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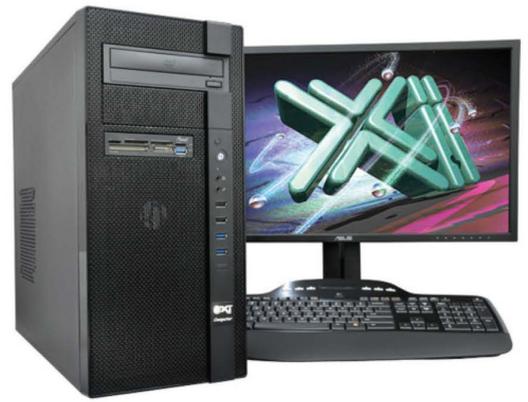
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## ON THE COVER



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### BIRDS OF PARADISE

CG artists and animators at Image-works transform Rovio's simplistic *Angry Birds* into a full-length animated film featuring Red, Bomb, Matilda, Chuck, and many other bird-like characters, along with a plethora of little green piggies. They also created the peaceful paradise of Bird Island and the industrialized Pig Island, where the war between the birds and pigs occurs.

## DEPARTMENTS

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**EDITOR'S NOTE** – The first thing that comes to mind when someone mentions “summer blockbuster” is a big visual effects film. But, let's not forget about the many CG animated features that are poised to make this summer's theater experience a memorable one.

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**SPOTLIGHT** – *Products:* The Foundry's Nuke 10 • AMD's FirePro W9100 32GB • Autodesk's new software versions • HP's Z1 G3 Workstation • Dell's VR-ready solutions • Unity's toolsets • Lenovo's ThinkStation P910 and P710

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**PRODUCTS** – Recent software announcements

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| Sound design: *The Jungle Book*  
| *Mother's Day* Director Garry Marshall  
| IMAX: *A Beautiful Planet*

## FEATURES



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**A FINE FETTLER OF FISH** – Disney-Pixar was no fish out of water when creating *Finding Dory*, the sequel to its 2003 hit *Finding Nemo*. Using updated technology, the crew created new settings and new acquaintances for the fish.



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**BATTLE LINES** – Fight scenes can be difficult, but when superheroes with superpowers are battling one another, the VFX can become complex, as the visual effects teams on *Captain America: Civil War* discovered recently.



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### SPECIAL REPORT: DRONES

This second part of a continuing series looks at the use of this advancing technology for aerial photography across various forms of entertainment.

# THE SUMMER OF 2016: MAKING ANIMATED MEMORIES

**F**or some time now, summer has been defined by that one special feature film that drives moviegoers out of the bright sunshine and into dark theaters. You know, that one film everyone talks about from May through August.

Most people associate summer blockbusters with big visual effects films. And, with little wonder. Our favorite archaeologist Indiana Jones led us on many summer adventures, as did our favorite pirate, Captain Jack Sparrow. Action heroes have saved the world in *Independence Day* and *Armageddon*, as did those men in black. And superheroes of all shapes and forms have been battling evil, and more recently, one another, in many top-grossing summer hits.

This year, a number of films will certainly gain attention: *Captain America: Civil War*, *X-Men: Apocalypse*, *Independence Day: Resurgence*, *Warcraft*, *Star Trek Beyond*, *Ghostbusters*, *Jason Bourne*, *Ben-Hur*, *Suicide Squad*, *Alice Through the Looking Glass*, *The Legend of Tarzan*, *Pete's Dragon*, and more. But, we also need to acknowledge animated movies in the role of summer blockbuster.

This year, we have some newcomers to the big screen, as well as some returning in popular franchises: *The Secret Life of Pets*, *Ice Age: Collision Course*, *Kubo and the Two Strings*, and others.

We kick off the summer animation with *The Angry Birds Movie*, based on the ultra-popular mobile game. But, how do you turn a very simplistic app title – based on the premise of loading angry-faced, ball-like birds into slingshot and shooting them at little green pigs – into a feature film story line? It seems that Rovio managed, and thanks to the talented artists at Sony Pictures Im-

ageworks, the end result is a colorful, funny movie that exceeded my expectations.

For quite some time, it seems that Rovio had bigger plans for *Angry Birds* outside the game world. Indeed, the characters have been featured in other forms of media, including “Angry Birds Toons.” Throughout these appearances, however, the characters were never shown speaking or with wings and legs – until now. In fact, Rovio has gone to great lengths to protect the origin story of these flightless birds.

Are fans ready for this character makeover that transforms the simple, 2D shapes into sophisticated furred and feathered 3D characters? In all likelihood, yes. After all, who wants to watch a full-length movie whose main characters are, in essence, little bouncing balls? This film has legs, as do the characters (pun intended). And, they have depth and personality. For a look at the technology behind the film, see “Birds of Paradise” on page 6.

Another animated feature film, *Finding Dory*, is a sequel to the summer 2003 blockbuster *Finding Nemo*, in which the forgetful blue tang befriends the clownfish Nemo as he tries to find his way home. A lot has changed since then. Now it is Dory who is searching for her family. But the biggest change of all is in the animation technology. See how the team at Disney·Pixar revived these characters and spawned new ones in “A Fine Fettle of Fish” on page 12. Also, check out our May 2003 coverage of *Finding Nemo* in the CGW archives for a trip back in time.

Of course, CGW will be covering a plethora of VFX and CG films being released this summer in upcoming issues and online at [www.cgw.com](http://www.cgw.com). Meanwhile, have a safe and happy summer, and make time for some summer theater! ■



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## RECENT AWARDS



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– Mike Pecci



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Mike Pecci with his EIZO ColorEdge CG277  
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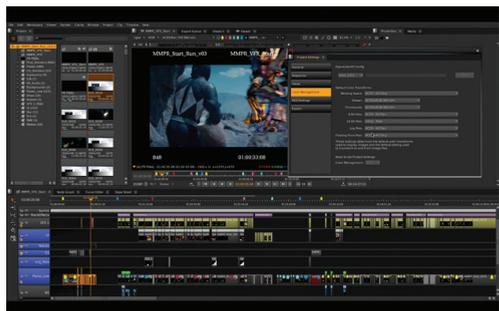
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## THE FOUNDRY DELIVERS NUKE 10

The Foundry has released Nuke 10 and Nuke Non-commercial 10, which focus on enhancing performance and delivering new functionality in the areas of paint, playback, export, and more. There are key updates across the entire product range: Nuke, NukeX, and Nuke Studio.



OpenColorIO integration leads the list of updates to keep Nuke in line with industry standards. And NukeX and Nuke Studio get a new Smart Vector toolset for automated cleanup, replace-

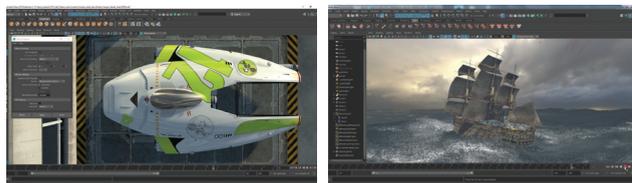
ment, and augmentation tasks. Nuke Studio's timeline toolset now has new in-timeline soft effects, including a real-time keyer and color correction and enhanced audio handling with audio scrubbing support. Users also have access to a brand-new raytrace renderer.

A new license plus a first year of maintenance costs \$4,272 for Nuke, \$7,998 for NukeX, and \$9,331 for Nuke Studio. Upgrade pricing is also available.



## AMD UNVEILS 32GB CARD

AMD introduced the new AMD FirePro W9100 32GB, touted as the first workstation graphics card with industry-leading 32GB memory support for large-asset workflows with creative applications, planned for availability in Q2 2016. AMD also introduced the AMD FireRender plug-in for Autodesk 3ds Max, which enables VR storytellers to bring ideas to life through enhanced 4K workflows and photorealistic rendering functionality.



## AUTODESK RELEASES NEW VERSIONS OF ITS OFFERINGS

Autodesk has unveiled the latest versions of subscription-based visual effects, post and 3D animation software, including Autodesk Flame Family 2017, Maya 2016 extension 2, and 3ds Max 2017. Each release includes an array of new features and enhancements to help studios and artists manage modern workflow demands.

The Autodesk Flame Family 2017 releases advance the art of finishing with new tools and workflows that connect color and VFX.

Building on a strong Maya 2016 release, extension 2 adds new capabilities for creating 3D motion graphics, a new rendering workflow, and tools for artists that allow them to create and animate characters faster and easier.

3ds Max 2017 offers artists a fresh new look as well as modeling, animation, and rendering enhancements, including: a new UI with support for high DPI displays, the Autodesk Raytracer Renderer, a 3ds Max asset library, and more.

Autodesk Flame Family 2017, 3ds Max 2017, and Maya 2016 extension 2 are available starting now.

## HP INTRODUCES Z1 G3 WORKSTATION ALL-IN-ONE

HP has introduced the new HP Z1 G3 Workstation, which combines the simplicity of an All-in-One design with the performance of traditional tower workstations. The third-generation HP Z1 Workstation is 47 percent smaller, 51 percent lighter, and 21 percent less expensive than the previous generation. It has a 23.6-inch diagonal anti-glare UHD 4K display and comes with Intel Xeon processor options. The HP Z1 G3 is expected to be available in May starting at \$1,498.

HP also detailed its new receiver software for Apple Mac OS X. Using HP Remote Graphics Software (RGS), the receiver gives Mac users access to their high-end HP Z Workstations. HP RGS allows users to securely use the workstation, even when they are away from that workstation.

HP Remote Graphics Software is available now for HP Z Desktop and ZBook Mobile Workstations as a free download for existing HP Z Workstation customers. The Mac receiver is free for HP RGS users and is coming soon.





## DELL DEBUTS VR-READY PRECISION TOWER

Dell has announced new VR-ready solutions that feature a refined set of criteria for optimal VR experiences, whether consuming or creating VR content.

Dell has defined VR-ready solutions by three criteria: Minimum CPU, memory, and graphics requirements to support optimal VR viewing experiences; graphics drivers that are qualified to work reliably with these solutions; pass performance tests conducted by Dell using test criteria based on HMD (head-mounted display) suppliers, ISVs, or third-party benchmarks where available.

Working closely with its hardware and software partners, Dell is formalizing its commitment to the future of VR by delivering solutions that are optimized for VR consumption and creation alongside mainstream professional ISV applications used by professional customers.

Dell also announced upgrades to its Dell Precision Tower Workstations to meet the needs of professional creators, with new increased performance, graphics, and memory for VR content creation. The newly refreshed Dell Precision Tower 5810, 7810, and 7910 Workstations and Rack 7910 have been upgraded with new Intel Broadwell EP Processors that have more cores and performance for multi-threaded applications that are ideal for professional modeling, analysis, and calculations.

Additional upgrades include the latest professional graphics technology from AMD and Nvidia, Dell Precision Ultra-Speed PCIe drives with up to 4x performance than traditional SATA SSD storage, and up to 1TB of DDR4 memory running at 2400MHz speed.

The Dell Precision Tower 5810, 7810, and 7910 Workstations and Rack 7910 are currently available.

## UNITY LAUNCHES TWO NEW VERSIONS

Unity Technologies announced the availability of two new versions. Unity 5.3.4 gives developers focused on a product launch the latest set of features and tools in a stable environment. Unity 5.4 offers a set of in-development features ideal for developers in experimentation and prototype mode. Unity also announced that moving forward, beta releases will be made available to personal edition users. Unity 5.4 is focused on new visual features, improved performance, and a major VR rendering upgrade.

Unity also announced that its Analytics service is moving out of beta and is available to all developers. Analytics is built into Unity, with no SDK required, providing one-click integration.

Also announced is the Unity Certification Program and Unity Certified Developer Courseware. It's a program designed to give developers the opportunity to prove their skills in Unity, achieve a qualification, and use that to further their careers. Courseware will be available for purchase online soon, and certification exams will be made available at Unity-hosted events worldwide.



## LENOVO DEBUTS NEW DUAL-PROCESSOR WORKSTATIONS

Lenovo has introduced a new dual-processor workstation line that includes the ThinkStation P910 and ThinkStation P710. Both feature the latest professional processors from Intel and represent the highest-performing workstations with the largest capacity for expandability within the Lenovo product line.

The new Intel Xeon E5-2600 v4 processors run up to 22 percent faster than those in the company's previous-generation workstations. The P910 can support three Nvidia Quadro M6000 graphics cards with 24GB VRAM. The P910 can be configured with up to 1TB of memory, with the P710 available with 384GB of DDR4. New, higher storage capacities offer further expandability within the 14 drive bays available in the ThinkStation P910 and 12 drive bays available in the ThinkStation P710.



# BIRDS OF PARADISE

**SONY IMAGEWORKS CREATES AN ISLAND HOME FOR BIRDS AND PIGS ALIKE IN THE ANIMATED FEATURE *THE ANGRY BIRDS MOVIE***

BY KAREN MOLTENBREY

**I**n December 2009, the world was introduced to flightless, wingless, legless (and “smileless”) birds in the mobile game *Angry Birds* from Rovio. The concept was simple: Players used a slingshot to launch the birds at hungry, green pigs that have poached their eggs. With colorful characters and addictive gameplay, the title became a huge hit, resulting in billions of downloads around the world.

Without question, the characters and property were highly recognizable – which can be both

a blessing and a curse with fans. According to Catherine Winder, who, along with John Cohen, co-produced the movie, one of the most exciting aspects of bringing the franchise to the big screen was that so many people had a connection to the game. “*Angry Birds* has a 91 percent awareness around the world,” she says. “Everybody knows who these characters are, so the expectations are high. Our aspirations had to be high; we want to make sure all the fans are happy with this movie.”



To get the movie off to a flying start, Rovio created Rovio Animation, which would retain creative control over the characters and ensure that the core elements that scored big with audiences would make their way into the film. To this end, Rovio previsualized the movie and crafted the story line, and Sony Pictures Imageworks completed the remaining work. Production spanned nearly three years, and at the peak, the Imageworks crew swelled to more than 80, with 300-plus working on it at one time or another.

According to Pete Nash, senior animation supervisor, the film is filled with homages to the mobile app and uses the story structure of the game.

## A MOVIE, WITH LEGS

Many undoubtedly pictured a movie with limbless, ball-like characters, upon hearing about the project. Nash thinks that initial reaction provided an advantage because people had no idea what to expect. "In some cases, people may have had low expectations because they couldn't imagine how the game could become a movie. So when you do something that is quite sophisticated, no one expects it or sees it coming," he says. "It is a movie with very developed characters."

According to the studio, *The Angry Birds Movie* is a culmination of a long-term plan to expand the game into the feature realm. Until now, Rovio made the conscious decision never to show the birds speaking or with wings and legs.

The primary challenge for Imageworks was designing characters and a world rich in detail suitable for a feature-length presentation. In this regard, the artists had to transition the cast from flat, graphic icons to fully

formed characters that could be animated in three dimensions.

"The characters in the game are really simplistic. They do not walk or talk," says Francesca Natale, character art director who designed most of the major CG cast. "The goal was to find a character that was complex but still recognizable to the audience and three billion fans."

The film leads – Red, Chuck, Bomb, and Matilda – were the main characters at the time of the game's launch. Red (Jason Sudeikis) is an angry bird who lives on Bird Island with the rest of the flock of large, flightless bird-like creatures. His crankiness and sarcasm are in stark contrast to the naively happy occupants of the island. Chuck (Josh Gad) is a fast talker and fast mover, which often lands him in trouble. Bomb (Danny McBride) is not the brightest bird in the flock but has good intentions. However, he has a tendency to explode when surprised, scared, or angry. Matilda (Maya Rudolph) is a New Age therapist with anger issues herself, whose anger management classes bring these misfits together.

The new friends-in-need live on Bird Island. One day a visitor arrives, a pig named Leonard (Bill Hader), and strikes up a friendship with the rest of the birds. Red does not buy the pig's act, especially when he discovers a whole lot of little piggies hiding in Leonard's boat. His concerns are not heeded; he is, after all, an angry bird, always pecking at something. The drift of pigs infiltrate the island, and the birds welcome their fun-loving, party presence. That is, until the pigs are caught stealing all the eggs. This does not fly with the birds, who build a raft and follow the pigs to Pig Island, a polluted, overbuilt pigsty, to reclaim their eggs.

First, though, the birds must

get angry. And they do, with help from Red. They attack by air, thanks to a giant slingshot, and collect their precious cargo and head back to their island paradise a little wiser and a little angrier.

## BIRDS OF A FEATHER

Before modelers created Red, Natale generated nearly 100 possible designs with ink and paint. In the end, Red and his friends became more anthropomorphic. "We found a design of a bird-like creature, with the feeling of a bird," says Natale. "The stance, the acting, and the appearance of the character all look anthropomorphic. Similarly, they don't have actual wings; instead, they have arms that have the feel and look of wings in the silhouette and shape."

Character modelers built the cast in Autodesk's Maya. Rendering was done with Imageworks' own version of Arnold (from Solid Angle, now acquired by Autodesk), and lighting was completed using The Foundry's Katana. Compositing was accomplished in The Foundry's Nuke.

Imageworks artists also used an in-house painting system within Maya, called KamiPaint, which is based on Autodesk's Artisan intuitive paint and sculpting interface used by the Maya brush tools.

The birds have a rather simple design but with complex material properties – fluffy and feathery, with hair fanned out in clumps to resemble feathers. For this, the artists used an updated version of the studio's proprietary grooming toolset called Kami, which is based on



**THE PIGS ARE MATERIAL-BASED, WITH A SUBTLE HAIR LAYER. THE BIRDS ARE COVERED IN HAIR THAT RESEMBLES FEATHERS.**



THE BIRD-LIKE CREATURES ARE ANTHROPOMORPHIC AND CANNOT FLY WITHOUT THE ASSISTANCE OF A SLINGSHOT.

Maya and Katana. The rendering and detailing of the hair was generated in Katana, while the curve building and map painting, as well as the simulation, was done in Maya.

"These are feathered creatures, not really birds. Rovio wanted them to look soft and fluffy, which is difficult to do if you are just using feathers," says Danny Dimian, visual effects supervisor. "They kind of resemble how birds look when they are first born: fluffy and hair-like. Huggable."

The wings, however, are smooth and appear feathery. For consistency in the characters' aesthetic, the entire groom is hair-based. On the wings, the hairs are lined up in a feather shape, and there is a fluffy layer of hair in between that is clumped to look like feathers. Animation controls within the groom system enabled the group to puff out the hair or flatten it down.

The Mighty Eagle, a former bird superhero that Red and his two friends seek to help them stop the pigs, is the most anatomically-based bird char-

acter in the film, though it had to look and behave similarly to the other birds. It, too, is made of hair, but the hair is lined up in geometric-looking quill shapes to resemble feathers.

In flight, Mighty Eagle's proportions are more anatomical; when on the ground, he is more cartoony. The wings transform, becoming more anthropomorphic, like hands, when he is around the other birds. "The transition affected both the groom and the rig," says Dimian. "We needed flexibility in the [bird] grooms as it related to the rigs. We needed more control over the grooms relative to what the rigs were doing so there wouldn't be a lot of interpenetration. Because the birds are not anatomical, the layout was hard to plan because the animators were not limited in the range of motion."

The judge – which was actually two characters perched atop each other, masked with a really long coat of feathers – presented a challenge, as well. "He had something like seven million hairs," says Dimian.

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## RED RUN

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The birds are incapable of flight (without the assistance of a slingshot), and move about the island on their own two feet.

"The directors wanted us to think of them more like an ostrich or bird-like creature, but not a real bird," says Nash. So here, as with the hair-feathers, the rules of reality were suspended in terms of the animation. Still, though, the animators would insert bird-like movements and mannerisms when possible – for instance, darting little head turns or an anticipatory little flutter before taking a step.

Because he is an outlier, Red had more anthropomorphic movement than the others. "Red is about four feet tall and 100 pounds," says Nash. "In fact, none of the birds are bird size; they are huge. It is a wholly invented world. As long as we obeyed the rules of their weight, they become believable in their movement."

The animators used an IK/FK rig for the characters; a switching system enabled them to change between the two effortlessly

over a frame to achieve some complex movements. "Our rigs are very flexible, especially the facial rigs," says Nash. "We can pull the corner of the mouth really far. We didn't do that so much for the birds, which have beaks, but we did for the pigs. The pigs have pliable faces, so we wanted to have some form of structure on them. There was a control for every single vertex on the face that you could move if you wanted to."

Red, as the central character, became the animators' primary focus, and his anger played a big part in how he was brought to life. "He was the most complex character as far as personality, and the trick was to make him appealing because he is always angry," says Nash. "If he is a jerk all the time, nobody is going to like him, and you need people to identify with the main character." Through trial and error, the animators discovered that a little anger goes a long way, choosing an understated approach.

The animators used reference of Sudeikis performing his lines and his comedy in general. "We saw the little things he does, like

when he says something that's sarcastic, he'll do it with a smile on his face. It's part of his charm, his appearance. We borrowed that for Red," Nash says.

Red, of course, has a pair of signature, thick, bushy, dark brows, which became "a major science project," says Nash. "There was this charcoal effect on the feathers of the eyebrows. It was difficult to not have them clump and not have the hair interpenetrate. If you go from an extreme surprise pose to an extreme worry pose, that is a lot of face change, and those clumps are going to blow all over the place. It ended up becoming a complex rig."

## BEAK BUDDIES

The bird community has roughly 130 types of birds, not counting the supporting crowds of characters. Even though the movie characters have limbs, they are still ball-like creatures, what Nash describes as "closed" characters, meaning their heads integrate into their bodies, as opposed to an "open" character that is tall and slender, with limbs. As a result, animation becomes difficult to solve at every angle – when you turn the characters around, their face distorts; when you animate their face, their body distorts.

Bomb presented a particular challenge when he would explode, which required the animators to deform his face quite frequently. Using an in-house plug-in called TweakIt, the animators could model and rig on the fly within a scene. "[TweakIt] allows you to grab a portion of the face and move it, then move the weights of the mesh," says Nash. "We did this at a very intricate level anytime something would expand or contort a lot, like when Bomb would explode."

While Bomb tries to control his explosions, Chuck has little,

if any, self-control. "Chuck is the most pushed character in the film because his power is super-speed. Josh Gad performs him like someone with ADD – talking a mile a minute, changing his ideas mid-thought – so we tried to treat his animation that way," says Nash. "We tried to cram as many ideas as possible into the performance as we could. We could do things like an impossible pose change without worrying about the actual mechanics of getting there. It was surprising how many ideas we ended up putting into his performance."

Further complications resulted from the slow-motion and time-lapse sequences involving Chuck.

And then there is Matilda, who, in the beginning, is touchy-feely, always trying to be overly pleasant. "So we wanted her movement to be overly graceful, fluid, and perfect," says Nash. "But then, because she is actually harboring a deep anger herself, you'd see a quick flash of a demonic face – snap – and then she'd be back to her extremely pleasant self in an instant."

Some characters were trickier than others, though the bigger animation issue resulted from large, complicated shots with many characters moving all at once. "When I came on board, they showed me some early storyboards, so I knew it would be an ambitious project," says Nash. In one sequence there are 50 to 100 pigs stealing the eggs in an orchestrated heist. "The whole movie is filled with shots like that," he adds.

## PIG POWER

While simple in design, the pigs were one of the artists' greater challenges. "It's deceptively hard to get very simple things right," says Dimian. "Francesca [Natale] and Clay [Kaytis, co-director] were very clear that they wanted

# BIRD PROFILE



### RED

Control curves – 3,000  
Feathers – 300  
Hair count – 3,000,000



### BOMB

Control curves – 3,000  
Feathers – 150  
Hair count – 2,500,000



### JUDGE (JUDGE + COAT, WITHOUT CYRUS)

Control curves – 4,500  
Feathers – 400  
Hair count – 4,500,000



### CHUCK

Control curves – 2,000  
Feathers – 200  
Hair count – 2,000,000



### EAGLE

Control curves – 3,500  
Feathers – 500  
Hair count – 3,500,000



### TERENCE

Control curves – 2,500  
Feathers – 200  
Hair count – 2,500,000



### MATILDA

Control curves – 3,000  
Feathers – 500  
Hair count – 3,000,000



ARTISTS BUILT PIG ISLAND WITH A CONSTRUCTION SET OF PIECES WITH VOLUME, SO IT COULD BE DESTROYED EASILY.

the pigs to have very smooth forms, very clean shapes – and also that the pigs would have to have a very wide acting range. However, the simpler a character is, the more the audience is apt to notice every imperfection and every change in that shape,” he says. “So our characters had to transition these simple, clean shapes into crazy animation.”

This meant that the rigs had to be especially complex – underneath, they have a very complicated, sophisticated model that required a lot of technology, says Dimian. “Oftentimes the rigs focus on the range of motion and what the character can do. On the pigs, because of the volumes and deformation, each needed to have very intricate, smooth controls so all the imperfections are smoothed out. The pigs stay soft, plump, and on model as they went through some very extreme poses.”

Volume controls were incorporated into the rig with predefined ways to create the skin folds and wrinkles, rather than have them result from the performance only. Because of this, there is a puffy little volume, as opposed to flat little wrinkles,

when the pigs move.

There are thousands of pigs, and they move in unison, like a hive, working for the same purpose. So, the question became whether to make them the same or different in appearance. The answer: to make them unique. “When you look at them as a mass of characters, they should move as one unit, but when you get close, each one has a very distinctive personality and a very specific role,” says Nash.

In terms of their appearance, the pigs are primarily material-based, with a subtle hair layer so they don’t look plastic-like. “They look especially good in some of the night shots where you have lighting that is rimming them and this nice fuzzy little hair layer that adds a lot of detail,” Dimian points out.

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## TALE OF TWO ISLANDS

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The movie has two very different civilizations. Most of the movie takes place on Bird Island, a lush, organic, visually rich environment that is stylized with a touch of realism. There is no electricity or machines. In contrast is Pig Island, an over-

built, polluted, industrial-type world. Between the two islands, there are more than 90 locations that appear in the film.

According to Pete Oswald, production designer, due to the more basic design of the characters, the filmmakers took the opportunity to make the worlds more realistic and complicated. “We wanted to design a film that was familiar yet unexpected,” he says. “So, the shapes in the film are very bold and exaggerated, and some are cartoony.” Nevertheless, they are textured with real-life materials. For example, the bark of the trees have a bird-feather motif, harkening back to the fact that the birds are flightless and have never been off the island.

The artists used a terrain system called GIT when generating the foliage on Bird Island. Dimian likens it to a grooming system, whereby the artists are “grooming” the terrain, only with objects instead of hair. “It’s procedural and works like a paint system. You can paint over an area, and that populates it based on a predetermined ratio of grass and flowers,” explains Dimian.

The artists also built an

extensive library of plants, trees, and shrubs, all in a bird-inspired motif, that allowed them to mix-and-match, scale, and create a rich world.

All told, there are more than 100 individual, organic components in the Bird Island library. There are 24 types of trees, a mixture of imaginative and realistic. In addition, the artists used a library of 40 to 50 plants, rocks, and other items. “We had to build more unique environments here because we didn’t want the island to look manufactured,” says Dimian. “However, making it look organic while doing it procedurally is difficult.”

A similar organic construction set library with roof types and side structures was used to build all the bird huts around the village.

In contrast is Pig Island, where there’s no rhyme or reason to how things are constructed. Buildings – more than 1,000 – are placed haphazardly and stacked vertically atop one another. “Pig Island is kind of a Rube Goldberg type of world,” says Dimian. “It is very complicated-looking and heavily instanced. But, it’s built to fall apart.”

According to Dimian, as the animators were working on the destruction sequence on Pig Island, they didn't know for sure which part of the city they would blow up or how that would happen. So, they decided to use a simple construction set comprising small blocks with volume that could be mixed and matched to create a range of structures. "We didn't have to worry about which pieces were going to be built specifically to be destroyed," he explains. "When we handed this over to effects to shatter, every piece was able to break."

The main destruction was achieved using the Houdini Bullet solver.

## EFFECT-IVE ANIMATION

Many effects from both islands came from a library of pre-simulated, pre-rendered elements – plumes of smoke, layers of smoke, explosions – that lighters could pull into a scene. The water effects, meanwhile, were simulated in Houdini using varying combinations of FLIP, regular particles (POPs), Ocean Spectrum tools, and the Ripple Solver, all within Houdini. Interactive fluid splashes were mostly achieved with Houdini FLIP fluid solver.

"We didn't want the water to look completely photoreal because it is a stylized movie. This is a make-believe place but has a touch of photorealism. The design is not real, but the materials are. But you do not want to overdo the complexity with things like water and smoke if they are to fit with more stylized characters," says Dimian.

The foam and bubbles were generated with Houdini particles, while a FLIP splash element produced a set of

fields that gave fluid-like motion to the particles. The beach-break, meanwhile, was too large for a single FLIP simulation, so it was broken up into a series of parallel sims that were surfaced together post-simulation. Only the water that was relatively close to shore was FLIP-simulated. Farther away from shore, the water transitioned to a non-interactive Ocean Spectrum surface, while foam at the water's edge was created with POPs. The wakes and splashes from the boats were made with a FLIP sim and merged into the surrounding non-interactive Ocean Spectrum surface.

Some of the more complex water work was done for the Lake of Wisdom, where Mighty Eagle nests. The waterfalls were made with a combination of FLIP, for the waterfall proper; Ripple Solver, for the radial ripples in the various pools; and Ocean Spectrum, for ambient ripples on the main lake. Each waterfall had its own unique mist simulation, generated in Gas Solver.

## A PERFECT BLEND

Nash and Dimian are no strangers to animated features, with both having worked on the more cartoony *Cloud with a Chance of Meatballs* and the more realistically animated *Surf's Up*, to name a few. "The *Angry Birds Movie* is a nice blend between the two extremes," Nash says.

Without a doubt, Sony Pictures Imageworks and Rovio Animation are putting a lot of eggs into this property's basket, transforming these popular, beloved characters for their big-screen debut. Will feathers fly, or will the movie make avid (angry) bird-watchers of us all? ■



Karen Moltenbrey is the chief editor of *Computer Graphics World*.



# A FINE FETTLE OF FISH

PIXAR ANIMATION STUDIOS SENDS FORGETFUL DORY ON A FAMILY-SEEKING JOURNEY IN THEIR LATEST CG ANIMATED FEATURE

BY BARBARA ROBERTSON

In Disney/Pixar's 2003 animated feature, the popular *Finding Nemo*, a forgetful blue tang fish named Dory helped reunite the clownfish Marlin with his son Nemo. Now, upbeat, perky Dory has her own movie titled *Finding Dory*.

But wait. Dory has no short-term memory. How would anyone know if she were lost, not the least Dory herself? If she were lost, how could she find her way back? And, would she want to?

"Dory was not wired up to be a main character," says *Finding Dory* Director and Writer Andrew Stanton. "Self-reflection is the reason you can follow why a character grows. But, we gave her short-term memory loss. She has emotional memory, but she can't track progress. So, how do you give her the opportunity of self-reflection when she can't do it herself? I would never recommend this to a writer."

Stanton, however, had an advantage over other writ-

ers who might try. He wrote and directed *Finding Nemo*, receiving an Oscar nomination for writing and a Best Animated Feature Oscar for directing the film. In addition, he has received an Oscar for directing *Wall-E*, and Oscar nominations for writing *Toy Story*, *Wall-E*, and *Toy Story 3*. Thus, he knew the characters in *Finding Nemo* better than anyone else, and he knows how to move characters from one film into another. But, why did he choose such an unlikely main character?

"I saw Dory as a tragic character," Stanton says. "I knew her backstory. She used optimism, charm, and selflessness to make sure people wouldn't ditch her. It was her protection. This story is about Dory finding herself – in every way. I felt she deserved to like who she is."

Ellen DeGeneres was Stanton's choice to voice Dory in *Finding Nemo*, and she returned for this film.

"Ellen is the only person I ever wrote for specifically," Stanton says. "Thank goodness she said, 'yes.'"

Also returning is Albert Brooks as Nemo's father, Marlin. Stepping in to fill Nemo's fin in *Finding Dory* is 12-year-old Actor Hayden Rolence.

A crew that topped 400 in all, but averaged 280 on a day-to-day basis, worked on the film. Of those, nearly 100 in the art, story, and editorial departments spent more than two years creating the story, designing the world, and developing the new characters. Storyboarding alone extended over two and a half years, resulting in 103,639 storyboards. Helping Stanton, who is also a vice president at Pixar, was Co-director Angus MacLane.

The first sequences moved into production approximately a year before the June 17, 2016, release date. Many of the technical challenges for the

production crew centered on an octopus's special needs, on compositing water simulations, and on new tools for working with Pixar RenderMan RIS.

## HELP FROM HER FRIENDS

The story begins in the colorful, cozy coral reef where Dory, Marlin, and Nemo have made a home. It's a happy family time until a massive stingray migration swims through the neighborhood and triggers deep memories in Dory of a family she thinks she might have left behind.

"While Dory forgets details in her day-to-day life, her emotional memory is fine," says Producer Lindsay Collins.

Determined to uncover her past, Dory talks Marlin and Nemo into helping her find her long-lost family. The search sends the three fish back across the ocean to a Marine Life Institute (MLI), a rescue reha-



### BAILEY THE BELUGA WHALE

bilitation center and aquarium loosely based on California's Monterey Bay Aquarium, and into a kelp forest nearby.

At MLI, Dory meets the other three stars of this film: a beluga whale with faulty sonar skills named Bailey, a clumsy nearsighted whale shark named Destiny, and a seven-legged octopus named Hank.

"I saw a beluga whale in Vancouver and couldn't keep my eyes off it," Stanton says. "The animator in me wanted to see what kind of character that species would be."

Character Designer Jason Deamer created the caricatured whale.

"He's like a giant pork bun," Deamer says. "I looked at pork buns

for reference, for the texture of his skin. It's soft, with ripples."

For Destiny, Deamer picked an even more unusual reference.

"She was weirdly difficult to design," he says. "I pitched the idea of thinking of her as an oven mitt with big mouth shapes. But we painted her like the real thing."

Bailey is gray. Destiny has evenly spaced dots on her tail, a more chaotic pattern on her middle section, with increasingly dense dots moving forward to her head.

As for Hank, he was the most challenging of the three new characters for Deamer, the technical directors, and the animators. But, arguably, the most helpful to Dory.

"We had to move Dory across the Marine Life Institute," Stanton says. "So one reason we thought of Hank was because he's so ambulatory, and octopuses are known for being good escape artists." In one scene, for example, Hank grabs a ride on a visitor's back, camouflaged as a backpack.

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### HANK

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"Hank is my favorite character in the movie, and he was one of the hardest things we've done on a character level," Deamer says.

"We wanted him to be a lovable, grumpy, old octopus. But what makes an octopus look old?

We struggled so hard to make him appealing. These things are slimy and gross. They're super intelligent, but that sideways eye thing doesn't make you think of motherly love. And where do we put his mouth? We ended up tucking it under his tentacles."

For Hank's color, red was the obvious choice.

"Hank is red because we thought if an animal could change color, he'd choose orange-red," Deamer says. "And, it contrasts with Dory's blue."

But Hank also changes color. And patterns. And shape. He's a cat on a wall poster, a camouflage backpack, even a potted plant. To create those textures and colors, the team wanted to mimic how these changes happen in the real world.

"We wanted it to look natural and not like a cross-fade," says Jeremie Talbot, character supervisor. "Our artists wanted to do something similar in the computer to what happens on a cellular level on animals."

Simply put, the artists manipulate many circles, dots if

you will, that create a texture with changing colors over Hank's body.

"When we combined that with noise, we got a naturalistic effect," Talbot says. "Hank could match a background or a supplied painting." Finding a way to make that work took the team two years.

Creating Hank's shifting shapes fell largely to the animators, but with new tools and sophisticated rigs making it possible. Even so, a shot of Hank sliding into an aquarium, for example, took six months for the animators to do.

"That's how hard it was to animate this character," says Mike Stocker, one of two supervising animators on the show. "We had two challenges. Getting all those suckers moving, and getting a rolling feeling for the tentacles. The muscle starts from the body and works to the tip, and that rolling feeling was something we wanted. Jeremy [Talbot] made a super complicated rig. We could use a 'grab cylinder' that I called the elbow. We had to lead with the elbow, not the end of the tentacle, to get an octopus feel."

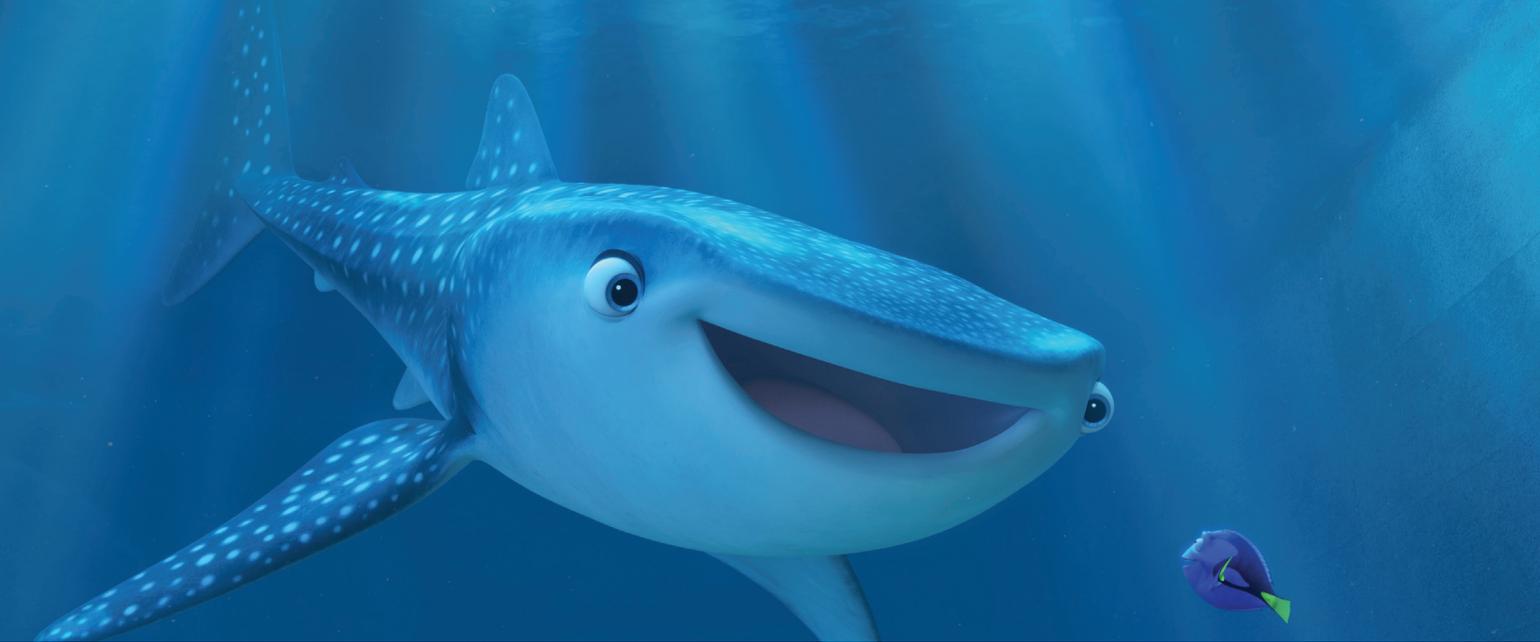
Another tool within Presto, Pixar's proprietary animation system, gave the animators a starting point.

"We could draw a tentacle and snap the model to the drawing," Stocker says. "That got us 60 percent of the way. Then, we polished the pose."

Talbot's character department

### HANK THE OCTOPUS





## DESTINY, A NEARSIGHTED WHALE SHARK, MEETS LITTLE DORY.

created the rig that animators used to pose Hank and his seven tentacles. One of the first reference videos Talbot looked at to determine how an octopus would move was of a mutable creature sliding into a bottle.

"It terrified me," he says. "Not the look, but how it moved over a rough surface; the way the flesh rolled."

First, the team created a control that animators could use to set the depth of the webbing between the tentacles, and developed a new curve function.

"After a lot of work, we had something for animation to play with," Talbot says. "But, we didn't have the sliding motion we needed."

For that, the rigging crew turned to the simulation department for help. There are 350 suckers on Hank's tentacles, and each sucker needed to squish, stick, and pull away in a believable manner. Solid mechanics came to the rescue.

"There's a whole branch of engineering that, given a force applied to an object, asks how are all the points in that object moved, displaced, and stressed," says John Halsted, supervising technical director. "We borrowed approaches from that field of science to

figure out how Hank moves."

Thus, each of Hank's suckers has a little tetrahedral mesh that provides input into a customized simulator. The simulator produces the squashing and sticking; it deforms the little sucker based on applied forces.

"The simulator is a heavily customized version of Physbam," Halsted says. "It uses finite-element analysis (FEA) to have a solid, elastic material behave like muscles or flesh. We use the tetrahedral mesh to do the volume-based jiggle and solve it with FEA. To get the skin sliding, we used a triangle mesh over his body."

Once the team managed to create one sucker that would squish, stick, and pull away, they could propagate the method to all the suckers. Then, they needed to make the tentacles look soft and fleshy as it squished along.

"A separate skin simulation allowed the skin to move along the same plane as the outer surface of the body," Halsted says. "It doesn't break the silhouette. It just slides along."

The techniques used to create Hank's simulation are likely to result in a SIGGRAPH talk this year.

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## WATER

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The second challenge for the technical crew centered on water. When Pixar created oceans of water for *Finding Nemo* 13 years ago, 3D water simulation was in its infancy. For this show, the team concentrated its efforts on water compositing.

"The way we approach effects is that if the characters are in a large body of water, we do a smaller domain where they are playing," Halsted says, "a play area where they can jump around and break the water apart. So we worked on techniques for this film in which we take a large body of water usually shaped with procedural systems, and composite in the 3D simulation from the play area such that the boundaries are seamless."

For fluid simulations, the team used Side Effects Software's Houdini; for lighting, The Foundry's Katana; for rendering, RenderMan RIS.

"We came up with a new system for doing the water composite that makes heavy use of an implicit field API to generate the surfaces," Halsted explains. "We also worked on water shading to make sure the water looked as good as it could. And we made all this

work within the new renderer."

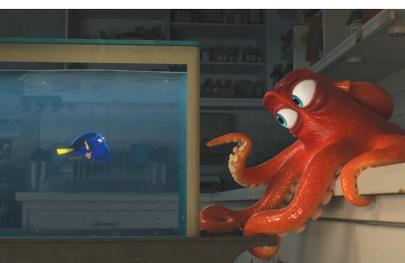
The fish in *Finding Nemo* spent most of the film in the ocean. *Finding Dory's* setting in the Marine Life Institute meant that often the fish in this film were in the aquarium's glass tanks. The lighting crew, led by Ian Megibben, put the new renderer through its paces for test shots with Dory in a fish tank and Hank staring in at her from outside.

"There's an inherent quality to the way water bends, refracts, magnifies, and scatters light," Megibben says. "Water inside a glass tank is like a fun house. There's magnification, distortion, and reflections. When the camera is from Dory's point of view, we see reflections that create a boundary between her and Hank."

Because *Finding Dory* is the first film for which Pixar used the RIS architecture, they employed Katana to author new shaders.

"It was a huge change," says CTO Steve May. "It affected all the back-end departments – lighting, rendering, shading. On *Dino*, we were still doing spherical harmonics and special shadow maps. Now, we're going to raytracing.

"We felt like we were a little behind the curve," May continues. "But the good thing is that



## LAND AND SEA

Dory and her companions Marlin and Nemo are never fish out of water, but their journey does take them into a human world, the Marine Life Institute (MLI). Production Designer Steve Pilcher and Art, Sets, and Environment Supervisor Don Shank created *Finding Dory's* environments. They used thematic design elements and color schemes for each of four worlds they identified: the reef, empty space, a kelp forest, and the human world.

Comforting circles, often intertwined, in rainbow colors make the reef feel like a safe place. Hues in grays and blues provide visual gradations in the water and heighten the loneliness of the empty space. Golden kelp flowing in rhythmic shapes in the greenish water mark the ocean outside the MLI as a somewhat friendly and safe place, but alien compared to the reef. By contrast, the human world inside the MLI has water only in small areas. That scary world has straight lines – horizontal and vertical – and many containers. And, the colors are those of concrete, metal, glass, and PVC pipe.



THE COLORFUL REEF PROVIDES A SAFE HAVEN FOR DORY, NEMO, AND NEMO'S FATHER, MARLIN.

now we're right on the cusp, doing bi-directional pathtracing for the caustics. And, we're doing some work with volumes to make a large number of volumes very efficient."

A de-noising filter developed by Disney Research and Disney Animation for use with Hyperion on *Big Hero Six* helped reduce computation time.

"All pathtracers exhibit noise, and to eliminate it would take an enormous amount of computation," May says. "We have a real advantage in that we're part of a bigger company that includes Disney Research, Disney Animation, and Industrial Light & Magic." Now, others can now take advantage of that technology, too, which is available as a program called Denoiser with RenderMan.

### DÉJÀ VU ALL OVER AGAIN

Sometimes, though, the new technology needed to comply with an older aesthetic. When the fish swim in a reef that replicates the environment

from the first film, the lighters re-created techniques they had used a decade ago.

"We forced a physically-based renderer to do something it didn't want to do," Megibben says. "Some of the engineers didn't want it to. But, we needed the reef to be familiar and safe. When we're in the MLI, we played with light and shadow, and the scenes have more contrast. We use backlighting and leave things in shadow. The reef is high key, almost comedic. It was a lot of fun to have two styles to play with between the two environments."

With any sequel, the production crew has the problem of respecting the first film and expanding it to take advantage of tools and ideas they didn't have before. And so, too, the writer and director.

"The best thing about this film was reuniting with the people I had worked with," Stanton says.

(Stanton had slipped away from Pixar to write and direct the 2012 live-action film *John Carter*.)

"But also, to be honest," he adds, "it was learning new stuff about the characters. It was like being with a cousin and hearing stories I'd never heard before."

But, these characters weren't just cousins, as he realized in one brilliant moment.

"It happened during our first scoring session," Stanton says. "I'm watching a finished section. The music is on. And there's a little separation, a rare moment. It was almost like looking at your kids the way the rest of the world sees them. It was the *Nemo* cue, the one moment in this film when we reference the first movie. I thought, 'Holy crap. I remember when I came up with him. With her.' I remembered the mundane office. These are characters everyone knows, but I had forgotten they came from me. It was profound." ■

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# BATTLE LINES

ANIMATORS AND EFFECTS ARTISTS CREATE A BATTLE ROYAL  
FOR *CAPTAIN AMERICA: CIVIL WAR*

BY LINDA ROMANELLO

**M**oving along at a seemingly unstoppable pace is the Marvel/Disney juggernaut, with yet another major release opening in theaters – *Captain America: Civil War* from director siblings Anthony and Joe Russo.

In the tradition of its predecessors – *The Avengers*, *Captain America: The First Avenger*, *Captain America: Winter Soldier*, *Iron Man*, and others in the Marvel franchise – this latest release, starring Chris Evans and Robert Downey Jr., promises epic battles of superhero proportions, and a respectable amount of wreckage and destruction, all requiring heavy doses of visual effects.

According to VFX Supervisor Dan DeLeeuw, *Captain*

*America: Civil War* combines the efforts of 14 vendors to complete just fewer than 3,000 visual effects shots. This includes environmental work, set extensions, and CG characters, and a reach inside a deep toolbox with everything from proprietary software to the standard Maya (Autodesk) and Nuke (The Foundry) toolsets.

“*Civil War* differs from the other *Captain America* films in terms of its scope,” says DeLeeuw. “It’s something you see in comic books: The characters have their solo outings, and then there are comics where the characters are all there to help out. The ‘Civil War’ comics are the ‘event’ comics, fan favorites who wouldn’t ordinarily interact with one another – and you certainly wouldn’t normally see them fighting against one another –





IT TOOK 14 VENDORS TO COMPLETE APPROXIMATELY 3,000 VISUAL EFFECTS SHOTS.

come together. That's what makes *Civil War* special. It's that you have these giant set pieces with the characters showcasing all their powers, fighting against one another.

"It was a combination of taking everything we've seen before, taking everything to the next level, and expanding on the heroes' powers so that you're culminating in this battle royal at [Germany's Leipzig/Halle] airport," DeLeeuw continues. "That scene was shot in multiple places on multiple continents. We shot a large portion of it in Atlanta, on a concrete slab they poured for us, with greenscreens. For the types of things we wanted to do, we couldn't film in an actual airport. They don't usually like you destroying their jets or anything like that (laughs)."

So, a large portion is all-greenscreen. There's a hangar at the end and a terminal towards the middle where Falcon, Spider-Man, and Winter Soldier fight that are practical, but everything outside is CG. But just by the nature of the heroes' powers themselves, a lot of those fights use digital doubles. "It's a great mix of hidden effects for the environments and bigger effects for the heroes themselves," says DeLeeuw.

Here, DeLeeuw talks about the latest Marvel/Disney release and what it took to create some of the film's most demanding visual effects.

#### **So most of the work in the film is a mix of environmental and character-based VFX?**

Yes, that's the best part of the magician's trick, it's the sleight of hand to distract the audience with the shiny object and actually perform the trick with the other hand. So, we tried to work with stunts and special effects to keep as much grounded as we could and mix the visual effects with that.

#### **And keep it seamless, so the audience can't tell the difference?**

Yes, and you keep changing it up, too. So, if you think you're starting to figure out the trick, you throw more live action in and keep people from tracking down what you're doing.

#### **What was the film shot on?**

The majority of the film was on the Arri Alexa XT with anamorphic lenses. The airport battle was on the Arri Alexa 65, which was completed for IMAX.

#### **You worked on *Captain America: Winter Soldier* and *Iron Man*, so you have a familiarity with these Marvel films and what they're looking for in terms of the VFX. Technically, is there a difference or any kind of advances on the VFX side from the previous films?**

The big advancement on this one was the overall scope and how much we were able to do. It's interesting, I came in on *Iron Man 3*, and as you come into the Marvel universe, you start picking up the play-book on the different characters. So, on *Iron Man 3*, you start learning how to shoot Iron Man. You have what we call the 'football suit' that Robert would wear. That was photo-ready from the waist up. As the films progressed, we got more and more to the point where we would end up replacing it with CG, as the suits themselves became more complicated. And what we found for this one, because of the hand-to-hand battles that were happening at the end, we didn't want to have Robert with just tracking markers on his body, because as Captain America grapples with Iron Man, you need to make sure he's grabbing something as big as the Iron Man armor and not just a person's normal size.

What was called the 'photo-ready' version, the 'football suits' in *Iron Man 3*, eventually evolved to what we called the 'displacement suit' for *Civil War*. It gave me the size of the suit but was softer so the stuntmen could wear it. It was more comfortable, but still, when Cap grabs Iron Man's arm, he's actually grabbing something that's the correct width. As we become savvier with the films, we find better ways to shoot with the different characters.

With *Captain America: Winter Soldier*, the shield even evolved with the films. If you go back to *Captain America: The First Avenger*, the shield had a shinier, brushed metal look, and it got duller and duller



THE AIRPORT BATTLE IS A KEY SEQUENCE IN THE FILM AND WAS ONE OF THE MOST CHALLENGING.

as the films progressed. That's something we went back and looked at and said, 'That was a better-looking shield,' so we ended up replacing the shield with a more brushed-metal feel to recapture what we had in *Captain America: The First Avenger*.

In terms of technology, has it improved? I think it's something that allows us to stage a bigger and bigger spectacle as we proceed. We had just under 3,000 visual effects shots in *Civil War*, and a lot of the shots are the spectacle shots in the airport. But in addition, we have the hidden shots we try to make as seamless as possible.

**Would you say there were any major overhauls in the pipeline, moving from production into post and with the visual effects?**

On *Winter Soldier*, working with ILM, one of the bigger things they had to deal with to move things through the pipeline were the three Helicarriers that were based on the Helicarrier from *The Avengers*. That model was very heavy, and they had to deal with three of them for *Winter Soldier*. So they had to push three Helicarriers through their render pipeline. Then, when we got to this [film], we modeled the entire Leipzig airport, which made the Helicarriers look paltry by comparison. So I think our moving forward and looking to the things we wanted to create, was pushing and creating environments and creating worlds that allow amazing amounts of details through the pipeline.

**Isn't there an age regression scene in the film featuring the Tony Stark character?**

Yes, there's the shot of young Tony, which is about a 4,000-frame shot, where we took Robert Downey Jr. and made him about 23 years old for the length of the shot. And that was one of those shots that, normally, if it was done in cuts, you could break it up and spread it over multiple artists to finish each individual shot in a simpler way. But with the Russos, they wanted the scene to feel a little bit off when you first see it. They wanted to do it as a single shot rather than as multiple shots. So Tony wakes up on the couch, and he's a little farther away from the camera, and has a

conversation with his mother. When she leaves, present-day Tony Stark shows up in the background.

In addition to it being a very long shot with the de-aging, it was also something that was shot in multiple passes. It was shot in a house just outside of Atlanta, and there was no way to get big motion-control equipment in there; the space was just too small. So we just married the two pieces together in addition to doing the age regression. That took quite a bit of time because you want to define what made a young Tony Stark.

**Would you say that the age regression scene and the airport battle are two of the more prominent scenes in the film?**

Yes, we wanted a large feel and scope to the film. The opening of the movie [takes place in Lagos, Nigeria] but was actually shot in Atlanta, and we needed to make it look like Lagos. There were some things we definitely had hopes of filming in Africa, but we weren't able to go because the Ebola outbreak was happening in Africa at the time. So, we went to Puerto Rico, since it is a coastal city like Lagos, and a lot of the architecture worked out fairly well.

But in terms of shooting time, we were not able to shoot in Puerto Rico. So, we went down there with an effects unit, shooting many plates – aerial plates, drone plates, scans, surveys, and then shot plates off a camera truck – all to make the initial fight. We kept the foreground pieces of Atlanta and replaced all the background pieces to make it look like Lagos.

A large challenge of the film was make Atlanta not look like Atlanta (laughs). But in terms of scope, the final battle, probably the biggest battle [in the film], was handled by ILM, and the finale with Cap facing off with Iron Man was completed by Method Studios. It's a very interesting tonal shift between the scope of the battle with all the heroes fighting and then getting into a more intimate fight at the end where it became all about the powers, the thought process, and the friendship falling apart between the two characters.



WHEN SUPERHEROES FACE OFF, SUPER EFFECTS ARE NEEDED. ARTISTS MAINLY USED MAYA AND NUKE.

#### What other VFX vendors did you work with?

We tried to break the film up by sequences. ILM was the lead house and started early, building the different digital doubles, the Iron Man armor, War Machine armor, Black Panther, Spider-Man, and then they would share their digital assets with the other companies. Method worked on the final battle between Captain America and Iron Man, and Rise handled the Lagos sequences at the beginning, where Captain and his team are fighting together after training together. Trixter did the fight with Black Panther, and Dneg worked on the fight with Hawkeye and Vision, when Hawkeye shows up to break Scarlet Witch (Wanda Maximoff) out of the Avengers' compound. Those are the major battles, and then we have an additional nine vendors working on the rest of the shots.

#### What tools did you use on the film?

I think we pretty much used everything. ILM has a lot of proprietary tools in their pipeline, but because we're sharing assets, they had to create the characters in such a way that the other vendors could pick up the intent of the rendering and the animation, so you can share the geometry, you can share the textures. Each vendor used its own animation systems, and the majority of those were built on top of Maya, which allows you to extend it quite a bit and add your own toolsets to it. So, if we shared the skeleton between the different effects houses, they could take that skeleton and hook up their own animation system on top of that and then skin the character. It just became tricky with someone like Iron Man. Imagine a suit of armor that wouldn't allow you to move, but through the magic of CG, you can force it to move in the way you need it to move.

We based our color pipeline on Nuke. We would create a sample Nuke file and then send it out to the effects houses and say, 'This is how we're applying our color, and this is the color space we like to use.' It came down largely to Maya and Nuke.

V-Ray was used quite a bit between the bigger vendors – Method and ILM, in addition to their in-house shaders.

#### What was the most challenging scene to pull off?

Definitely the scope of the fight at the airport was the biggest challenge to overcome because it was balancing the different characters together. I was working out the fight with the previs department and just keeping track of all the characters. We had a table laid out in our offices with all these little toys, they're called hero clicks, and they're basically little plastic sculptures of the heroes – not unlike war movies where they have the map on the table all laid out with these statues to show the armies. We did the same thing with the heroes in the splash panel, so Black Widow and Ant-Man are fighting each other over here and these characters are fighting each other over there, and as the fight rages, there is a logic to where everybody is, and there's a sense of design.

Part of the movie is about heroes causing too much damage, so one of the rules going into planning the fight at the airport was that there shouldn't just be full-on destruction of the airport. A lot of time when you're planning a sequence, you fall into a trap where it's, 'Hey, it would be easy to blow up this fuel tank over here.' We said, 'No, let's not do that, let's have the heroes fight each other using their powers without destroying everything because it's something new.' The Russos always described it as a fight that breaks out, like at a family dinner. They're a family, and they care about each other, but the fight gets a little out of hand. That's what was great.

The fight goes on for just under 20 minutes, and it ends on a down note when War Machine gets injured. We pay off the second act with this fight that's fun and a little bit serious. It prepares you for the final battle when we do get serious with Captain America, Iron Man, and Winter Soldier, and the movie then takes this tonal shift from being a fun superhero movie to, Wow, this is something that's very serious, and it is going to have ramifications beyond this film. ■

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**SPECIAL  
REPORT:**

# DRONES

PART 2



# EYE IN THE SKY — CAPTURING FOOTAGE FROM UAVS OFFERS A UNIQUE PERSPECTIVE TO CERTAIN PROJECTS

BY KAREN MOLTENBREY

**A**erial cinematography is hardly new. In fact, directors and filmmakers have utilized helicopters for years, whether for in-project shots or simply for planning purposes. For the feature film *The Walk*, a camera attached to the front of a helicopter provided the visual effects team with reference footage of how light changes within the city and how traffic moves, as well as the perspective of what it felt like to be high-wire artist Philippe Petit as he made his famous walk between the Twin Towers, 110 stories above the ground.

Using a helicopter, however, is often an expensive measure, making it inaccessible to those working on projects with lower budgets — mainly those outside the realm of higher-end features. Alternatively, users have employed wire systems or hard-mounted systems such as cranes for shots that are limited in height. However, that equipment is cumbersome to set up and transport. In just the past few years, though, filmmakers have discovered a new, cheaper alternative to capturing aerial shots: unmanned aerial vehicles (UAVs).

As drones buzzed onto the hobbyist scene, they already were making an impact in the professional realm, including media and entertainment. And, no wonder: They are lightweight, nimble and easily maneuverable, and can be used in tight spaces where alternatives are not feasible. And, they are relatively inexpensive to rent: A camera-equipped UAV (also called unmanned aerial system, or UAS) and crew can cost a fraction of what a helicopter shoot runs. And, it takes little time to set up a scene shot from a UAV.

Nevertheless, flying a UAV for this purpose is not for amateurs.

## DRONES ARE HELPING TO TAKE VIEWERS ON NEW AND UNIQUE EXPERIENCES.

Getting the right shots still requires an experienced pilot and the right equipment. To be as responsive as possible, the UAV needs to be lightweight yet strong enough to carry the necessary cameras. Which camera is ideal? It all depends on the needs of the filmmaker and project. (Part 3 of this series will focus on cameras used with UAVs.)

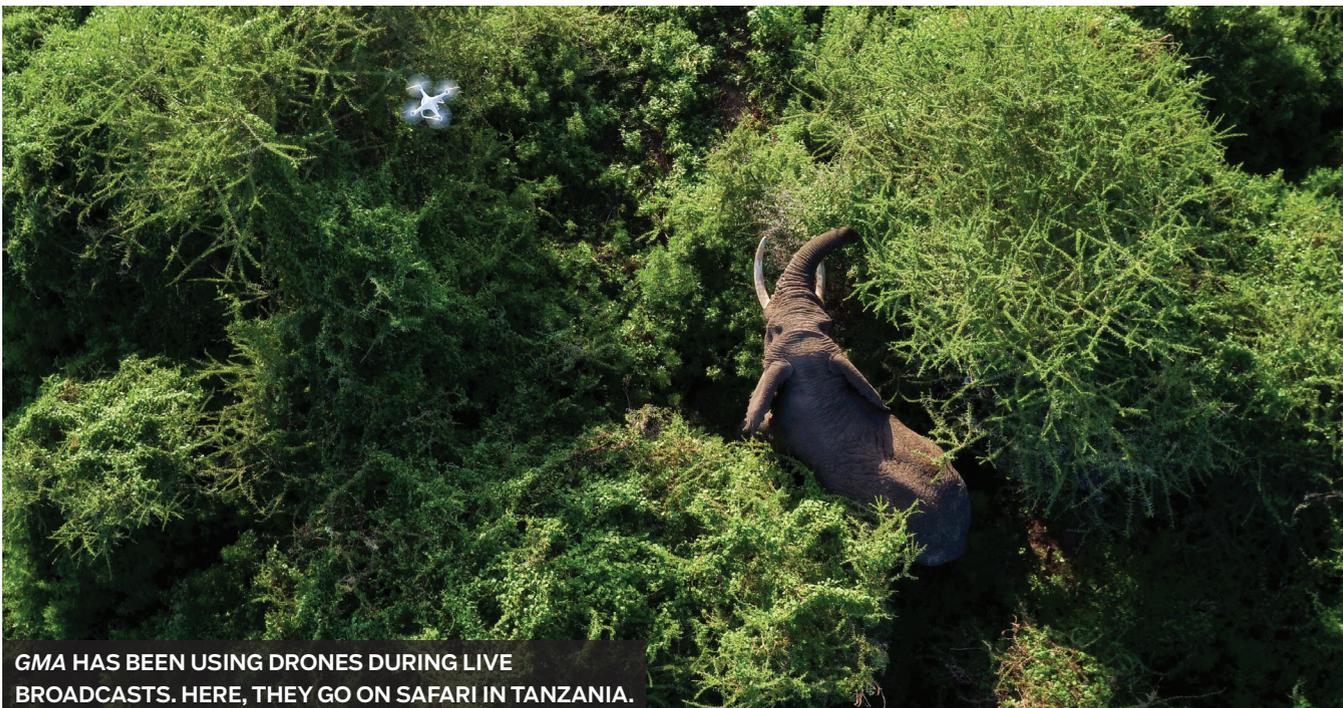
## NEWSWORTHY APPLICATIONS

The use of UAVs, or drones as they are commonly called in the public sector, has been getting plenty of media attention, generating both positive and negative publicity. Indeed, there have been news stories of drones interfering with commercial flights and public events. Late last year, a camera-carrying drone nearly crashed into skier Marcel Hirscher during his World Cup run in Italy, missing him by inches. In fact, there have been similar incidents, and accidents, reported around the world and throughout the US, mostly involving amateur pilots and local and regional events.

In contrast, there have been positive drone headlines, too. Last year, *Good Morning America* (GMA) sent a pair of Inspire 1 quadcopters from DJI with attached GoPro cameras — piloted by DJI's Eric Cheng and Skynamic's Ferdinand Wolf — into the heart of Iceland's most active volcano, capturing the amazing view of Bardarbunga Volcano from just 380 feet above the boiling surface.

The drone systems had to endure wide-ranging weather condi-





**GMA HAS BEEN USING DRONES DURING LIVE BROADCASTS. HERE, THEY GO ON SAFARI IN TANZANIA.**

tions, from freezing cold and high winds to burning temperatures inside the volcano. But the results were well worth the effort. The footage showed the lava bubbling inside the crater and erupting into fire. The scene was broadcast live using the Inspire 1's built-in Lightbridge wireless HD transmission system, marking one of the rare times that drone footage had been streamed live on television.

At the start of the year, *GMA* flipped the experience from fire to ice, again enlisting the services of DJI to explore an Icelandic glacier sinkhole. Using a pair of Inspire 1 Pro platforms, DJI maneuvered into the depths of the glacier, delivering never-before-seen images to millions of viewers. The onboard camera captured a team as they expertly descended thousands of feet into the icy caverns of the Breiðamerkurjökull glacier, switching between the two camera angles to show the depth of the crevasse.

Stepping up its game, *GMA* followed up the Icelandic experience with a drone-filmed

safari in Tanzania's Ngorongoro Crater, enabling viewers to watch the annual Great Migration in that region. Employing a DJI Inspire 1 Pro RAW and Phantom 4, *GMA* was able to traverse the open savanna to capture the animals in their natural habitat, seemingly unfazed by the slight buzzing overhead. This time, the drone carried IM360's 360-degree virtual camera; as a result, viewers could immerse themselves in the VR experience during the live broadcast by using Google Cardboard or Samsung Gear VR head-mounted displays.

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## MUSIC VIDEOS

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Director Gil Green first used UAVs, as he prefers to call them, approximately three and a half years ago for an international project. "The local production company bid the job out for shooting aerials of cars driving along a really windy road in Monte Carlo," he says. "Due to the budget and us having to get low shots, using drones as opposed to a helicopter made sense."

Since then, Green has used UAVs for a handful of projects in the US – including two music videos for the same artist. "One was a really good experience, and the other involved lots of the obstacles that can occur with UAVs," he notes.

For the Pitbull video "Fun," Green, along with co-producers 305 Films (Green's Miami company) and Artists and Derelicts

(Los Angeles), had to capture the look and feel of 1980s Miami during a one-day shoot. This included footage of Pitbull and his partner-in-crime, Chris Brown, in a speedboat – a segment that had to be filmed in just an hour.

"We were able to pull off some amazing shots with ease," says Green.

In this instance, the group used a DJI Inspire with a 4K cam-





## HELICOPTER FILM SERVICES AND OTHERS HAVE BEEN USING DRONES TO SUPPORT FEATURE-FILM SHOTS.

era attached. Had they used a helicopter, the price would have been nearly 10 times that of the UAV, contends Green, while the setup time would have been longer and the communication more challenging during the shoot. “From that standpoint, it just made sense to go with the UAV. Plus, I wanted to get some really close shots,” he adds.

In fact, the UAV worked so well that Green did not have to use the support production boat (with elevated extensions for the cameraman) he had brought with him that day. “After I saw how close I could get with the drone, I didn’t need it to get the other shots I had planned,” he says. Also, the UAV offered a more stable platform from which to film than the support boat.

“It was an awesome tool, and we didn’t have any issues. That day it benefited the workflow – everything was on schedule, and it gave me better shots than I had anticipated,” Green says.

In all, approximately 30 seconds of the UAV footage was used in the video.

The second Pitbull music video – this one a collaboration with Norwegian Cruise Line (NCL) – did not go as smoothly. As part of a promotion, the music video was filmed on an NCL ship, with Pitbull at the front in the midst of a big celebration. To show just how large the ship was, Green had planned aerial

shots overhead, around the ship, and behind it.

“I wanted to film aerial shots of Pitbull, but we could not bring heavy equipment, like a technocrane, onto the ship. That would have been the traditional way to do this, to get 30 feet above the artist,” explains Green. “The UAV can go high and low, and has the ability to go underneath and around the ship – amazing aerial moves that are not good for a track system. A UAV can move anywhere, and a good pilot can get pretty close to the subject.”

On the day of the shoot, however, the winds were particularly strong, making it too difficult – and dangerous – to fly the UAV. “They never died down, so I was never able to get any type of aerial shot,” says Green. As a result, he had to incorporate some aerial footage that Norwegian had from a previous commercial helicopter shoot. Pitbull was not in them, though.

Recently, Green also used a UAV from Inflight Solutions to film behind the scenes at an art event in Miami. “It’s hard to believe that we were able to get these production-quality shots for a behind the scenes,” he says. “UAVs are so inexpensive today that even up-and-coming filmmakers will have a drone in their package that offers this type of quality. I’m starting to see these shots in wedding videos, too. They are no longer

just for big-budget films, all because of drones.”

More recently, Green used a UAV for Spotify, featuring DJ Khaled, as he inspires people throughout the city to work out. A camera-mounted drone filmed him running on the beach and down a pier. “We had a tight window, maybe 16 minutes, to get the shots. They put the drone in the air and got the shots. It was amazing,” Green says.

## FEATURE FILMS

For some time now, filmmakers have used UAVs for special shots, mostly, however, outside the US where laws governing UAVs are less stringent. For instance, Director Neill Blomkamp used them for his movie *Chappie* (2015), to obtain footage as well as to serve as a reference point for actors during filming in South Africa. They have also been used for scenes shot in Hong Kong (*Transformers: Age of Extinction*), Istanbul (*Skyfall*), and others.

Jeremy Braben, an experienced aerial cinematographer at Helicopter Film Services (London), has been hired to fly UAVs for a number of film productions, including *Spectre*, *Into the Woods*, and *Avengers: Age of Ultron* – for which he used Intuitive Aerial’s Aeriigon UAV. “We got into using them about two years ago,” says

Braben, whose company has extensive experience filming with helicopters. “That was at the insistence of a number of studios that wanted to work with a UAS but wasn’t allowed to under the studio system, but could do so with a recognized helicopter aerial film operator.”

Like others, Braben points out that UAVs can go places that a conventional helicopter cannot, and because they have the ability to move in different directions, they can replace wire systems or other hard-mounted systems like cranes. However, he notes that they cannot replace these alternatives completely because there are things that a UAV simply cannot do. “But, they are another tool for the filmmaker to use as another way of completing shots,” he adds.

For *Spectre*, Braben helped capture a shot in central London that provided a point of view during a simple approach to a building, with Trafalgar Square in the background. “The director wanted to put the shot into the geographical location, and this was the only way to do it. Otherwise, it would have been a building just anywhere,” he explains. And, “we couldn’t have gotten low enough with a conventional helicopter.”

Braben’s foray into using drones came during the film *Avengers: Age of Ultron*. For that project, he used the Aeriigon for numerous shots – both

# DRONES

live-action and VFX plates.

"On many occasions, we had extensive use of helicopters and UASs on the same day. There were instances when we did the first half of a shot with a helicopter, with a takeover to the drone," says Braben. "It worked very well. We used that principle on a number of movies, such as

*Captain America: Civil War.*"

A shot from *Into the Woods* started out with a crane reaching through the treetops, and followed the actors through the woods. Then, Helicopter Film Services took over the shot through the trees to the forest canopy. The company also recently acquired shots for *Now*

*You See Me: Second Act*, with an interesting outside/inside shot in a large casino with various actors.

Braben has used UAVs to film in the UK and China. However, there are still regulations in place there, too. "The biggest challenge we face is where the filmmakers want us to fly

and film, because there are still regulation challenges and restrictions," he says.

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## COMMERCIALS

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Because of the reasonable price of using a UAV versus a helicopter, many from outside the realm of high-end feature films

## GENERATING A BUZZ

### DRONES CAPTURE FLYOVER FOOTAGE FOR A UNIQUE VR ADVERTISING CAMPAIGN

BY KAREN MOLTENBREY

What happens when creatives and artists use two of today's cutting-edge technologies – unmanned aerial vehicles (UAVs) and virtual reality – to create an advertising campaign? The innovative and buzz-worthy "The Art of Patron: VR Experience."

New York agency Firstborn, which had developed VR initiatives for a number of iconic brands in the past, did so again, this time for spirits maker Patron. Working with various partners, including Director Mark Kudsi (aWhiteLabelcompany) and Legend VR, the group devised an interactive tour that takes viewers through the tequila-making process – from the viewpoint of a virtual bee as it flies across agave fields and through the Patron distillery.

The goal of the virtual-reality experience, which is being used at Patron-sponsored road shows, is to educate the public about the handcrafted process used to make the tequila, providing a firsthand experience from the point of view of Patron's signature bumblebee as a guide. "We developed a creative concept around the Patron bee, an iconic part of Patron's identity, as well as a natural part of the tequila-making process," explains Seth Tabor, Firstborn's vice president of content development.

The project was fun and unique, but groundbreaking as well, with Firstborn and Legend using drones to film most of the shots, and then devising new techniques for merging the spot's live-action footage and computer graphics into one seamless, moving, 360-degree VR experience. At the time, this had never been done before, and it presented many production challenges.

"There was a lot of cool technology used for the project," says Matt Akey, executive vice president at Legend, which has extensive expertise in stereo conversion and integrated VFX.

#### SKY-HIGH VIEW

"The Art of Patron" is a longer-form advertisement that provides a four-minute, unedited journey to Patron's Hacienda and distillery, where people are handling batches [of tequila] throughout

the distilling process, similar to bees in a hive, but systematically and organized, says Akey.

The film footage needed to be from "bee's-eye" level, and the best – and, most likely, only – way to achieve that was through the use of a UAV. A customized drone from Aerial MOB in Carlsbad, California, was used to film on location in Mexico, with a local group there enlisted to operate the drone.

Legend, meanwhile, rigged the UAV with its own 360-degree camera system needed for the VR aspect. According to Akey, the group used GoPro cameras mounted onto a seven-camera rig they had developed, and shot at 60 frames per second in 4K resolution. The cameras were lightweight, thus making the drone as nimble as possible so it would mimic a bee in flight.

In addition, Legend developed a proprietary node that stabilizes all the cameras on the drone, ensuring a steady image from each. "Basically it's a rotation killer," says Akey of the software called R-Kill, which digitally removes all rotation from a VR rig's motion, whether it is mounted to a car or being flown on a UAV. "It gives you a set horizon line and allows you to have a clear, processed view of all the cameras."

As Akey explains, a UAV bobs and weaves, jostling the lenses of the cameras onboard. R-Kill post-processing software is used after the images are captured, so it will work with any UAV camera footage. In essence, it locks those cameras in place, so the camera footage is consistent per shot, as opposed to footage from each having a slight range of motion. As a result, all the cameras produce one fluid motion. "The tool was integral to the VR project," Akey says, noting the company is in the process of patenting the software.

With the exception of two instances, all the shots used for "The Art of Patron" came from the UAV footage. This includes outdoor sequences of agave field flyovers and indoor sequences throughout the Patron Hacienda and production facility. Prior to filming, Legend previsualized the entire experience. And while the crew was setting up between takes, the Legend team did a rough stitch of all the

are benefiting from this new tool. In fact, Braben says he has seen an uptick in lower-budget productions using aerial photography from these systems. This includes television series, commercials, and more.

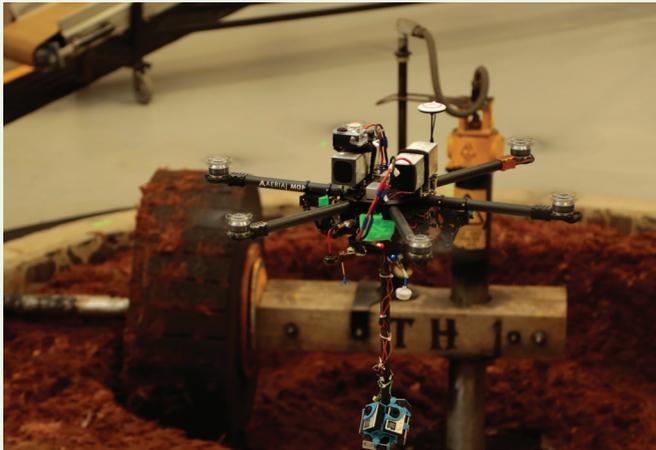
One of the more compelling commercials using footage captured from a UAV is “The Art

of Patron,” a longer-form advertisement that takes viewers on a VR journey to witness Patron’s handcrafted tequila-making process, all from the point of view of a bumblebee. The spot, which is available online and used at Patron-sponsored events, combines live footage, nearly all of which was captured

from a UAV, along with CGI, and presented in stereo (see “Generating a Buzz,” page 28).

The use of a UAV for aerial photography, both here and in other projects, goes far beyond the “cool” factor. It enables a director to get a novel point of view or move into a scene in a dramatic way. “Steadicam was

revolutionary in that regard. Today, the drone is becoming one of the most useful tools of VR filmmaking. You have the ability to get really high angles, but you also can push the depth more than what would naturally be there in a captured moment like that, through 3D conversion,” says Matt Akey, executive vice



camera footage, so the director could scroll through in 360 degrees before moving on to the next shot.

“With ‘Patron,’ we pushed the rules to the limit. We are always moving,” says Akey of the camera motion used for the production. “If you use motion well, you will get far better VR than if it is just static.”

## THE PRODUCTION PROCESS

Shooting the footage for “The Art of Patron” took a few days, but postproduction spanned eight weeks and involved 35 to 40 people at Firstborn and Legend. Without question, the project contained a lot of moving pieces and required input from a number of parties. To help manage production tracking, digital asset management, and team collaboration, the groups utilized ftrack’s cloud-based creative project management tool.

For the most part, Legend was responsible for stitching the video in 360 degrees, 2D-to-3D stereo conversion, VR formatting, color correcting, cleanup (such as rig removal), and integration of the VFX work from Patron and Firstborn. Legend used The Foundry’s Nuke for all the painting and compositing work.

The post process was far more involved than just compiling on-set video. “To accomplish a complete tour of the Patron-making process and to do it at the highest quality, we needed to combine live-action VR filming with vivid, cinematic CG, a first in the VR world,” says Tabor.

To this end, Legend developed custom systems to track the CGI amid the 360-degree live footage. The facility used its proprietary S-Track software, which provides an automated camera track of a

stitched live-action image for easy VFX integration. This enabled the teams to stitch together the footage captured simultaneously by the drone cameras, while accommodating the CG additions and tweaks within the presentation.

“We used R-Kill for the plates, and we did a stitch on those plates. Then we used our tracking software to create a solid track and did VFX integration into the virtual environment,” explains Akey.

Photorealistic CG was integrated into the stitched-together footage, to put people in places where the camera couldn’t go.

“When you put on the VR headset and become the bee [in the finished experience], and you are flying around the Patron Hacienda, it’s unlike anything I have ever seen. You forget that you are human, and you get this sensation of flying and floating through the air,” says Adrian Parker, VP of digital marketing at Patron Spirits Company. The final experience was finished in 4kx2k resolution for presentation on Samsung Gear VR headsets.

Finishing and posting shots with the GoPro-based system was especially challenging at the time. “Everyone was trying to figure out how to get the highest-caliber image, but also find a way to play it back and not have to wait hours for it to download,” says Akey. “There was a lot of R&D required with the codecs.”

The work was challenging and groundbreaking, but the end result is impressive. And for some, the irony of using state-of-the-art technology to present the story of an old, handcrafted process for an inventive project was not lost.

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Karen Moltenbrey is the chief editor of *Computer Graphics World*.



“THE ART OF PATRON” PRESENTS THE COMPANY’S BUSINESS FROM THE PERSPECTIVE OF A BUMBLEBEE.

president at Legend VR, which teamed with Firstborn to create the project.

With these advantages, however, comes more work for directors, who now have to consider everything that is happening around them, not just in front of them, when shooting with UAVs. But, the results can be amazing, as viewers of the Patron VR experience can attest.

“The UAVs had to maintain a steady sense of motion [that was] both comfortable to the viewer yet also provide a bird’s-eye point of view as we fly through the factory,” says Akey. “This gives viewers the ability to watch what is happening in one area, and if they watch it again, they can see something else happening in another corner of the warehouse and bottling room. They will have a different experience every time they watch it.”

## JUST THE START

The use of UAVs to capture footage is increasing, so much so that it’s difficult to tell which project – film, commercial, music video, television series, or what have you – is using the tool. Without question, the devices are gaining

acceptance as a vital tool in a filmmaker’s toolkit.

A UAV from Aerial MOB captured a scene for a recent episode of *Criminal Minds: Beyond Borders*, *Supergirl*, *The Leftovers*, and more, as well as in commercials for Nike and Tesla. Aside from *Into the Woods*, *Skyfall*, and *Chappie*, there are a growing number of films in theaters containing shots from UAVs, including *The Wolf of Wall Street*. For that movie, a drone from Freely with an attached Canon C500 captured the Hampton pool party scene, starting from the coast and moving in for a closer aerial shot.

While the use of unmanned aircraft systems are not ubiquitous, they are gaining in popularity as the industry continues to reap the advantages they offer – cost and agility among the top. As Green points out, a person can rent a UAV system for 10 to 20 percent of the cost of a helicopter, and all the equipment can fit into a person’s hand. And, the devices offer the chance to capture some never-before-achieved shots – a filmmaker’s dream.

Currently, the UAVs used by filmmakers are limited in payload and do not fly for long periods of time (many for just

several minutes). Also, they are limited in the distance they can fly, speed, and altitude. “There are compromises to be made,” says Braben. And while UAVs may not be the ideal solution for all situations, they do provide those who know what they are doing with amazing results.

While some countries offer more relaxed regulations, there remains strict rules in the US: closed sets, no night shoots, use below 400 feet – and more. Indeed, there are safety concerns, particularly since they are so new. “They are in their infancy. Once they become more commonplace, people will become more comfortable using them. People are just learning what they can do with them. They are experimenting now,” says Braben.

Also, weigh your options, Green suggests, and determine whether a UAV is the best choice in a particular situation.

“Eight years or so ago we did a music video for R Kelly and Rick Ross, and used a helicopter to shoot them in a so-called cigarette boat. We used a helicopter, and if we did that today, we would still use a helicopter because a drone couldn’t have kept up with the

boat,” Green points out.

There is still a lot to learn. Braben believes the entire industry should be educated on how to work with the devices on set. “Often, they are considered a nuisance, a safety hazard, and seen as a piece of peripheral equipment. However, they should be treated with the same respect and reverence as a helicopter,” he says. “They are flying aircraft, and there are constraints, just as they are with helicopters. The aerial crew, whether flying a UAV or a helicopter, should have their decisions respected. On some sets, UAVs are dismissed as a toy. But there is an education process happening, which will bring them the respect they should have.”

There’s no doubt that filmmakers will increasingly turn to UAVs to get unique shots. “They have already revolutionized filmmaking as a tool that gives professionals the ability to film their craft in a way that used to come at a great cost. As a tool, it certainly does open up a new world of filmmaking,” Green says.

Now, the sky is literally the limit when it comes to getting great shots for a project. ■

Karen Moltenbrey is the chief editor of *Computer Graphics World*.

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# SOFTWARE

## VISUAL PROGRAMMING

### New Fabric

Fabric Software has released Fabric Engine 2.1 with numerous Canvas presets, samples, and UI improvements aimed at making the development framework easier to use. Highlights of the release include: Canvas presets that focus on geometry attributes, Canvas presets for Alembic, and DFGBindings for treating Canvas graphs as objects.

[www.fabricengine.com](http://www.fabricengine.com)

## DIGITAL CONTENT CREATION

### New Pricing

Maxon has announced the immediate availability of short-term licenses for its flagship software application, Cinema 4D Studio. These licenses are valid for three months (\$600) or six months (\$1,100) and are available as single-workstation or floating multi-licenses. Plug-ins that require the use of serial numbers can also be used with the short-term licenses. Perpetual licenses for Cinema 4D Studio and all other packages (Visualize, Broadcast, and Prime) as well as BodyPaint 3D will continue to be available.

[www.maxon.net](http://www.maxon.net)

## GAMING MIDDLEWARE

### Sweet Set of 3D Tools

Marmalade Technologies has unveiled its Marmalade 3D with an all-new 3D editor and next-generation graphics architecture. Marmalade 3D Kit brings together a suite of tools and middleware to simplify the creation of 3D games, allowing users to export models from Maya, 3ds Max, or any modeling tool with FBX or Collada support into resources that can be directly used in Marmalade projects. The editor allows users to easily import 3D models and then lay out scenes rapidly with the

help of controls. Once users are happy with their layout, they can simply export them in Marmalade format for direct inclusion into a project. Also new to Marmalade 3D Kit is the company's next-generation graphics architecture, built to take full advantage of leading industry technologies. Marmalade 3D Kit is available now as part of the latest Marmalade Platform release, with the editor and next-generation graphics architecture debuting later this year.

[www.madewithmarmalade.com](http://www.madewithmarmalade.com)

## POSTPRODUCTION

### Tracking Made Easy

VR3 has developed a new workflow and tools for recording data in a greenscreen production. Track2go records camera data and prepares it for postproduction, while giving an on-set impression of the final output. All tracking data is automatically synchronized and recorded with the video signals. Track2go records all camera parameters in parallel to the video signals. The camera movements can be exported to FBX format. In postproduction, this data can be used to drive virtual cameras in 3D or compositing software, and can be used to add or change elements in the scene, after studio production.

[www.vr3.de](http://www.vr3.de)

## COMPOSITING



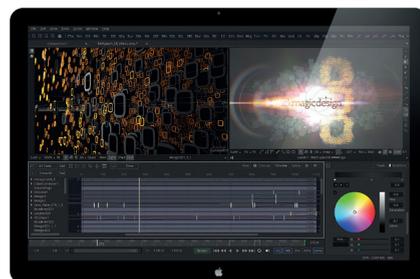
### Energized by Nuke

Chaos Group has released V-Ray 3.3 for Nuke, a node-based VR system with improved GPU rendering speeds and 200-plus updates. V-Ray for Nuke allows compositors to alter

3D assets themselves. Nuke's first VR system arrives via two new cameras, covering spherical and stereo cube maps. V-Ray Standalone brings real-time, GPU-accelerated rendering, including full access to the entire V-Ray lineup (bucket, progressive, and V-Ray RT). The addition of a V-Ray VRscene node will help teams transmit full render-ready assets from V-Ray for 3ds Max and Maya to Nuke artists (or vice versa). V-Ray for Nuke is available now for \$1,040.

[www.v-ray.com](http://www.v-ray.com)

## VISUAL EFFECTS



### Fusion 8 Initiated

Blackmagic Design is now shipping Fusion 8 and Fusion 8 Studio advanced visual effects and motion graphics software. The release of Fusion 8 is the first Mac-compatible release, and projects can be easily moved between Mac and Windows versions. Fusion 8 Studio is now also available in 10, 20, or 50 multiuser licenses. Fusion 8 offers a large toolset for pulling keys, tracking objects, rotoscoping, retouching images, animating titles, and creating particle effects, all in a true 3D workspace. Fusion 8 for Mac and Windows is free for customers and offers a full professional 3D visual effects and compositing system. Fusion 8 Studio for Mac and Windows is priced at \$995 and has the same features as the free version, but also adds advanced optical flow image analysis tools for stereoscopic 3D work, retiming, and stabilization.

[www.blackmagicdesign.com](http://www.blackmagicdesign.com)

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