

# STEREO PHOTOGRA

## Technology Trends Lead to 3-D Innovations

By Stewart Walker, director of marketing, BAE Systems (www.socetgxp.com), San Diego.

Photogrammetry and stereoscopy have been intimately linked for decades. Early generations of photogrammetric instruments, such as stereocomparators and analogue and analytical stereoplotters, incorporated intricate mechanisms. These ingeniously designed precision instruments superimposed two photographs of Earth's surface in the human vision system to form a stereomodel.

A "floating mark" was inserted in this virtual miniature to measure points, lines, areas and contours.

The advent of digital photogrammetry brought great change. The "floating mark" became simple indeed, with a few colored pixels in the corresponding positions on each image. There were challenges to achieve smooth roaming of two large RGB images with respect to stationary cursors, as opposed to simply moving the cursors over the images, but modern PCs and graphics cards have overcome these obstacles. The focus, therefore, falls on the technology used

Today's stereoscopic viewing solutions, such as StereoGraphics' CrystalEyes, allow geospatial professionals to extract complex geographic information from a wide variety of imagery.

Fakespace Systems Inc.

# ASYMMETRY



Geospatial professionals can easily upgrade 17- or 21-inch monitors to 3-D viewing with MacNaughton's NuVision stereoscopic display kits, which feature a liquid crystal modulator viewing screen, control box and circular polarized glasses. The company's 60GX wireless stereoscopic glasses (below) are compatible with all of today's stereo-ready workstations, PCs and software.



MacNaughton

to achieve stereoscopic viewing of two digital images.

## A Historical Perspective

During the analogue and analytical years, photogrammetrists placed enormous importance on the minutiae of the instruments' viewing systems. Entire benchmarks could swing on whether an analytical plotter's floating mark was opaque or transparent or on the magnification ratio of its oculars. This emphasis reappeared in the digital world in the early 1990s, when suppliers asserted the merits of their chosen viewing systems.

The antagonists fell into two clear camps. One group preferred active viewing, whereby the left and right images were shown in rapid succession on a cathode ray tube (CRT) monitor. Left-right progression was synchronized by means

animated, but still vocal, debate concerned the method of controlling the movement of the "floating mark" with respect to the stereo model. A standard computer mouse could be used, accompanied by arrow keys for the Z axis until the three-button mouse or scroll wheel versions were invented. Soon after, various types of space balls, force sticks, 3-D mice, digitizing tablets and other devices were pressed into service. Meanwhile, some users have remained faithful to the traditional hand wheels and foot disk combination from the analog and analytical eras.

## *Stereoscopic viewing seems destined for a bright photogrammetric future for many years to come.*

of an infrared emitter with a pair of active, battery-powered eyewear containing liquid crystal display (LCD) shutters. The other group opted for passive eyewear, whereby the images were circularly polarized in opposite directions by means of a liquid crystal bezel placed in front of the CRT monitor and viewed through eyewear resembling sunglasses. Moreover, there was a vigorous debate about the advantages or disadvantages of single monitor or "single-head" workstations vs. dual monitor or "dual-head" workstations. In the latter case, one monitor was typically used for the stereoscopic view and the other for the user interface.

Some users also regarded monitor sizes and shapes as critical. A less

## Current Systems

Most of these debates have subsided, as today's suppliers are deferring to customer requirements by offering a variety of solutions. Customers can choose active or passive viewing systems; cursor sizes, shapes and colors are flexibly controlled by software; suppliers support 3-D control devices of several types from several sources; and workstations can be accommodated in either single- or dual-head configurations from the same software.

Today's most common viewing solutions used for production photogrammetry are from MacNaughton ([www.nuvision3d.com](http://www.nuvision3d.com)) or StereoGraphics, a Real D Scientific Division ([www.stereographics.com](http://www.stereographics.com)), both of which offer both active and passive

solutions. MacNaughton's NuVision 21SX bezel kits and 60 GX active eyewear kits and StereoGraphics' range of CrystalEyes Eyewear with Emitters and Monitor ZScreen bezel kits are the workhorses of photogrammetric production today. Enabling photogrammetric software to operate with one solution or another is much easier than it was a decade ago, when even changing a graphics card implied a daunting programming effort. Additionally, active eyewear solutions have become lighter and less expensive while the passive ones have become brighter and better, and they can be integrated into monitors as well as in the form of bezels placed over off-the-shelf monitors. Many sizes and shapes of CRT monitors have been used. Refresh rates of at least 100 Hz are necessary to make the left and right images appear and disappear quickly enough for the brain to achieve stereoscopic fusion without flickering.

Not only has the debate about the various technologies died down, but the role of stereoscopic viewing in photogrammetry has lessened, too. In the days of analogue instruments, most operations were stereoscopic, and the bulk of daily work consisted of manual measurement and the tracing of features for line maps. Today, the emphasis has moved toward orthorectified imagery, often delivered as a layer for a GIS database. Moreover, triangulation and

*Planar's SD1710 stereoscopic monitor can be used simultaneously by multiple users—standing or sitting. There is no restrictive "sweet spot" for viewing, and there is no need to work in a dimly lit environment. Here an SD1710 displays an aerial image of downtown Portland, Ore.*



extraction of digital terrain models are highly automated, so processes formerly requiring a human operator now run unattended. There is greater use of multimode imagery, acquired from different sensors. Stereoscopic viewing is more difficult in this context, owing not only to scale differences between the images (the human brain can accommodate a scale difference of 15 percent, but stereoscopy becomes difficult beyond that), but also to the characteristics of different kinds of images. For example, images from space are usually lower resolution than aerial photography, and radar images look rather unlike electro-optical imagery.

There is still no practical substitute, however, for human labor in two photogrammetric operations: editing automatically generated digital terrain models—though the increasing popularity of airborne Light Detection and Ranging (LiDAR) technology may eventually reduce the role of photogrammetric heighting—and collecting and editing point, line and area features. Thus, stereoscopic viewing seems destined for a bright photogrammetric future for many years to come.

#### Recent Advances

Many companies continue to pursue improved solutions for stereoscopic viewing, especially with the decline of CRT manufacturing. A recent entry to the field has been Planar Systems ([www.planar.com](http://www.planar.com)), whose StereoMirror uses two LCD screens mounted vertically at an angle to each other and viewed through a semi-reflecting mirror. The natural polarization of the LCD screens is exploited, as the polarization of the image viewed in reflected form on the mirror is reversed and the stereoscopic image can then be seen by means of passive glasses. Because both images are "on" all the time, there are no issues with refresh rate, synchronization, flicker or loss of resolution. Also, the mirror reduces the brightness of each image by about 50 percent, significantly less than with the established active and passive

**MARS®**  
Best LIDAR Software on Earth...

- No Limit to Quantity of Data Loaded
- Automatic and Manual Ground, Building, Filtering
- Instant 2D / 3D and Point Cloud / TIN Rendering
- Batch Import / Export to Multiple File Types
- Control Reports Providing Statistics and Standardized Accuracy Adherences
- Contour Display and Batch Export
- Easy Orthophoto Background Display
- Fast and Easy Cross Section and Profiling
- Uses Industry Standard LAS LIDAR File Format

Merrick & Company  
800-544-1714 ext 3901  
E-mail: [GIS@merrick.com](mailto:GIS@merrick.com)  
<http://www.merrick.com/servicelines/gis/mars.aspx>



solutions. Planar Systems' technology also reverses the image going to one of the screens, so the reflected image appears the same as the one viewed directly.

The holy grail of stereoscopic viewing, however, is a solution requiring no eyewear. Many manufacturers have been pursuing this capability, including StereoGraphics with its Synthagram products, Sharp Systems of America ([www.sharpsystems.com](http://www.sharpsystems.com)) with its LL-151-3D 15" XGA LCD Monitor, Light Space Technologies ([www.lightspacetech.com](http://www.lightspacetech.com)) with its DepthCube Z1024 Volumetric 3D Display and Neurok Optics ([www.neurokoptics.com](http://www.neurokoptics.com)) with its 3-D monitors. In many cases, a major challenge has been to dispense with eyewear yet retain sufficient depth perception for precise depth measurement and display resolution without reducing the viewing position so much that it becomes uncomfortable (i.e., the user must enjoy some freedom of movement without visibly compromising the stereoscopic

*Users will enjoy increasingly economical systems that will ensure greater productivity and accuracy, as well as reduced fatigue and eye strain.*

effect). Suppliers have developed some exciting, novel solutions, the role of which will grow in photogrammetry as the products evolve to meet the requirements.

Although this article focuses on workstations, there's also an array of projection technologies available. Like the workstation displays, these technologies find their main applications not in photogrammetry, but in more popular applications such as gaming, visualization and simulation. Some of the aforementioned manufacturers, such as StereoGraphics and Neurok Optics, offer projection solutions, whereas others focus on the projection side, such as VizEveryWhere ([www.vizeverywhere.com](http://www.vizeverywhere.com)). Although several approaches are available, the technologies mentioned here typically are based on high-performance data projectors that project through polarizing filters on high-brightness screens viewed through passive polarizing glasses. As such photogrammetric hardware and software solutions evolve, users will enjoy increasingly economical systems that will ensure greater productivity and accuracy, as well as reduced fatigue and eye strain. ■

## Get More From Your Pixels

**You have invested in imagery –  
get the most from it!**

Create high accuracy orthos and seamless mosaics for mapping, or extract features and information from the richness of your image data. With accurate spatial and spectral information, we can help you and your customers make better decisions with those valuable pixels.

At PCI Geomatics, we have been providing the tools necessary to process and analyze both satellite imagery and aerial photography for over 22 years. Get more from your imagery investment with:

- Rigorous and RPC orthorectification
- The BEST pansharpening
- Smart Digitizer semi-automated line digitizing
- Comprehensive image analysis suite
- Automation • Customization • Multi-platform support

**From desktop production tools to custom-built solutions, PCI Geomatics can help you turn your images into answers.**

Imagery processed by Geomatics  
courtesy of Space Imaging



**PCI**  
Geomatics

**For more information**

Phone: 1 905 764 0614 Fax: 1 905 764 9604

Email: [info@pcigeomatics.com](mailto:info@pcigeomatics.com)

[www.pcigeomatics.com](http://www.pcigeomatics.com)