



# RE-CREATING KRAKATOA AND AVOIDING SELF-INFLICTED WOUNDS

**Bad weather cancelled a Hawaii trip to shoot big waves, but that didn't keep Scott Billups and crew from re-creating the infamous 1882 eruption and tsunامي.** By Scott Billups

I love pixels. I put them right up there with the wheel, penicillin, and the remote control as far as inventions go.

In today's congested media world, it is easy to assume that a high-priced pixel may be better than a cheaper pixel, or that the perceived value of a project is affected by the name on and price of the equipment used to create the little binary buggers. However, no matter how fancy you dress it up, a pixel is basically only a string of numbers that represent a synthetic graphic element or a sampled unit of reality.

Some pixels have more ones and zeros (color space), some travel in larger groups (resolution), some jump through digital hoops (transposition), while others are put on diets (compression). The bottom line is that a pixel is a simple thing, so why is the world of digital production so complex?

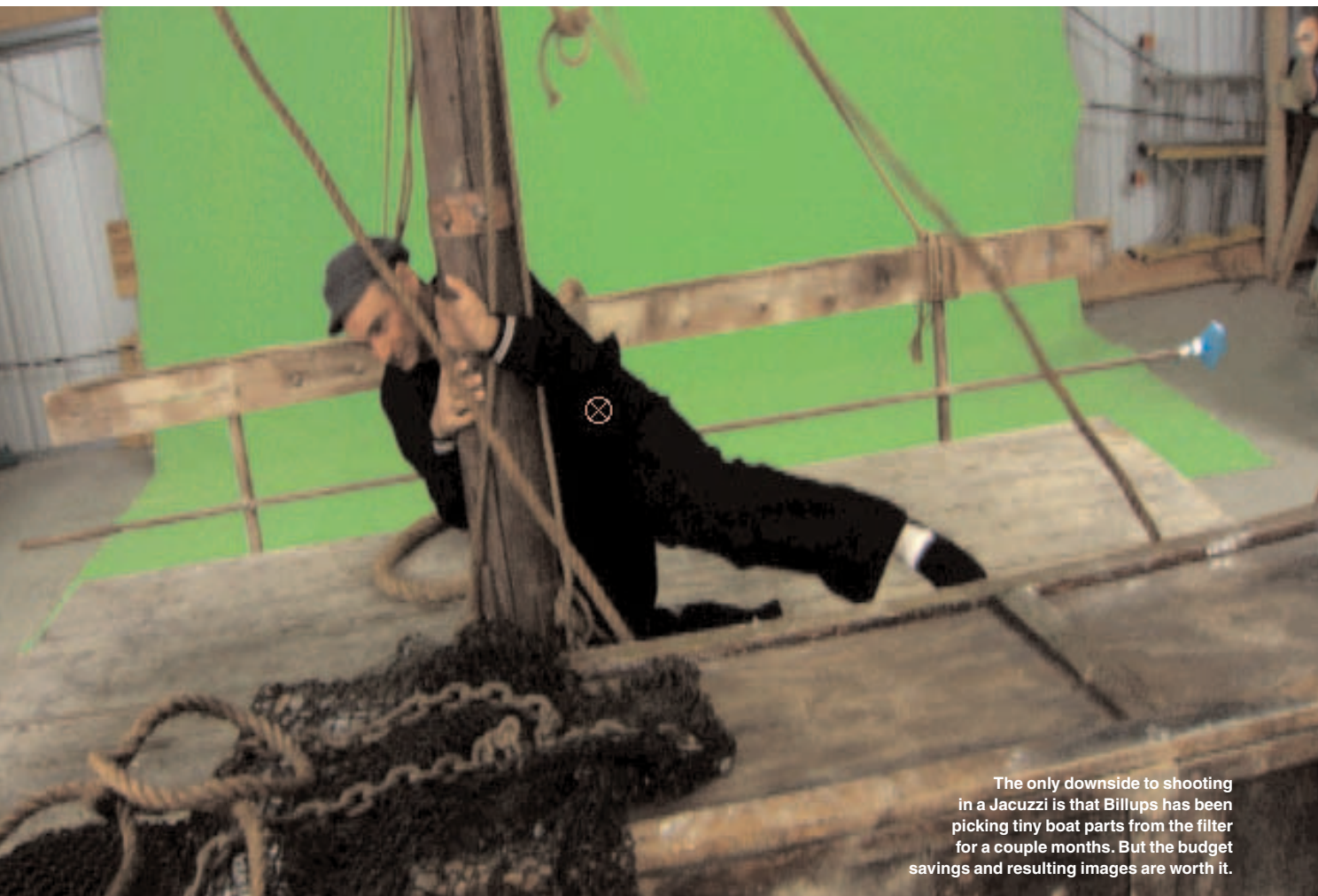
In the past, you picked a video format and basically stuck with it for years, perhaps for the majority of your career. In analog's last days, the choices were relatively simple: Betacam SP camcorder or Betacam SP remote recorder.

Along comes the pixel, and not only are production standards up for grabs but features such as increased light sensitivity, auto-focus, auto-iris, auto-white balance, and image stabilization reduce the learning curve needed to capture a usable image. Notice that I used the word *usable*, not *professional*.

## A dozen formats

From miniDV to high definition, the assortment of tools and formats keeps expanding to the point where the true limiting factors on what we can do are no longer the tools we use, but rather the way in which we use them. As one of my favorite Marshall McLuhan quotes puts it, "We shape our tools, and they in turn shape us."

The look of a show or movie is largely established by a combination of the format



The only downside to shooting in a Jacuzzi is that Billups has been picking tiny boat parts from the filter for a couple months. But the budget savings and resulting images are worth it.

and the methodology with which it was created. The use of HD elements in film-based motion picture projects has become common, as has the use of DV in network and cable programming. New desktop tools blur the borders of previously disparate image types and open the floodgates of interoperability.

I experienced a good example of pixel mixability while recently working on a Discovery Channel series called *Moments in Time*. By the time the shows were in the can, they held pixels from more than a dozen different recording formats and mediums.

One specific episode covered the catastrophic 1883 explosion of the Krakatoa volcano. Executive Producer and Writer Steve Eder thoroughly researched the event and wrote a dramatically compelling script that follows the life and death struggle of a Dutch family who lived on the island of Sumatra. Although the initial eruption of the mighty Krakatoa volcano didn't cause much actual damage, the subsequent pyroclastic flow and associated tsunamis killed well over 36,000 people.

We had planned on shooting dramatic re-creations in Hawaii, but an unexpected



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series of storms forced us to reschedule at the last minute and shoot in the much less volcanically active Los Angeles. Because the intent of the show was to depict events as genuinely as possible, we needed to shoot almost 100 shots of greenscreen, find ways to stretch production dollars, and make do with a lot fewer extras.

In such circumstances, generally the director and the visual effects supervisor go



off to some remote location and duke it out until they arrive at a mutually agreed upon game plan. The director generally rants about all of the elements he needs to tell the story visually, while the visual effects supervisor whines about cost factors and deadlines. The biggest problem that we faced with the Krakatoa show was that in addition to serving as visual effects supervisor, I was also the principal director. Hence the subtitle of this article.

Much of my crew was scattered around the globe shooting elements for other shows we were working on. To get everyone up to speed on the abrupt change of plans for this show, I shot movies of the new locations with a gadget camera and posted them on a private Web site. Thus the first format that we used on the show was the highly compressed MPEG movies of the tiny Sony CyberShot camera.

When we planned to shoot in Hawaii, Eder specified that the show should be shot in anamorphic 16:9 widescreen Digital Betacam and that we should attempt to soften the hard-edged electronic presence. Although the Sony DVW709WS camcorder that our DP, Randy Love, chose to use makes the best-looking pixels short of HD, we felt the camera was too expensive to rent for the weeks of tricky effects shots we faced in Los Angeles. We needed an alternative.

Motion provides viewers a visual clue about sense of scale. The faster something moves, the smaller it looks. Slower and more ponderous movement denotes bulk. With something as deadly as a killer tsunami wave or the silent wall of death known as a pyroclastic flow, scale is everything. With neither the very active Kilauea volcano looming nearby nor the winter breaks of Hawaii's famous North Shore at our disposal, we had to create our own water, cloud, and volcano elements.

Back in the early days of motion pictures, the film's speed through a camera was controlled by the guy turning the crank. If you wanted something to move fast on the screen, you turned the crank a little slower. If you wanted something

Krakatoa volcano. Our special effects unit had come up with a mixture of Fuller's earth, vermiculite, and burnt cork that created a realistic look when pumped through air canons.

The problem we faced was most video cameras can't overcrank. Therefore we decided to use a high-speed ARRIFlex 16 SR3 film camera to shoot the volcanic pumice elements and eruption plumes we needed.

Effects unit DP Christopher Buchijian decided to shoot the air canon at a variety of angles using different mixture ratios of materials and velocities of air. For the element that we wanted to use as the initial column of smoke coming out of the volcano's cone, Buchijian placed the camera right next to the air canon's nozzle and shot around 200 fps. For the ever-present drift of smoke, ash, and pumice that enveloped the entire Sumatra area, he backed the camera up and rolled film at 140 fps.

We had the film telecined to SGI files and then loaded onto an IEEE 1394 drive for transporting to my Mac-based desktop system, where the files were color timed and converted to uncompressed QuickTime files.

The mighty Kilauea volcano was originally going to stand in for Krakatoa, but because of the



**(top)** The tiny 160 x 112-pixel MPEG movies from the Sony CyberShot don't give HD a run for its money, but they proved indispensable for fast communication among crew members over the Internet. **(middle)** Director of Photography Randy Love kept the Sony DVW709WS Digital Betacam camcorder well protected from the dust, dirt, and smoke flying around our effects sets. **(bottom)** The dust and smoke present at a large number of the special effects shots meant keeping not only the equipment protected, but also the cast and crew.

to move slowly, you turned the crank faster to expose more frames per second. Overcranking became one of the first in-camera special effects and remains a cornerstone of contemporary film and video production.

We wanted to overcrank the shots we needed to simulate the eruption of the



rescheduling, we decided to build it from pixel dust. I emailed a sketch of the triple-cone Krakatoa to artist David de la Roca in France, and two days later received an email from him with a small attachment that was an Electric Image Universe 3D setup file. After rendering the 3D project—yet another flavor of pixels—and running it through the approval process, I sent de la Roca some comments. He made a few tweaks to the project and then emailed me a final setup file.

### PigeonVision

One of the episode's main dramatic sequences follows a Dutch family's escape through a bamboo forest to a vacation cabin located high on a local mountain. The actual location that we used for the sequence was situated in a remote marshy area with bamboo so thick and uneven that we couldn't lay track for dolly crane shots.

After some measurements and a quick trip to the hardware store, we rigged our own version of the famous Skycam cable-guided aerial camera and named ours PigeonVision. Okay, ours wasn't as slick as Skycam—it had to be pulled back by hand. But PigeonVision only cost \$40.37 and proved to be a real workhorse.

The PigeonVision shots were supposed to follow the Dutch family as they thrashed through thick bamboo, smoke, and ash billowing around them. Rather than risk a \$60,000 D-Beta system on my spur-of-the-moment engineering, we decided to use a high-quality, three-chip miniDV camcorder, a Canon XL1S, to capture the unique POV.

Of course, when you are cutting miniDV in with D-Beta, you have some special issues to deal with. Each DV camcorder has its own look based on a number of factors: the lens, mechanical elements, and encoder design, to name but a few. We went with the Canon XL1S for several reasons, including the interchangeable manual and auto lenses—and the fact that XL1S footage most closely matches D-Beta footage once you get both formats into a post-production system.



We had strung the PigeonVision cable on a slant so all we needed to do to make the camera move faster was give it a little more weight. Each take would start with the production special effects crew blowing a fine cloud of Fuller's earth into the air. Once the

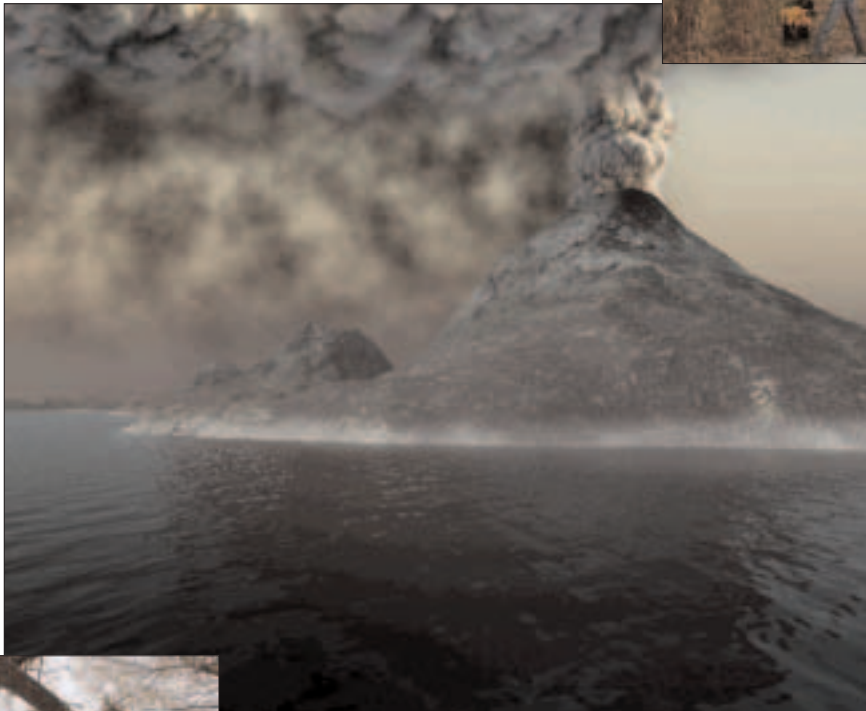
cloud had settled into its hang time, the actors would start bashing their way through the bamboo, we'd release the camera, and gravity would do the rest.

The nasty bit about the real Krakatoa volcano eruption was that it delivered a lethal one-two punch. After the far-reaching pyroclastic plumes had killed thousands of people, the eruption generated a series of tsunamis that washed thousands of the remaining survivors out to sea.

### Growing a wave

Our original plan to visualize the tsunamis was to shoot some winter waves on Oahu's

**(bottom and top) Crew members Kent Nichols and Minky Billups ran a homemade \$40 cable camera, dubbed PigeonVision, for shots of a family running through the bush. (middle) David de la Roca emailed Billups an unrendered Electric Image Universe 3D file of this volcano. Billups composited it with practical smoke elements shot by Christopher Buchijian and water Billups created in Universe and Psunami.**



north shore (okay, so maybe I planned to take my long board along to conduct a little research), and then comp in various foreground elements to generate perspective and scale. After we scrubbed the Hawaii shoot, we needed an alternative source for killer tsunamis.

We tried modeling the waves in several different fluid dynamics software applications, including Alias|Wavefront Maya and a combination of Northern Lights's Psunami plug-in in Electric Image Universe. The modeled waves were adequate for short bits, but we needed shots even longer than those in the

movie *The Perfect Storm*. Because the majority of Krakatoa's tsunamis hit land on rather nice days, we couldn't hide the digital look of the CG elements with nighttime lighting and gale-force winds. We needed another solution.



One of the mainstays of contemporary visual effects production is the Artbeats stock footage library. Artbeats offers a 3-CD set called *Monster Waves*, and the selection of shots in that set met nearly all of our requirements—except the bit about me doing some location scouting on my surfboard.

The wave elements we selected were originally shot on 35 mm motion picture film (I'm counting that as another format) and then transferred to NTSC at

24p. The waves in the *Monster Waves* collection are big, but not nearly big enough to represent the enormous tsunamis that washed away towns. We needed to make them appear bigger. In much the same way that overcranking gives a shot a more ponderous tempo and elements a sense of bigger size, there are a number of really cool software tools out there that do a wonderful job of changing the time base of preexisting footage.

The tool we used, Re:Vision Effects's Twixtor plug-in, can slow down, speed up, or change the frame rate of a clip by creating new frames based on careful interpolation

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between source frames. The end result is Twixtor can easily extend the runtime of a shot by up to 400 percent without introducing noticeable image degradation. The overcranked effect made the waves we were working with take on the appearance and motion of much, much bigger waves. The amazing thing is that you just can't tell which frames are original footage and which frames are math creations of Twixtor. These weren't simple shots. We are talking about waves with a lot of spray, speculars, and little clumps of foamy



stuff. We even keyed the clear blue sky out from the crest spew of the wave and inserted a more ominous sky element. Twixtor made it all look great.

Two of the more unusual stories that Eder uncovered concerned ships in the area at the time of the great eruptions. We made physical models of the two boats and planned on shooting them in a wave research tank

at the University of Hawaii. The last-minute rescheduling relegated the shoot to my Jacuzzi.

The larger of the two ships was modeled on a small luxury liner for Dutch tourist excursions to view the rumbling volcano up close. We felt that stop motion would give us the best control over the interaction with the digital stormy sea created in Maya by colleagues in northern California. The steady motion path created by shooting in stop motion also made it easier to roto-scope the tiny digital people onto the deck.

One of the best stop-motion recording systems in the industry is built into Adobe Premiere, which works on Windows and Mac and can capture with most of the video cards on the market. The interface is so simple that you may be inclined to overlook it for serious work. Don't. The procedure is easy: You move the model and then you hit the space bar to record the frame. Then you

repeat it again, and again, and again until you've got enough shots to make your sequence.

The Premiere interface also includes a great little intervalometer that can give you a *Koyannasquatsi* look by automatically capturing time-lapse frames. With Premiere, we recorded a number of cloud formations at the rate of one frame every 10 seconds, creating a very dramatic look and further accentuated the massive effect of the waves.

One way in which visual effects work differs from standard production is the amount of time that you actually spend with your tools. Our production schedule for the dramatic re-creations was a little over two weeks, but effects production lasted over a 6-month period. As with many of the shows we do, this one's core format was anamorphic D-Beta. The rental on the D-Beta gear for the two-week shoot was nominal, but if we had to rent for a

much detail, I took an old analog Betacam SP camera body and lens that I got for \$1500 total, upgraded the chipset for \$800, and routed the uncompressed, component RGB signals into an \$890 AJA D10A component analog-to-serial-digital converter.

Back when the camera was new, the lens was worth nearly \$6000, but because it was attached to an outdated system, it could be had for pennies on the dollar. With the addition of a \$550 anamorphic adapter, the signal that comes out the other side is uncompressed serial digital widescreen video. Does it compare with a \$60,000 dollar D-Beta system? In this case, yes.

Because the signal from my homemade camera goes directly into the computer, it bypasses both the compression and transposition stages of a signal that gets recorded to tape. The image that it creates has the same resolution as D-Beta, but the pixels are a little fatter and a little healthier. Most

important, since it cost so little to build, I'm not concerned when it sits in the locker for a year while I work on motion picture projects.

At one time, direct-to-disk recording was a hassle. But recent innovations have conspired to create a system that can go just about anywhere and do just about anything. My current direct-to-disk system uses a Macintosh PowerBook G4



(top) Aside from its Rube Goldberg engineering, this old hot-rodded analog camera with an AJA analog-to-SDI converter kicks out Digital Betacam quality at the price of a miniDV camcorder. (middle) Premiere's camera control interface provides simple functions that made easy work of capturing stop-motion animation. (bottom) Billups's mobile HD capture and editing station consists of an Apple PowerBook G4 and a Magma PCI expansion chassis holding a Pinnacle Systems CineWave HD card, and an Atto UL3D Ultra160 SCSI RAID controller that feed the 146 GB Maxtor Atlas III SCSI drives in the external enclosure.



six-month period of visual effects shooting, it would have been a real budget killer.

### Direct-to-disk stop motion

Faced with a consistent long-term need for D-Beta acquisition, I've built my own D-Beta-quality camera that I've used on nearly a hundred shows. Without going into too

connected to a Magma expansion chassis via the PowerBook's PC Card-CardBus slot. The system can run off of either AC or batteries, so it makes a great mobile system for acquiring visual effects elements with the least amount of compression artifacts.

The other model ship we had made was based on a Dutch gunboat that was carried three miles into the jungle by one of Krakatoa's huge waves. Although there are no records of any of the crew surviving, their ride made for a great story element.

## Virtual Krakatoa Toolbox

For more information on the products mentioned in this article, visit these Web sites.

### After Effects

Adobe  
[www.adobe.com](http://www.adobe.com)

### AJ-HDC27 HD camcorder

Panasonic  
[www.panasonic.com/pbds](http://www.panasonic.com/pbds)

### Arete Psunami 3D plug-in

Northern Lights  
[www.northernlights3d.com](http://www.northernlights3d.com)

### ARRIflex 16 SR3 camera

ARRI  
[www.arri.com](http://www.arri.com)

### Artbeats *Monster Waves* CDs

Artbeats  
[www.artbeats.com](http://www.artbeats.com)

### Avid|DS

Avid  
[www.avid.com](http://www.avid.com)

### CineWave HD

Pinnacle Systems  
[www.pinnaclesys.com](http://www.pinnaclesys.com)

### D10A converter

AJA  
[www.aja.com](http://www.aja.com)

### DVW709WS D-Beta camcorder

Sony  
[www.sony.com/professional](http://www.sony.com/professional)

### Expansion chassis

Magma  
[www.magma.com](http://www.magma.com)

### Maya

Alias|Wavefront  
[www.alias.com](http://www.alias.com)

### PowerBook G4

Apple  
[www.apple.com/powerbook](http://www.apple.com/powerbook)

### Premiere

Adobe  
[www.adobe.com](http://www.adobe.com)

### Twixtor

Re:Vision Effects  
[www.revisionfx.com](http://www.revisionfx.com)

### RAID system

Medea  
[www.medea.com](http://www.medea.com)

### Universe

Electric Image  
[www.electricimg.com](http://www.electricimg.com)

### XL1S

Canon  
[www.canondv.com](http://www.canondv.com)

The shot of the gunboat getting sucked up by a huge wave needed interaction with the water—the water in my Jacuzzi. Rather than rent the high-speed film camera and deal with processing, telecine, and data transfer again, I decided to use a Panasonic AJ-HDC27 VariCam camcorder. In addition to being one



By altering the time base of a wave clip from the Artbeats *Monster Waves* collection, a tasty surf wave turns into a city-eating wall of death.

of the only video cameras that can overcrank in progressive mode, it has a nicely defined color space that makes it equally great for chroma key work.

As with just about every camcorder made, the VariCam offers a much better signal out of its SDI connector than it does off of the on-board tape recorder. Although the internal drives of the Magma system are more than sufficient for standard definition work, capturing HD required hooking a Medea RAID system to the SCSI card's external connector.

Live-action elements for both boat gags were shot on greenscreen using the Sony DVW709WS D-Beta camera. The sets included a few practical elements for interaction and tracking reference. Much of the footage was plug and play, but the new tracker in Adobe After Effects 6.0 came in handy.

"But wait!" you say, "I only counted 10 types of pixels and you promised a dozen." Okay, the shots got burned to CD and delivered to the postproduction facility, where they were loaded into an Avid|DS system and conformed to the fine cut. Once approved by all parties, the entire show was laid off to D-Beta and shipped off to the

network to be transposed to the delivery spec. That's 12.

As is fitting for an article about mixing formats within a single show, I leave you with a quote from the series' esteemed postproduction supervisor, Lisa Pegnato. "Remember how jarring it was when you were watching those *Masterpiece Theater* shows from England and they mixed interiors that were shot on tape with exteriors which were acquired on film? Mixed formats looked really freaky back then but now everyone is quite used to them.

"Nearly every show we do these days is a patchwork of formats; everybody composites, everybody uses greenscreen. Many people use different formats intentionally to convey texture and tone and delineate between narrative voices. The trick to using mixed formats successfully is to get the best colorist you can afford. Seek out these people and worship them because they will save your butt." ■

**Scott Billups** is a Los Angeles-based director and visual effects artist. You can learn more about Billups and his work at his Web site [www.pixelmonger.com](http://www.pixelmonger.com).