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Next Generation Display Technology

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Alliance Atlantis's 8th Floor Master Control Suite

A technological matter often overlooked as we twist and turn our way towards HDTV, is the control room monitoring and display facilities. Design engineers must overcome many technical challenges when conceiving and planning a HDTV monitor wall in an edit theatre or a master control suite. Heat dissipation, power consumption, space planning, ergonomics, weight and mounting, image resolution, EMI / RFI, colourimetry and image matching are a few of the major HDTV concerns that need to be addressed when designing your new control room. The classic monitor wall of the analog era requires re-invention and re-engineering for tomorrow's HDTV purposes.

Technical issues aside, it is still all about producing a truthful image! The image must serve the purpose of its application. It must meet both subjective and objective evaluation measures and criteria. Control room design is a great environment to stretch your creative energies and to uncover the perfect intermingled balance between form and function. An emerging technology that will greatly enhance the final solution and go a long way to resolve these design challenges is the multi-image processor when combined with a large-screen, virtual display.

A critical point learned from the past that is still valid today is that the display technology needs to be transparent to the display process. The display should not influence your technical personnel into seeing aberrations or distortions that do not exist. Your editors and master control operators want to view a pure representation of the source signal. They need to see what the consumer will ultimately see in their homes. Truthfulness is essential.

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Consumers are now purchasing large, high-resolution displays for their homes. These displays use new advanced imaging technologies like DLP, LCD, and Plasma. They come as flat panels, rear-projection, front-projection and traditional CRTs. The average display size in the consumer's home is growing from 20" and 27" to 42" and 50". Giant screen displays are now commonplace. These large displays produce exceptional high-resolution pictures that allow the consumers to see everything, including our mistakes, errors and distortions. As a result, viewers are demanding more from broadcasters. Therefore, it is only natural that broadcasters need to improve their effort to catch problems before they hit the airways.

"We went with the Barco multi-image processors and the new Barco DLP rear-projection display cubes for our upgrades to the 8th Floor Master Control Room", says Paul Thomas, Director of Engineering Services at Alliance Atlantis. "They offered us flexibility, expandability, high image quality, and a means to future-proof our investment". "HDTV is a real possibility for us in the near future; so we needed to ensure that we could accommodate a wide variety of signal input formats".

Paul Thomas, Director of Engineering Services, Alliance Atlantis

Thomas contrasted the upgraded 8th floor facility with the original Alliance Atlantis 1st floor facility by saying, "the new multi-image displays outperform the older CRT monitors used downstairs". "The 1st floor Master Control Room exhibits poor image uniformity, lower image quality, and has high maintenance costs". "We knew that we had to move away from CRTs in order to be better prepared to take on HDTV when it comes." "Our company is growing fast." "So, we needed to be ready for whatever new specialty channels our management may want to add to the line up next." "A resolution-independent approach was the answer and multi-image displays provide us with this freedom."

Multi-image displays allow for the digital mapping of many images over the entire raster of the display. By controlling the processor, users can layout any number of configurations. These set ups can be changed as needed. This flexibility allows one display technology to be used in a variety of applications, environments and functions. Even if these parameters change throughout the broadcast day, the set up can simply be changed to match the new application.

As with most technology transitions, broadcasters face simultaneously operating both the old and the new equipment. Therefore, a modern monitor wall may need to support many formats:

- analog NTSC composite video,
- component analog and digital video,
- serial digital interface (SDI) streams in both SDTV and HDTV,
- analog balanced audio,
- AES-EBU digital audio,
- RGB graphic inputs,

Resolutions can vary wildly depending upon the source content and the application. Some extreme post-production applications may need to feed 2,000 x 2,000 pixel images to a display for colour correction purposes. Luckily, most raster resolutions are standardized by organizations such as VESA (www.vesa.org) and DDWG (www.ddwg.org).
The Video Electronics Standards Association or VESA has published many relevant documents and set standards for the PC, computing and other related environments. For example, VESA has published a valuable document that offers guidelines on

how to mitigate magnetic interference. The guideline is available at no charge from the VESA web site. Download the document entitled, "Guideline to Reduce the Visible Effect of Magnetic Interference on Computer CRT Displays". Not all specifications are free like this one. Membership in the organization is important for most display manufacturers.

The Digital Display Working Group or DDWG is an open industry group lead by Intel, Compaq, Fujitsu, Hewlett Packard, IBM, NEC and Silicon Image. The objective of the Digital Display Working Group is to address the industry's requirements for a digital connectivity specification for high-performance PCs and digital displays. The DDEG set the DVI specifications (see Table 1).

Table 1 – DVI Resolutions

DVI Resolution Formats				
Term	**Name**	**Pixels**	**Lines**	**Year**
VGA	Video Graphics Array	640	480	1987
SVGA	Super Video Graphics Array	800	600	1988
XGA	Extended Graphics Array	1024	768	1990
SXGA	Super Extended Graphics Array	1280	1024	2000
UXGA	Ultra Extended Graphics Array	1600	1200	2002
HDTV	HDTV - Ultra Extended Graphics Array	1920	1080	2002
QXGA	Quasar Extended Graphics Array	2048	1536	2003

The table shows the various formats and resolutions applicable to the display of an image using a CRT, front-screen projector, rear-screen projector, LCD, or plasma display device that utilize a DVI interface as specified by the Digital Display Working Group (DDWG) within their document "Digital Visual Interface (DVI) Revision 1.0 published on 02 April 1999". An updated specification is expected shortly.

By making use of these new displays and their computer style interfaces, several issues that we had resolved in the older CRT monitor walls seem to be reappearing. Several Broadcasters have mentioned that some of the new low cost displays like LCD and plasma flat panels are greatly lacking in their ability to display deep rich black, wide contrast range, correct colourimetry, sufficient gain and overall uniformity. So, they do not represent a perfect display solution yet. More development is needed to produce the ideal product that delivers superior resolution and crisp, vivid pictures that accurately reproduce the quality that we need. Do not be fooled by using consumer-grade flat panel displays and then expect to see broadcast-grade image results. You still get what you pay for!

One topic of great confusion seems to be resolution. As noted in the DVI Resolution Formats table, there are many resolutions available to feed a display. None of them are a perfect match pixel-to-pixel match for the current SDTV or the future HDTV formats. The result is a process called, "scaling". Many modern displays can accept an input at one resolution and then scale it to the display resolution. The process of scaling adds to the linear distortion of the image and can generate new issues of concern. As you might expect, low cost displays often do not scale the images very well. Precision image scaling is still a serious engineering art.

Gamma is an issue that is poorly understood as well. Gamma is a measure of contrast in an image, typically in the midrange grays (mid-tones). Many image editing programs express gamma as a curve, which can be manipulated by moving points to change the contrast of the image. Adjusting the gamma allows you to correct mid-tones without noticeable changes in the highlight and shadow areas. Gamma is also the way the brightness of an image is interpreted by computer hardware. Many monitors and graphics cards let you adjust the gamma level to alter the monitor appearance or to compensate for brightness or colour in a room. This is one reason why the same image may look very different on two different monitors.

A big concern for all of these new displays is performance as it relates to "duty cycle". In a control room, we challenge manufacturers to perform to the riggers of a 24 / 7 workweek. Many of our monitor walls are used all day and are expected to continue working without fail. A year has 8,760 hours so a three-year ROI term is in excess of 26,000 hours! None of the consumer displays can perform to this demanding schedule nor can they provide for the necessary ROI. Many plasma displays will actually burn-in fixed images within just 100 hours of service. They are forever etched with the fixed images of a character generator or a static graphic element that may be shown in your picture. Broadcasters require equipment that can meet their needs for a long-term duty cycle and provide for a cost effective return.

These virtual displays can do more then just replace a wall of TV monitors. They can offer attractive add-on features like under monitor displays or UMD. The UMD is a name and perhaps a logo to identify the source of a signal. Often, it is integrated directly to the station's routing switcher via an Ethernet connection. It is able to pass the router's source input nomenclature directly to the display.

Audio inputs can be graphically displayed on the screen too. Therefore, audio levels are viewed at a glance and peaks or low audio can be corrected quickly.

Station IDs, logos, as well as analog or digital clock displays can all be incorporated into the same virtual display. If you wish to display the closed captioning text or the Canadian TV Classification System, then these new monitor walls can integrate these data sources too.

One of the most powerful features of these new virtual monitor walls is the ability to incorporate test and measurement displays and alarms. Alarms can cause the border or the UMD to change from one colour to another, say green to red. This instantly alerts the operator to a technical problem or a potential fault.

The transition to HDTV will bring many challenges. A monitor wall display is one challenge that can be better managed by leveraging this technology and to embrace the virtual display and the multi-image processor. They offer you flexibility, scalability and a truthful, high-resolution image. The overall performance and cost effectiveness of this approach outperforms the classic monitor wall. The bottom line is that this approach offers you a better, simpler answer to the HDTV monitor wall problem.

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