



Avatar: the filmmaking future is now

James Cameron and crew bring breathtaking stereoscopic 3D film to life using Adobe® Creative Suite® Production Premium software



James Cameron- the director of Avatar.
Photo credit: Mark Fellman
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The movie *Avatar* takes viewers to a spectacular world beyond imagination, where a reluctant hero embarks on an epic adventure, ultimately fighting to save the alien world he has learned to call home. James Cameron, the Oscar-winning director of *Titanic*, first conceived the film 15 years ago, when the technological means to realize his vision did not exist yet.

Now, after four years of production, *Avatar* delivers a fully immersive cinematic experience of a new kind, where the revolutionary technology invented to make the film disappears into the emotion of the characters and the sweep of the story. A team of exceptional filmmakers under Cameron's charge, including Producer Jon Landau, has brought *Avatar* to life—with help from Adobe technologies including Adobe Creative Suite Production Premium software.



Part love story, part tale of intergalactic colonialism, *Avatar* is a unique blend of CG and live-action in stereoscopic 3D. During the movie, Actor Sam Worthington was transformed into a human-alien hybrid.

AVA_Neytirijake_DT_w2.0 L to R Jake Sully (Sam Worthington) and Neytiri (Zoë Saldana) Photo credit: Twentieth Century Fox

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“Certain software enables you to do your job,” says Landau. “Other software allows you to do your job better. Adobe has come up with a suite of software that allows us to do our jobs better.”

Brave new world

In the tale of intergalactic colonialism, humans remotely insert their psyches into the bodies of nine-foot-tall aliens cloned with a mixture of human and alien DNA. The CG and live-action epic adventure in stereoscopic 3D uses visionary new filmmaking techniques.

The film includes more than 3,000 visual effects shots. Entire virtual worlds had to be created—from every blade of grass to every creature, spacecraft, floating mountain, and background. In addition, the crew had to undergo the time-consuming process of shooting actors in front of a green screen and subsequently meshing their actions seamlessly into the 3D virtual worlds.

To bring the characters to life, Cameron used a new type of performance capture process. Actors wore special bodysuits with head rigs equipped with cameras that captured constant images of their faces. That data was then transmitted to another system that created a real-time image of the live actors appearing as their CG avatars. This process allowed him to hold a “virtual” camera, point it at the actors, and see them as their CG characters in real-time and make sure he got the right shots.

Another new motion capture technique used on *Avatar* is Facial Performance Replacement (FPR), which allowed Cameron to digitally rework an actor’s facial movement. Lines of dialogue that got changed after principal photography could be seamlessly implemented into the finished scene, without the actors having to re-don their body suits or head rigs for another take.

Reinventing reality from the ground up

The process of creating the virtual world of Pandora as well as the CG characters began in Adobe Photoshop® software. Robert Stromberg, production designer; Yuri Bartoli, supervising virtual art director; Rey Perez, art department asset manager; and their teams worked closely together with Cameron to design and catalog the film’s characters and environment, answering questions such as “Does the character have horns?” “Will it breathe through vents or nostrils?” and “What are its markings?”

“We worked with Photoshop Extended to paint geometry on different models of creatures and characters,” says Bartoli. “It let us work in layers and drop in texture and detail quickly. We were able to come up with many different designs and present them to Cameron right away to quickly refine the overall look of the film and boost the movie’s photorealism.”

During the making of *Avatar*, thousands of concept images were created and every single take in live-action generated dozens of photographs. “Adobe Photoshop Lightroom® helped us organize thousands of photographs into a clean, manageable project,” says Nolan Murtha, digital effects supervisor for *Avatar*.

From pitch reel to post-viz

Throughout the filmmaking process, Adobe After Effects® was at the heart of the production. Initially, concept art for the film was brought into After Effects to create a pitch reel that ultimately sold the film to 20th Century Fox.

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Jon Landau, producer, *Avatar*



AVTR-264 Jake (Sam Worthington, left) and Quaritch (Stephen Lang) get a virtual look at a massive, gnarled and ancient willow tree that is the Na'vi epicenter and an extension of their lifeblood. Photo credit: WETA

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After Effects also powered “Simulcam,” a process pioneered by Virtual Production Designer Glenn Derry, that swapped the green screen with the CG backgrounds generated in Autodesk MotionBuilder 3D character animation software. This allowed Cameron to use his virtual production toolset while shooting live-action and was a great morale booster for the actors, who could see their performances in context. After Effects was also the engine behind the post-viz process of precisely tracking the live-action elements and adding the CG elements, as well as creating full-fledged comps to hand off to vendors such as ILM and WETA Digital for final production.

Scripting in After Effects saved countless hours in production and helped the team overcome numerous technical hurdles. For instance, the team rendered JPEG sequences from MotionBuilder, automated conversion of FPR files into an editable format, and streamlined creation of right-eye and left-eye comps for the stereoscopic film through After Effects scripting.

“The amount of time we saved through scripting in Adobe After Effects was exponential,” says Dan Neufeldt, digital pipeline developer for *Avatar*. “It added up with every render and version to save tens of thousands of hours.”

Adds Stephen Lawes, creative director of Pixel Liberation Front, one of the VFX firms on the project, “After Effects gave us extreme versatility in compositing as well as in creating motion graphics. The quality of the graphics we handed off to WETA and ILM for final production was superb.”

Interoperability for streamlined production

As sequences came together, the editorial department brought them into Adobe Premiere® Pro software to see the flow from shot to shot and gauge timing. “With Adobe Premiere Pro CS4, we were able to export files from Avid and import them into Adobe Premiere Pro without any loss of information or metadata, significantly reducing the weight on editorials’ shoulders,” says Murtha. “We were essentially working on cuts in parallel with Cameron, without him even knowing it.”

With a team of artists spread across several facilities, Adobe software also helped everyone stay synchronized and productive. Art and production departments used Adobe InDesign® CS4 software to create easy-to-read forms used throughout production. The team also used Adobe Acrobat® Connect® Pro software for web conferencing to coordinate efforts between the lab at Lightstorm Entertainment, Inc. and the set.

Avatar required seamless blending of live-action and CG worlds—not to mention over 3,000 visual effects shots.

Lightstorm Entertainment, Inc. 20th Century Fox

Los Angeles, California
<http://foxmovies.com>
www.avatarmovie.com

Challenge

- Transport audiences into a 3D, stereoscopic world
- Break new filmmaking ground
- Pave future of filmmaking and CG animation
- Save time and money
- Successfully market breakthrough film

Solution

- Tap into end-to-end capabilities of Adobe Creative Suite 4 Production Premium
- Leverage full Adobe suite of software for film creation, collaboration, and marketing

Benefits

- Created photorealistic 3D world
- Leveraged groundbreaking film techniques to create unique viewer experience
- Extended Cameron legacy of film innovation
- Automated routine processes to save more time for creativity in production
- Created an innovative marketing vehicle, with an interactive trailer application delivered via Adobe AIR, to extend the fan experience to the desktop

Toolkit

- Adobe Creative Suite 4 Production Premium. Components used include:
 - Adobe After Effects CS4
 - Adobe Illustrator CS4
 - Adobe Photoshop CS4 Extended
 - Adobe Premiere Pro CS4
 - Adobe Acrobat Connect Pro
 - Adobe AIR
 - Adobe InDesign CS4
 - Adobe Photoshop Lightroom

Using Adobe After Effects, the team was able to send high-quality graphics and comps for final polishing to companies such as WETA Digital and ILM.



AVTR-326 A Na'vi warrior races into battle on a Thanator, a fearsome panther-like creature native to Pandora. Photo credit: WETA

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Dan Neufeldt, digital pipeline developer, *Avatar*



AVTR-295 Zoë Saldana is Neytiri, a fearless and beautiful warrior, and a member of Pandora's royal clan of Na'vi. Photo credit: WETA

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"When we were doing a shot recently, we had to get one of our artists back to our lab, but he was able to connect to the set and work everyone through shots thanks to Acrobat Connect Pro," says Landau. "One of the great things Adobe does in their suite of products is give you everything you need to complete your whole process, from concept to finish."

Breakthroughs on many fronts

Adobe Creative Suite software and the Adobe Flash® Platform also played a major role in marketing the film. Posters and billboards were created in Adobe Illustrator® CS4 software, while an Adobe AIR® application delivered an entertaining, interactive experience for fans. Billed as the "Official *Avatar* Interactive Trailer," the AIR application brings *Avatar*'s Pandora natives straight to fans' desktops, provides *Avatar* trailers, and includes dozens of video shorts, along with social media feeds from Twitter and YouTube. Fans can also purchase tickets.

While the technology behind the film is impressive, what's most important is that the end result is breathtaking. It draws on Cameron's extensive innate talent, the skills of a multifaceted team of artists, and advanced software and technologies from Adobe that are charting the future of filmmaking.



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