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.

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**Avatar: the filmmaking future is now**

James Cameron and crew bring breathtaking stereoscopic 3D film to life using Adobe® Creative Suite® Production Premium software
“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.
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 editors' 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.
“The amount of time we saved through scripting in Adobe After Effects was exponential. It added up with every render and version to save tens of thousands of hours.”

Dan Neufeldt, digital pipeline developer, Avatar

“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.