Panorama Photography: Expand your images.

The National Aeronautics and Space Administration (NASA) landed the Spirit and Opportunity rovers on planet Mars in January. Since that time we've been treated to some fantastic images from the Red Planet, including some great panoramic shots. If you haven't seen the images, go to marsrovers.jpl.nasa.gov/home/index.html. I've always enjoyed working with panorama photography and seeing the Mars images reminded me that panorama photography would be a great topic for an article.

Panorama photography is almost as old as photography itself. The first panoramic camera was patented in 1843 and used Daguerreotype plates. Most of us are familiar with using wide-angle lenses in 35mm photography. With a 35mm camera used in the landscape mode (horizontal), a 'normal" 50mm lens has a 40 degree angle of view, a 35mm lens gives 54 degrees, a 28mm lens gives 65 degrees, a 24mm lens gives 74 degrees, while a 20mm lens gives 84 degrees.

Wide-angle lenses can squeeze a lot of information onto a single 35mm frame, but they don't really make panoramas. Panorama photography is more than just wide-angle lens photography; it's ULTRA wide-angle photography. Panoramas have a much wider aspect ratio than 35mm photography's 3:2 (width to height) aspect ratio and can have angles of view well over 100 degrees.

There are three general categories of panorama cameras – swing lens, rotating, and extreme wide-angle. The first two categories, swing lens and rotating, expose the film through a narrow slot that "scans" the image on to the film.

With swing lens cameras, the camera's body remains stationary while the lens swings in arc. The film is fixed with a curved film plane that keeps the image in focus as the lens swings. The exposing slit is moved in synchronization with the lens movement. These cameras generally cover a maximum of about 150 degrees.

With rotating cameras, the camera body rotates while the lens and slit remain fixed in relationship to the camera body. The film moves in synchronization with the camera movement. These cameras can make a full 360-degree panorama.

With the third category, extreme

wide-angle cameras, both the body and lens are fixed and the camera has a flat film plane with a long narrow format. The wide-angle lens used must have an image circle sufficient to cover the entire width of the film plane.

Kodak Cirkut panorama cameras were probably the most popular panorama cameras. They were first introduced in 1907 and are of the rotating camera body design. They were used to make shots of large groups of people without having to position the camera a great distance from the group. I've seen school class group photos from the 1920's made with such cameras. As the cameras slowly rotated, scanning the group from one side to the other, it was possible for young boys who positioned themselves at the starting edge of the camera's scan to run behind the group and also be photographed at the other edge of the group.

There are still a variety of panorama cameras of the various types being made, including some that you can build from kits.

In 1994, Apple announced QuickTime VR (for virtual reality) technology that changed the way we can create panoramic images. QuickTime VR technology defined two new kinds of computer images: QTVR Panoramas and QTVR Objects.

QTVR Objects can be very useful if you are trying to sell objects on one of the Internet's many auction sites. I'll cover QTVR Objects in my next article.

A QuickTime VR panorama is made from a carefully shot series of photographs, "stitched" and blended together and mapped onto the inside of a virtual cylinder. On a computer screen, a viewer has a "window" looking out on the whole panoramic image. To explore the panorama, the viewer can pan and zoom across the entire image with their mouse. Apple says "QuickTime VR panoramas immerse you in a photorealistic environment".

The first actual software to create such images was released in by Apple in 1995. The first two versions of Apple software were difficult to use. In the fall of 1997, Apple released QTVR Authoring Studio which was far more user friendly and it was updated once in the fall of 1998. It no longer runs on the latest Macintosh computers, but it's a great program and I still use it.

Images that are to be stitched together need to have some overlap. Ideally they are shot using a tripod and a panoramic tripod

head that keeps the camera level while making it possible to easily rotate the camera in uniform steps around a circle. Kaidan is a good source of such tripod heads (www.kaidan.com).

All lenses produce some level of image distortion. If you were to photograph a square grid of lines, the grid would be distorted – especially towards the edges of images made with wide-angle lenses. We don't normally care about the distortion in our photos, but the distortion becomes a problem when we are trying to superimpose images and stitch them together to create panoramas.

To produce the highest quality panoramas, software like Apple's QTVR Authoring Studio must correct for this distortion as well as carefully blend the images.

Apple's primary intended use of QTVR technology was on computers and the Internet, but the software also creates panoramic images that can be printed and viewed traditionally.

To demonstrate Apple's QTVR Authoring Studio, I shot a series of images of the George Eastman House and International Museum of Photography and Film, Rochester, New York. Go to www.eastman.org/home.htm for more information about the museum's collection. I used my Olympus C-2020Z digital camera with its zoom lens set to the wide-angle position (roughly equivalent to a 35mm wide angle lens on a 35mm camera). I mounted the camera in the vertical (portrait) position on a Kaidan KiWi+ Panoramic Head and shot 10 images in 20-degree increments. This gave plenty of image overlap for the stitching process to work.

Figure 1 shows the QTVR Authoring Studio user interface, Figure 2 is the completed panoramic image that covers approximately a 200 degree angle of view, while Figure 3 shows how the panorama appears on a computer screen when viewed with Apple's QuickTime Player application. Using your mouse, you can pan and zoom to explore the entire image. By the way, Apple's QuickTime Player application is available for both Mac and PC computers and can be used as a plug-in with most Internet web browsers. [www.apple.com/quicktime/products/qt/]

Since 1995, a number of panorama software developers and products have come and gone. However, there are several great panoramic products available today for a range of prices. Apple's original approach wrapped the panorama

image around the viewer like a cylinder, but new hardware and software makes it possible to also put the viewer inside cubes and spheres, creating totally immersive images.

In 1996, Omniview's Photo Bubbles (now iPix) were introduced. iPix uses back-to-back fisheye lens images to give the viewer a window on their computer screen to see the VR world as if they were inside a sphere. IPix has a patent on the use of fisheye lenses to create such images, so other software developers like RealViz (www.realviz.com) must rely on special tripod heads that make it possible to capture images in vertical rows as well as horizontal steps to create spheres and cubes.

If you want to get started in panoramic imaging, it's actually pretty simple to create panoramas without a lot of fancy equipment. Without a computer you'll be limited to a "cut and paste" approach using prints and the prints will limit your final quality. However, if you have a computer and a digital camera, or can get some of your film images scanned, you can get great results without spending much money on additional hardware or software.

To demonstrate the Cut and paste prints method, I made 5 overlapping images of the George Eastman

House with an Olympus Stylus camera. The camera has a 35mm lens and I hand-held the camera in the portrait mode (vertical). The total angle of view captured is about 110 degrees. Figure 4 shows the results of the cut and paste process.

This method has some obvious problems. You have no control over how your photo lab makes the prints and they may have color and density differences. When pieced together, such differences can produce a very visible seam between images. Because of the lens distortion problem mentioned earlier, you may also have difficulty in lining things up when matching objects in the overlapping areas. The cut and paste method works best with using only the center area of images taken with long focal length lenses.

If your computer has photo enhancement software like Adobe's PhotoShop Elements, you can create panoramas with Elements' Photomerge function. A version of this is also included in the new Adobe Photoshop CS software. The Photomerge approach is a lot like using the cut and paste method with a computer, although it does offer some control over color and density differences.

Figure 5 shows the PhotoShop Elements Photomerge user inter-

face and Figure 6 is the resulting final image. For consistency in comparing methods, I used scans of the original 35mm color negative film images used to make the prints I used in the cut and paste example.

Photomerge works well for some people, but I prefer to use software with a slightly more sophisticated approach.

ArcSoft's Panorama Maker 3 is a good, low cost, cross-platform panorama photography application (www.arcsoft.com/en/products/panoramamaker/). It's about $40US and is available by Internet download from ArcSoft.

Panorama Maker 3 combines horizontal, vertical, or tiled sets of images to create panoramic photos up to 360 degrees wide. After the program automatically stitches the images together, it is also possible to manually adjust their positions to create the perfect panoramic effect. Panorama Maker includes a camera lens focal length setting to correct for lens distortion; its automatic setting has worked quite well for me.

Figure 7 shows the Panorama Maker 3 horizontal panorama user interface, Figure 8 is the resulting final image. Again for consistency, I used the scans of the original

35mm color negative film.

Panorama Maker 3 also makes it possible to create super-wide shots from several images tiled together. In this example, I shot 8 hand-held digital images with the Olympus C-2020Z set to the wide-angle position with the camera in the landscape (horizontal) position.

Figure 9 shows the Panorama Maker 3 user tile interface while Figure 10 is the resulting final image.

Once you've created your panoramic images, you may want to create large prints to display or share them with you friends. I have an Epson ink-jet printer that accepts their Panoramic Photo Paper (2210 x 594 mm) and it makes great panoramic prints. Have fun!
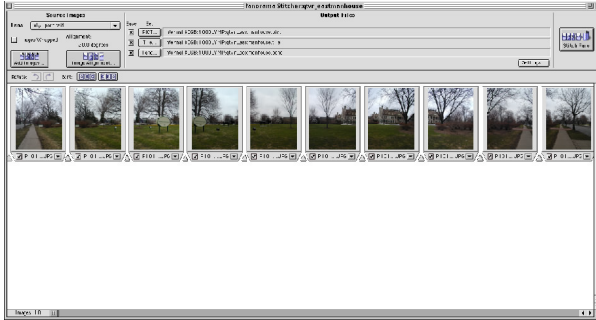
Figures:

Figure 1. The QTVR Authoring Studio user interface.

Figure 2. The completed panoramic image created by QTVR Authoring Studio that covers approximately a 200-degree angle of view.

Figure 3. This is how the panorama appears when viewed with Apple's QuickTime Player application. Using your mouse, you can pan and zoom around the entire image.

Figure 4. A panorama created by the cut and paste process covering approximately a 110-degree angle of view.
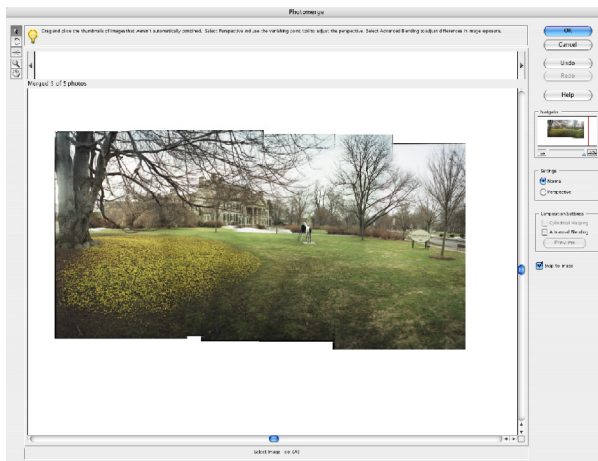

Figure 5. The PhotoShop Elements Photomerge user interface.

Figure 6. The resulting final Photomerged panorama.
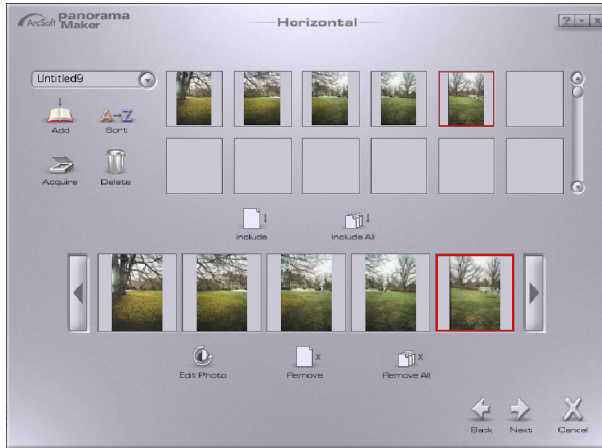
Figure 7. The Panorama Maker 3 Horizontal Panorama user interface.

Figure 8. The resulting final Panorama Maker 3 panoramic image.

Figure 9. The Panorama Maker 3 user Tile interface.

Figure 10. The resulting final Panorama Maker 3 tiled image.