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Audiovisual technology: A short history of the videowall

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By **Robert Simpson** , founder Director of **Electrosonic**, and a holder of the INFOCOMM Distinguished Achievement Award.

The videowall emerged in the early 1980s. Whether it originated in Europe, the USA or Japan is a matter of debate, but two factors affected what was achieved. First was the fact that early videowalls were all based on standard CRT (Cathode Ray Tube) monitors, typically 28 inch diagonal, with the resulting large gap between image sections. Second was the difficulty of achieving the “image split”, that is the means by which a single input video signal could be split into, say, 16 separate image signals to produce one large image on a 4 × 4 array of monitors.

(Image, left: *A large Philips Vidiwall installed in the Canada Pavilion at EXPO 86 in Vancouver. Picture from “The Expo Celebration” of the 1986 World Exposition.*)

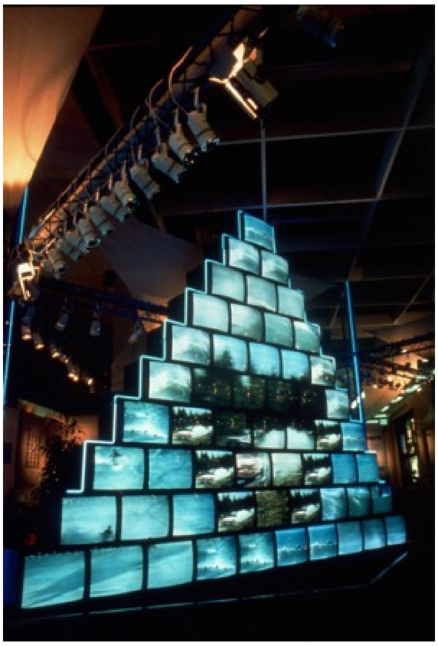
Such “splitting” required computer memory and at the time this was extremely expensive. Thus early products from vendors such as Philips Vidiwall and Delcom (Gundermann) were very expensive. One way round this problem, that could be applied only to “permanent show” systems used in long running exhibitions was to use the (also new at the time) laser disc.

Here the arrangement was to use multiple laser disc players, one player for each monitor. The show would be prepared at a production house equipped with the latest DVE (Digital Video Effects) equipment. The original programme would be repeatedly played through the DVE equipment, each time producing, for example, an image corresponding to one sixteenth of the overall image (for a 4 × 4 display). A master tape carrying the sixteen streams would be transferred to laser discs, and show replay would be by, in this example 16 players all playing in sync, with each player programmed to play one sixteenth of the picture.

This method gave remarkably good results, but had only limited application since clearly most users wanted a system that would split images in real time.

Electrosonic’s PICBLOC™ system was introduced in 1987 and was to be a major influence on the market for the next ten years. Two things initially distinguished this product; first, that by the creative use of a CCD memory device from Philips (actually intended for a quite different application) it was possible to get the cost per channel (monitor) down to a reasonable level. Second, right from the start PICBLOC was designed to be programmed.

(Image, right:*This unconventional videowall was used by Electrosonic to promote its PICBLOC image processing and C-THROUGH programming systems at the Photokina trade show 1988.*)



The C-THROUGH™ program emerged from Electrosonic's long experience in multi-image programming (based on slide projection). It allowed videowalls to be used creatively, and to exploit the "multi-image" nature of the medium, especially when multiple image sources were used. It was no surprise that producers who had made the best multi-image slide shows also started to make the best videowall shows.

The next significant development was the arrival of the videowall "cube". One of the first products to appear was from Pioneer around 1989. This was soon joined by products from Electrosonic, Sony, Toshiba, Electrohome, Barco, Gundermann and others. The "cube" consisted of a CRT projector mounted in an enclosure fitted with, typically, a 41 inch diagonal rear projection screen.

(Image: The arrival of the videowall "cube" opened up new opportunities. This 53ft × 8ft (16m × 2.5m) display (*below left*) was installed in the then brand new MGM Grand Hotel (Las Vegas) in 1994. It used 80 cubes in a 20×4 array. It ran 24 hours a day for many years.)

The videowall cube transformed the market. Now the gaps between screen sections was negligible, and the screen brightness, enhanced by the high contrast screen material that did not give specular reflections like the directly viewed CRT, meant that videowalls became a viable "big image" presentation medium. They could present a much brighter image than any single video projector could produce, occupied less space, and could work in relatively high ambient light. For nearly ten years cube based videowalls were a mainstay of big trade shows and corporate events. They were also used as a basis of TV studio sets, a role they maintain even today (albeit with different projection technology).

So far this brief history has concentrated on "video" walls, that is to say display systems showing full motion standard definition video. It was natural that as viable High Definition playback systems became available (e.g. Sony's HD laser video disc) such walls would also be able to show HD. However, a quite different development was taking place in industry. Here a demand was emerging for large scale displays for control rooms, typically in the telecommunications and energy markets. The idea was to replace previous fixed "hardware" displays, indicator lamps, meters etc with graphic displays driven by computers.

It was soon realized that CRT projectors were not ideal for this purpose. Although many CRT cube based displays were installed in control rooms, especially in Japan, their limitations soon became obvious. Most troublesome was "burn in" whereby a still image maintained for long periods would produce a permanent shadow image. Since most control room displays make much use of still images (or at least images with little motion content) this is a significant problem. The other problem was that "video" oriented CRT displays did not give high enough resolution for detailed graphics, and did not give the "crisp" edges needed for graphic status displays. Finally CRT projectors required a tedious "convergence" procedure to line up the separate red, green and blue images.

(Image: The control room of the Northern States Power company *(right)* in the early 1990s. This used an LCD based projection videowall with multiple VGA images. The installation, in Minneapolis, was by Siemens, but the videowall technology actually came from Dr Seufert.)

One of the pioneers in this market was the German firm Dr Seufert (subsequently taken over by Barco in 1998). Dissatisfied with CRT, it developed its own projection system based on LCD technology. The projectors used large LCD panels, not the microdisplays used in LCD projectors today. To be honest the resulting systems gave terrible color, and were no good at showing full motion video – but they did give absolute image stability, high resolution and crisp text and graphics.

The architecture of these industrial videowalls differed from that used in the "video" displays. Instead of using a dedicated "image splitter" to process an NTSC or PAL moving image, these walls were based on computer networks working in the Unix operating systems environment. Unix features the "X-Window" system that can manage multiple windows simultaneously. An "X-server" can sit on the network and, when fitted with the appropriate number of graphics cards, can support a multi-screen display.

This arrangement worked fine so long as the only images required were ones generated by the applications sitting on the single Unix network. Severe problems arose, however, when it was also required to display full motion video images (e.g. from CCTV cameras or off-air news channels) or from other computer sources not on the same network.

So the second half of the 1990s saw the emergence of a new breed of processor that could handle the combination of high resolution computer images and video images. Some were simple, combining the features of an X-server with special output cards that could window standard video on a specific screen; others were more sophisticated allowing real time processing of all images across all screens. Significant players in the market included Jupiter of the USA and Synelec of France. Electrosonic joined the party at the end of the decade with the introduction of its VECTOR™ processor.

Meanwhile LCD projection cubes improved enormously, with Dr Seufert (by now Barco) and Clarity (now Planar) leading the pack. But around 1997 Texas Instruments DLP™ projection technology, based on the Digital Micromirror Device, came on the market. Synelec (today a part of Planar) was the first company to offer DLP cubes, but was rapidly followed by other players eventually including Mitsubishi, Toshiba, Barco and others.

Initially DLP was a little disappointing. It was fine for graphics, but its video performance was not perfect, and its contrast was poor. However, these problems were rapidly overcome and DLP became the dominant technology in the videowall cube market.

At the turn of the century the videowall in its "traditional" form went into decline. The arrival of both giant LED pixel based displays and high resolution projectors with high light outputs effectively meant an end to the videowall's role as a provider of big bright images in staging and trade shows.

However, the market for sophisticated control room displays continued to expand. Here customers were demanding much higher performance at ever lower system cost; only achieved by the advances in "chip" performance that allowed the image processors to handle many more image sources. The demand for more sources arose for two reasons, the dramatically lower cost of computer hardware that could generate high resolution graphic images, and the requirement to show many more "live" video images from CCTV systems. Typical applications here included control rooms for highways, where hundreds of cameras might be deployed.

The last few years of the first decade of the 21st century saw the arrival of large LCD flat panel displays. Ten years ago it was thought unlikely that LCD would be suitable for displays above about 30 inch diagonal, and that these would be very expensive. It was expected that Plasma displays would take the large panel market.

(A typical modern control room videowall display (*above*). This one uses DLP projection cubes, and can show up to 36 simultaneous live video images (from a choice of 800) and as many RGB computer images as may be required. It is the control room of Trafik Stockholm in Sweden.)

What has actually happened is that LCD panels of 50 inch diagonal and more are now commonplace, and their prices are unbelievably low. Plasma still has an important role, but is now almost a niche product. The LCD panel's dominance has led to two significant market developments.

In the "control room" field many users have changed from using "cubes" to using flat panel displays. This is especially true of the surveillance market, where the need to show a large number of small images (as opposed to one or two large ones) is not compromised by the comparatively large gap between screens. But even here the LCD panel makers (led by vendors like Samsung and NEC) have managed to get the mullion between screens down to around 7mm, which is comparable to that achieved with projection cubes.

(Image: Many control rooms whose primary function is surveillance use multiple LCD displays. This (*right*) is one of London's Metropolitan Police Service rooms. The MPS system has inputs from 30,000 cameras!)

At the same time the high brightness of LCD panels and their extreme thinness has reawakened interest in the "old" style of videowall, made up from multiple displays. The attraction to users is that they get a large attention-getting high resolution display made up from standard products that can be easily reconfigured.

Specialized displays in the military and control room markets still require dedicated image processors to handle a multiplicity of sources. However the public display application is now more usually met by the use of computer servers with multiple-output graphics cards. Many software applications developed for the digital signage market can now support multi-screen and "videowall" displays.

(At INFOCOMM 2009 Christie introduced new LED illuminated projection cubes for 24/7 applications *(below left)*. Barco, Eyevis, Planar and Mitsubishi have announced similar products.)

But projection videowalls are by no means dead. For 24/7 applications projection cubes can be shown to have lower lifetime costs than other technologies, especially now that LED lightsources can be used. The major cube manufacturers, such as Barco, Christie, Mitsubishi and Planar have all announced new LED illuminated products claiming improved color, absence of color wheel artifacts and exceptionally long life.

Opening up the possibility of new applications in architectural displays, as well as higher resolution displays in existing applications, Christie has recently announced the "microtile", a compact display with screen size 16in × 12in and only 10in deep (400×300×260mm). The tiles lock together to produce seamless displays of any size and format, giving images of a resolution far superior to that which is practical with LED pixel based displays or LCD panels. Each tile has a resolution of 720×540, and uses a DLP projection engine sequentially illuminated by Phlatlight™ LEDs. This "brick" approach may represent the ultimate in "wall building"! No doubt many other technologies will vie for attention in the coming years.

This article has compressed a near 30 year history into a couple of thousand words. Many byways such as LCOS cubes, fiber optic coupled LCD, seamless plasma, Jumbotrons, Plasmatron displays and others could have been explored, but for the most part these have fallen by the wayside. The "videowall" can now be considered mainstream, available in many different guises, both as a big picture device and as a multi-image display.

In the heyday of the videowall as a distinct medium, the author wrote a couple of books that may be of interest to those interested in "history". Both are out of print, but as of writing are available second hand at both Barnes & Noble and Amazon.

Videowalls Focal Press 1991. *A "Media Manual" with simple line illustrations, written at a fairly early stage in the development of videowalls*.

Videowalls – The Book of the Big Electronic Image. *Focal Press 1997. Billed as a "second edition" of the above book by the publishers, it is in fact an almost completely new book and is profusely illustrated in color. Although it covers some now obsolescent technologies such as CRT and ILA, for the most part it is still a useful reference book today.*

Robert Simpson is Founder Director of Electrosonic, and a holder of the INFOCOMM Distinguished Achievement Award.

See also:
Themed Entertainment : Getting Interactive at the London Transport Museum
Themed Entertainment: Live Interaction with Electrosonic's Chris Conte

Image at top : *This videowall was installed in the Living Seas Pavilion at EPCOT on behalf of sponsors United Technologies in 1986. It used 35 laserdisc players running in sync.*

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