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VESA Special Article

By Chris Chinnock, Sr. Analyst at
Insight Media

DisplayPort – Why this New Digital Interface is Important

By Chris Chinnock, Sr. Analyst at Insight Media

The analog VGA PC connector is running out of steam. It has served the industry well, but it is time to implement a new digital interface with capabilities to accommodate current and future needs. Sound familiar? It should. This was the type of language proponents of the Digital Flat Panel (DFP) standard and the Digital Video Interface (DVI) standard have used in promoting these interfaces.

Unfortunately, neither has become the widespread replacement connector that many had hoped for. Now, developers of the DisplayPort digital interface standard say they have improved on some of the shortcomings of DFP and DVI and can finally implement the promise of a ubiquitous digital connector in PC-related products. Given the arguments laid out in this article, we think DisplayPort is indeed worthy of a closer look. Given it has the support of some key PC players, like HP and Dell, it now seems like to receive wide spread adoption.

Learning from the Past

One of the problems that slowed widespread adoption of DVI was its poor scalability at the silicon level. DVI requires a DC-coupled, relatively high-voltage architecture, but this requirement makes fabrication using ever-smaller design rules difficult which use decreasing voltages to drive circuits. That means it is difficult to integrate with other silicon modules and more likely to be fabricated as a discrete component – a disadvantage for systems designers hoping to

reduce part counts and shave costs. This is not such a big issue if the silicon is placed on a plug-in graphics cards, but it is for more integrated implementations like notebooks.

With DFP, the implementation was also flawed says Bob Myers, Distinguished Technologist at Hewlett-Packard's Display Technology Center, and a lead proponent of the DisplayPort standard. "DFP tried to replace the functionality of the VGA connector in the digital domain without really taking advantages of what digital can offer. As a result, there was no strong motivation to move away from VGA," explained Myers.

VGA and HDMI Shortcomings More Evident

Myers thinks that the analog VGA connector will run out of steam by about 2010. One clear driver is the push toward higher resolution displays. The VGA connector can support UXGA, but its limitations are evident beyond that resolution. More and more of these higher resolution displays are becoming mainstream so there is need for a better solution.

In addition, the content creation community is becoming more concerned about protecting high definition and high resolution content – which can "leak out" video analog connectors right now – the so-called "analog hole." There is a big push to sunset the VGA connector for this reason so other interfaces with digital right management (DRM) protocols can be implemented.

In consumer TVs, the HDMI connector with the HDCP DRM protocol is already well established and on track to become a dominant connector in this market. This connector standard can clearly support HDTV signals so why not adopt it for the PC world, you ask? Apparently, there are some shortcomings that make it less attractive for PC use. This includes the linked audio-video streams – something PC users like to un-link.

Why DisplayPort?

The DisplayPort 1.0 standard was approved by member companies of the Video Electronics Standards Association (VESA) last May. It is designed to unify the desktop and notebook PC markets to a common high-bandwidth display interface. But it can also help to ease connection with TVs and projectors as well. DisplayPort is not being aimed to compete with HDMI, but rather to complement it for PC and PC-based products.

Speeds and Feeds

DisplayPort incorporates a Main Link, a high-bandwidth, low-latency, unidirectional connection supporting isochronous stream transport. One uncompressed video stream with associated audio is included in Version 1.0. DisplayPort is seamlessly extensible, enabling support of multiple video and/or audio streams. Version 1.0 also includes an Auxiliary Channel to provide consistent-bandwidth, low-latency, bi-directional connectivity with Main Link management, and device control based on VESA's EDID and MCCS standards. The Link configuration enables true "Plug-and-Play."

The Main Link bandwidth of up to 10.8Gbit/s, equivalent to a data transfer rate of 1080 Mbytes/second, uses four lanes; the auxiliary channel features minimal delay, with maximum transaction periods less than 500 microseconds.

Data is transmitted across the DisplayPort interface using a micro-packetized format which provides both high performance and the flexibility to handle the evolving requirements of a high performance display interface.

Specifically, it addresses the need for separate high definition audio and video paths, but it does this in a single cable. There is realized as an optional digital audio capability. In addition, there is an optional content protection capability to support viewing high definition television, video and other types of protected content.

With standards like DVI- in fact all of the TMDS-based interfaces - a physically separate clock signal is supplied, which must be recovered and then used to clock in the data signals. This has the potential to lead to a skewing between the data and clock signals, especially over long distances, which can degrade signal integrity, and of course requires additional conductors just to carry the clock signal.

DisplayPort is a packetized protocol, and carries its own clock within the data stream. This approach eliminates the skew issues and requires fewer wires – a cost savings. Packetized data protocols are also more robust in dealing with different type of video, data or audio signals. In such systems, each signal type is merely a packet of data, which is identified by the header on the packet. In other systems, non-video data is forced into pre-defined “windows” or “islands” within the transmission, which makes for a less-efficient use of the available bandwidth, says Myers. In contrast, the DisplayPort system automatically adapts to make the best use of the capabilities of both the transmitting and receiving devices, accommodating video, audio, and other data as needed.

And, in a move to offer cost savings over company product lines that span notebooks to desktop PCs and monitors, the standard enables one protocol to be used for both internal and external connections. For external connection, this means it can replace the VGA or DVI port to connect a PC to a monitor, in addition to enabling the connection of the PC to a projector or TV, or connection between a DVD player and the TV.

DisplayPort Supports New MCCA Standard

On August 14, VESA announced the release of Version 3 of the Monitor Control Command Set (MCCA) Standard. The purpose of this standard is to define a universal set of commands to control the screen settings of displays within any communication protocol established between the host and display.

Historically, displays have provided hardware control panels (on screen display or OSD) to accomplish adjustments like contrast and brightness. But with the emergence of bidirectional communication interfaces like DisplayPort, it is possible to use the host processor to run a ‘virtual control panel’ or VCP application to provide this functionality. The release of Version 3 MCCA Standard provides the opportunity for a standardized user interface regardless of the manufacturer of a particular display.

This standard describes the list of control commands that may be used to control a display and it defines requirements for compliance of the MCCA VCP codes. Although there are different communication paths, the basic content of the information communicated can be standardized offering everyone the same experience in accomplishing the same goal.

The scope of MCCA is not limited to traditional computer-monitor applications. Digital television products also have suitable bidirectional communication paths. Additionally, some VCP codes are designed specifically for television applications.

The new version of MCCA is available for sale from the VESA web site and is offered free of charge to VESA members.

The internal connection ability means that DisplayPort can also act as a “panel interface” to an LCD or PDP module, replacing the current TTL- or LVDS-based standards. This creates the opportunity to produce “direct-drive” monitors that eliminate the need for front-end scalers and controllers located in the monitor. These functions can now be done in the host, eliminating electronics that is often redundantly located in the monitor – a clear cost savings.

DisplayPort also provides performance scalability so that the next generation of displays can feature higher color depths, refresh rates, and display resolutions. The external connector is small, user-friendly and optimized for use on thin profile notebooks in addition to allowing multiple connectors on a graphics card.

So, there are a number of compelling reasons why DisplayPort offers a viable next-generation standard for PC-based products, and even some consumer electronics products. And, with IP-based TVs just around the corner, don't be surprised that DisplayPort might show up in some of these sets too.

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Market Intelligence

Ken Werner, Steve Sechrist

Philips to Withdraw from LG.Philips LCD JV

Royal Philips Electronics announced in early August that it intends to withdraw from LG.Philips LCD (LPL), the joint venture founded by Philips and Korea's LG Electronics in 1999 that has become one of the two largest LCD panel makers in the world. Officials at LPL and at the Philips branch in Korea confirmed Philips' plan to pull out of the partnership, reported the *Korea Times*. The original agreement between the parties required Philips to hold more than 30% of LPL's shares until July 2007, so the Dutch company is giving itself plenty of time to liquidate its shares.

In 1999, Philips obtained 50% of the shares in LPL for 725B won. Philips has sold some of the shares, but retains 117,625,000 shares (32.9%), which are worth more than 4T (that's trillion) won or \$4.2B, based on Monday's market price, according to the *Korea Times'* story. That means Philips will realize over 3T won (\$3.2B) in capital gains if it sells all of its shares.

LPL has been stumbling recently, reporting a record loss of 322B won in 2Q and postponing investment in a next-generation production line. The *Korea Times* said, “The departure of Philips will deal a painful blow to the world's second-largest liquefied [sic] crystal display panel manufacturer,” but spokesmen for LPL and LG Electronics did not sound alarmed.

Cho Jung-kwon, a public relations officer for LG Electronics, said, “Philips has to keep its shares until next July. In this industry, one year is a very long time. Even if Philips sells its shares next year, there will be no big change to the investment plans of LG.Philips.”

Philips has not disclosed how much of its holdings it will sell, although it is likely it will liquidate all of its shares. Nor have there been discussions between LG Electronics and Philips regarding how many of these shares LG might purchase. LG Electronics is currently the largest shareholder in LPL with

37.9% of the stock. “In this industry, 40% is thought to be enough to hold management rights. As we already have 37.9%, adding 3% will not be a big issue for us,” said Cho.

A former LPL executive told Insight Media that this is really an old story, and that the handwriting was on the wall last December when Philips sold a substantial block of stock, breaking the 50/50 stock parity with LG Electronics. He did not see this as a problem for LPL, though. “Selling shares at a profit does not hurt Philips or LPL.”

A former Philips employee in the US said the Philips action is consistent with the company's long-term record of shedding display businesses. That view was echoed, and even extended, by Park Yong-beom, a public relations official at Philips Korea: “The announcement means that Philips is going to reduce its investment from cyclical tech industries such as components and semiconductors, where earnings are volatile and associated with market conditions. The company plans to shift the R&D investment to healthcare and lifestyle businesses.” -KW

iSuppli: IPTV Subscribers to Grow to 60M by 2010

iSuppli recently announced its IPTV research findings and we were surprised to learn that in four short years Internet delivery of video programming will reach 63.1M subscribers world wide with a compound average growth rate of over 92%, generating over \$27B in overall revenue in 2010. In 2005, iSuppli estimates there were only 2.4M users and forecasts that to grow to 5.3M by the end of this year.

While some see video over broadband as just a way geeks watch TV in a tiny square on a computer monitor, futurists connected the dots a while ago. They see the exceptional potential of the Internet as the primary digital content delivery network to distribute DTV signals now that the long awaited analog to digital transition in TV broadcasting is underway.

IPTV will offer more than the lateral technology shifts experienced when cable TV and satellite delivery became available to consumers. These distribution mechanisms broadened the reach of OTA (over the air) local and network broadcast, but did little beyond expanding programming choice to shift the broadcast scheduling paradigm. Network planners still decided both the content and the time viewers could watch specific programming. To make matters worse, the TV service providers bundled these new channels in “good,” “better,” “best” duopolistic pricing plans that maximized profits but offered viewers no choice in selecting the channels they really wanted to buy. (It’s the old huckster ploy—one egg or two eggs in your beer, Mr.?) This gave rise to the phrase, “...hundreds of channels but nothing to watch.”

No more and its about time. Savvy IPTV sites are springing up all over the Web as IP fast becomes the protocol of choice for delivery of any type of media rich content. This can now be delivered anytime viewers want, breaking the old broadcast one-to-many business model and opening up targeted point-to-point programming (and advertising) to a highly targeted audience.

In the past content was dependent on the network for delivery, now with the ubiquitous network connectivity of the Internet, the network itself is vanishing into background and content is emerging as the focal point—with advertisers keenly aware that messaging can be delivered with pin-point accuracy and with the immediacy of interactivity.

The iSuppli numbers are not at all surprising when viewed from the perspective of pent up demand for real choice in TV program viewing. TiVo was the beginning in offering the “time-shifting” option and early adopters often said once you experience it—you never want to go back.

So too it will be with IPTV delivery of mainstream video programming. Get ready for something new all over again. –SS

Flat Panel Watch

Ken Werner, Steve Sechrist

Sharp Planning \$4.25B Gen 10 LCD Fab

It may not quite be written in stone yet (or etched in display glass), but *Nihon Keizai Shimbun* reported in mid-July that Sharp will invest \$4.25B – yes, that's *four and a quarter billion US dollars* – to build a tenth-generation TFT-LCD manufacturing plant. Construction is slated to begin in 3Q'07, with volume production ramping up in mid-2008. The plant will use glass substrates of 2,850×3,050mm, which can be used to make 57-inch panels 8-up or 65-inch panels 6-up.

Sharp declined to comment on the report, and DisplaySearch said the plan is not yet definite.

Sharp has a history of being more aggressive than other display manufacturers in moving on to next-gen fabs, and the company's competitors are not rushing to jump on board the 10G train.

Sang-Wan Lee, president of Samsung Electronics' LCD business, said last fall that Samsung will continue its Gen 8 LCD investments and will invest in Gen 9 LCD production. He left open the possibility of Gen 10 lines at Samsung, but did not embrace the concept with unbridled enthusiasm.

This spring, Chi Mei Optoelectronics (CMO) said it would ramp up volume production at its 8G plant in 2Q'08. But, according to *DigiTimes*, suppliers said CMO is postponing the installation of equipment at the plant until 2008 to avoid conflicts with the expansion of its 7.5G plant. The expansion schedule was recently delayed in an attempt to manage the CMO's currently excessive manufacturing capacity.

Most panel makers in Taiwan said they will not follow Sharp's lead in the near or intermediate future, but left open the possibility a Gen 10 plant could be built in Taiwan in 2 or 3 years, according to the Chinese-language *Apple Daily*.

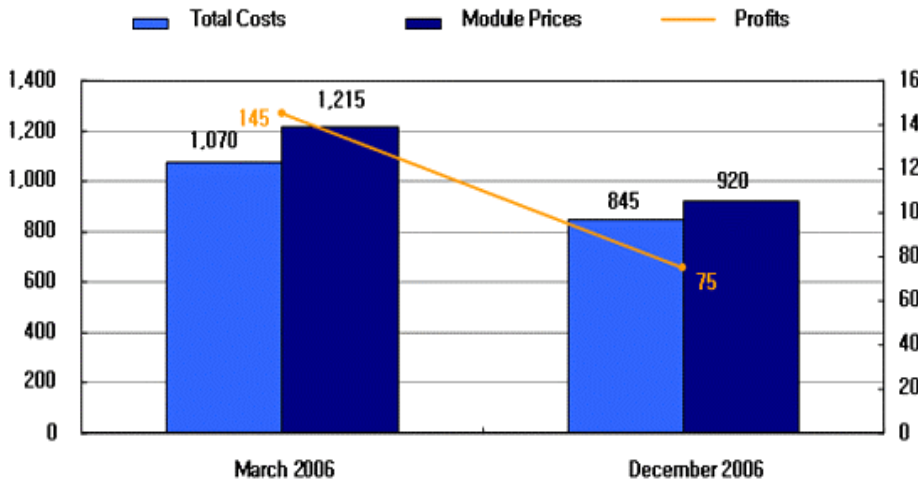
The most advanced LCD fab in Taiwan today is Gen 6, which has been a source of criticism from private and Taiwan-government technology analysts. But AUO has a Gen 7.5 plant that will start ramping up production of 42-inch panels in October, in addition to CMO's Gen 7.5.

Taiwan's Industrial Economics and Knowledge Center (IEK) is taking a cautious position on Gen 8 and higher fabs, saying it remains to be seen whether the huge investments needed to build advance-generation LCD fabs are worthwhile, according to *DigiTimes*. Such fabs only make sense for the manufacturing of large panels, and IEK noted that plasma technology is currently more viable for panels with diagonals of 50 inches or more. A major reason for this is the construction of a PDP plant for these sizes costs only one quarter to one third as much as a TFT-LCD plant, according to IEK.

As discussed in Insight Media's July *HDTV Retailer*, LCD is currently on the verge of closing the price gap with plasma for 42-inch TV sets, which some people doubted would ever happen. Will it happen for 50/52 inches? 57? 65? The answer to that question will answer another: Are the product planners at Sharp inspired – or deluded? –KW

50" HD Modules to Drop Below \$1K in Q4

DisplayBank (Seoul, Korea; www.displaybank.com) said prices for 50-inch HD PDP modules are



expected to fall below \$1,000 by the end of this year. Its latest PDP Module Manufacturing Cost Analysis and Forecasts costs for 50-inch HD modules are expected to reduce by almost 21% from \$1,070 in March to \$845. The report predicts that the decline in prices for PDP modules, accompanied by the fall in PDP-TV prices will stir up demand further for large-format PDPs.

Source: Displaybank PDP Module Manufacturing Cost Analysis and Forecasts

The company predicts the PDP circuit/driver,

which comprises the bulk of the material cost, is likely to see cost reductions as much as 24%, while the panel section will also post a sharp cost drop of up to 26%. Glass, which represents more than half the material costs for the panel is expected to create cost savings through a reduction in thickness from the current 2.8T to 1.8T with a ripple effect in logistics and handling costs.

Displaybank predicts a reduction in profit margin as PDP panels continue down the ASP curve to keep pace with reductions in LCD pricing. Profits for PDP modules could drop as low as \$75 per unit, the research firm predicts.

Displaybank sees the 50-inch module prices falling below \$1,000 with the result of greatly stimulating demand by the holiday season based on the historical precedent set

| 50-inch PDP Cost Structure (Unit: US\$) | | | |
|---|------------|------------|-----------------|
| | Mar. 2006 | Dec. 2006 | Decreasing Rate |
| Material Cost | \$685.30 | \$522.40 | -23.8% |
| Processing Cost | \$384.70 | \$322.60 | -16.1% |
| Total Cost | \$1,070.00 | \$845.00 | -21.0% |
| Module Price | \$1,215.00 | \$920.00 | -24.3% |
| Profit and Loss | \$145.00 | \$75.00 | -48.3% |
| Set Price | \$3,185.00 | \$2,490.00 | -21.8% |
| Source: Displaybank | | | |

in the 42-inch space with an upsurge in shipments when that size panel hit the \$1K mark in the first quarter last year. The firm foresees that 50-inch PDP set prices will be down below \$2,490 by the end of this year, with the price differential between modules and sets to narrow incrementally. This is expected to stimulate demand further for the 50-inch size TVs the company concluded.

With continued price pressure expected from LCD makers, particularly in the +50-inch segment, the only road for PDP makers is improved efficiencies and a successful cost-out strategy for its primary components. For the PDP maker's sake, let's hope the generational head-room in PDP fab development is real. –SS

OLEDs

Ken Werner

OSRAM Intensifies R&D on OLED Lighting in Regensburg

OSRAM GmbH (Munich, Germany; www.osram.com), one of the world's two largest lighting manufacturers, sees a future for general lighting based on organic light-emitting diodes (OLEDs). Wait a minute. That's OLEDs, not LEDs that has Osram excited about general illumination! This is a decidedly different technology view, but OSRAM Opto Semiconductors is serious as it announced intensifying its research and development work on OLEDs, applying the results to general lighting as well as its existing OLED displays business.

Research and development work, which has been brought together in Regensburg, will focus on the design and implementation of OLED device architectures, on increasing device efficiency and lifespan, scaling up to large areas, and developing processes for high-volume production.

Although OSRAM is continuing the development of polymer-based solutions for displays, it is now also focusing on small-molecule OLED technology for illumination applications. The objective is to take advantage of the company's development experience in the technology to commercialize extremely thin light sources with large surface areas. In the medium term, OLEDs could enable lighting products that cannot be made right now. For example, OLED lighting panels could be produced on transparent substrates, contoured substrates, and even flexible substrates.

OSRAM announced it has made white-light prototypes with brightness levels suitable for general lighting applications with a luminous efficiency of 18 lm/W. That is better than conventional incandescent light bulbs but a long way from the 60 lm/W routinely delivered by common fluorescent lamps. The current luminous efficiency is the result of R&D that produced an improved sequence of organic layers that delivers much better results than previous versions.

About 16 months ago, OSRAM announced the specifications of an OLED light source on the first anniversary of initiating its OLED lighting program. At that time, the lighting prototype had a luminous efficiency of 7 lm/W, an average luminance of 250 cd/m², and a color-rendering index of 80. Those light sources were glass tiles measuring 2 x 3 inches. The U.S. Department of Energy funded the research.

In March of this year, OSRAM reported in Applied Physics Letters the fabrication of a white OLED incorporating a blue phosphorescent dye and a down-conversion phosphor that achieved a luminous efficacy of 25 lm/W at nearly 39 cd/A. Lifetime and sensitivity of the materials to humidity and oxygen

remain problematic issues, but the down-conversion approach makes fabrication easier and improves color stability.

OSRAM really has not forgotten its commitment to OLED displays, however. This past January, the company announced a new 2.7-inch, 128x64-pixel unit with 2000:1 contrast ratio and a 55K hour lifetime.

Why should Display Daily care about OLEDs used for general lighting? Because general lighting applications offer a huge application potential, that can drive a tremendous amount of research. Some of the advances developed for general lighting applications will benefit OLED displays and, perhaps even more importantly, OLED backlighting for LCDs. –KW

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3D Displays

Matt Brennesholtz

3D Displays—Have You Seen One Lately?

Insight Media was at SIGGRAPH in Boston recently and we observed that 3D was everywhere. There were monsters with tentacles in odd places wriggling through hyperspace, warriors with full armor and axes chopping up trolls in caves, and virtual cars driving through familiar cities. 3D was everywhere, except on the displays.

SIGGRAPH is the primary trade show of the computer graphics industry. The before-show estimate was there would be 25K attendees. There were 205+ exhibitors and numerous special events including an art show, an electronic cinema theater with the latest Sony 4K SXRD projector and the world's largest Etch-a-Sketch, technical papers, training sessions and more, including endless networking opportunities.

We went to SIGGRAPH to learn more about 3D to support development of a new report we are working with the US Display Consortium (San Joes, CA; www.usdc.org). We went to the show knowing that 3D was a minor sideline for the display industry and assumed that 3D was also minor branch of the computer graphics industry. How wrong we were.

The following table from Jon Peddie Research, which was provided as part of the SIGGRAPH press kit, shows that the 3D graphics industry is about 12 times larger than the 2D graphics industry. At \$122B in 2005, forecast to grow to \$218B in 2010, 3D graphics is not a small business by any measure.

The worldwide base of SIGGRAPH exhibitors were all competing for the jaded eyeballs of game developers, movie animators and other graphics professionals. They all had big displays showing off their latest product, which was often a 3D drawing, modeling or rendering package that was better than the guy's in the next booth. Or maybe it was a server farm or a graphics card that could render high-resolution 3D images in real-time. You would think that they would be using 3D displays to show off their 3D products. They were not. We counted five booths with one or more 3D displays in them. Some of these 3D displays looked good, including ones from Philips, Planar and Barco. Others, to put it politely, did not look so good.

It is not that the people in computer graphics do not want 3D displays. While working on their latest creations, they spend a significant amount of their time grabbing their virtual objects with their mouse and twisting them around in space so they can get an impression on their 2D display of what they look like in 3D. We asked a couple of these people if they would like to have a 3D display and they said “Sure!”

| Application | 2005 \$ Billion | | 2010 \$ Billion | | CAGR | |
|--------------------------------------|-----------------|-----------------|-----------------|-----------------|------------|------------|
| | 2D | 3D | 2D | 3D | 2D | 3D |
| CAD/CAM Software | \$3.90 | \$2.70 | \$7.20 | \$5.70 | 13% | 16% |
| 2D Animation Cel | \$0.27 | | \$0.34 | | 5% | |
| Modeling and Animation | | \$0.27 | | \$0.43 | | 10% |
| Multimedia/Desktop Video Software | \$1.10 | \$0.11 | \$2.70 | \$0.69 | 20% | 44% |
| Visualization Simulation* | | \$19.30 | | \$30.30 | | 9% |
| Photo Imaging | \$0.91 | | \$1.05 | | 3% | |
| Vector Graphics & Desktop Publishing | \$0.82 | | \$1.05 | | 5% | |
| Other | \$1.00 | \$3.00 | \$2.00 | \$5.00 | 15% | 11% |
| Total Applications** | \$8.00 | \$25.38 | \$14.34 | \$42.12 | 12% | 11% |
| Hardware | | | | | | |
| Workstations | \$2.00 | \$2.72 | \$2.86 | \$3.06 | 7% | 2% |
| Game Consoles | | \$3.60 | | \$12.70 | | 29% |
| Gaming PCs | | \$90.79 | | \$159.74 | | 12% |
| Total Hardware*** | \$2.00 | \$97.11 | \$2.86 | \$175.50 | 7% | 13% |
| Total Hardware plus Software | \$10.00 | \$122.49 | \$17.20 | \$217.62 | 11% | 12% |
| | | 3D/2D | | | | |
| | | | | | | 12.2x |
| | | | | | | 12.7x |

Source: Jon Peddie Research www.jonpeddie.com (SIGGRAPH 2006 Press material)

However, the 3D display needs to be as good as the 2D display for all its important characteristics, including resolution, brightness, color points, bit depth, contrast and refresh rate. Left/right eye separation needs to be good. And by the way, the 3D display cannot cause eyestrain, headaches or vertigo: some of these graphics people work long hours.

Until 3D displays can match 2D displays in all the things 2D displays do so well, plus provide 3D images, the 3D display business is bound to remain a minor and not very important sideline for the display industry. –MB

Alternative Displays

Ken Werner, Chris Chinnock

Japanese Consortium to Produce Bendable LCDs by 2009

The *Nihon Keizai Shimbun* report in mid-July that a consortium of 14 Japanese LCD panel and materials companies—including Sharp, Sumitomo Chemical and Dai Nippon Printing – plan to develop a bendable LCD panel by fiscal 2009. The consortium, which calls itself the Technology Research

Association for Advanced Display Materials (TRADIM), is planning to make a display roughly 1mm thick – about one third the thickness of conventional LCDs used in mobile handsets – by using polymer instead of glass substrates, and by making a single LCD film perform multiple functions.

We have already seen a variety of flexible and bendable demonstration displays using different technologies, but this seems to be a different kind of effort. For one, the companies want to make a display with a resolution comparable to that of today's flat-panel TV sets.

Second, previous development efforts have involved only one or two companies. The combination here of leading display, materials and processing companies offers at least a hope that the significant hurdles on the way to mass production of bendable displays will be addressed at each appropriate level. And for even more cooperation and support, TRADIM will work with Japan's National Institute of Advanced Industrial Science and Technology and the Tokyo University of Agriculture and Technology.

Third, it's significant that the consortium is talking about "bendable" – rather than "flexible" – displays for use in portable products and on curved surfaces. There can be many degrees of flexibility in a display, from a display that unrolls like a window shade each time you want to use it to a display that is bent once when it is inserted into, for example, a curved watch case or applied to a curved surface. Making a "bend-once" display is far less challenging than making a roll-able display, although it will still keep the consortium's members busy until at least 2009.

TRADIM's budget for the project is \$27M, including \$10.3M from Japan's New Energy and Industrial Technology Development Organization.

So, what are we to make of this remarkable degree of cooperation? Some years ago, Japanese companies licensed and transferred much of their LCD and PDP technology to Korean and Taiwanese companies, rapidly becoming the third largest display-making nation in the world instead of the first, with interesting results.

On the one hand, the Japanese display industry has prospered by selling materials and components to its non-Japanese licensees and other customers, and there has also been resurgence in display manufacturing. Sharp is a leading maker of large LCDs for television, as Matsushita is a leading maker of large PDPs. And Japanese companies such as Toshiba Matsushita Display (TMD), Sharp, and NEC retained leading roles in the making of sophisticated small and/or medium displays.

But how is Japan positioned for the next wave of display technology? Frankly, not well. Although Sony, TMD, and others have OLED programs, it would seem that Korea's Samsung SDI and Taiwan's AUO are closer to (relatively) high-volume roll-outs. And some of the most exciting recent OLED developments have been coming from Kodak (USA), DuPont (USA), Samsung SDI (Korea), UDC (USA) and CDT (UK).



Philips RADIUS rollable display prototype. Is the new Japanese consortium taking a different path?

There is an even newer category of displays: highly reflective displays with very low power consumption being developed by Qualcomm (USA) and Liquavista (The Netherlands).

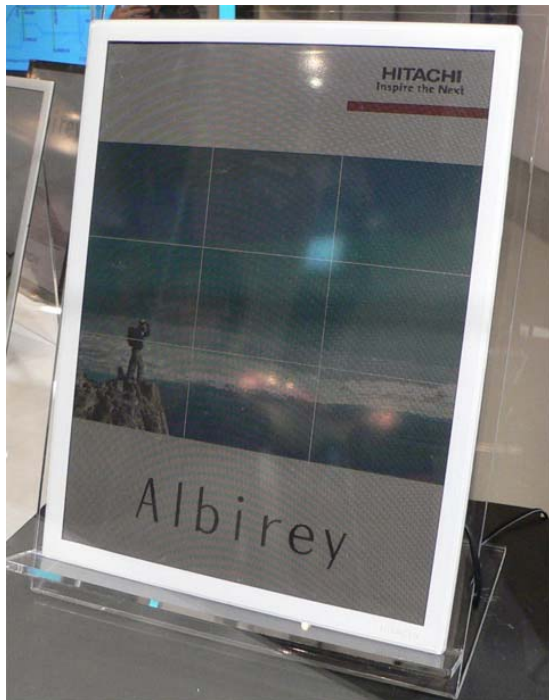
So an obvious question: where does the Japanese display industry go next? One place to go is flexible displays, where the Japanese industry's impressive expertise in materials, processes, and display integration could give it a significant jump on its national rivals. That's a goal worth the cooperation of 14 companies, 2 government organizations, and a university. –KW

A Digital Signage Display in e-Book Clothing?

Hitachi, Ltd. has developed a new 13.1-inch display that we believe breaks new ground. It is the largest color display based on E Ink's electrophoretic display (EPD) technology. Although EPD is generally referred to as an "electronic paper" display technology, Hitachi appears to be aiming its version more at signage and infrastructure use than at consumer e-books.

The display is an upgraded model of a monochrome version that Hitachi released last May. That model, called "Albirey", measures 223 x 289 x 13 mm, offers XGA (1024 x 768) pixels, 7:1 contrast, a built-in lithium polymer battery and CPU with WiFi connectivity.

Hitachi's web site shows the Albirey display being used in a number of commercial applications, especially where the display can be updated wirelessly. A trial of the panel, or its predecessors, was apparently used in train signage at Tokyo station. The key advantage of the E Ink technology is that it is bi-stable. Write the image and no additional power is needed to keep the image refreshed. It is thus ideal for application where the content is static or semi-static. Hitachi listed the price of the Albirey at about \$3,600 each in lots of ten displays – clearly not a consumer product.



The new color demonstration unit uses the same Albirey platform but instead of the white/black inks, it features a combination of red, green, blue and white inks. These are arranged in a quad pattern, which reduces the effective color pixel count to one-quarter of XGA (512 x 384). The display achieves 4096 different color shades – not impressive by TV standards, but not bad by commercial standards.

The demonstration panel was made with manufacturing partner Bridgestone Corporation, which has previously showcased an 8.1-inch 4096-color display using "dry" electrophoretic technology, most recently at SID in San Francisco this past June.

Hitachi says the new display, in addition to being larger, features higher contrast and better reflectivity than the previous model. Hitachi says it will be able to commercialize the color display in 2007. Given the reduced resolution of this product, and the commercial focus of the monochrome version, this display is not

likely to be aimed at e-book applications.

Our take: Hitachi, Sony and Toshiba are now all in the E Ink game. Toshiba has showed a 14.1-inch monochrome WXGA-resolution demonstrator at SID, while Sony has commercialized a 6-inch e-book product using an E Ink display. E Ink technology is still in the early stages of commercialization, but with major and experienced display developers behind it, the prospects are good. More importantly, the technology fills a need in the market – a low-power bi-stable electronic display that has no competitors at this time. What's not to like about that?

On the other hand, another E Ink developer, Prime View International, has had to scale back its manufacturing ramp up of E Ink-based products as its customers are delaying their product introductions. Prime View supplies the panel to Sony. No one ever said it was easy to commercialize a new display technology. –CC

Mobile Standards

John DiLoreto

Mobile Phone Industry Looks to 4G

Several mobile players have come together to form an organization that backs the creation of a 4G mobile phone network standard that they say will coexist with, and eventually replace, existing standard networks, according to a report in *Electronic News*. The organization, Next Generation Mobile Networks (NGMN), was started by KPN Mobile NV, Orange SA, Sprint Nextel Corp., T-Mobile International AG & Co KG, and Vodafone Group PLC. The partners say they have extended an invitation to other members of the mobile industry to join the organization.

“The vision of the initiative is to provide a platform for innovation by moving towards one integrated network for the seamless introduction of mobile broadband services,” according to a statement on the organization’s website.

“The initial objective of the initiative is the commercial launch of a new experience in mobile broadband communications by 2010 to ensure a long and successful cycle of investment, innovation and adoption of new and familiar services that would benefit all members of the mobile ecosystem,” the group added.

Target mobile technologies for the group include Packet Switched network architecture, HSDPA, HSUPA and EVDO. NGMN further said it addresses other industry issues, such as intellectual property rights.

Mobile DTV Alliance Readies DVB-H Standards

The Mobile DTV Alliance, which promotes the DVB-H (digital video broadcast-handheld) standard, is developing North American implementation guidelines to forestall the type of interoperability issues that plagued the launch of the first IEEE 802.11b wireless-network devices, said alliance chairman Yoram

Solomon. The guidelines, expected to be finished in September, will also “deliver consistency between what is transmitted and what the receiver can receive,” he added in a report from *TWICE*.

Official plans for interoperability testing, however, have not been announced.

“The implementation guidelines will be different for different frequency bands,” said Solomon, but for each band (1.6GHz for Modeo’s planned network and 700MHz for Hiwire’s), the guidelines will define issues “that are not in the standard and options that are in the standard.” Such issues include resolution, frame rate, audio and video codecs, and whether stereo or stereo-compatible 5.1-channel soundtracks will be delivered to handsets, he said.

“We will define how to implement the standard, and the network operators will define what they will implement,” he continued. The network operators, for example, will determine how many audio and video channels they will offer, but the alliance will specify “how to implement a video channel.”

The guidelines will also include channel-switching time, which can be as little as 1.2 seconds, not the six seconds that some have said. DVB-H can accomplish a 1.2-second channel-switching time by transmitting a reference still frame with every data burst, said TI product marketing manager James Hymel.

Other alliance guidelines will include the implementation of DVR capability and in-background downloads intended for later playback. Such services could include news updates and podcasts, Solomon said. Consumers on the go will view content for perhaps only as long as 20 minutes at a time, and must do it on their own schedule, he said.

The alliance, founded earlier this year to promote DVB-H adoption, consists of about 30 companies, including promoter members Intel, Microsoft, Modeo, Motorola, Nokia and Texas Instruments. Contributor and associate members include Samsung, SonyEricsson, Freescale Semiconductor, Harris Corporation, Mediaphy, MobiTV, Royal Philips Electronics, Silicon & Software Systems, LSI Logic, Broadcom, DiBcom, and PacketVideo. More than 100 companies worldwide support the DVB-H standard, he said.

Although US DVB-H carriers Modeo and Hiwire plan commercial launches in a few markets in 2006, Solomon doesn’t expect pre-guideline phones and services to enter the market. Modeo, handset manufacturers, and silicon manufacturers are alliance members and part of the process of creating the guidelines, he said.

Solomon expects cellular carriers to stick to high-tier phones priced from \$149-\$299, at first, to be conservative in “managing consumer expectations.” However, TI has developed a >\$10 chip that can drive DVB-H into mid-tier handsets starting around \$59, Solomon said. The chip will appeal to emerging-market carriers as well as to makers of consumer electronics products such as portable DVD players, handheld GPS devices, and in-car entertainment systems. —*JD*

Channel News

Jane Bowman

Dell Direct Stores Open in Retail Malls

Dell (Round Rock, TX; www.dell.com) opened its first company-owned store at the upscale NorthPark Center mall in Dallas. The 3,000-square-foot store carries Dell's full line of flat-panel HDTVs, desktops, notebook PCs, printers and MP3 players, as well as devices from outside vendors such as digital cameras. A second Dell Direct store is slated to open in West Nyack, NY later this year.

Dell already maintains 170 kiosks in airports and malls throughout the country, which are limited to displaying about 12 SKUs. As reported by *TWICE*, neither the stores nor the kiosks carry inventory, requiring customers to place orders for delivery. A company spokesman said the arrangement is in response to consumers wishing to inspect products first-hand before making a purchase.

Steve Baker, vice president of NPD Group for industry analysis (www.npd.com) said the storefront concept copies and expands on the kiosk model, which Dell claims generates good sales.

PC vendors have had mixed results handling their own retail operations. Gateway created the large Gateway Country Store chain, but this strategy imploded two years ago after attempting to convert them to full-line CE outlets. On the other hand, Apple Stores are a huge sales generator for the company and Apple just opened a new facility on Manhattan's trendy Fifth Avenue.

CE manufacturers including Sony, Bose, Bang & Olufsen and more recently, Nokia and Pioneer, have also entered the retail business. This led market research firm ABI Research to warn that the strategy could disrupt traditional CE retail channels and backfire for vendors.

"Stores mean ongoing operational costs as well as infrastructure," said ABI research director Vamsi Sistla. "Anybody can make money when times are good, but when economies contract, retailers are the first to be tested. Some will remain profitable, others may not." -JB

Dell, Jeremy Bolen, 512-728-8329, jeremy_bolen@dell.com

Residential Installation Channel Still Growing: Parks

Revenues for residential custom installers rose 18% in 2005 to \$7.3B, according to a first quarter survey by Parks Associates (Dallas, TX; www.parksassociates.com). Installing dealers are optimistic about 2006, with almost 40% expecting their businesses to grow by more than 20%, and another 30% projecting growth of 11% to 20%. The figures include hardware sales and installation charges.

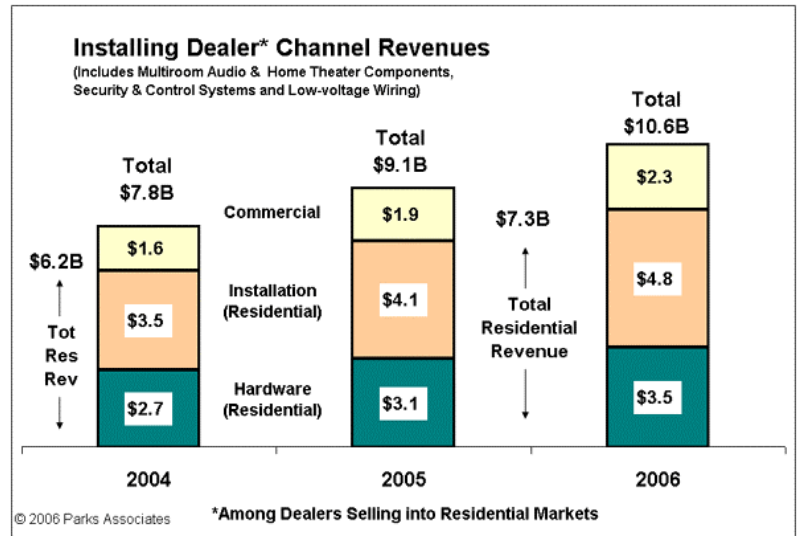
Multi-room audio, home theater and related control systems accounted for the largest share of the channel's revenues, posting sales of \$2.15B, \$2.11B and \$1.29B, respectively.

Factors driving demand for multi-room audio and home theater include more affordable systems that are broadening the market, more builders aggressively marketing the systems, and more home buyers wanting entertainment systems incorporated into the infrastructure of their homes, said Bill Ablondi, home systems research director, in a report by *TWICE*.

“The installing dealer channel is expanding, both in numbers of integrators/installers and in the sales each firm generates annually,” Ablondi added. “We’re seeing the evolution from a custom-only channel to one which is beginning to embrace prepackaged systems in an effort to expand its reach in the market,” he continued.

Russound and Denon were the top brands for audio components, and SpeakerCraft was the most popular brand of speakers, the survey found.

Parks regularly collects online feedback from electronic systems integrators, designers and installing dealers across the US. –JB



Parks, Bill Ablondi, 972-490-1113, sales@parksassociates.com

Best Buy Expands Private-Label Lines

This summer Best Buy (Minneapolis, MN; www.bestbuy.com) will expand its own Insignia brand to include a 42-inch plasma HDTV, which is HDMI compatible and will retail for about \$1,500. The sets will begin appearing in stores by mid-August, followed by three smaller LCD-TVs, including a 27-inch widescreen model.

Complementing the flat-panel array is an Insignia up-converting DVD player with 1080i output via HDMI. The unit, in stores now, has a vertical form factor and retails for about \$70, TWICE reported.

Best Buy will also introduce new line of A/V cable and accessories called Rocketfish. It will join the company's four current house brands, including Insignia (CE and PC products); Init (cases, bags and furniture); Geek Squad (PC accessories and software); and Dynex (computer peripherals, power and camcorder accessories).

According to Mike Vitelli, Best Buy's product management senior vice president, the private-label programs allow Best Buy to eliminate dozens of opportunistic off-brands while providing customers with good value and performance at opening price-points, where “we try not to compete with our technology providers.”

House brands also offer retailers richer margins. According to Bank of America Securities analyst David Strasser, the strategy can add over of 1,200 basis points of margin to a product, and in-house brands could comprise as much as 25% of Best Buy's sales within five years.

“The power of the brand has finally moved from vendor to retailer in the CE space,” Strasser observed. Other national chains with substantial private-label CE programs include Circuit City (Nexxtech), RadioShack (Accurian), Wal-Mart (ilo) and Target (TruTech). –JB

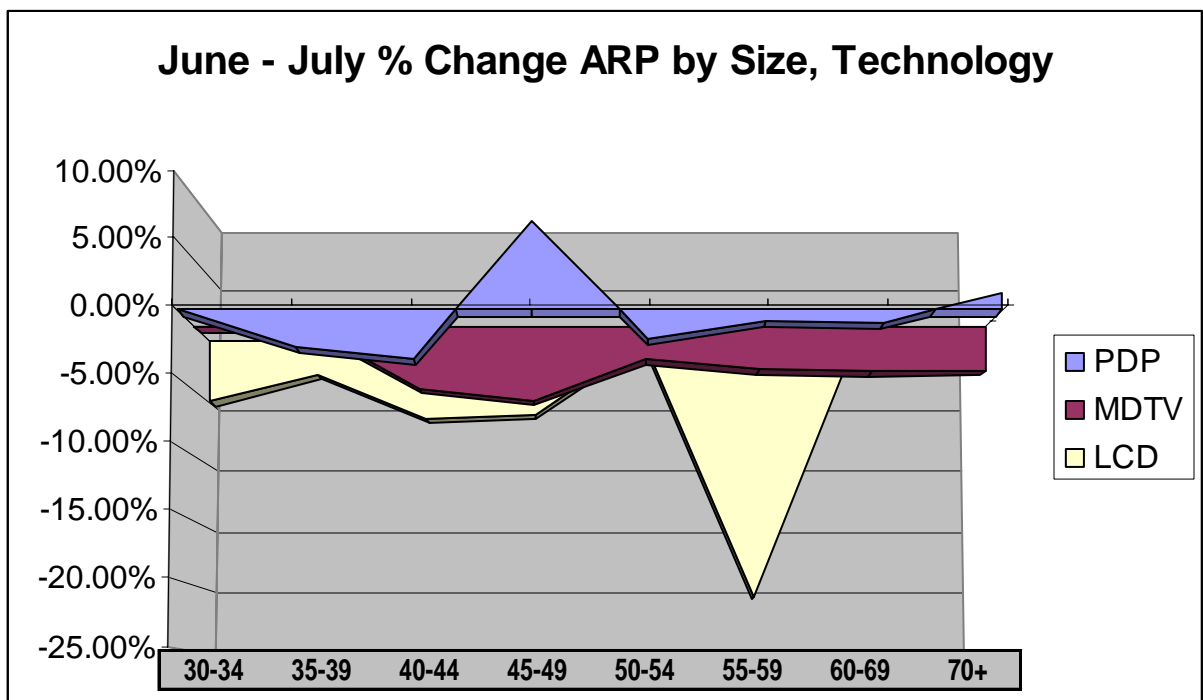
Best Buy, Jennifer Driscoll, 612-291-6110, jennifer.driscoll@bestbuy.com

Trend Analysis

Ken Tompkins

All Model Analysis

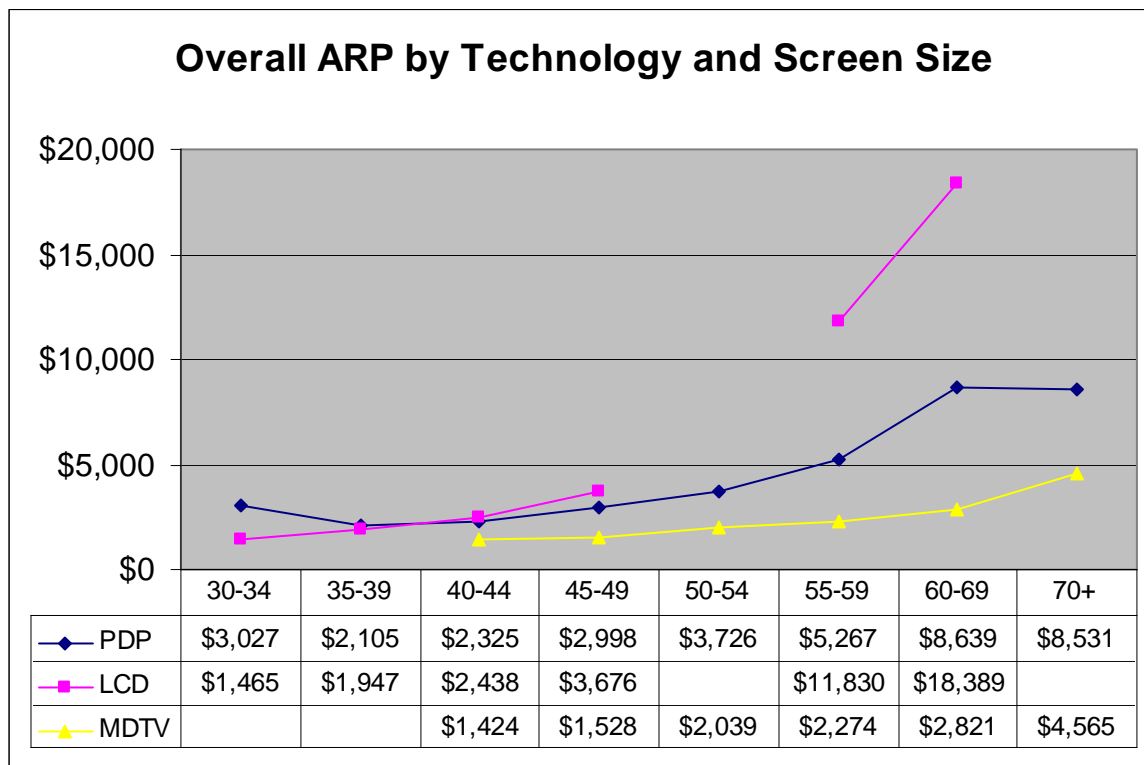
In our last issue of this report, we noted the aggressiveness of LCD-TV discounting, which resulted in 40-44" LCD-TV average retail prices (ARPs) falling to prices that are within striking distance of similarly sized PDP-TVs. This month's survey again sees LCD-TV falling by the largest percentage across most size segments. Were this trend to continue, we would see flat-panel ARP parity across all size segments. This phenomenon would take a long time to play out, however, because most LCD-TV segments are still far more expensive than the PDP-TV sizes.



Furthermore, some of the LCD-TV discounting comes from new entrants into larger sizes. As we will see in the LCD-TV analysis below, Samsung's appearance in 55-59" LCD-TV has also spurred retail discounting for a Sharp model of the same size. In this segment, Sharp and Samsung together accounted for all the fall in the size's ARP. LCD-TV's large ARP decline in 55-59" merely smoothes the LCD-TV ARP curve extending from the 40-44" and 45-49".

| June to July % Change in ARP by Size, Technology | | | | | | | | |
|--|-------|-------|-------|-------|-------|--------|-------|-------|
| | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-69 | 70+ |
| PDP | | -2.8% | -3.7% | 6.7% | -2.2% | -0.8% | -1.0% | 1.3% |
| MDTV | | | -4.8% | -5.8% | -2.5% | -3.4% | -3.4% | -3.4% |
| LCD | -4.9% | -2.6% | -6.2% | -5.9% | | -20.6% | 0.9% | |
| 3LCD | | | -3.9% | | -4.9% | -2.8% | -3.3% | |
| DLP | | | -5.5% | -5.8% | -3.5% | -5.4% | -4.0% | -3.5% |
| LCOS | | | | | 4.3% | 3.8% | -3.2% | 2.7% |

We expect this competitive jousting to increase as new flat-panel capacity ramps up for both technologies and all sizes, resulting in parity among the flat-technologies within five years.



This ARP parity is already a *fait accompli* for the smaller sizes in our survey. As we will see in the analysis below, the LCD-PDP delta continues to shrink for the key 40-44" market. In this size segment, flat-panel competition continues to put LCD-TV prices on par with PDP-TV prices of the same or similar sizes. Once the current \$113 delta falls to under \$50, the new mainstream 40-44" flat-panel technology will be LCD-TV. This switch to LCD-TV in 40-44" may begin as early as 4Q'06.

Fragmentation in the MDTV market, meanwhile, has slowed MDTV's progress in fighting off the flat-panel competition. At an ARP of \$1,424, 40-44" MDTV is too expensive to swing the momentum in

its direction. Had there been a plethora of SKUs available at under \$1K in this quarter, 40-44" MDTV may have staved off its own obsolescence in this size range. Some MDTV manufacturers are moving to put this 40-44" counter-attack in effect soon, although the momentum in favor LCD-TVs this size makes such a move difficult. –KT

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VESA is an international non-profit corporation led by a Board of Directors, which represents a voting membership of more than 140 corporate members worldwide. VESA supports and sets industry-wide interface standards for the PC, workstation, and consumer electronics industries. VESA promotes and develops timely, relevant, open standards for the display and display interface industry, ensuring interoperability and encouraging innovation and market growth.

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