

ARETE IMAGE SOFTWARE

Digital Nature Tools for Softimage

Tutorial

DIGITAL NATURE TOOLS FOR SOFTIMAGE

Tutorial

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Introduction

Digital Nature Tools for Softimage is a comprehensive set of physics-based tools for simulating high-fidelity ocean and atmospheric effects. The complete package includes:

1. **NatureFX for Softimage.** The NatureFX plugin for Softimage uses physics-based models to generate photo-real images of 3D oceans, skies, and clouds that follow the laws of nature. NatureFX is fully integrated into the Softimage modeling environment to simplify scene construction and includes a full suite of mental ray shaders so that images can be previewed and rendered entirely within the Softimage environment. In addition, NatureFX provides an interface to Arete's award-winning product RenderWorld for scenes which require absolute photo-realism. The NatureFX plug-in currently includes:
 - NFX_Sun: An infinite light source with shadowing options.
 - NFX_Air: A full 3D-volume shader for simulating sky effects including haze.
 - NFX_Ocean: A time-accurate, dynamic ocean wave simulator. The ocean wave direction and wave height can be modified interactively using the NFX_Ocean icon, and a mesh grid is created for previewing the ocean surface. A mental ray shader is automatically added so that the mesh grid can be rendered. In addition, the NFX_Ocean includes a displacement shader option for rendering large ocean scenes at high resolution.
 - NFX_Ripple: Simulates ripples caused by objects hitting the ocean surface. Ripple characteristics can be modified interactively using the ripple icon.
 - NFX_Swell: Simulates the large amplitude waves that travel long distances on the ocean surface (characteristically produced by storms). The swell parameters can be modified interactively using the swell icon.
 - NFX_Wake: Simulates boat wakes. The wakes are "straight," and they are generated by specifying the size, speed, and direction of the boat.
 - NFX_Output_Scaler: An output image scaler that performs gamma, Log10 or linear scaling on rendered images.
2. **The RenderWorld rendering engine.** This is a standalone product that creates images of oceans and atmospheres of extremely high fidelity. It is driven through a set of ASCII text input files that are described in the RenderWorld documentation.

3. **The NatureFX/RenderWorld interface.** This interface enables the launching of RenderWorld from within Softimage. The interface generates ASCII text input files for RenderWorld using the positions and settings of the NatureFX scene elements. In this mode of operation, the mental ray renders can be used to provide a preview of the final RenderWorld image.

RenderWorld and NatureFX provide complementary capabilities. RenderWorld is able to generate vast ocean scenes that stretch to the horizon at high resolution with great efficiency. NatureFX, on the other hand, seamlessly interacts with other Softimage objects. The combination of the two capabilities allows the user to create complex, photo-realistic, nature-based scenes.

The following examples are designed to acquaint the first-time user with the NatureFX plug-ins. It is recommended that the user have the *NatureFX Reference Guide* handy while working through these examples.

Skies and Sunsets

BASIC SKY SCENE

- Start a new Softimage session.
- Add the NatureFX Sun to the scene by selecting **Model→Get→NFX_Sun**. A dialog box will appear with controls for modifying the red, green and blue color levels of the sun and its shadowing properties.

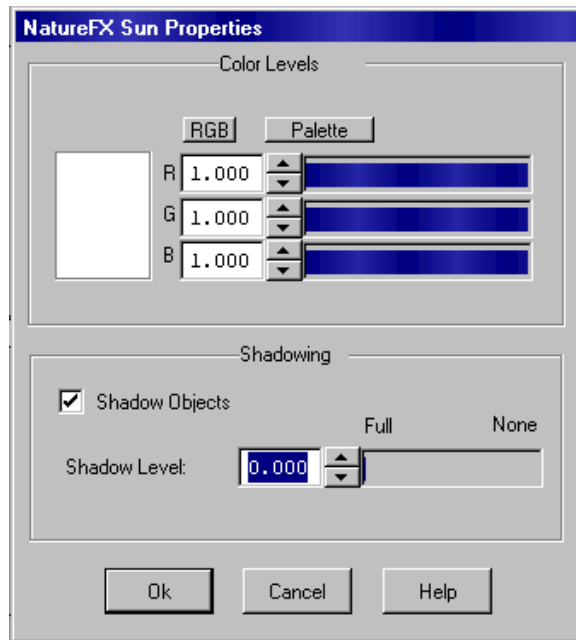


Figure 1 - NatureFX Sun dialog.

- Accept the default values. The NatureFX Sun icon, an orange sphere, should appear in the scene. To modify the position of the NFX_Sun in the sky, select the Sun and translate its position in (x,y,z).

Note: The (x,z) plane represents the surface of the Earth for the NatureFX Sun. If the NFX_Sun is positioned below the (x,z) plane, the NatureFX Air (when using the flat Earth model) will not be illuminated.

- Select **Model→Get→NFX_Air_Shader** to add the NatureFX Air Shader to the scene. A dialog box will appear with three parameter groupings for modifying Clean Air properties, Light Source Display Properties, and Haze properties. See the *NatureFX Reference Guide* for a description of each of these parameters. For this tutorial, simply accept the default values.

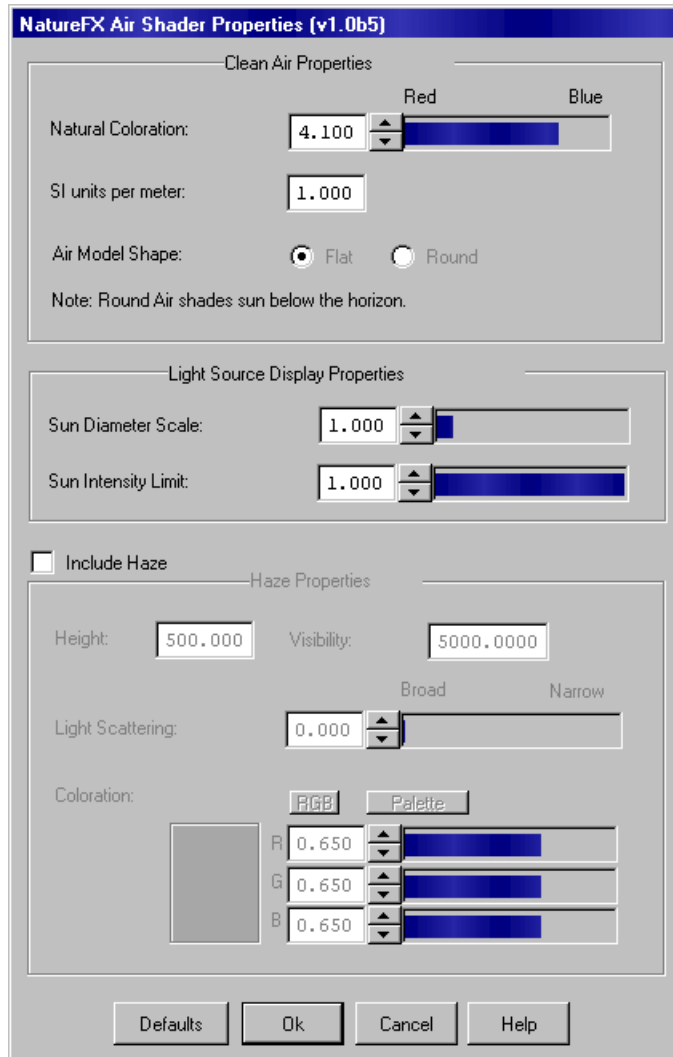


Figure 2 - NatureFX Air Shader dialog.

- When the NatureFX Air Shader is added to the scene, a large circular arc is created to provide a reference for the horizon. If desired, this arc can be deleted by the user.
- Select **Matter→Atmosphere→Depth Fading** to modify the NatureFX Air Shader properties. A dialog box entitled Depth Fading Setup will appear. At the bottom of this dialog box in the mental ray section, the Shader box should be

checked, and the NFX_AirShader should be listed in the selection field. To edit the NFX_AirShader properties, simply click the **Edit** button.

- Next, add an object to the scene by selecting **Matter→Get→Primitive→Sphere** and accept the default values. *Note: An object must be present in the scene for Mental Ray to perform a render.*
- Translate the Camera Interest to $(x,y,z) = (0.0,2.0,0.0)$ to increase the amount of sky in the Field of View (FOV).
- Select **Matter→Preview→Setup...** and set mental ray as the Preview Renderer.
- Preview the scene by selecting **Matter→Preview→All**. A rendered image will appear which includes a blue sky and a gray sphere. The realistic gradations in the sky's hue are computed automatically by the NatureFX Air Shader using the position of the NFX_Sun in the sky.

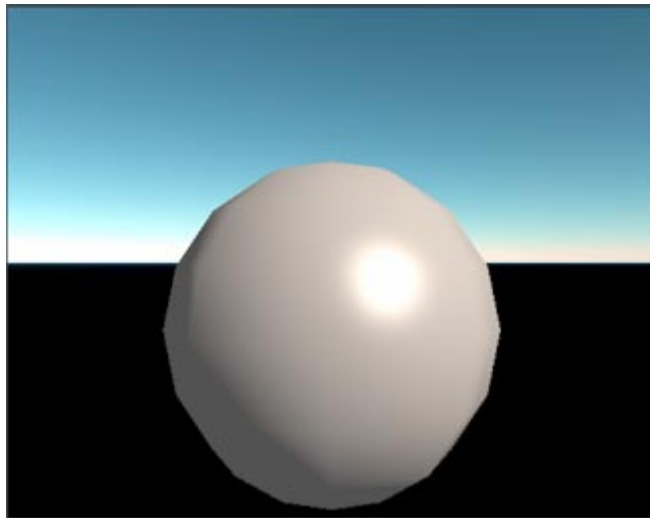


Figure 3 - Preview render of basic sky scene.

SUNSET SCENE

- To create a sunset scene, simply translate the NFX_Sun to position $(x,y,z) = (8.0, 1.0, -20.0)$ and select **Matter**→**Preview**→**All**. The rendered sky should now have an orange hue near the horizon.

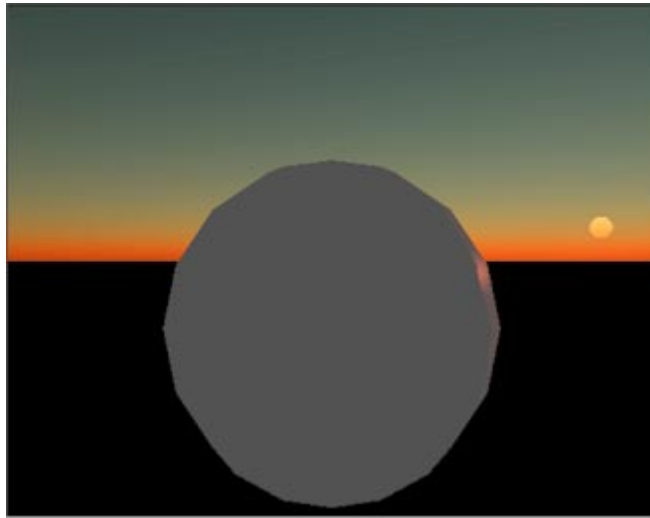


Figure 4 - Preview render of sunset scene.

SUNSET SCENE WITH HAZE AND LARGE SUN

- Select **Matter**→**Atmosphere**→**Depth Fading....** to edit the properties of the NatureFX Air Shader, and click the **Edit** button in the mental ray section.
- To enlarge the sun, set the **Dilation Factor** to **3.0** in the Light Source Display Properties section.
- To add haze to the scene, check **Include Haze** and adjust the Haze RGB color values to Red=0.2, Green=0.2, and Blue=0.65, and click **Ok**.
- Preview the scene by selecting **Matter**→**Preview**→**All**.

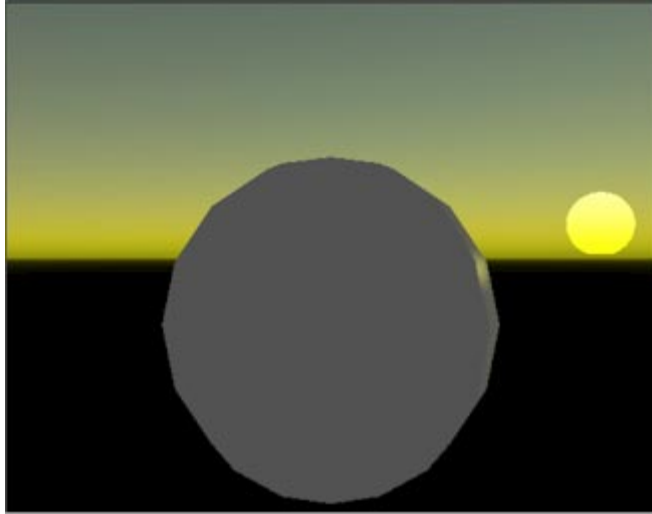


Figure 5 - Preview render of sunset with haze and large sun.

Ocean Part 1

BASIC OCEAN SCENE

- Start a new Softimage session.
- Add the NatureFX Sun to the scene by selecting **Model→Get→NFX_Sun**. Accept the default values.
- Select **Model→Get→NFX_Air_Shader** to add the NatureFX Air Shader to the scene. Accept the default values.
- Add the NatureFX Ocean to the scene by selecting **Model→Get→NFX_Ocean**. A dialog box will appear with four parameter groupings for modifying the Wave Field, the Wave Preview Grid, the Global Wave Model, and the Ocean Displacement Shader. See the *NatureFX Reference Guide* for descriptions of each of the parameters in these groups. For this tutorial, simply accept the default values.

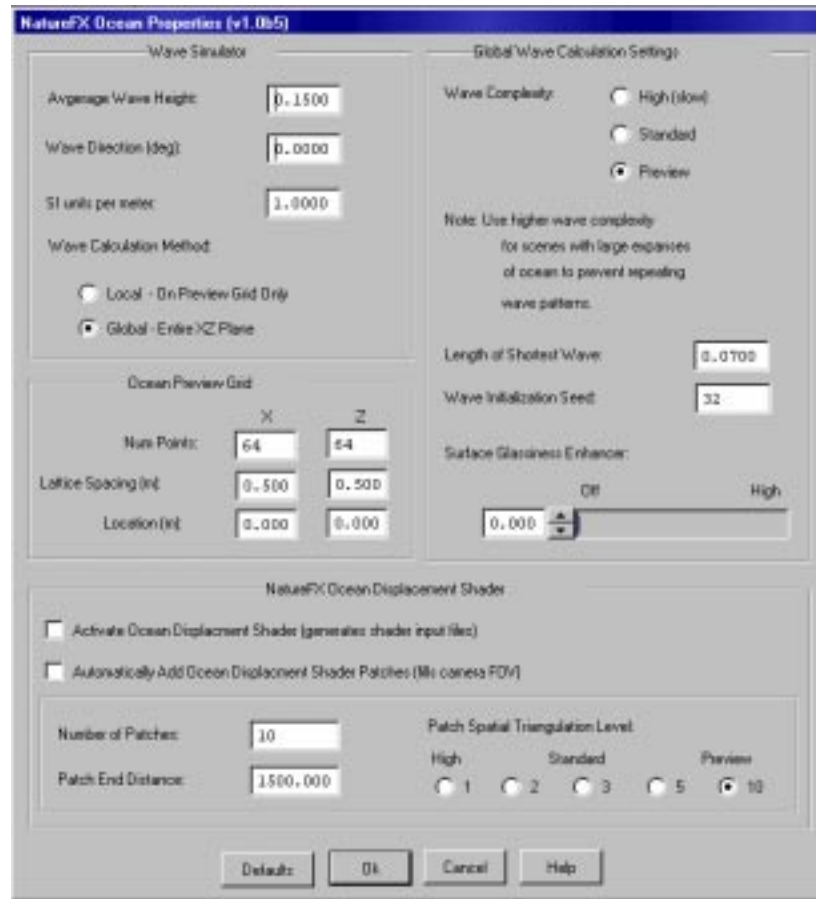


Figure 6 - NatureFX Ocean dialog.

- After accepting the default values, an Ocean Preview Grid (polygonal mesh) should appear in the scene along with the Ocean icon (the extruded arrow). The Ocean Icon points in the direction that the waves will flow and allows the user to interactively modify the properties of the wave field. For example, to modify the average height of the waves, select the Ocean Icon and change its y-scaling. To modify the direction that the waves flow, simply rotate the Ocean Icon about the y-axis.

Icon Action	Effect
Scale in Y	Modify average wave size
Rotate about Y	Modify average wave direction

Table 1 - Ocean icon functionality.

- When the ocean preview grid is created, the NatureFX Ocean Material Shader is automatically added. To verify this, select the ocean preview grid and then select

Matter→Material. In the mental ray section, the Material Shader box should be checked, and the NFX_OceanShader should be listed in the selection field.

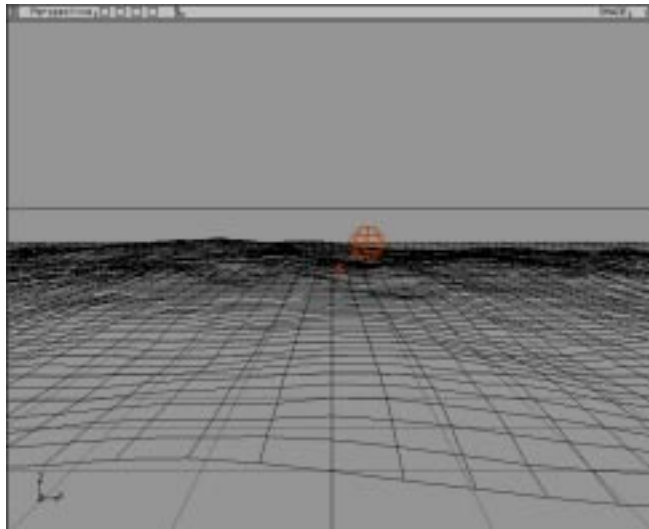


Figure 7 - Wireframe perspective view of ocean preview grid.

- To preview the scene, select **Matter→Preview→Setup...** and set mental ray as the Preview Renderer. Then select **Matter→Preview→All.** A rendered image should appear which includes both blue sky and ocean surface waves.

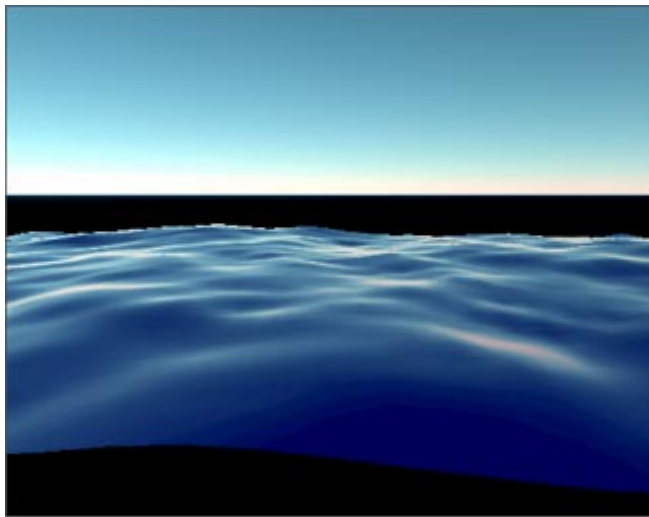


Figure 8 - Preview render basic ocean scene.

REFLECTING BUOY

- Add a buoy to the scene by selecting **Model→Get→Primitive→Cylinder**, and then accept the default values. Next, shade the buoy red by selecting **Matter→Material** (this brings up the Material Shader dialog box). Change both the Diffuse and Ambient RGB settings to $\text{rgb} = (1.0, 0.0, 0.0)$. Click **Ok**.
- Preview the scene by selecting **Matter→Preview→All**. A rendered image will appear with a red buoy reflecting in the waves.

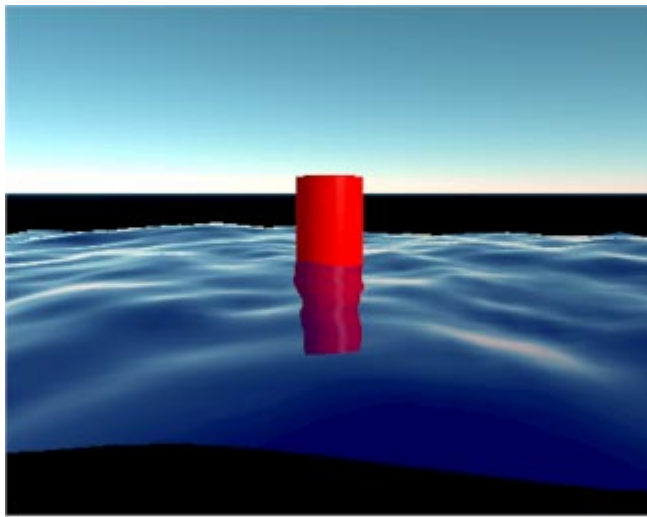


Figure 9 - Preview render of reflecting buoy.

BOBBING BUOY

The ocean preview grid is a polygonal mesh that allows objects to be constrained to its lattice. In this exercise, you will first attach three null objects to the ocean preview grid, and then you will constrain the red buoy to the three null objects. The following steps implement the “bobbing” effect.

- Using the Top view window, select the ocean preview grid and tag a point on it at the coordinates $(x=0.0, z=-2.0)$. To tag a point, hold down the “t” key and drag the mouse over the point while holding down the left mouse button.
- Set the tagged point as a cluster on the ocean preview grid by selecting **Model→Tag→Set Cluster**, and then click on the **New** button.

- Create a null object by selecting **Model→Get→Primitive→Null**. Constrain the null object to the cluster that you just created on the ocean preview grid by selecting **Motion→Constraint→Object to Cluster**, and then click on the ocean preview grid (the grid should momentarily turn red). At this point, Softimage will attach the null to the ocean preview grid at the location of the cluster.
- To untag the tagged point on the ocean preview grid, hold down the “t” key and drag the mouse over the point while holding down the middle mouse button.
- Repeat the steps listed above to constrain two additional null objects to the ocean preview grid at the following coordinates: (x=2.0, z=0.0) and (x=0.0, z=2.0).
- To constrain the red buoy to the three null objects that have just been created, change the Right view window to a Schematic view window. Select the buoy, and then select **Motion→Constraint→Three Points**. Click on each of the three null objects in order in the Schematic view. At this point, the red buoy should shift to the center of the triangle formed by the three nulls. To see the red buoy bob with the ocean waves, click on the play button in the lower right-hand corner.

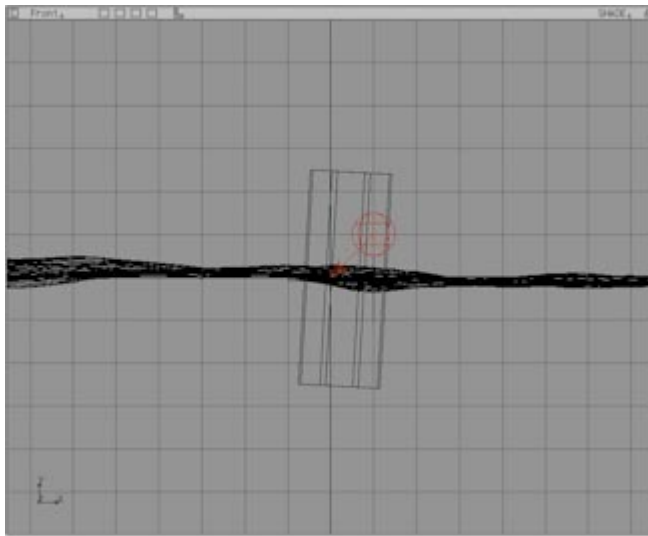


Figure 10 - Wireframe front view of bobbing buoy.

RENDERING A SEQUENCE OF FRAMES

To finish this section, you will render a sequence of images of the bobbing buoy scene. This will take 10-15 minutes, but it will illustrate the realistic wave dynamics of the NatureFX Ocean simulator.

- Display the Render Setup dialog by selecting **Matter→Render**. At the top of the dialog box, the Rendering Type should already be set to mental ray. Next, click the **ON** button next to Antialiasing field in the Settings section, and a mental ray antialiasing dialog will appear. Increase the Max Samples to 2 and click **Ok**. In the Render Setup dialog box, change the output filename to nfx_bouy and then click **Render**. Mental ray will start rendering 100 frames of the bobbing buoy scene. When completed, view the rendered frames using FlipBook.

Ocean Part 2

In the previous examples, you probably noticed that the NatureFX Ocean is only visible on the ocean preview grid. This local coverage model is best for scenes which require small expanses of water and which will not include any of the advanced ocean effects such as ripples, wakes, and swells.

For scenes that require large expanses of ocean and/or ripples, wakes, and swells, the global coverage model should be used. The following example illustrates some of the basic capabilities of the global coverage model.

GLOBAL OCEAN SCENE

- Start a new Softimage session.
- Add the NatureFX Sun to the scene by selecting **Model→Get→NFX_Sun**. Accept the default values.
- Select **Model→Get→NFX_Air_Shader** to add the NatureFX Air Shader to the scene. Accept the default values.
- Add the NatureFX Ocean to the scene by selecting **Model→Get→NFX_Ocean**. When the NFX_Ocean dialog box appears, select **Global Coverage** in the Wave Field parameters section. Then check the **Activate Ocean Displacement Shader** box and the **Automatically Add Patches for Ocean Displacement Shader** box in the NatureFX Ocean Displacement Shader section. Finally, select a Patch Triangulation Level of 5 (Standard) and click **Ok**.
- At this point, the ocean surface preview grid will appear in the scene along with eleven patches that fill the entire field of view (FOV). The first ten patches will have the NatureFX Ocean Material Shader added and the NatureFX Ocean Displacement Shader added. At render time, these ten patches will have ocean waves superimposed on them. The final patch, which starts at the Ocean End Distance and stretches to the horizon, has only the NatureFX Ocean Material Shader added as it is not necessary to generate wave heights at great distances from the camera.

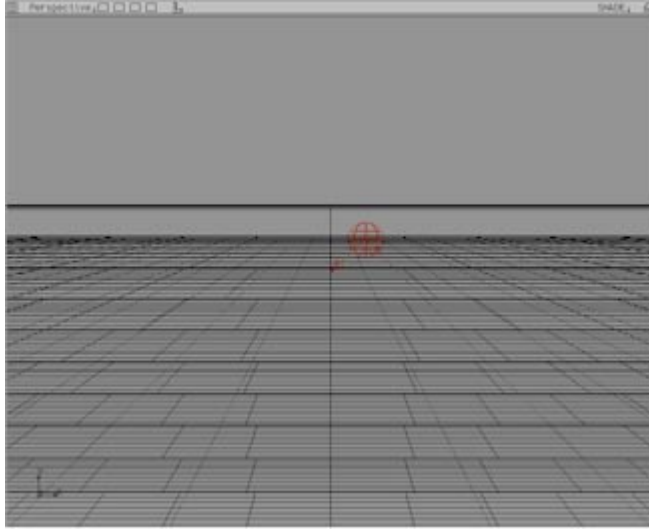


Figure 11 - Wireframe perspective view of displacement shader patches.

- The displacement shader patches will automatically re-position themselves to fill the entire FOV whenever the camera settings are modified. To verify this, modify the look direction of the camera and then hit the scene refresh key [**r**].
- IMPORTANT NOTE: With the displacement shader patches in the scene, you will no longer need to render the ocean preview grid. To turn-off mental ray rendering for the preview grid, do the following: 1) select the ocean preview grid, 2) select **Model→Info→Selection**, 3) click the **Render Setup** button, and 4) unselect all of the options in the Object Visibility section.
- Reset the camera to its original position, and then increase the y position of both the camera and the camera interest to **2.0**.
- To preview the scene, select **Matter→Preview→Setup...** and set mental ray as the Preview Renderer. Then select **Matter→Preview→All**.



Figure 12 - Preview render of global ocean scene.

GLOBAL OCEAN SCENE WITH GLITTER AND HAZE

Glitter is an Ocean Material Shader option that can be turned on or off. By default, it is turned off. To turn glitter on for all of the Displacement Patches, you will need to modify the Ocean Material Shader glitter option on the ocean preview grid and then refresh the scene; the new Ocean Material Shader options will then be copied automatically onto all of the Displacement Patches. The following steps will generate a sunset scene with yellow haze and glitter.

- Select the **ocean preview grid**. Then select **Matter**→**Material**, and the material shader dialog will appear. In the mental ray section, the Material Shader box should be checked and the NFX_OceanShader should be listed in the selection field. To edit the NFX_Ocean Shader parameters, click in the selection field and then click on the **Edit** button. The NFX_Ocean Material Shader dialog box will appear.

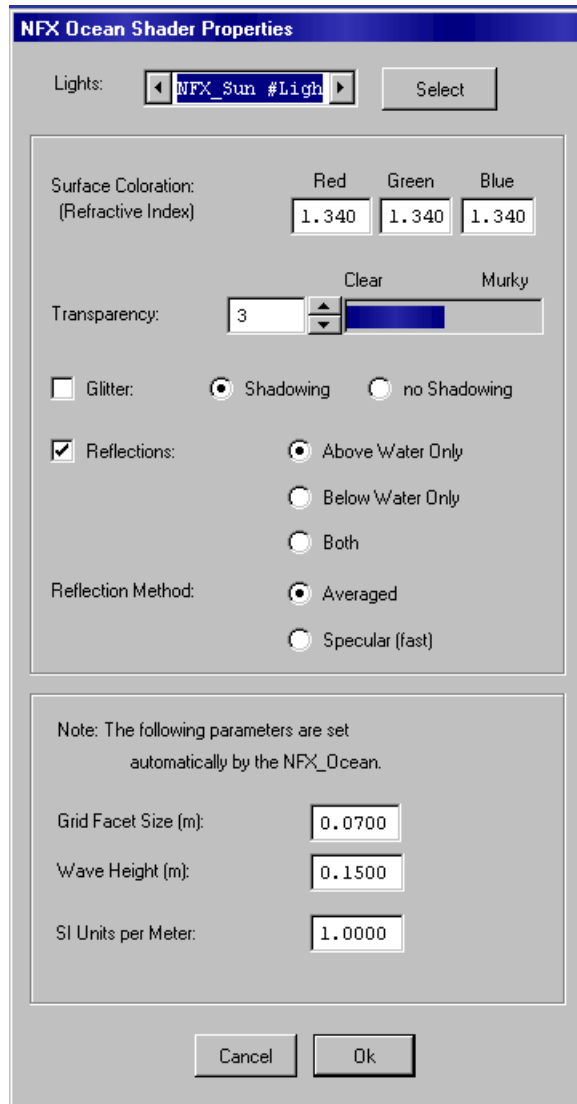


Figure 13 - NatureFX Ocean Material Shader dialog.

- First, unselect the Reflections option. Second, select the **Glitter** option and then select the **Shadowing** option. The Shadowing option enables shadowing of the glitter by other objects in the scene including the Atmosphere. Click **Ok**.
- To modify the NatureFX Air properties, select **Matter**→**Atmosphere**→**Depth Fading...** and click the **Edit** button in the mental ray section. Enlarge the sun by setting the Diameter Scale Factor to 2.0 in the Light Source Display Properties section. Next, add haze to the scene by checking the **Include Haze** box, and adjust the Haze RGB color values to rgb = (0.2, 0.2, 0.65) and click **Ok**. Finally, set the Haze Visibility to 1000.0 (m) and the Haze Height to 150.0 (m). Then click **Ok**.
- Select the **NFX_Sun** and translate it's (x,y,z) location to (1.0, 1.0, -20.0).

- Increase the average size of the ocean waves by selecting the ocean icon and increasing its y-scale to 2.0.
- Translate the (x,y,z) position of the Camera to (0.0, 10.0, 20.0) and the (x,y,z) position of the Camera Interest to (0.0,9.0,0.0). Refresh the scene by hitting the [r] key to reset the placement of the Displacement Patches.
- Produce a final rendered image of the scene by selecting **Matter→Render**. At the top of the dialog box, the Rendering Type should already be set to mental ray. Next, click the **On** button next to Antialiasing field in the Settings section, and a mental ray antialiasing dialog will appear. Increase the Max Samples Field to 2 and click **Ok**. In the Render Setup dialog, change the output filename to nfx_sunset and then click **Render**. Mental ray will start rendering 100 frames of the sunset scene (or as many as you choose.) When completed, view the rendered frames using FlipBook.

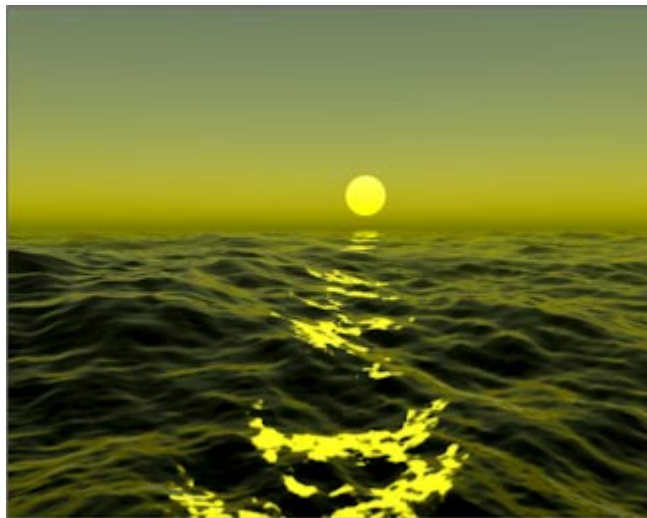


Figure 14 - Final render of ocean with glitter and haze.

CONTROLLING THE QUALITY OF OCEAN RENDERS

The NatureFX Ocean Displacement Shader has five levels of resolution: 1, 2, 3, 5, 10. These levels adjust the size of the triangles that mental ray generates when tessellating the Displacement Patches at render time. The preview level (10) will generate larger triangles (therefore fewer of them) and will result in faster renders. The very high level (1) will generate very small triangles which greatly improves the resolution of small-scale waves on the ocean surface, but the large number of triangles will significantly increase render time and memory requirements. The following images illustrate the quality differences between the preview level (10) and the high level (3) in Shader Resolution.

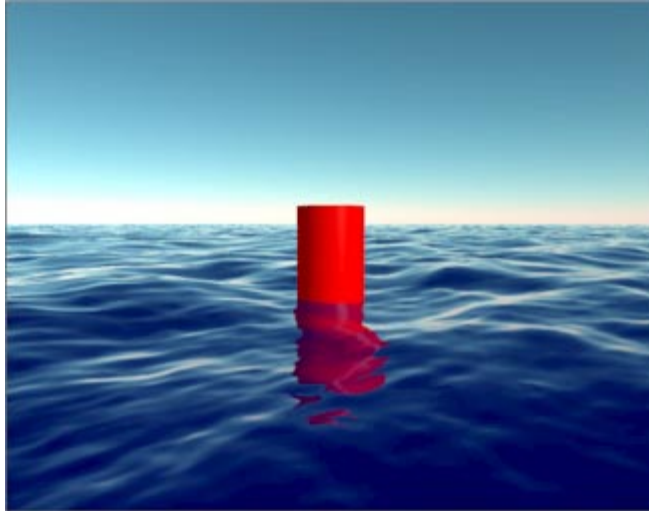


Figure 15 - Final render of ocean with triangulation level of 10.



Figure 16 - Final render of ocean with triangulation level of 3.

Ripples

NatureFX includes a set of advanced ocean effects for simulating Ripples, Boat Wakes, and Swell (large waves). To include any of these effects, the NatureFX Ocean must be present in the scene with the Global Wave Coverage option set. This example demonstrates how to add the NatureFX Ripple to the NatureFX Ocean and describes how to modify the NatureFX Ripple properties interactively using the Ripple icon.

- Start a new Softimage session.
- Add the NatureFX Sun to the scene by selecting **Model→Get→NFX_Sun**. Accept the default values.
- Select **Model→Get→NFX_Air Shader** to add the NatureFX Air Shader to the scene. Add haze by clicking on the Include Haze check box and change the Haze Height to 100 units and the Haze Visibility to 500 units.
- Add the NatureFX Ocean to the scene by selecting **Model→Get→NFX_Ocean**. In the Wave Simulator section, set the Average Wave Height to 0.05 and select the Global wave coverage option. In the Global Settings section, select the Standard level of Wave Complexity. In the Ocean Displacement Shader section, select both the Activate Displacement Shader option and the Automatically Add Displacement Patches option. Also, select a Patch Spatial Triangulation level of 5. Click **Ok**.
- **IMPORTANT:** With the displacement shader patches in the scene, you will no longer need to render the ocean preview grid. To turn-off mental ray rendering for the preview grid, do the following: 1) select the ocean preview grid, 2) select **Model→Info→Selection**, 3) click the **Render Setup** button, and 4) unselect all of the options in the Object Visibility section.
- Select **Model→Get→NFX_Ripple** to add a Ripple to the scene. A dialog box will appear with parameter groupings for modifying: the impact characteristics of the disturbance that causes the ripple and the size and resolution of the underlying ripple grid. The NatureFX Reference Manual provides descriptions of each of these parameters. Click **Ok**.

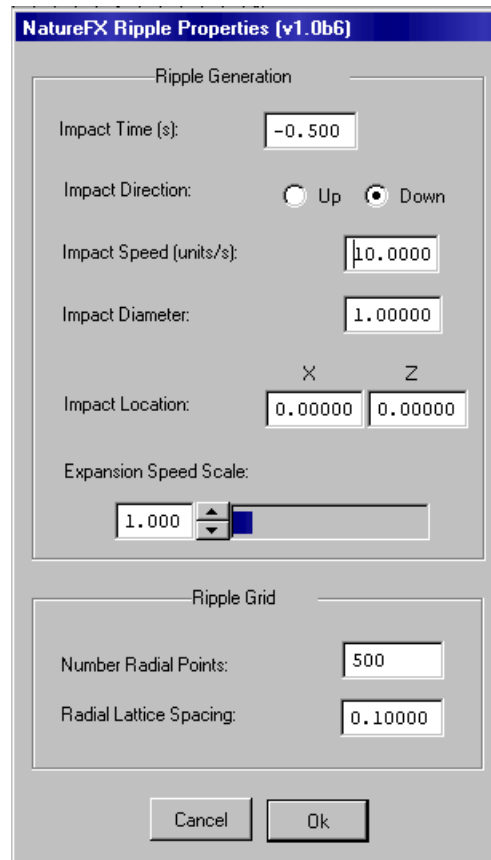


Figure 17 - NatureFX Ripple dialog.

- An indentation should appear on the NatureFX ocean preview grid where the ripple is located.

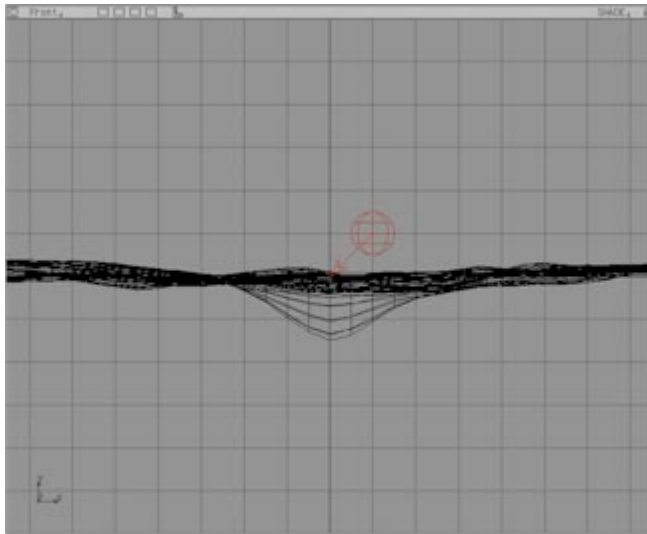


Figure 18 - Wireframe front view of NatureFX Ripple on the ocean preview grid.

- The Ripple icon allows the user to interactively modify the Ripple characteristics without having to retrieve the dialog box. A summary of the Ripple icon's functionality is presented below.
- For example, to modify the initial amplitude of the ripple, change the y scaling of the Ripple icon. To modify the initial diameter of the Ripple, change the x scaling of the Ripple icon.

Icon Action	Effect
Scale in X	Modify initial Ripple diameter
Scale in Y	Modify Ripple amplitude
Rotate about Y	Modify Ripple start time (seconds)
Translate in X	Modify Ripple X location
Translate in Z	Modify Ripple Z location

Table 2 - Ripple icon functionality.

- To modify the time (in seconds) at which the ripple starts, change the y rotation of the Ripple icon. For example, if you are on frame 1 and you set the y-rotation of the Ripple icon to -4.0 seconds, you will notice that the ripple is more fully developed at the current frame time. Alternately, if you rotate the Ripple icon to +4.0, you will notice that the ripple indentation disappears from the Ocean

Preview Grid because the ripple has not yet begun. To create the image presented below, follow the next few steps.

- Set the y-rotation (start time) of the Ripple icon to -0.5.
- Set the y-scale of the Ripple icon to 5.0.
- Translate the Camera to $xyz = (0.0, 12.0, 36.0)$.
- Set the current frame to 150.
- Render the scene.

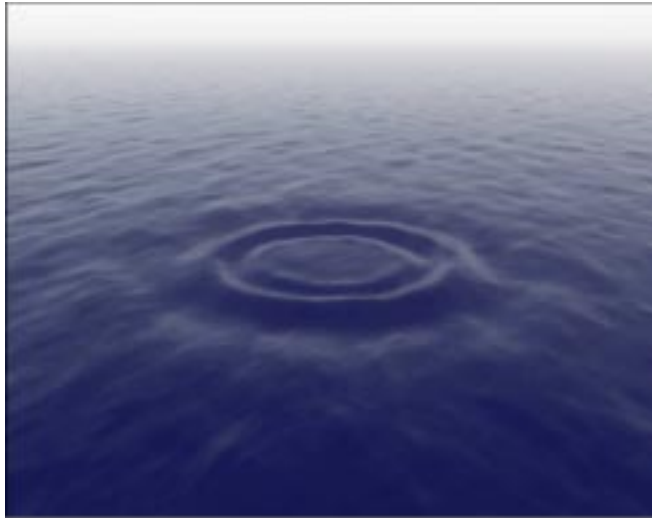


Figure 19 - Final render of ripple with haze.

Boat Wakes

The NatureFX Wake simulator provides a simple way to simulate the wave pattern generated by a boat traversing the ocean surface. A very useful feature of the Wake simulator is that the user can easily constrain a boat or any other object to the Wake icon and the boat will then follow the wake and undulate with the ocean surface.

Currently, the Wake simulator only generates wakes for boats that move in a straight line - it does not model wakes generated by boats that move along curved paths.

The following tutorial demonstrates how to add the NatureFX Wake to the scene and shows how to constrain an cone to the Wake icon.

- Start a new Softimage session.
- Add the NatureFX Sun to the scene by selecting **Model→Get→NFX_Sun**. Accept the default values.
- Select **Model→Get→NFX_Air_Shader** to add the NatureFX Air Shader to the scene. Make the sky gray by setting the Natural Coloration to 0.0. Click **Ok**.
- Add the NatureFX Ocean to the scene by selecting **Model→Get→NFX_Ocean**. In the Wave Simulator section, set the Average Wave Height to 0.1 and select the Global wave coverage option. In the Global Settings section, select the Standard level of Wave Complexity. In the Ocean Displacement Shader section, select both the Activate Displacement Shader option and the Automatically Add Displacement Patches option. Also, select a Patch Spatial Triangulation level of 5. Click **Ok**.
- IMPORTANT: With the displacement shader patches in the scene, you will no longer need to render the ocean preview grid. To turn-off mental ray rendering for the preview grid, do the following: 1) select the ocean preview grid, 2) select **Model→Info→Selection**, 3) click the **Render Setup** button, and 4) unselect all of the options in the Object Visibility section.
- Select **Model→Get→NFX_Wake** to add a Wake to the scene. A dialog box will appear with parameter groupings for modifying the Boat Geometry, the Boat Trajectory, and the Wake itself. The NatureFX Reference Manual provides descriptions for each of these parameters. Click **Ok**.

NatureFX Wake Properties (v1.0b6)

Boat Geometry

Hull Length:

Hull Width:

Keel Depth:

Boat Trajectory

Speed (units/s):

Direction (deg.):

Start Location: X Z

Wake Settings

Wake Length (boat lengths):

Wake Damping:

☒ Hide Constraining Nulls on Icon

Figure 20 - NatureFX Wake dialog.

- A boat wake wave pattern should appear on the NatureFX ocean preview grid where the wake icon is located.

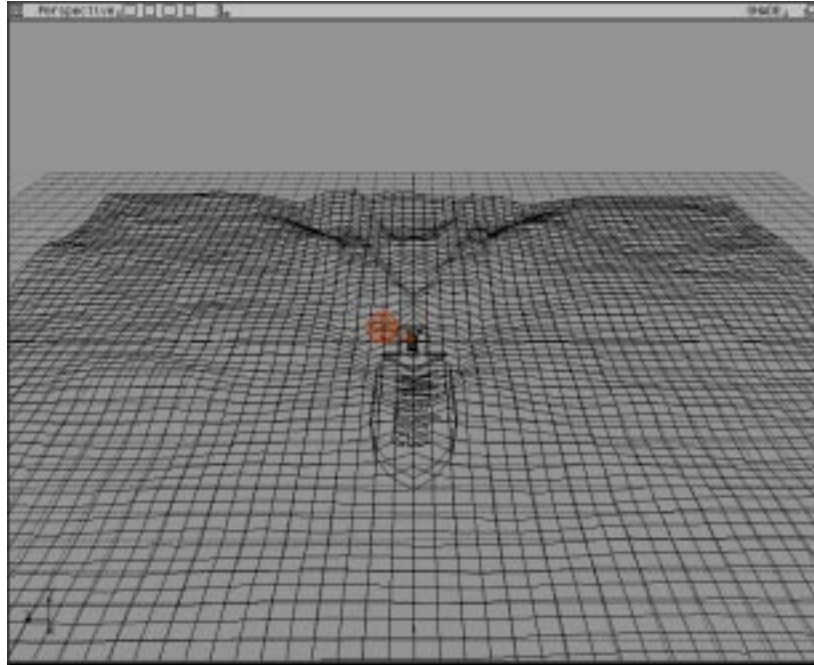


Figure 21 - Perspective view of NatureFX Wake on the ocean preview grid.

- The Wake icon allows the user to interactively modify the Wake characteristics without having to retrieve the dialog box. A summary of the Wake icon's functionality is presented below.

Icon Action	Effect
Scale in X	Modify boat length
Scale in Y	Modify boat depth
Scale in Z	Modify boat width
Rotate about Y	Modify boat direction
Translate in X	Modify boat X position
Translate in Z	Modify boat Z position

Table 3 - Wake icon functionality.

- In addition to the Wake icon, three null objects are added to the scene. These three nulls are constrained to the position of the Wake icon and are located at the front tip and the two back corners of the Wake icon. The height of each null is set to the height of the ocean surface and is updated as the Wake moves across the

ocean surface. The nulls make it simple to attach an object to the Wake icon when using the Motion->Constraint->Three Points option.

- To see the three constraining nulls, switch one of the Softimage windows to a Schematic view and zoom in on the NFX_Wake objects.

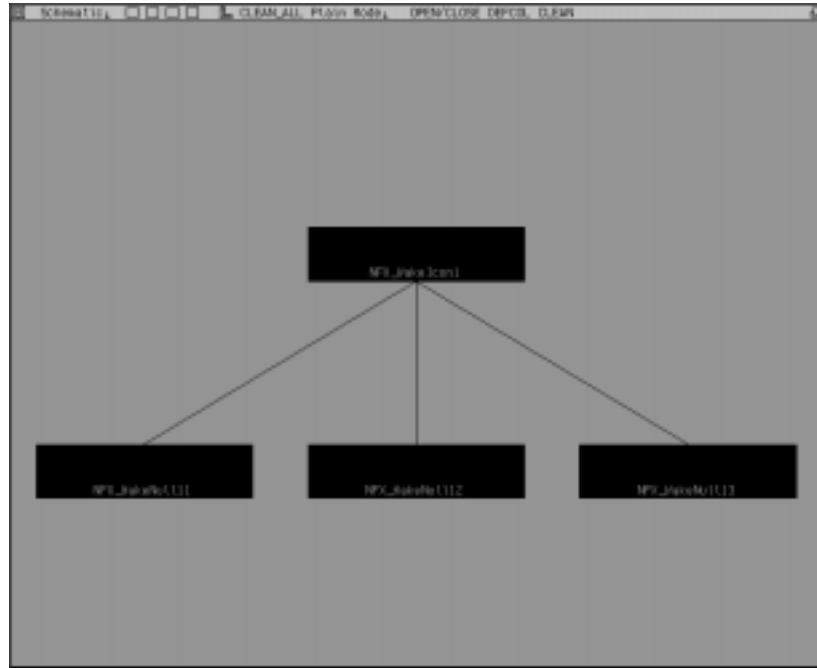


Figure 22 - Schematic view of NatureFX Wake hierarchy.

- In this example, we will constrain a cone to the Wake icon. First, add a cone to the scene by selecting **Model→Get→Primitive→Cone...** and accept the default values.
- Rotate the cone -90.0 degrees about the Z axis and then freeze the cones transformations by selecting **Model→Effect→Freeze→Transformations**.
- Constrain the cone to the three wake nulls by selecting **Motion→Constraint→Three Points** and then click on each of the wake nulls in order from left to right. Selecting the nulls is most easily done in the schematic view. Also, it is important that the nulls are selected in order because the first null is aligned (in this example) with the X axis.
- At this point, you may want to adjust the position of the cone "up" in relation to the three constraining nulls. This is accomplished by adjusting the position of the center of the cone "down". Also, set the xyz scale of the cone to (1.15, 1.15, 1.15).
- Make the cone red by setting both the Diffuse and Ambient color levels in the **Matter→Material** dialog to rgb = (1.0, 0.0, 0.0).

- Translate the Camera to $xyz = (36.0, 14.0, 0.0)$. Then, under **Camera**→**Settings...**, change the Custom Angle to 20.0 degrees.
- Translate the NatureFX Sun to $xyz = (-3.0, 1.0, 1.0)$.
- Render the scene.

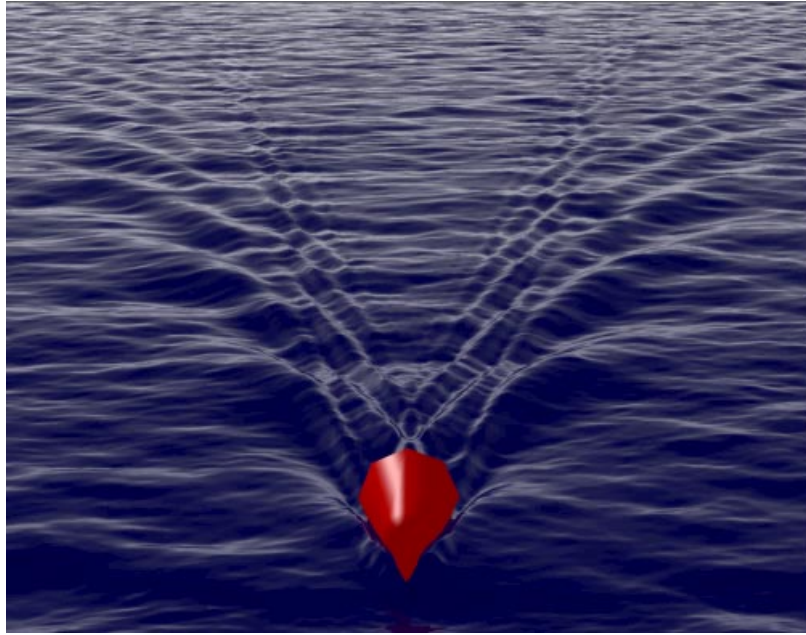


Figure 23 - Final render of Wake with gray sky.

Swells

In nature, swells represent the large-scale waves generated by storms and high winds that travel great distances on the ocean surface. The NatureFX Swell simulator allows the user to add these large amplitude "swell" waves and control their size and structure. For example, the user can create large waves with a very ordered "sine-wave" structure or a very disordered "random" structure. The following tutorial will demonstrate the difference.

- Start a new Softimage session.
- Add the NatureFX Sun to the scene by selecting **Model→Get→NFX_Sun**. Accept the default values.
- Select **Model→Get→NFX_Air_Shader** to add the NatureFX Air Shader to the scene. Click **Ok**.
- Add the NatureFX Ocean to the scene by selecting **Model→Get→NFX_Ocean**. In the Wave Simulator section, select the Global wave coverage option. In the Global Settings section, select the Standard level of Wave Complexity. In the Ocean Displacement Shader section, select both the Activate Displacement Shader option and the Automatically Add Displacement Patches option. Also, select a Patch Spatial Triangulation level of 5. Click **Ok**.
- IMPORTANT: With the displacement shader patches in the scene, you will no longer need to render the ocean preview grid. To turn-off mental ray rendering for the preview grid, do the following: 1) select the ocean preview grid, 2) select **Model→Info→Selection**, 3) click the **Render Setup** button, and 4) unselect all of the options in the Object Visibility section.
- Select **Model→Get→NFX_Swell** to add a Swell to the scene. A dialog box will appear with parameter groupings for modifying the Basic Wave Properties, the Complexity, and Advanced Wave Properties of the Swell. The NatureFX Reference Manual provides descriptions for each of these parameters. Click **Ok**.

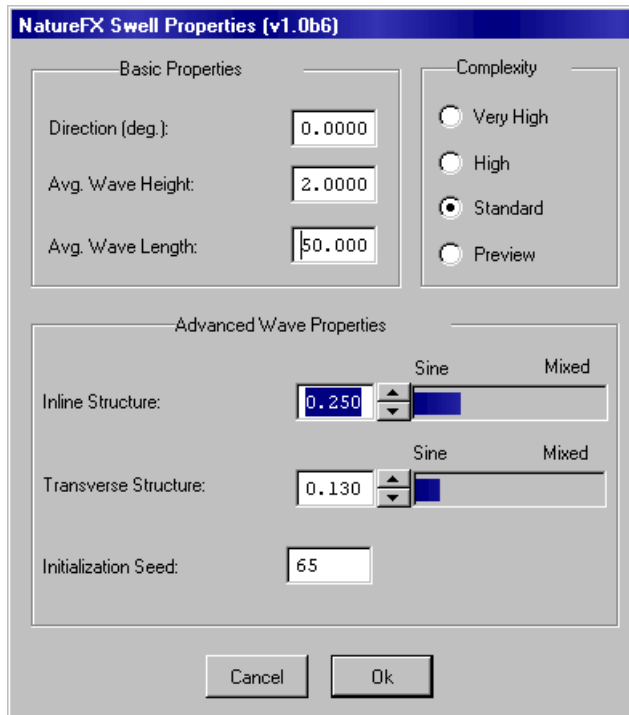


Figure 24 - NatureFX Swell dialog.

- The Swell icon should be visible and a large sinusoidal wave pattern should now appear on the NatureFX ocean preview grid.

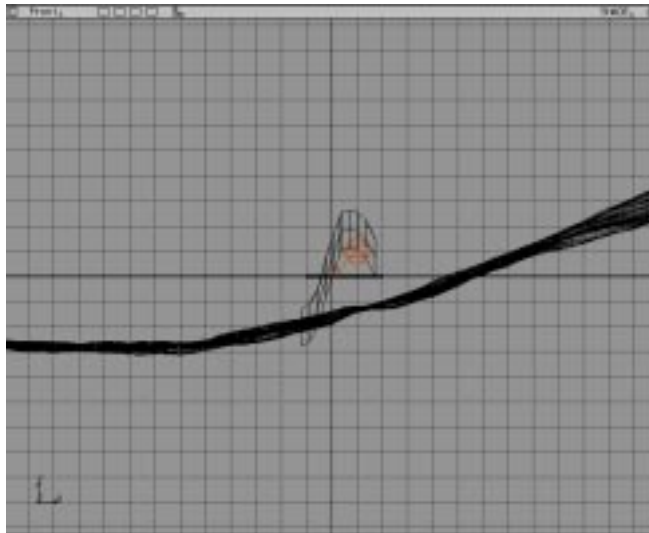


Figure 25 - Front view of NatureFX Swell on the ocean preview grid.

- The Swell icon allows the user to interactively modify the Swell characteristics without having to retrieve the dialog box. A summary of the Swell icon's functionality is presented below.

Icon Action	Effect
Scale in X	Modify average Swell wave length
Scale in Y	Modify average Swell wave height
Rotate about Y	Modify average Swell direction

Table 4 - Swell icon functionality.

- Translate the camera to xyz =

Interfacing with RenderWorld

RenderWorld is Arete Image Software's stand-alone renderer that generates very high fidelity images of oceans, skies, clouds, sprays, wakes, ripples, and swells. RenderWorld has generated nature imagery for feature films such as WaterWorld, the Fifth Element, and Titanic just to name a few.

The current version of RenderWorld runs from a set of ASCII text input files that the user must edit - there is no visual interface to assist in laying out a scene. For this reason NatureFX has been designed to function as a scene layout tool for RenderWorld. The user can quickly create a scene within Softimage using the NatureFX scene elements and then launch a RenderWorld from within Softimage.

Bobbing Camera

In order to make the camera "bob" with the ocean surface, you need to create two sets of objects and link them together. The first is a set of null objects that are used to constrain the motion and orientation of the camera and its interest to the movements of a single null object. The second is a triangle of three nulls that are attached to the ocean in a manner that allows you to vary how much the camera bobs. The bobbing effect is achieved when the null object to which the camera is constrained is tied to the motion of the triangle of null points.

PART 1: GETTING THE CAMERA READY

- Choose **Model→Get → Primitive→Null**.
- Choose **Model→Info→Selection**. Change the name of the object to `under_camera`, and click **Ok**. This will be the point that gets attached to the ocean surface. The camera will be positioned directly above it.
- Middle click on **Model→Get**. (This repeats the last get command, **Model→Get→Primitive→Null**.)
- Middle click on **Model→Info**, change the object's name to `camera_sit`, and click **Ok**. This point will be the point where the camera itself is positioned.
- Click on the **y translation** box, and move the `camera_sit` point up 2 units from the `under_camera` point.

- Get another null object and change its name to camera_point. This null, is where the camera's interest will be placed.
- Translate the camera_point null up 2 units on the y-axis to where the camera_sit point is located.
- Translate the camera_point null 4 units along the x-axis away from the camera_sit point.
- Get another null and name it camera_up. This point will be used to make the camera's up vector normal to the ocean surface.
- Translate the camera_up vector 4 units up the y axis away from the origin.
- There should now be an arrangement of null objects that looks like a "T" lying on its side in the (x,y) plane.
- The next step is to tie all these objects together. Change the right view window to a schematic window by left clicking on the right text and selecting **Schematic** in the pull down menu.
- Select the under_camera null.
- Enter parent mode by clicking on the parent box.
- Left click on the camera_sit, camera_point and camera_up nulls. Exit the parent mode by right clicking. You should see these four nulls arranged in a hierarchy with the under_camera null as the parent and the other three as its children. Now, when the motion of the under_camera null is constrained, the other three nulls should follow it around and remain in their respective positions with regard to the under_camera null.
- Next, the motion of the camera needs to be constrained to the motion of the four nulls. Switch to the motion module.
- Select the camera and choose **Motion→Constrain→Position**. Then left click on the camera_sit null in the schematic window. The camera's position will now move with this null. By left clicking on the text that says **Plain Mode** in the schematic window and selecting **Motion**, you will obtain a visual representation of how all these objects are constrained to one another.
- Next, you need to fix the up direction of the camera. Make sure the camera is still selected and choose **Motion→Constrain→Up Vector**. Then left click on the camera_up null in the schematic window.

- The point at which the camera will look now needs to be set. Select the camera interest in the schematic window.
- Choose **Motion→Constrain→Position**. Then left click on the camera_point null in the schematic window.
- The camera's position and orientation is now tied to a set of null objects. By making these nulls the children of the under_camera null, their positions and orientations are now tied to the orientation of the under_camera null. All that remains to be done is to tie the motion of the under_camera null to the ocean surface. In order to do this in a manner that allows you to vary the amount of "bobbing" the camera experiences, the motion of the under_camera null should be tied to three points on the surface of the ocean. This results in taking an "average" of the normal vector to the ocean's surface over some region rather than tying the motion of the camera to the normal vector at one specific point on the ocean's surface.

PART 2: CREATING THE TRIANGLE

- Add the NatureFX Ocean by selecting **Model→Get→NFX_Ocean**. Accept the default values.
- Select **Ocean Preview Grid**.
- Zoom in the Top view so that a 10 unit square region centered on the origin is visible.
- Press and hold the "t" key, and left click and drag a small rectangle around the point on the ocean grid that is at (z=-3, x=0). This point on the ocean wave grid should be tagged.
- Choose tag→set cluster. Name the cluster "cluster1".
- Get a null and name it "point1".
- Verify that the point1 null is selected and switch to the motion module.
- Choose **Motion→Constraint→Object to Cluster**. Then left click on the **Ocean Preview Grid**. The null should move to the cluster that you just tagged.
- Switch back to the model module and again select **Ocean Preview Grid**.

- Press and hold the "t" key. Middle click and drag a box around the cluster1 point to untag it.
- Tag the point on the wave grid at $x=-2, z=0$.
- Make this point another cluster called "cluster2"
- Get another null and name it "point2".
- Constrain this null object to cluster2 on the wave grid in the same manner as was done for point1. This point should then move to the point on the ocean wave grid that was most recently tagged.
- Repeat this process again, this time making a "cluster3" by tagging the point on the ocean wave grid at $(x=2, z=0)$. Create and constrain a third null, "point3" to this cluster.
- There should now be a triangle of three nulls tied to the ocean grid in the x-z plane.
- Change the right view window to a schematic window. Switch to the model module and make sure that nothing is selected.
- Click on the **Parent Mode** box. Now left click on the point1, point2, and point3 nulls in the schematic window. A new null should be created, and it should be the parent of the three other nulls. Name this null "triangle". This null just serves to make it clear in the schematic window that the three nulls collectively form a triangle.

Now comes the final step for tying the under_camera null to the triangle of points on the ocean. This will be done using the `constraint→three points` command. The order that the three triangle points are selected is important so that the camera will be correctly oriented. When using the three points command, the three points must be selected in sequence. Softimage then creates an imaginary triangle bounded by these points. Next it computes a center for this triangle. It places the x-axis for the center of this triangle pointing towards the first point that is selected. It then decides if the y-axis should point up or down based upon the "right hand rule". This means that if one imagines picking the points in an order that follows the curvature of one's right hand, the y axis vector will be picked so that it points up from the triangle in the direction of one's thumb. Basically, one needs to click on the points in an order that follows them counter-clockwise around the triangle as viewed from the top view window.

- Switch to the motion module.
- Select the under_camera null in the schematic window.
- Choose **Motion→Constraint→Three Points**. Left click on the point1 null, followed by the point2 and point3 nulls.
- Choose **Motion→Camera→Show Camera**. The camera should be visible above the water. In the perspective window, you should see a view looking out over the ocean from above it.
- If the camera is under the ocean, select the under_camera null, and choose **Motion→Constraint→Relax**. Then choose **Motion→Constraint→Three Points** and click on the three triangle points in a different order.
- If the camera is oriented properly above the ocean, click on the right arrow in the lower right corner of the screen to watch the camera bob for a couple of frames. In the perspective window, the viewpoint should bob up and down with the ocean's surface.
- In order to vary how much the camera bobs, vary the size of the triangle of nulls on the ocean. A larger triangle will lead to less bobbing since it will be tied to points further apart from each other which will be less likely to be moving in the same direction. Using a small triangle should lead to more vigorous bobbing since the points in a small triangle are close together and will be moving in a more similar manner.

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