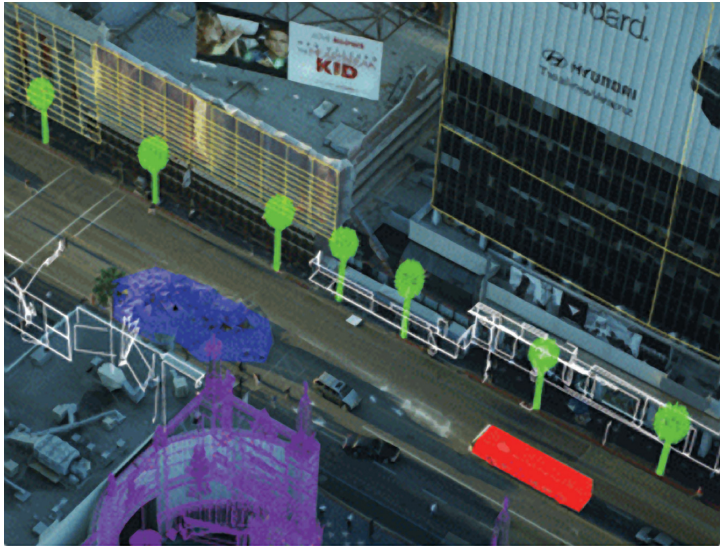July 1, 2008

Step-By-Step:
Hancock

Ellen Wolff

Actor Will Smith has joined the ranks of the superheroes this summer with Hancock, directed by Peter Berg for Columbia Pictures. Because no superhero saga is complete without a big battle, *Hancock* builds to a face-off between Smith and a superheroine played by Charlize Theron — a confrontation in which tornadoes, thunder, and lightning are unleashed. Creating that chaos was the challenge for Sony Pictures Imageworks in Los Angeles.

That this battle had to occur on a famous stretch of Hollywood Boulevard simply added to the scene's degree of difficulty, says Sony's Digital Effects Supervisor Kee-Suk "Ken" Hahn. "In one overhead shot, we see multiple tornadoes on one side and lightning flashes on another," he says. "The director wanted to get as much of this scene in camera as we could."

Top - Live-action plate indicating the matchmove geometry for the shot. Grid lines indicate the lidar services scans.

Center - Sony's animatic indicating the blocking for the twister animation done in Autodesk Maya.

Bottom - A rough representation of the tornado showing the core generated in Side Effects Houdini.

Filming on Hollywood Boulevard was extremely limited, and it was impossible to light for a storm. "We knew we'd need to create an overcast look in plates shot in bright sunlight," Hahn says. "This was probably one of the most difficult exercises that our DP had because of what we asked him to get, lighting-wise, to help us integrate CG tornadoes." Hahn knew that Imageworks would face significant plate manipulation to get what he calls "a pseudo day-for-night look."

"On set, we had ginormous wind machines, but they weren't enough to make it feel like there were tornadoes blowing," he says. "We knew we'd have to add lots of CG debris." Because the director wanted a handheld look in this film, a gyro-stabilized helicopter was used to film this shot. "Afterwards, we'd have to rough it up to make it feel like we're in a windstorm."

Previsualization Supervisor Steve Yamamoto gave Imageworks a previz he had created in Autodesk Maya, which had rough dimensions of the street and buildings. To ensure that Imageworks would have precise information about the environment into which it would be adding CG tornadoes, Lidar Services spent four days surveying the scene. That data allowed Imageworks to precisely seat the tornadoes within the background plate. The movement of the camera was tracked using 2d3 Boujou as well as Sony's proprietary matchmove plug-ins for Maya, so Imageworks could replicate the previz that the director had approved. Maya was used to animate the tornadoes themselves.

"We treated them as characters. We didn't go for fluid dynamics because we wanted to choreograph

their motion," Hahn says. "We looked at tons of tornado references, though there's very little on multi-spawn tornadoes. The interaction between tornadoes is a complex phenomenon, and sometimes they're odd shapes. We decided to put a big hook on the tornado coming through the foreground and have it wipe through the frame.

The Final Composite

"In the blocking phase of the animation, each tornado was nothing more than an extracted tube with checkerboard patterns so that we could gauge the speed and rotation," Hahn says. "We built each one with a core, which was a multiple set of rotating ribbons. Then we translated that information to [Side Effects] Houdini. We extruded the rotating ribbons into volumes and then populated those volumes with noise and lots of points." Lightning flashes, which illuminate the tornado from within, were also generated in Houdini, as was the billowing dust that swirls around the tornado and is sucked into it.

In only one area did Imageworks opt for what Hahn calls "pseudo simulation." "This was done in Houdini for some flying debris. We generated a bounding box and created vector fields through that," he says. "Into those vector fields, we fed various bits of CG debris—like pizza slices, palm fronds, and newspapers — which interacted with the tornado. This entire frame was fed into our proprietary volumetric renderer Svea, originally developed for the Sandman character in Spider-Man 3. We were always layering more stuff to look ominous and threatening."

In the face of twisters churning down Hollywood Boulevard, any people nearby would run away in panic, so Hahn's team was tasked with creating them digitally. "The plan was to film real people, but since they shot this at 6 a.m., only the crew was there. We had to paint them out, clean up the street, and replace them with digital versions," he says. "We had some generic run cycles and we put them on various random paths so they looked like people running out of control." Imageworks used SilhouetteFX software to rotoscope the plate, Maya to animate the CG people, and Pixar RenderMan to render them.

The final challenge was integrating all of these elements into dramatically altered plate photography. Sony's still photographers had shot Hollywood Boulevard with fish-eye and prime lenses to get specific details, and these were later assembled in HDR format and used for reflection maps, ambient occlusion maps, and textures. Imageworks had specific geometry information from the Lidar scans. "[So] we were able to relight and do projections to get proper shadowing," Hahn says. "Most of the projections are proprietary stuff that we hook through RenderMan, but we can also do projections through our inhouse lighting tool, Katana. And our inhouse tool Projection Paint allows us to do projections and then a little paint work on top." The team composited with Autodesk Flame, Sony's inhouse compositor Bonsai, and Apple Shake.

Hahn assesses the complexity of Hancock by saying, "The information that's being put into images now is mind-blowing. When I worked on *Hollow Man* [in 2000], the amount of data we had online at one time was 2TB. For *Hancock*, we probably had 25TB or 30TB online. I think that trend will continue. Machines will get faster, but we'll keep throwing more at them!" 1. Live-action plate indicating the matchmove geometry for the shot. Grid lines indicate the Lidar Services scans.

CREDIT ROLL

DIRECTOR: Peter Berg
DP: Tobias Schliessler
VISUAL EFFECTS SUPERVISOR: John Dykstra
VISUAL EFFECTS SUPERVISOR: Carey Villegas
DIGITAL EFFECTS SUPERVISOR: Kee-Suk 'Ken' Hahn
CG SUPERVISOR: Bob Winter
SHOT TD: Mark Wendell
TORNADO DEVELOPMENT: Vincent Serritella
VOLUME RENDERING: Magnus Wrenninge
TORNADO LOOK DEVELOPMENT: Kevin Souls
LIGHTNING DEVELOPMENT: Ryan Laney, Aaron McComas
VISUAL EFFECTS SURVEYOR: Messrob Torikian
LIDAR SERVICES ANIMATION: Stephen Buckley, Jack Cheng
PREVISUALIZATION SUPERVISOR: Steve Yamamoto

for more information about Carey Villegas, visit

CGVFX