lot of samples to produce a noise-free rendering. In short, it's slow.

Besides the true node, there are other ways to simulate Subsurface Scattering in Cycles. All the recipes in this chapter faking the SSS effect use the **Translucent** shader node to achieve this effect, and shifting of colors is simulated by giving a main color to the translucent component. Keep in mind that even if the scattering effect in the true SSS node could be basically considered a sort of translucency effect, these tricks are not comparable to the real Subsurface Scattering effect. They are just ways to give the impression that light is being scattered through a material surface.

Also, depending on the recipe, you'll see that the effects of Subsurface Scattering can be quite different, and the more suitable method should be used according to the type of material you are going to create. The differences in these recipes are basically in the way translucency mixing is driven by different types of input.