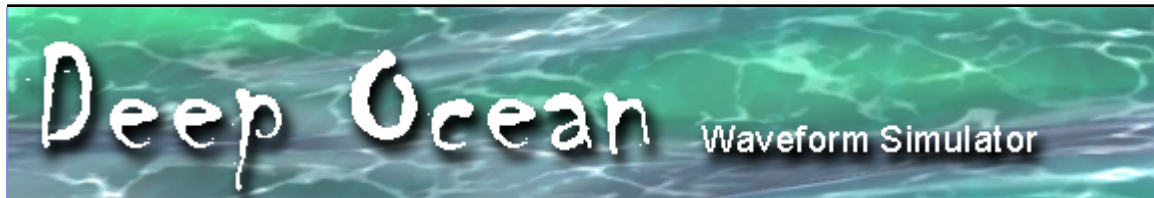


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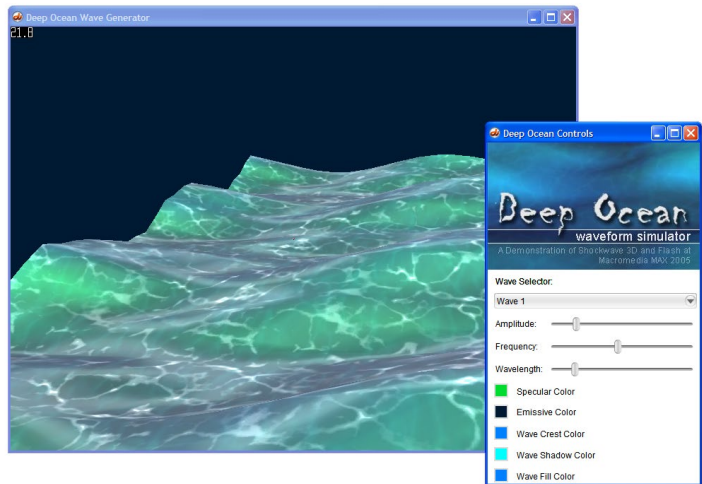
A Demonstration of Shockwave 3D and Flash at Macromedia MAX 2005

Andrew Phelps

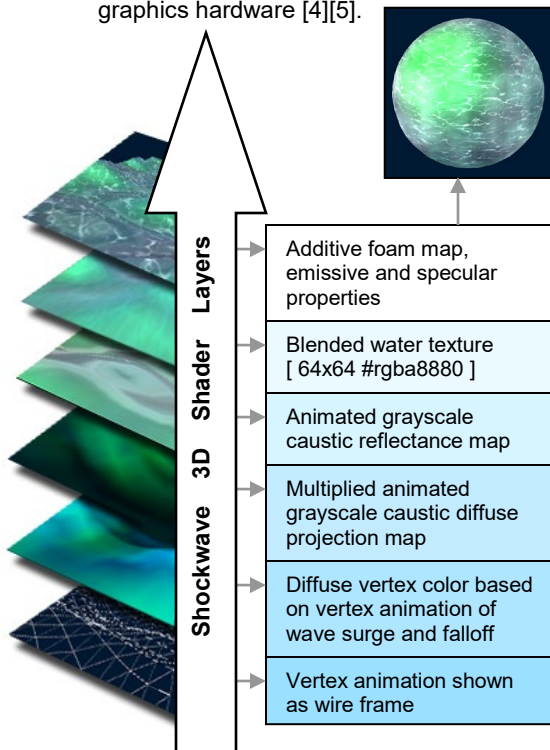
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The Deep Ocean Wave Simulator is based upon a technique called “Gerstner Waves,” which is a popular method for wave simulation within the graphics community. Several resources exist for implementing these algorithms [1][2][3], and there is even material available to implement these algorithms on real-time programmable graphics hardware [4][5].



In adapting the technique to Shockwave 3D, the demo uses the Gerstner evaluation function to sum a series of individual waves to produce the final height values for an animated mesh. The implementation of the wave simulation is contained in the “Ocean_Water” parent script, and the sub-classes/property objects Ocean_Data[1-4]. Each Ocean_Data object computes an individual waveform, which are then summed in the per-frame update of the Ocean_Water update loop to provide a vertex location. Finally, to avoid overt regularity, Perlin noise [5] is applied to add a small random factor to the vertex position.

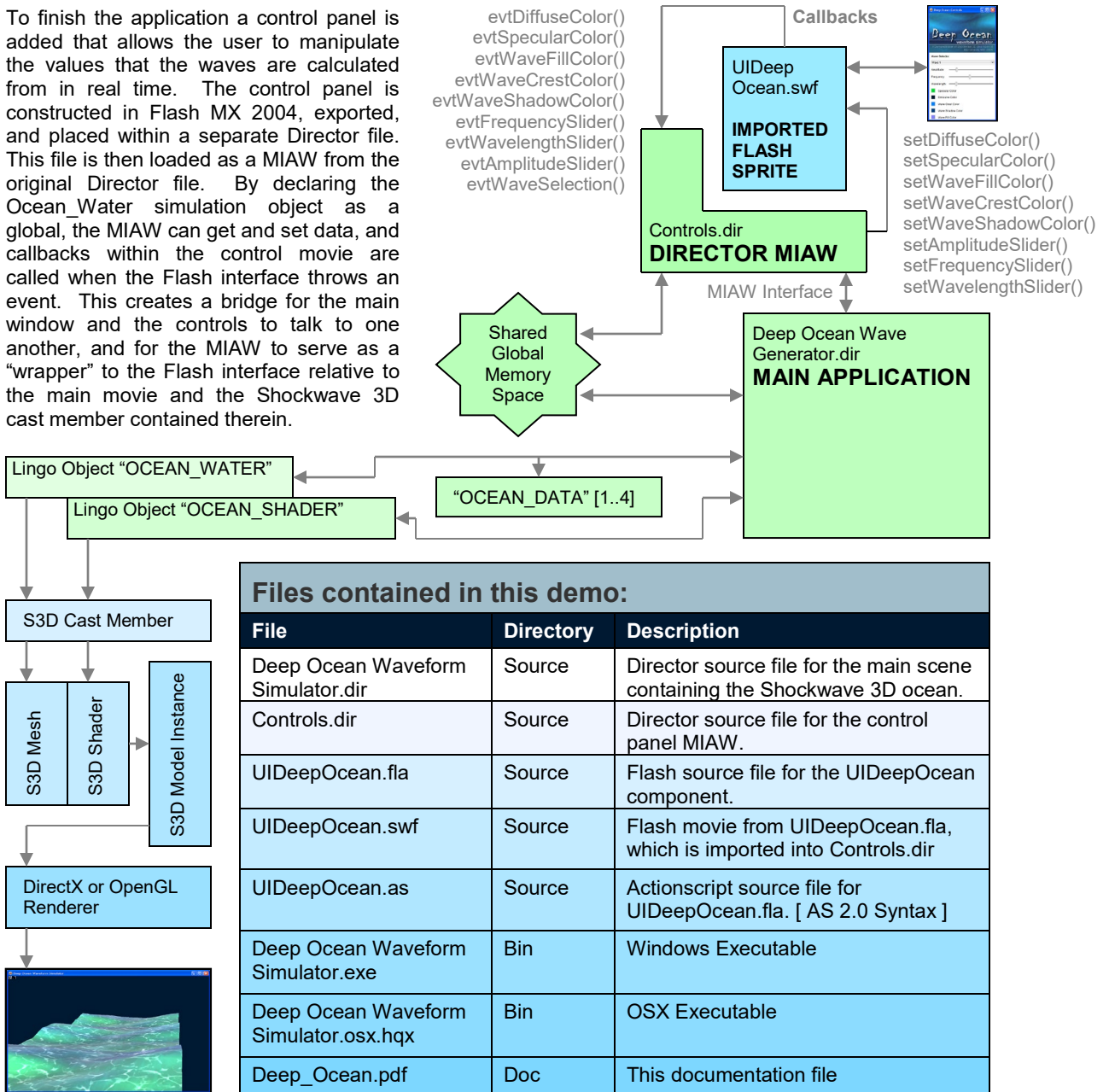


The look-and-feel of the ocean water is accomplished primarily through the Ocean_Shader, which is an object built around a standard Shockwave 3D shader. Several layers are composited to compose the final render. As a part of the simulation, a basic vertex color is derived for each point on the mesh in reference to whether that vertex is rising or falling relative to the previous frame. These colors are used as the diffuse base for the mesh. Next, an animated grayscale caustics map is projected onto the mesh from the perspective of the point light in the scene. A second animated caustics map is projected as a reflection map on the surface. Next a base water texture is blended over the scene at a high level of transparency. Finally a foam map is added using additive texture blending. Appropriate values for emissive glow and specular falloff complete the shading.



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To finish the application a control panel is added that allows the user to manipulate the values that the waves are calculated from in real time. The control panel is constructed in Flash MX 2004, exported, and placed within a separate Director file. This file is then loaded as a MIAW from the original Director file. By declaring the Ocean_Water simulation object as a global, the MIAW can get and set data, and callbacks within the control movie are called when the Flash interface throws an event. This creates a bridge for the main window and the controls to talk to one another, and for the MIAW to serve as a "wrapper" to the Flash interface relative to the main movie and the Shockwave 3D cast member contained therein.



Andrew Phelps regularly publishes work at the Macromedia DevNet Center and the Director Online article repository [www.director-online.com], and is the editor for the Director column in the MX Developer's Journal.

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 [3] Hinsinger, D., Neyret, F., and Cani, M. 2002. Interactive animation of ocean waves. In *Proceedings of the 2002 ACM Siggraph/Eurographics Symposium on Computer Animation* (San Antonio, Texas, July 21 - 22, 2002). SCA '02. ACM Press, New York, NY, 161-166. DOI= <http://doi.acm.org/10.1145/545261.545288>
 [4] Finch, Mark. Effective Water Simulation from Physical Models. GPU Gems. Randima Fernando, editor. Addison-Wesley, Boston, MA, p 5-28.
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