Smoker Pyrotechnics
by Vince Tourangeau

I've developed a nifty little technique for creating fire and explosion effects. It's quite simple, and better yet, it's free — it uses nothing more than a combination of smokers and lighting effects.

Tutorial One: Fire Effects
Create a new file in ElectricImage.

Step One: Add a spotlight.
Make sure the spotlight's cone is pointing directly up. Give it an outer cone angle of about 50°, and in inner cone angle of, say, 40°.
We don't want this spotlight actually illuminating anything in the scene — we're interested in faking a fire effect using the glow attributes of the light. Turn of the **Enable Illumination** chekbox in the light's properties window. Later, we'll add a flikering radial light for the purpose of illuminating things. Give this spotlight a name like **Flame Light**.

Step Two: Add a somker around the spotlight.
Make the smoker fairly tall - say, three times its width and length. This will give the smoke the effect of being stretched vertically, which will add to the illusion. Rename this smoker **Flames**.
In the smoker's **Info** window, set **Properties** similar to those shown in **Figure 1**.
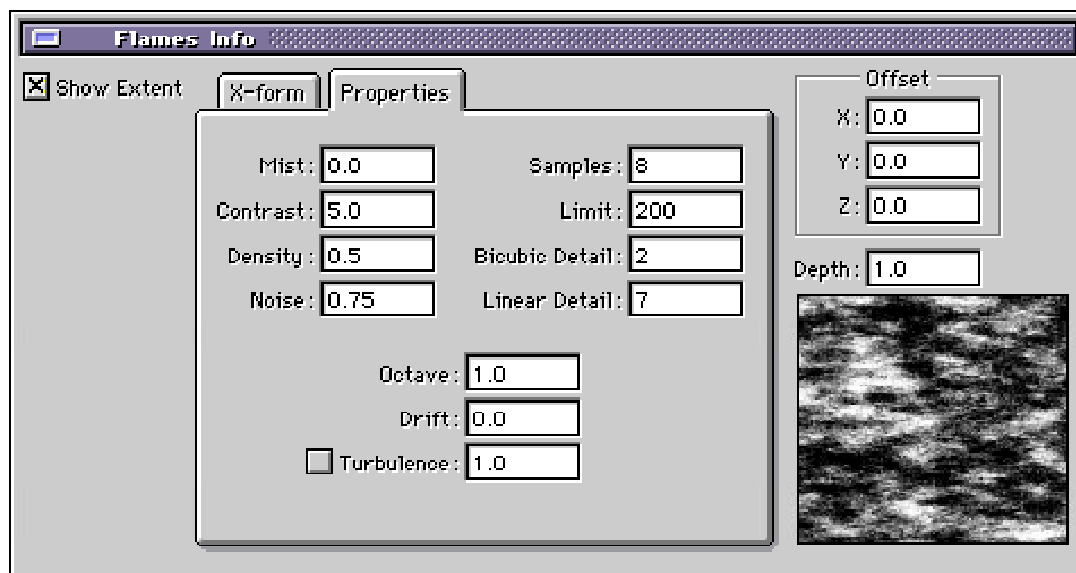

Figure 1: **Flames**'s properties.

Step Three: Set **Flame Light**'s glow attributes
Open the light's **Info** window and press the **Glow** tab. Turn on the light's **Enable Glow** checkbox. We're looking for a campfire kind of flame, so set the **Inside Color** to an orangy-yellow, and the **Outside Color** to red. Set the inner radius to something small like 35, and the outer radius to 200. Keep the factor at 1, and set the intensity to 10.

Make sure **Enable Glow Blend** is on; we're going to duplicate this light, and if this box isn't cheched, the flames where glows overlap won't have much detail.

Next, set the **Smoke** pull-down menu to **Flames**.

Step Four: Do a test render.

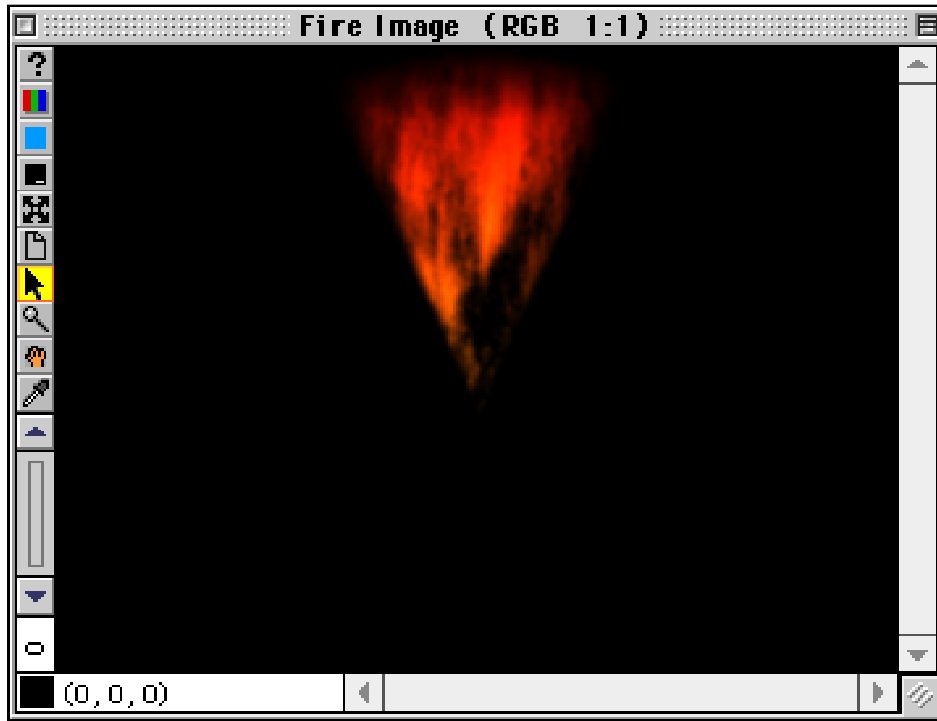You should get something like **Figure 2**.

Figure 2: The scene so far...

This is a pretty good start; you can already see the fire effect, although it's clear that everything's being light by a spotlight. We'll take care of that in a moment, but first we'll animate the smoke.

Step Five: Animate the **Flames**

This is pretty simple. Just keep in mind that, in general, you'll only want to animate the **Turbulance** channel for the smoke. ElecricImage's shaders are generated much like procedural textures (in fact, that's basically what they are), and aren't based on the physical properties of smoke. Because of this, animating the other channels can produce pretty strange, unpredicatble results; your flame will look quite a bit different from one frame to the next.

To aviod this, stick to animating the **Turbulance** of the smoker. Turn on the checkbox next to **Turbulance**.

In the **Project** window, move the time marker to 2.0 seconds. Back in the **Flames Info** window, change the turbulance to 1.5.

The flames will now appear to flicker when you render the scene. That's not quite enought, though; we need them to rise. All you have to do to get this effect is animate **Flames** moving upwards.

Do another test render.

Wow, that's pretty.

Step Six: Fill out the fire

     Duplicate **Flame Light** a couple of times. Offset them a little, so the scene looks something like **Figure 3** (this is the view from **Camera 1**).
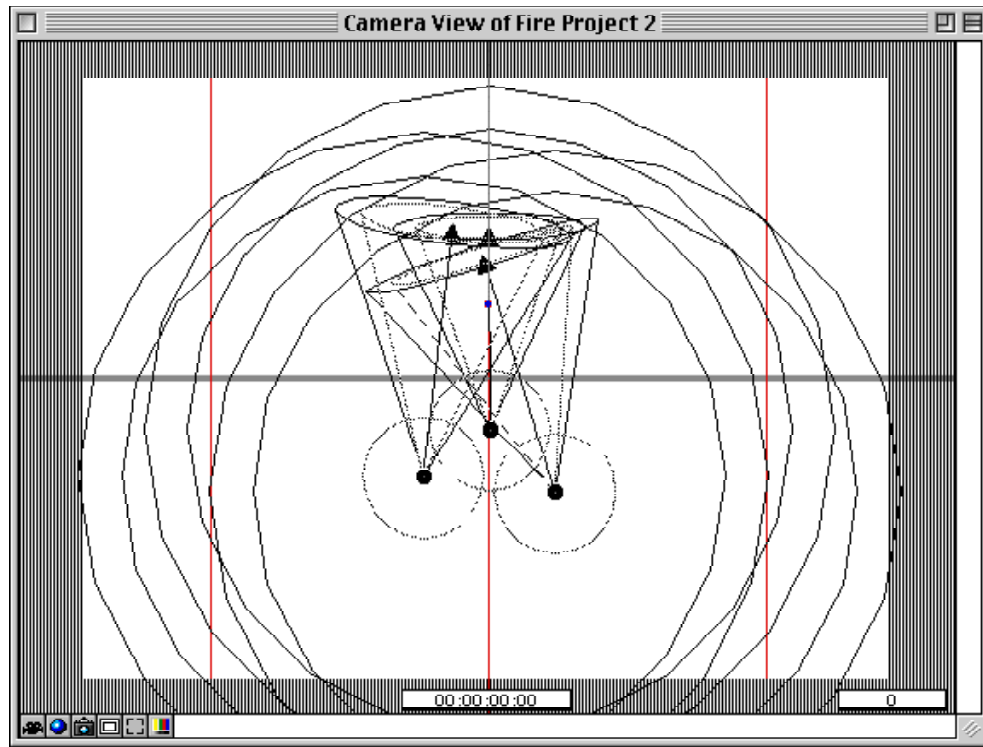

Figure 3: A few more lights...

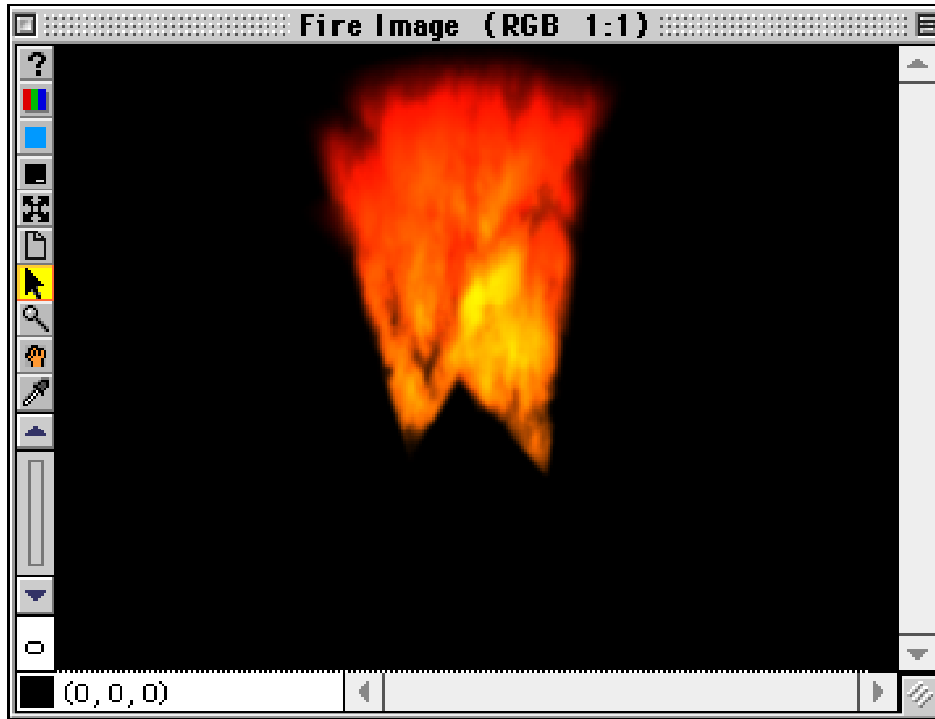   A render should produce a frame like **Figure 4**.

Figure 4: ... and how they affect the scene.

Step Seven: Add some smoke

We're now going to smoke to the flames. The procedure for this is basically the same as that for creating the flames. Create a spotlight pointing srtaight up, and give it a name like **Smoke Light**. Give it relatvie narrow cones - set the outer cone to 25°, the outer cone to 15°.

Open **Smoke Light**'s **Info** window. Click on the **Fog** tab. Turn on the **Enable Fog** checkbox, and set the inside and outside colors to about 20% gray. Set the inner radius to 300 and the outer radius to 350.

Duplicate **Flames** and rename it as **Smoke**. Change the properties of **Smoke** so that it's a little lumpier than **Flames**, keeping in mind that the only channel that should be animated is **Turbulance**. You might want the **Smoke** to rise slower than the **Flames** — in a real fire, the flmaes are hotter than the smoke, so it rises more quickly. To do this, move the time marker to 2.0 seconds and translate **Smoke** down a little bit (keeping in mind not to move it below its y-value at 0.0 seconds).

You can fill out the smoke like we did the fire: duplicate **Smoke Light** a coulple of times, and orient them accordingly.

Render this, and you should get a rather nice effect.

Step Eight: Hide the light sources

The main thing that gives away the gag at this point is that the sources of the light are visible — we can tell that everything's generated from potlights, since the cones trace back to the points where the light is coming from. To hide this, create a plane using **Standard Shapes** and simply place it abice the lights so the sources are hidden. If you render this and nothing shows up, you probably have the **Enable Shadows** and **Enable Rays** boxes turned on in the lights' **Info** windows. Turn this off, and the fire should be visible.

Of course, you won't always need a plane; most of the time, you can hide the sources of light in the geometry of your scene.

Step Nine: Add an illuminating light
　　　　Right now our fire looks nice, but it's not illuminating anything. To change that, simply add a radial light at the center of the flames. The dropoff and intensity is up to you — whatever the scene dictates. Just make sure to give it a color close to that of the flames.
　　　　To enhance the effect, you might want to give this light a flicker. All you have to do for this is view your project in frame mode and select all the frames in the **Intensity** channel. Then click on the **Fill** icon (the paintbucket) at the top of the **Project** window, and selsect the **Randomize...** menu. Enter in an appropriateamount, make sure the **Rleative** checkbox is selected, and press **OK**.
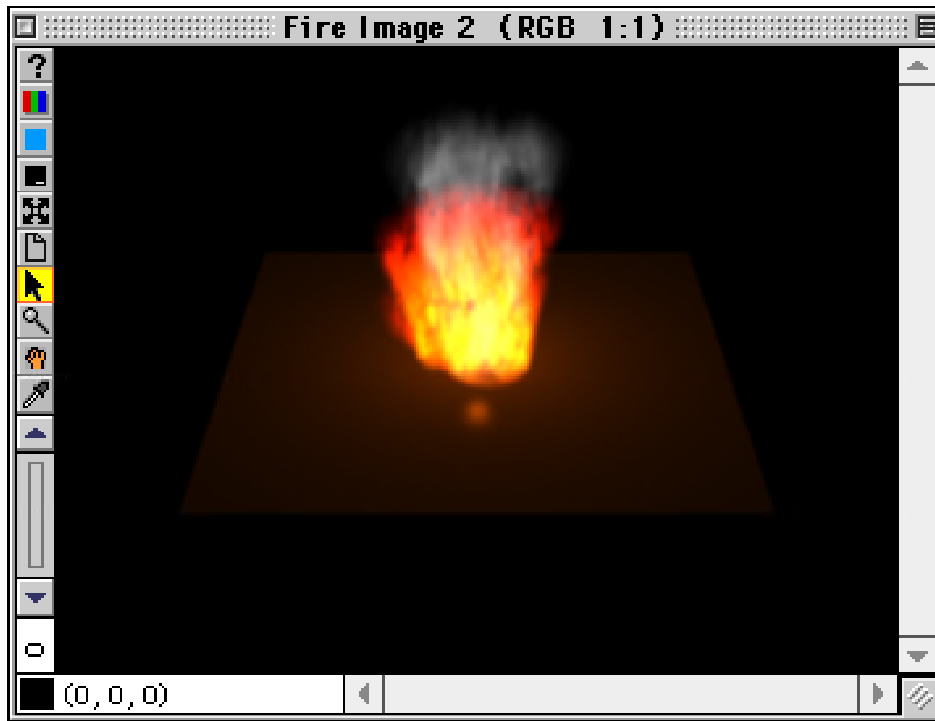　　　　When you render, you should get something like **Figure 5**.

Figure 5: Voilà

Tutorial Two: Explosions
　　　　This is really just a variation on the technique above.
　　　　Create a new file in ElectricImage.

Step One: Add a smoker to the scene.
　　　　Make it fairly large and lumpy. This should be as big as the radius of the explosion.

Step Two: Add a light.
　　　　Give the light a name like **Explosion**.
　　　　This time we're using a radial light to make the smoker visible. Center the light with the smoker. This should illuminate the scene, so give it an orangy color. The explosion will initially be invisible, so give it an **Intensity** of zero. Click on the **Glow** tab and set the **Smoke** channel to **Smoker 1**. Make sure **Enable Glow** is turned on.
　　　　The color of the explosion is up to you. For a bright flash, give the glow a white **Inside Color** and a red **Outside Color**. Leave the **Outside Glow Radius** and **Inside Glow Radius** at 0. Give the glow an **Intensity** of 1.5.

Move the time marker up to 2.0 seconds and add a keyframe to **Explosion** (Command-K).

Step Three: Animate the explosion
This is really easy, especially with the new funtion editor in ElectricImage 2.8. First, animate **Smoker 1** like you did in the Fire Tutorial above. Next, add **Explosion**'s **Outside Glow Radius**, **Inside Glow Radius** and **Intensity** channels to the **Key Path Editor** (Command-double-click on the channel names in the **Project** window).
Whenever I've seen an explosion in a movie, they seem to grow logarythmically: really quickly at first, then suddenly their rate of growth slows down significantly. To get this kind of growth, give your channels a shape like those in **Figure 6**.
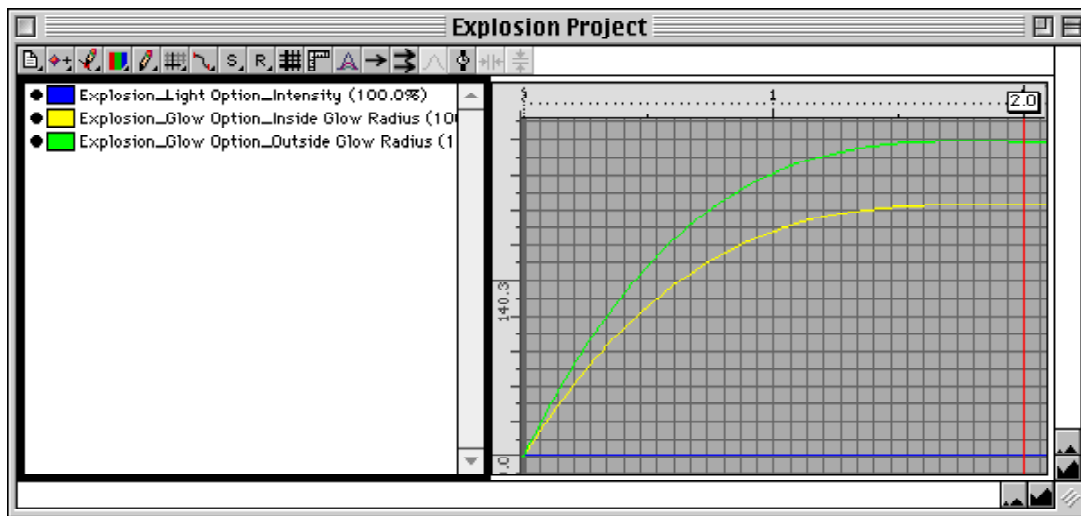

Figure 6: Growth of **Explosion**'s glow radii.

(**Explosion**'s **Intenisty** curve is much the same shape as the glow radii, only it's too small to be seen here, as it varies between 0 and 1.)

Step Three: Add a lens flare
On a personal note, I'm sick to death of lensflares in computer animation. So the one we'll add here will be very subtle; it'll just give the center of the explosion and orange hue.
Open **Explosion**'s **Info** window and set its **Flare** to **LensFlare**. Give it a yellow-orange origin glow and an orange-red outer glow . Set the checkboxes as in **Figure 7**.
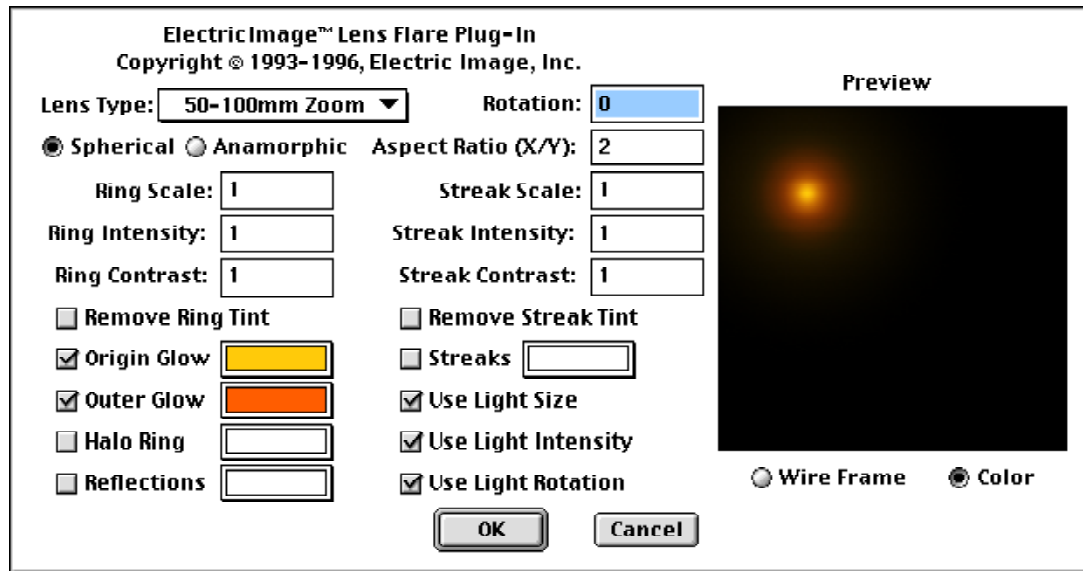
Figure 7: LensFlare settings.

That's really all there is to it. Render away and you'll get a nice looking explosion. You can also use this technique to get a cool sun effect; just give the glow a high **Factor** value so that the dropoff between the inside and outside glows is quick, and keep the glow radii constant. To speed up rendering, you can render a high-rez still as a camera map and map it on to a sphere centered at the sun light, with a radius equal to the **Outside Glow Radius** of the sun (and, of course, remove any glow effects from the sun itself). This will look just as good, and EI won't have to recalculate the smoke effects for every frame, greatly speeding up the rendering process. On top of that, you can add **Motion Vector Blur** to the sun sphere. (You can use this trick to speed up renderings of primitives mapped with still procedural maps.)

Oh - these suns looks a lot nicer than the lensflare-as-sun effect we've all seen way too much in the past few years, something that quickly gives away any computer generated space shot. Let's hope that that awful era is behind us.

Note to Lee: You might want to add something about using AfterEffects and multiple renderings of explosions composited together for a different explosion effect. Unfortunately, I don't have AE yet, so I wasn't able to experiment with this.

Bio:

Vince Tourangeau still lives with his parents, but that's okay because he's 22 and is currently studying Mathematics at Carleton University in his hometown of Ottawa, Ontario. In his spare time, he runs an animation/multimedia company called Digital Motion Studios (www.epoxygroup.com/dms). He can be reached via email at: vince@epoxygroup.com