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VFX FOR FILMS by Christine Bunish

Order your tub of popcorn and super-sized soft drink and be prepared to enjoy the latest round of summer and early fall movies with VFX that will knock your socks off — or make you wonder how you missed the undetectable visual wizardry.

Columbia Pictures

HANCOCK

Many studios have become expert at VFX for superheroes but Hancock has been billed as "not your average superhero." Starring Will Smith as the superhero with an attitude and Charlize Theron, the action comedy set in contemporary Los Angeles enlisted Sony Pictures Imageworks in Culver City as the lead visual effects house.

"With any superhero, you have characters doing the unnatural: flying, lifting and throwing things," notes Imageworks VFX supervisor Carey Villegas. "One of our favorite shots is when Will steps in front of a train and it hits him. There was one front-end freight car in the [live-action] plate but the derailment was digital: The engine in the foreground was crushed and the rest of the train cars stacked up like dominoes. We removed palm trees, added a digital matte painting of the LA skyline, populated the roads and created all the destruction. It was a ton of work."

Imageworks was also charged with the big fight sequence on Hollywood Boulevard where mayhem ensues. The combatants unleash lightning and tornadoes, and trigger collateral damage while remaining oblivious to everything happening around them. VFX designer John Dykstra oversaw all the plate photography for the main unit shoot.

"Once the battle began, it switched to the digital realm with set extensions, digital environments and weather," explains Imageworks digital effects supervisor Ken Hahn. "For the weather we started off with references of real tornadoes and lighting and destruction, but director Peter Berg wanted to make it more supernatural and stylized so it would be far more menacing. It wasn't critical to match the science."

"It's always a challenge to adapt to the style of the director," Villegas notes. "Peter is really high energy: he thinks and moves fast, and it's hard to keep up with him. He likes fast, frenetic camera movement so there were a lot of long-lens shots and snap zooms. In the past, VFX required the camera to be locked down as much as possible; we didn't like to see that amount of camera movement." Imageworks used 2d3 Boujou and proprietary plug-ins for Autodesk Maya for camera tracking these shots.

Since the fight sequence starts on a sunny day, the sky had to reflect the transition to violent weather. "We went through a DI-like process using our node-based Bonsai in-house compositing system, [Apple] Shake and [Autodesk] Flame to fine tune the mood and tone of the sequence before we really got started," says Villegas. [Editor's Note: the real DI was via Technicolor.]

"Every job leverages our past work," Hahn points out. "To create the weather we leveraged SVEA, the volume renderer we developed on *Spider-Man 3* for the Sandman character, and wrote additional plug-ins for Houdini and Maya."

Imageworks also built on its character animation skills to match digital doubles to the actors. "A lot of times we switched from a digital Will to the live Will, or vice-versa, in one shot," says Hahn. "We got cyberscans of the actors in their various costumes and still and film footage of them in controlled on-set lighting and on location along with some facial motion capture of Will and Charlize."

One shot finds Hancock as good as his word when he threatens to shove a guy's head up another man's butt. "I think it's the first time we've seen that onscreen and, hopefully, the last!" Villegas laughs.

"Peter never intended it as a visual effect; he shot multiple camera angles but never got quite the gag he wanted," notes Hahn. "I had my doubts about making it fully digital, but my team said, this isn't a request you get very often so let's take a chance. We did the modeling and animation in Maya, rendered in RenderMan and composited with Bonsai and Flame. The end result was really great!"

THE MUMMY: TOMB OF THE DRAGON EMPEROR

LA-based Rhythm & Huesww shared lead VFX house credits with Digital Domain for The Mummy: Tomb of the Dragon Emperor, which takes the O'Connell family of archaeologists from Egypt to Asia, where a now-grown Alex awakens the ruthless, cursed dragon emperor and his vast terra-cotta army.

Rhythm & Hues (R&H) was charged with completing 363 shots in the Shanghai chase and Himalayas sequences. "We had a very, very short schedule but enjoyed working with Rob Cohen, one of the most interesting and charismatic directors we've worked with," says R&H VFX supervisor Derek Spears. "Rob communicated very well and was very proactive in his interactions with us, and that made all the difference in the world."

It's in the Shanghai sequence that the mummy emperor first comes alive. He breaks out of a museum window and along with his team of bronze horses leads our heroes on a chase through the city streets. "Digital Domain designed the Emperor as a terra-cotta mummy. For our shots, we rebuilt the mummy with their models and textures and cracking technology," Spears explains.

He and his R&H team faced a number of challenges during the chase. "We had to create realistic horses pulling the mummy's cart, make the mummy animation believable and integrate them behind the smoke and debris they crashed through," he says.

To achieve that they digitally painted out the large battering ram mounted on a carriage, which plowed over the streets in a suburban Shanghai backlot churning up dust and debris, and put a team of four bronze horses behind the debris. "To get the motion we wanted we combined motion capture of horses with hand animation," Spears reports. "The horses were modeled after bronze set pieces, and to prevent them [from] looking rubbery we had them crack a bit when they flexed."

A further challenge was crafting a mummy emperor that realistically drove the horse cart. "We didn't want him just holding the reins and cracking a whip," says Spears. "We wanted him interacting with people and the environment."

R&H used Autodesk Maya to model the horses, its proprietary Voodoo software for animation, Side Effects Houdini for effects and its own Wren and Houdini's Mantra for rendering.

For the Himalayas sequence, the company crafted set extensions, clouds, digital snow and the legendary Yeti. "The Yeti was designed by Aaron Sims and Rob [Cohen] to be powerful and beautiful," Spears notes. The creature was animated with Voodoo, rendered with Wren and his fur simulated by technical animators in Voodoo.

R&H also brought to life a three-headed dragon emerging from a pool of liquid diamonds. "The dragon moves in some interesting ways; he has arms and legs and wings which act like another set of limbs," says Spears. "We used fluid simulation to drive the liquid diamonds and a combination of our internal tools and Houdini to give them a very sparkly look."

Adding drama to the Himalayan setting was an avalanche created with Houdini and fluid simulation toolkits, and R&H's volumetric rendering software, which netted a technical Academy Award last year. "Rob did an avalanche in *XXX*, but for this picture he wanted an avalanche with more solid matter instead of clouds," Spears reports. "We created something we hope you've never seen on film before with snow, boulders, other solid matter and cloudy material misting up from it."

THE X-FILES

Mat Beck, VFX supervisor/owner of Santa Monica and Vancouver's Entity FX, has had an intimate relationship with "The X-Files". He was VFX supervisor on the iconic TV series' pilot and first three seasons; his company handled VFX for the show's last two seasons and Beck himself served as VFX supervisor for The X-Files: Fight the Future, the franchise's first theatrical feature. Little wonder that he's reprising his role on the new motion picture The X-Files: I Want to Believe, directed by show creator Chris Carter.

"I've known Chris and [executive producer/co-writer] Frank Spotnitz a really long time so I have a sense

of The X-Files aesthetic, what they're looking for," notes Beck. "We have a bit of a shorthand between us, and they trust me enough that if I take things in a certain direction they know it's worth considering."

As lead VFX studio, Entity FX supervised about 380 shots for the film and DVD edition, including 66 farm-outs done by Illusion Arts, Hybride, Frantic Films, and At The Post. The number of shots grew so quickly at the end that all of the feature shots were declared final in the last two-and-a-half weeks of the schedule.

Working at mixed 2K and 4K resolutions, Entity FX crafted CG environments, water, cars (some of them crashed), 3D matte paintings and CG blood; they also helped make characters look more or less gruesome as required, created 3D cloth simulations and weaponry, and removed numerous footprints in the snow.

"A lot of this movie takes place in a snowstorm," Beck notes. "It was shot in Canada [which doubled for another location] but there wasn't necessarily enough snow falling at the right times so we had to do a lot of digital meteorology where the snow became a character in shots. We even de-snowed some shots for continuity."

To accomplish all this precipitation, Entity FX CG supervisor David Alexander wrote Frosty, a custom software application that dialed in all the possible variations of a snowstorm: flake speed and size, wind, turbulence, mist, lighting and interaction with 3D objects. "Frosty sat on top of Maya, which has a good particle system, and went into RenderMan," Beck reports. "With the appropriate lens info, Frosty allowed us to do atmospheric blur, motion blur and defocus, all in the right order."

Frosty's ability to give real creative control to 3D artists was key in using the snow "as a tone tool," he says. "In one scene, where a woman finds herself in danger, the snowfall is initially a bit lighter so you can see the landscape, but as trouble builds so does the snow; you see less and less of the surroundings and the atmosphere becomes more oppressive" matching the emotion of the moment.

Entity FX used RenderMan and Mental Ray for rendering, expanding its renderfarm as necessary. "We have a lot of rendering power here in Santa Monica and linked to our facility in Vancouver," he notes. "Our Vancouver office made it easy to service the shoot in British Columbia."

Rod Park was Entity FX's VFX producer, with Trent Smith senior creative producer and Andrea Shear heading the previz team.

THE DARK KNIGHT

London's Double Negative (Dneg) was the lead VFX studio for the latest in the Batman franchise, *The Dark Knight*, and for *The Dark Knight IMAX Experience*. Dneg delivered 370 shots, 170 of them IMAX and the rest Cinemascope.

"*The Dark Knight* was shot primarily in two different formats: anamorphic Cinemascope and full-aperture IMAX. Rather than shoot simultaneously in both formats, the scenes were shot on either one format or the other," explains Dneg VFX supervisor Paul Franklin. "Four major sequences were shot in IMAX as well

as numerous establishing shots and key moments. When seen in an IMAX cinema these sequences will fill the entire screen; the rest of the film will be letterboxed in the center of the screen. The Cinemascope material is being up-rezed with the IMAX DMR process. For standard theatrical release a 1:2.35 extraction is made from all the IMAX shots so, to all intents and purposes, they look the same as the rest of the Cinemascope material."

The dual-format delivery required a custom workflow solution. "All IMAX work was carried out at a resolution of 5.6K, and all Cinemascope work was done at 4K," says Franklin. "Rather than render all the IMAX stuff again letterboxed at 4K we pulled out 1:2.35 extractions from the 5.6K renders and then reformatted to 4K. The biggest challenge was the much higher resolution of both the IMAX and 'scope images. We developed an entirely new rendering and compositing pipeline to cope with the extra pixels and invested a lot of time, money and effort in upgrading our infrastructure, adding more CPUs to the renderfarm and building lots and lots of extra server space. With that all in place, the 5.6K IMAX work went very smoothly, and it was just as easy for us to do the Cinemascope work at 4K."

But one area in the IMAX pipeline that still has to be addressed is how to view the full 5.6K images, Franklin notes. "We developed a method of breaking down the images into 2K tiles, which could be viewed on our standard playback systems. That was fine for quality checking, but it doesn't allow you to assess a shot's overall balance and composition. And shooting everything out to 65mm and viewing it in an IMAX theater would have been prohibitively expensive."

While *The Dark Knight* is set in the same universe established by Dneg in *Batman Begins*, the new film "is even more firmly rooted in an observed, recognizable reality," says Franklin. "While Gotham City has definite continuity with our earlier depiction in *Batman Begins*, the more Gothic-looking aspects of Chicago's Art Deco landscape give way to the cooler minimal lines of classic modern architecture. It's a new take on an old friend!"

The powerful Armored Chase sequence required many weeks of location work on the streets of Chicago as well as extensive stage work in the UK, Franklin reports. "As with the car chase in Batman Begins [director] Chris Nolan was determined to shoot as much of the sequence for real as possible. Our role was to seamlessly extend the in-camera action and to provide some key dramatic moments at full IMAX resolution. Our shots involved a wide range of standard VFX tasks — rig removal, background clean-up, greenscreen inserts — but perhaps the two biggest challenges were the Batmobile Death/Batpod Birth sequence on the underground freeway and the set of fully-digital shots on LaSalle Street during the chase climax."

Although Nolan attempted practical effects for the Batmobile/Batpod sequence he ultimately opted for fully digital replacement of the vehicles and their surrounding environments. "One thing that really helped us was that we were given all the time we needed with the crashed Batmobile, which was no longer required for filming," Franklin points out. "This allowed us to work up a highly-detailed digital model which would hold up to intense scrutiny on the IMAX screen. Animation involved a combination of hand-keyed action and an extensive secondary dynamics system that added the wobbles and gyrations of the damaged car. For the final ejection, the panels were blown off the car using dnDynamite, our proprietary rigid body dynamics system; the Batpod's swerving journey was enhanced with smoke and dust elements created

with a combination of Maya fluid dynamics and dnSquirt, our new in-house fluid dynamics toolset. All smoke and dust was rendered with our volumetric renderer, DNB.

"Most of the underground freeway moments were shot on Lower Wacker Drive in Chicago, but key moments — such as the crash itself — were filmed in the UK," he continues. "Whilst looking very similar, the two sets had significant differences so our digital model had to bridge the gap. Initially we created the environment from reprojected plates, building only simple geometry, but as the sequence developed and the camera moved further from the angles in the available plates we decided to go with a fully-digital build of a long section of the freeway created from a combination of survey data from both locations."

On-set supervision for Dneg was carried out by Stuart Farley and Peter Bebb. Bebb and David Vickery were co-CG supervisors with Andrew Lockley 2D supervisor and Matt Plummer VFX supervisor.

MEET DAVE

Eddie Murphy has an unusual dual role in Meet Dave, playing both an alien spaceship in human form and the miniature alien captain piloting the spaceship. It's a scenario that cries out for extensive VFX, and CIS Hollywood delivered 163 shots for the Brian Robbins-directed comedy.

"It's an oddball mix of goofy Eddie Murphy movie and sci-fi film, which offers an eclectic combination of traditional 2D compositing and interesting 3D animation and design," notes CIS Hollywood VFX supervisor Bryan Hirota.

One of the most fun sequences revolved around starship Dave getting hit by a car forcing the miniature alien crew — which resides inside Dave — to make repairs. A crew member opens a hatch in Dave's ear, repels down his body, pushes a mole on his ankle opening a panel and repairs the wires found there. To assess further damages, a CG camera flies out Dave's nose, dips under his suit collar and enters a vent to his body interior. Another camera exits Dave's pants pocket, re-enters his butt, then ascends Dave's main elevator shaft to the Bridge. "It's one long, continuous 2,000-frame shot that introduces the audience to the concept of spaceship Dave with its different components," Hirota explains. "We match moved and synced CG environments with full-size sets and Steadicam photography."

CIS Hollywood was tasked with devising the "flight plan" through spaceship Dave's body that would seamlessly link one piece to another and deliver what Robbins and production visual effects supervisor Mark Stetson envisioned.

The company primarily used Maya for modeling and animation, with Houdini for some effects and Pixar RenderMan for rendering. It tapped Next Limit's RealFlow and custom software for fluid-dynamics simulation, the Maya plug in SyFlex for cloth simulation, and Shake and Autodesk's Inferno for compositing.

"At 2,000 frames, the shot was a beast to wrangle," Hirota points out. "We couldn't have done it without our proprietary job tracking and workflow system Damit [Data Asset Management-It]."

Several scenes take place inside spaceship Dave's mouth. A partial mouth set was built at Universal and

the alien crew was shot greenscreen. When Dave drinks a glass of water or downs a Mojito, complete with giant mint leaves, the aliens clad in wetsuits, who are cleaning his mouth, experience the hazards of working inside the humanoid spaceship. "They couldn't dump as much water on set as the shot demanded so we replaced the bulk of it with CG," Hirota recalls. "We tried to keep as much as we could, like the splashes, because it's always helpful to keep practical effects in a shot. But the bulk of the water flow we did as a fluid simulation."

CIS Hollywood ventured beyond Dave to realize an idea of Stetson's, which Robbins decided to make part of the opening titles. Prior to spaceship Dave's arrival, the aliens send a probe to Earth, which hits a satellite, veers off course and ends up in a fishbowl where it sucks up all the water. CIS Hollywood choreographed the probe's journey whizzing past Pluto, passing close to Jupiter and Saturn, speeding by Mars and flying up to and over Earth. "We used volumetric effects for the planets and particle effects for those with rings or moons," says Hirota. "We got maps of city lights seen from space so we could illuminate parts of Earth's continents."

The probe itself was driven by blue plasma propulsion, a product of particle and volumetric effects. "When you see the probe in space it seems large — you think it's big and important," he notes. "But when it crashes into a fishbowl in a child's room you see it's not. That's a prelude to knowing the aliens must be very small." Santa Monica's Hydraulx picked up the shot once the probe entered Earth's atmosphere.

At CIS Hollywood, Patrick Kavanaugh was 2D supervisor, Gary Abrahamian lead animator and Lisa Maher VFX producer. Diana Miao helped with look development and Dottie Starling assisted with on-set and CG supervision.

for more information about Carey Villegas, visit

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