Flash Film Works spent more than one year in R&D before devising a method of handmanipulating the water surfaces to control the majority of the fl uid in the fi lm. The studio accomplished this task using proprietary and commercial tools.

And, like the water work in The Perfect Storm and Poseidon, the CG fluid simulation in this movie sets a new precedence of what can be done within the digital realm by opening different avenues for the creation of virtual water. "Anytime you are doing a procedural method, you need to think out the process—make calculations—and that utilizes computer power," says Mesa. With this method, all the computer had to do is render out the surfacing or positions the group told it to create, which results in a huge leap forward in actual speed, time, and changeability. And after the render, if the artists want to change something, the shot can be quickly re-rendered without the computer having to recalculate the whole process over again. Since the water was laid out in a morph-target fashion, the artists just animated it as they would any other animation.

"So many people were worried that we had to render out all this CG water. And, I remember back when we did The Deep Blue Sea; some shots took a week to render the water," says Mesa. "For this film, we rendered out the general surfacing in multiple layers, about five on average. We didn't try to render all the CG water with the lights reflecting on it. Things like that were rendered out separately and composited together. If we didn't like it, we could control it in the composite."

In the film, the Coast Guard rescue swimmers have to battle the most horrendous storms conjured up by Mother Nature. Similarly, the digital effects artists had to control the natural phenomenon that they themselves had created. In the end, both triumphed

Karen Moltenbrey is the chief editor for Computer Graphics World.

Go With The Flow

With a PhD in fluid mechanics, Mark Stasiuk, co-founder of Fusion CI Studios, along with producer/director partner, Lauren Millar, has worked with software developer Next Limit Technologies in its R&D efforts for the past three years while using the company's commercial RealFlow software in features and commercials. Most recently, Stasiuk assisted Flash Film Works in creating millions of particles that augmented the digital surfacing technique devised by Flash Film Works for generating turbulent water in The Guardian. In a Q&A with CGW chief editor Karen Moltenbrey, Stasiuk discusses the work he did for the film.

What was your task/role on the film?

I worked in-house with Flash Film Works as the fluid simulation supervisor. My main role was to supervise and teach a group of eight RealFlow artists to work with Dan Novy (the technical supervisor) on pipeline issues, to develop custom production tools, and to communicate with VFX supervisor William Mesa and various CG artists and compositors involved in shots requiring CG fluid effects.

Have you done similar work in the past?

I did similar work on Poseidon, working within CIS Hollywood, and have also consulted with several studios on CG fluid projects. For many of our clients, I have acted as an advisor for their workflow and pipeline, done troubleshooting, and

provided fast turnaround custom scripts to accelerate their simulations or eliminate problems.

How did you apply that knowledge to The Guardian?

I came into this project with an accumulated library of optimization procedures, algorithms, simulation methods, and rendering ideas that I had already developed. I then extended many of those to a more advanced state, or customized them for this project's particular needs. I was also familiar with the issues that new RealFlow users face, so was able to find ways to get junior artists productive faster.

Is your specialty solely in fluid sim?

Really it's in general dynamics, including general particle FX, with fluid simulation being a special (and especially difficult) area of dynamics. We work on problems involving rigid bodies, soft bodies, dust, smoke, plasma, fire, explosions, etc., including interactions between these different things. In addition, we provide help with render pipelines related directly to the FX elements we create.

What can you provide that a VFX studio cannot do on its own?

Typically, small to midsize VFX studios can't easily maintain a high level of expertise in these kinds of effects over the long term; it's just not what they are focused on from day to day, so it becomes expensive and unwieldy. And, certainly, they have difficulty maintaining a highly specialized line of R&D. We bring along years of accumulated R&D, a rare ability to quickly perform robust, new R&D, plus strong, specialized support from Next Limit Technologies, with whom we have an exclusive collaborative relationship.

Exactly what does that R&D entail?

Our body of R&D includes everything from ways to make simulations run two or three times faster than they would otherwise, to stability methods, to custom force fields for achieving certain behaviors. In addition, we have the hardware and a group of artists who we've trained to get shots done fast. So we can quickly turn around complex effects with very little ramp-up time. Studios can struggle for months to get to the point where they are productive with complex fluid FX, whereas we can turn around useful iterations in a matter of weeks. It's just because that's what we're focused on and experienced with.

Why was this task specially challenging?

The Guardian was challenging for two reasons. First, a significant amount of R&D had to be done during production, just because of the timeline and the evolving needs of the production. Second, many of the scene elements were non-dynamic and strongly art-directed, because the shots needed to achieve very particular story elements.

Why couldn't you use out-of-the-box fluid technology?

For a minority of elements, we did just that. But for many of the elements, the needs were very particular and art-directed. Simulations generally do cool and realistic things, but sometimes that's not what the director needs. We needed extra control. Plus, for a number of effects, there just aren't pre-fab tools available in RealFlow—for example, there are none for generating realistic splashes around the intersection of any two polygonal objects. We also needed to keep the simulation times manageable and stable.

How did RealFlow enable you to accomplish your goals?

RealFlow is a relatively fast and stable dynamics solver with a lot of flexibility built into it now that the product incorporates scripting. It provided the foundation for us. The fact that the software provides a lot of potential for custom control via scripting within a well-developed UI makes it ideal for this kind of work. In addition, RealFlow's new 64-bit version allowed us to access massive amounts of RAM and, therefore, run much-larger-scale simulations.

Did you use any other software or hardware?

We used LightWave 9, and made use of both 32-bit and 64-bit AMD Opteron systems. The 64-bit systems had up to 16gb of RAM to deal with the large number of particles and polygons in the simulations.

Which features/functions did you use, and for what end?

We used a combination of the built-in tools (fluid particles, force fields, fully coupled fluid-object interaction) plus the Python scripting capability to do custom tasks, like tailor-made force fields.

How long did you work on this project?

Fusion's part in the project lasted about four months; the solution to the rendering issue was developed over just a few weeks early in the production work, which was early enough that it was really solved before we got into the peak of the simulation work.

Are there any other points about your work that are worth mentioning?

For me, a highlight of this work was that a relatively small group of talented VFX artists, without massive resources or months and months of pre-production R&D, could deliver advanced CG fluid effects. That speaks to the quality of the tools (RealFlow and LightWave), as well as to the skill of the artists involved and the support at critical moments from the software developers.

At any time did you have to dial back the effects?

One of our favorite custom simulation tools was a script I created to magnify forces to get bigger splashes—we dubbed it the "cowbell force." We'd often get requests for more cowbell. But by the end, in a lot of cases, we toggled on too much cowbell. It was nice to hear, 'OK, less cowbell, please' from the supervisor.

What's next for you?

We're focusing on providing fluid effects elements for features now, and working less in-house with other studios. And we're currently involved in a few projects requiring large-scale, non-water-type fluid effects and continuing to work with Next Limit Technologies to ramp up to RF5 in the process. Watch out for some amazingly violent and yet highly 'directable' particle effects coming soon.