

# HDTV Technology Review - 2007 Consumer Edition

## HDTV Magazine



By Rodolfo La Maestra

# HDTV Technology Review 2007

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## Introduction

As with every year, this report reviews the state of HDTV technology for consumers, its implementation, industry matters, government affairs, and the industry behind it.

This year, in addition to this report, I have produced a more comprehensive Industry Edition distributed by Display Search (almost 600 pages). On this Consumer Edition, I concentrate most of the material on what the readers of the HDTV Magazine usually devote more interest to: HDTV hardware, especially TVs.

Additionally, to round up the presentation, I provide a brief review of the main subjects related to DTV. However, due to space considerations, the full coverage of those subjects, such as digital connectivity, multi-channel audio for HD, content protection, satellite/cable/broadcast, IPTV, DTV implementation, etc. will be released in separate editions.

The review includes future products and technologies announced as of May 2007, with information supplied directly by manufacturers, or gathered at HDTV conferences, CEDIA, NAB, CEATEC, and the International CES (Consumer Electronics Show), where the industry also introduce innovations, prototypes, and technology statements.

If you are looking for a previously released product or technology that is not mentioned in this report, please consult the other annual reports available at no cost published by the HDTV Magazine:

<http://www.hdtvmagazine.com/reports/hdtv-technology-review.php>

These reports also provide a historical background of government mandates, industry agreements, satellite/cable plans, and descriptions of the technologies introduced during the covered year, including some previously reported products



that are current to facilitate reading and comparison analysis within the same document.

The group of reports can be used as a research tool for past, present, and future products and technologies, and to analyze the evolution of HDTV.

When applicable, a brief background is provided to give an historical perspective of a given subject before getting into the detail of the current year.

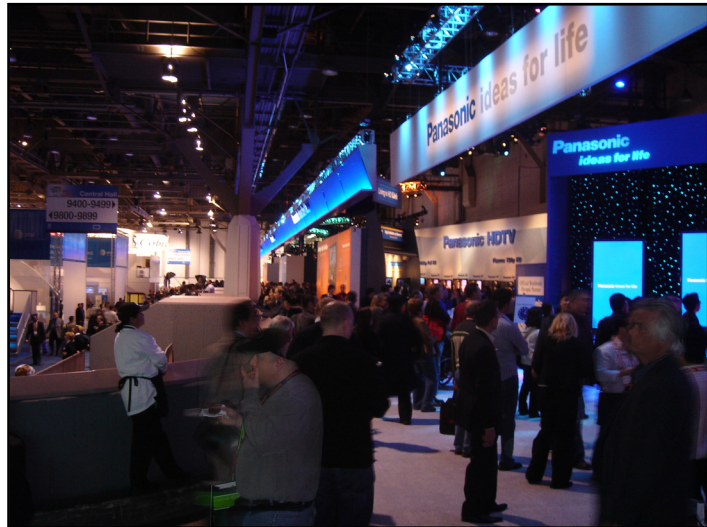
Products are mentioned highlighting the month of their introduction and future availability to provide a perspective of their maturity in the market. CEDIA and CES announcements are highlighted within each manufacturer.

Most publications show current DTV products with basic specifications and do not analyze the market to guide consumers to help them make the right choice for their needs. Hundreds of manufacturers and products are included in this report, with detailed specifications and features to facilitate comparisons with other models, brands, and technologies.

However, this report is not only about products and technologies, there is abundant coverage in sections dedicated to standards, connectivity, government, IPTV, etc. that provide a broad picture of the history and implementation of HDTV beyond a TV set, unlike any other publication or book.

From the consumer point of view, many attend CES to plan future purchases and maybe start saving for products that could be released months or

years later. Some decide to rather buy now a current product because CES helped confirm that it might not be worth the wait. This report helps consumers making those choices because of its full coverage of the subject.



The report also highlights industry trends, the adoption (or abandoning) of H/DTV technologies, the remarkable growth of flat panel displays, the endurance of continued LCoS support, the 1080p Holy Grail, the CinemaScope implementations with new 1080p projectors and anamorphic lenses, the Hi-Def DVD format war, the oversize panel competition, 3-D, and the ED display technology in all its varieties (SED, NED, OLED, FED).

This report assumes that the reader has a basic understanding of H/DTV. Certain technical information might seem overwhelming to readers that feel the need to

understand the basics first. The Glossary at the end of the report and tutorial articles at the HDTV Magazine are recommended:

<http://www.hdtvmagazine.com/articles/articles-author.php?id=16>

All types of H/DTVs and technologies are covered in this report: RPTV (rear projection TV), FP (front projectors), Direct-view (CRTs, CRPs, etc), Plasmas (PDP), DLP (Digital Light Processing), LCD (Liquid Crystal Display), LCoS (Liquid Crystal on Silicon, including JVC's D-ILA and Sony's SXRD), and the EDs displays mentioned above.

This report also reviews DTV related equipment such as Hi-Def DVD for playback and recording, HD tuning set-top-boxes (STB) for small-dish satellite, digital cable, and over-the-air (OTA) w/antenna reception, HD DVRs (Digital Video Recorders), the implementation of digital video connectivity, etc.

The information about models, prices, and specifications has been researched and confirmed with product demonstrations, lab reviews, press releases, technical material, and manufacturer interviews at CES and other conferences. Prices are quoted as MSRP and rounded to facilitate reading and quick comparisons; when unknown, TBA or TBD is generally used. Product availability is stated as TTM (Time to Market).

As the industry grows in complexity, variety, and number of HD products, the effort to research, review, analyze, and compare products, added to a full H/DTV coverage at CES and other HDTV events, and issue final projections, is becoming an overwhelming task for one person year after year.



In the past, many people referred to this effort as a "CES report". The truth is: CES is important but is just one piece of the industry perspective offered in this document. Although I know in advance the technologies and products expected to appear at CES, the show permits me to eyewitness them and talk to the engineers that participated in their development. No press release or magazine's new-product page can provide such transparent review, a unique and complete

picture of the H/DTV industry.

Additionally, the effort for preserving a broad scope facilitates the linking of all the HD areas and allows for a deeper analysis and a wider perspective across manufacturers, technologies, and the industry in general.

Although considerable effort was made to consolidate and verify the correctness of the data included in the report, I cannot assume responsibility for omissions or errors.



Should you have any comments or questions, please contact me at:

<http://www.hdtvmagazine.com/about/contact.php?name=lamaestra>

Thank you for your continued support and interest in my work.

Rodolfo La Maestra

HDTV TECHNOLOGY CONSULTING  
SENIOR TECHNICAL DIRECTOR



<http://www.hdtvmagazine.com/>

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## **Chapter 1 - H/DTV Implementation**

For a complete coverage of this subject, please consult the Industry Edition version of this report.

### **The Updated Transition Plan (2006 and 2007)**

#### **Approved New DTV Deadline**

##### Feb 06

As part of a \$40 billion budget-cutting package, it was reached a compromise DTV bill ending analog television services by the hard date of February 17, 2009. The compromise of date, budget, subsidy, etc. was achieved after doing an effort to reconcile the proposals of Senate Commerce Committee's (April 7, 2009), with the House Commerce Committee's (December 31st, 2008).

The bill finally passed as 216-214 on February 1, 2006, and the President signed it into law on February 8, 2006. The new hard date for the discontinuation of analog broadcasting is February 17, 2009.

According to some sources, the February 17, 2009 date was apparently selected considering that is two weeks after the Super Bowl and a month before the widely watched National Collegiate Athletic Association basketball tournament.

The auctioning of the analog spectrum has a new date as well: January 28, 2008. It is estimated that such auction could raise about 10 billion for the federal budget.

#### **Approved Public Education / Emergency Program**

A five million dollar budget was also approved for a consumers awareness program. The legislation would also set up a \$1 billion program for emergency workers to upgrade their communications systems.

#### **Cable DTV Downconversion**

Although the House proposal had it included, the agreed bill excluded language that would have allowed HDTV broadcast signals to be down-converted to analog by cable operators at the head-end, which would have permitted cable subscribers to view digital content using the existing analog TV's without any changes at their homes (for up to 5 years after the transition).

Such initiative would avoid requiring the acquisition of a cable digital-to-analog converter at the viewer's end, an investment estimated to be more expensive than the down-conversion at the head-end, which would have required also the continuation of the analog version of those digital channels within the cable service, and the cable spectrum required for that duplication.

According to some industry estimates, about 40 million cable television households with analog TVs would be required to get a box upgrade (and pay) for digital cable service to be converted to analog for viewing on their existing analog TVs.

The bill also excluded language addressing a) a mandate to cable for the must-carry of DTV multi-channels broadcasters pushed for, and b) the Broadcast Flag. Both issues would affect directly a broadcaster's future.

In April 2007, the FCC decided to allow Cable companies to continue their analog subscriber services even after the Feb 2009 broadcast switchover to digital.

### **Approved DTV Converter Box Budget for Subsidy**

A DTV tuner-box subsidy was also agreed (Senate proposed 3 billion, House \$1 billion), and approved as 1.5 billion. The subsidy is to help consumers that rely on OTA TV broadcasting to obtain a Digital-to-Analog converter box that would allow the viewing of DTV content on their existing analog TVs.

Consumers that need the economic support to acquire a converter could request up to two \$40 coupons. It was estimated that converter boxes would cost about \$60 each in the future; the two coupons cannot be applied to one box.

This would not affect consumers who own integrated digital televisions or subscribe to satellite services or digital cable services, which service provider already supplies the necessary decoder equipment.

### **Converter Box Subsidy Program Updates**

#### Update Jul 06

The U.S. Commerce Department proposed eligibility of an estimated 21 million U.S. households, for coupons to aid in the purchase of converter boxes, based on an estimate of the number of households who rely solely on OTA television broadcasts.

Congress passed a law providing an initial \$990 million, and as much as \$1.5 billion, to subsidize the purchase of converter boxes that would allow analog sets to receive digital signals, up to two \$40 coupons per household, to which consumers that could demonstrate eligibility would have to apply between Jan 1, 2008 and March 31, 2009.

The government requested public comment on the proposal. Ideas of limiting the coupons to low-income families living below the poverty level were suggested.

NAB's estimate of 73 million TVs not connected to cable or satellite, does not reconcile with the Government Accounting Office (GAO) estimate of 44 million TVs.

NAB's representative Dennis Wharton said "we would hope that no broadcast-only TV sets are forced to go dark during this transition".

#### Update 2007

The National Telecommunications & Information Administration, responsible for the converter coupon program, plans for their system to distribute the \$40 coupons to be ready by January 2008.

Of the budget of 1.5 billion, approved by Congress for the digital TV transition, the first \$990 million is spent in subsidizing converter boxes for the coupon program, it was decided that the remaining \$510 million would be released upon Congress approval to TV households with only over-the-air antennas receiving analog NTSC.

#### Mar 07

Rules were established regarding the coupons program for converter boxes for the DTV transition:

- 22.5 million coupons are expected to be available from the \$890 million fund.
- Starting January 1, 2008, coupons can be requested via toll-free phone number, Web site, fax or postal mail, until March 31, 2009.
- Converter boxes could cost between \$50 and \$70 each.
- NTIA can request Congress additional \$450 million, for extra 11,250,000 coupons if needed.
- The extra coupons are reserved for households that self-certify that only receive TV over the air (no cable or satellite), estimated at 19 million households.
- No income limit is required for coupons.
- Coupons could not be used for equipment exceeding the services of just tuning (DVD recorder for example); acceptable features include EPG, equipment for software upgrades, antenna inputs, and video outputs.
- Coupons expire within 90 days of receipt, releasing the money for further coupons.

#### **Integrated Tuner Mandate Update**

In mid 2005, the FCC received the input from manufacturers, broadcasters, and industry trade groups regarding an FCC's tentative decision to accelerate tuner integration on all TV sizes from July 1, 2007 to December 31, 2006, advancing 6 months the current deadline, and also including sets under 13 inches (which was not within the current mandate).

Advancing the deadline was also viewed as a way to reduce the number of D/A converters that would be needed in the subsidy program when analog signals stop broadcasting.

The CEA also requested to "eliminate the July 1, 2005 deadline that requires manufacturers to make half of the 25-35 inches sets capable of receiving digital.

Manufacturers had argued that the 50 percent deadline did not work because consumers would end up buying the cheaper analog sets, and retailers were less willing to order the more expensive, digital sets." The FCC rejected that request.

While Walt Disney, the NAB, and the Association for Maximum Service Television (MSTV) urged the FCC to adopt the advanced deadline of Dec 2006, the CEA, the CERC (Consumer Electronics Retailers' Association), Sharp Electronics, and Philips Electronics North America opposed and claimed not having enough time to manufacture those receivers by the end of 2006.

The CEA and CERC issued the following statements: "the FCC should refrain from making any rulings regarding the inclusion of digital tuners in new receivers with screen sizes less than 13 inches until manufacturers, retailers and the commission adequately are able to examine the impact of the small chassis products that currently are subject to the commission's tuner requirements." They opposed accelerating the timetable claiming that no evidence justified the change.

Other comments from the CEA regarding the effect on manufacturing and consumers of accelerating the mandate, were as follows:

"Some manufacturers could opt to market monitor-only models that remove both digital and analog tuners, or stop manufacturing certain sets altogether. For smaller sets, 13 to 26 inches, the requirement would double the development costs for manufacturers, as well as double the price of a typical 13-inch television to consumers," Shapiro said, and he added: "If the product is rejected by lower income and other consumers because the price exceeds their budget, it will not be carried by retailers and, eventually, not produced by manufacturers."

Shapiro said the "the unfortunate result of accelerating the tuner mandate deadlines for all sets would be to decrease the number of DTV tuners in the marketplace, which clearly does not serve the transition."

On November 2005, the FCC voted for setting the new date as March 1, 2007 for all sizes including those smaller than 13 inches, which received the support from the NAB taking into consideration how important they are in times of emergency, and that they are commonly used without STBs.

The revised mandate has been approved as follows:

Upon approval  $\geq 36$  inches

Mar 1, 06 for  $\geq 25$  inches (was July 1, 06)

Mar 1, 07 for  $\geq 13$  inches (was July 1, 07, although the FCC proposed Dec 31, 06)

Mar 1, 07 for  $< 13$  inches (was not required before)

The mandate does not apply to other small screen video capable devices that do not receive OTA broadcasting, even when they might be used to watch TV shows, such as PDAs, mobile phones, iPods, etc.

### **Tuner-less DTVs**

2007

Toshiba introduced new lines of HD flat-panels, rear-projection, and direct-view sets that do not include the mandated ATSC OTA tuner by not including any tuner, which then qualify the sets as "monitors."

Toshiba is not alone in this approach. CableCARD-less TV lines are appearing as well from various manufacturers that find no merit in integrating a unidirectional cable tuner w/CableCARDs into DTVs, while the cable industry is gradually moving toward a bi-directional OCAP solution.

According to Toshiba, the monitors will cost \$300 less than comparable "integrated" TVs with mandated tuners.

"This is all the video display a consumer needs if they get programming from a cable or satellite TV box," Toshiba said, and the company is absolutely correct, the large majority of TV consumers subscribe to cable and satellite services anyway.

A quick look at the background of this mandated integration on my other reports will highlight my anticipation to what Toshiba is actually doing.

### **Analysis and Projections For 2007/8/9**

The target base for DTV implementation has increased from last year's figures, it is now 289 million people / TVs (from 285) for 111 million households (from 109.7), and the 2.6 rate of TVs per household did not change.

According to CEA projections, by the end of 2007, 13 months before the analog cut-off date of Feb 2009, 83 million DTV sets would be purchased by consumers (based on the sales to dealers figure). If another 30 million would be sold in the remaining 13 months (using the 2007 estimate also for 2008), there would be 113 million sets sold to dealers by the deadline. On the surface, some could say that each of the 111 million households could be supplied with one of those 113 million DTVs, "if they buy it and if the distribution is 1 to 1".

However, what the statistics still do not show is that many of the DTV early adopters households have most probably purchased a 2nd or 3rd DTV set already for their homes, making the actual distribution of DTVs to unique households different than 1 to 1.

The projections are not indicative of how many households would actually be covered with those 113 million DTVs by Feb 2009, so I would assume a guess-estimate of around 70 million households (of the total target of 111), or maybe even less.

In such case there could be about 41 million households without a DTV by Feb 2009 ( $111 - 70 = 41$  million), which would need to have cable or satellite STBs to be able to continue receiving television content converted to analog for their analog TVs. If they do not subscribe to cable or satellite, they would have to purchase a converter box (DTV to NTSC) for over-the-air reception, hopefully, qualifying for the Government coupons for the transition.

In order to cover the 2.6 ratio eventually all the 289 million TVs would have to be replaced by a DTV set to be as capable as the TVs consumers have today regarding tuning over the air.

## Chapter 2 - DTV Standards

For other standards not mentioned on this update, please consult the HDTV Technology Review Report of earlier years.

For a complete coverage of DTV Standards, please consult the Industry Edition of this report.

### **A-VSB - Advanced-Vestigial Side-Band**

Nov 06

A-VSB is a DTV broadcast system for mobile purposes proposed to the ATSC in December 2005. During 2006 Sinclair Broadcast Group, Samsung Electronics, and transmitter manufacturer Rohde & Schwarz, joined efforts to successfully test DTV mobile reception at highway speeds.

A-VSB is expected to be included in the Advanced Television Systems Committee (ATSC) digital-TV standard by 1H07, and is backward compatible with 8-VSB the current DTV terrestrial system.

A-VSB, was previously simulated at NAB in April 2006, using forward-error-correction (FEC) "turbo-coding" for difficult signal environments, which used about one fifth of the transmitted bits for the actual video, the rest was to provide robustness so the signal is tuned well by the receiving device.

In other words, 1.5 megabits per second (Mbps) of transmitted signal would have only 375 kbps of actual video. That number of bits is considered sufficient for small devices such as cellphones and PDAs.

Sinclair's Buffalo digital station, WUTV-DT, received a temporary license for the joint group to test A-VSB in a real-world environment, and it did successfully up to 150Mph using a Samsung YEPP portable digital media player to decode and display the MPEG-4 video carried within the turbo-coded streams transmitted from a server specially suited for the parallel transmission of 8-VSB and A-VSB.

### CES 2007

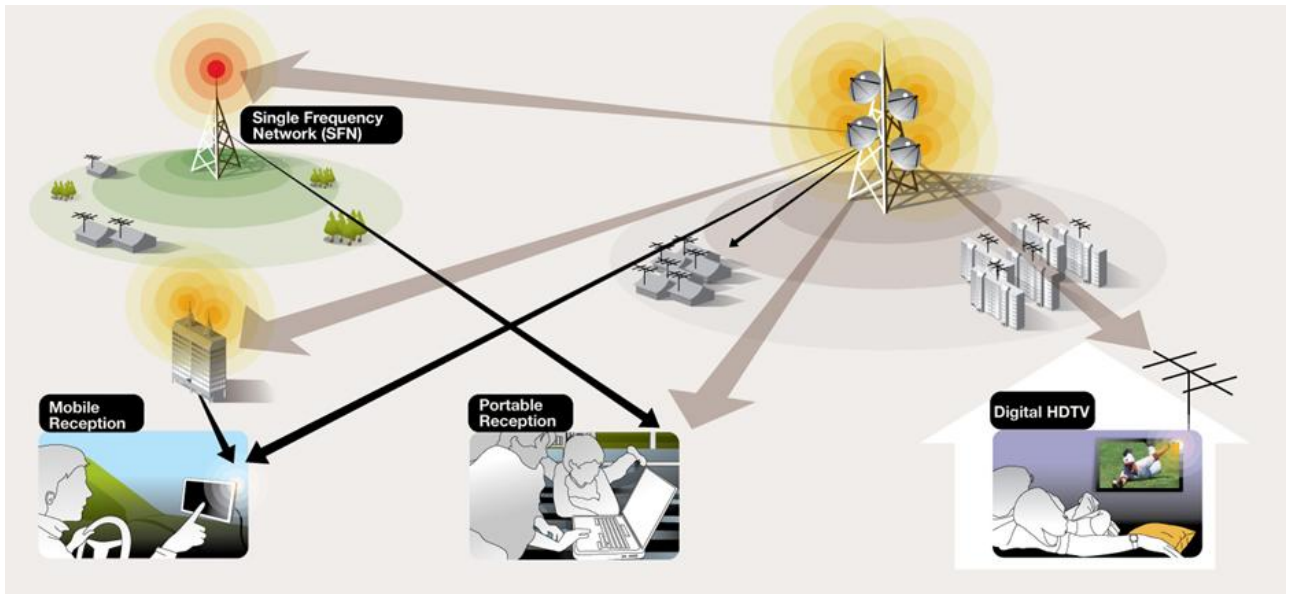
Samsung announced A-VSB and did a demonstration at the show.

According to Samsung:

"The A-VSB technology eases synchronization of broadcast signal timing of different towers in a Single Frequency Network (SFN). SFNs can improve broadcast quality with higher uniform signal strength throughout a service area, even in locations that normally would have their signals interfered with by obstacles such as hills or buildings."

"A broadcaster adds a specified Supplementary Reference Sequence (SRS) to the transmitted signal. A-VSB receivers can use the SRS in order to remain "locked in" to the transmission. This helps maintain reception of the main signal and extra 'turbo' signal(s) even when interference would normally disrupt a signal, like when the signal is reflected from moving objects near the receiver. A-VSB also enables

the receiver to stay 'locked on' to the signal when the receiver itself is moving, such as when someone is walking with their portable TV."



"Broadcasters can implement A-VSB technology with no impact on legacy (non-A-VSB) digital TV receivers. Existing legacy receivers (e.g. TV receivers not A-VSB enabled) will ignore the added information in the signal while continuing to receive the main TV stream (e.g., high definition TV programming). In addition, as A-VSB technology helps broadcasters deploy SFNs to fill gaps in the coverage of their service area, owners of legacy receivers may find their reception quality is also improved."

"The upgrade to the current 8-VSB standard could be implemented by broadcasters at low cost, possibly with just a software upgrade", said John Godfrey, VP of government and public affairs for Samsung Information Systems America, a corporate R&D lab.

"One of the options available in the A-VSB standard, he added, would enable terrestrial broadcasters to reach homes and apartments whose over-air signals are currently blocked by tall buildings or mountains. The option would enable broadcasters to build additional towers whose signals could be synchronized with their main towers in much the same way that satellite-radio providers synchronize the signals from orbiting satellites with ground-based repeaters."

"Another optional A-VSB technology is called "single-frequency network," a delay signal that broadcasters could insert into their transmission to synchronize the simultaneous transmission of a program on their assigned channel from multiple towers in a market. By filling in coverage gaps, the technology would further improve mobile and portable reception but also improve reception by legacy DTV sets in homes where over-air line-of-sight signals might otherwise be blocked. Synchronization is needed because the reception of two signals slightly apart in time would confuse the tuner and cause the screen to go black", he said.

The complete analysis and coverage of this standard is included in the Industry Edition of this report.

## **x.v.YCC**

x.v.YCC is a technology established as an industry standard by the International Electronics Commission in January of 2006 that expands the current color data range of video by approximately 1.8 times. It is based on the "Munsell Color Cascade" a universal color chart defining the colors of natural objects and is used to evaluate color expression capability of displays, which provides the ability to display more natural and vivid colors similar to what the human eye can actually see.

Sony, Mitsubishi, Silicon Image, HDMI Licensing, LLC., and others are implementing and facilitating xvYCC, a technical standard that expands the range of colors of the current standard, BT.709-5, used for HDTV; it adds shades of cyan, bright green, etc. making the colors more natural and richer. Sony is implementing the technology under the name xvColor.

"The existing standard works for most TVs, but it constrains the capabilities of LCD televisions with light-emitting diode (LED) backlights and rear-projection TVs with digital light-processing technology", Vik Murty said, senior manager of product marketing at Mitsubishi Digital Electronics America.

In a demonstration of HDMI 1.3 facilitating this feature at Dolby Laboratories in December 06 in New York City, Mitsubishi announced plans to incorporate the standard into their HDTVs beginning in April, some use lasers rather than LEDs or regular lamps.

It was commented that broadcasters are also preparing their systems to be xvYCC-compliant, and that pre-recorded media, such as Hi-def DVDs might eventually take advantage of the expanded color palette and the hi-bit support provided for that purpose with HDMI 1.3.

Features like Deep Color are also part of the benefit, which smoothes out the fine gradients between shades of colors.

More details of Deep Color and xvYCC are covered in the section dedicated to HDMI 1.3 digital connectivity, a connectivity requirement that source and display devices must have to be able to transport the higher requirements of Deep Color and xvYCC.

I discussed with Silicon Image, HDMI Licensing LLC, and HDMI the issues of what consumers should know when buying HDMI suited products, such as TVs, players, etc.

Some consumers demand that HDMI be 1.3 without looking at the features of the products. Specifying the existence of 1.3 in a product spec is not enough to determine if a TV is able to do everything the 1.3 specification can facilitate, such as xvYCC and Deep Color, therefore is recommended and necessary for manufacturers to clearly indicate the implemented features rather than just indicating (or consumers requesting) only a 1.3 HDMI specification version.

## **LG's MPH (Mobile-Pedestrian-Handheld)**

In April 2007 at NAB, LG introduced a system developed by Zenith Electronics and Harris to broadcast ATSC DTV broadcasts to mobile devices. It was not disclosed if the system was submitted to consideration as a standard, to compete with the A-VSB system from Samsung and Sinclair, mentioned above.

The system uses a multiple-stream approach, the main stream for legacy DTV devices tuning to A-VSB and the MPH stream for mobile devices even operating at high speed.

## Chapter 3 - Satellite, Cable, Broadcasting

For the complete coverage of the subjects of this chapter, please refer to the Industry Edition report.

### Satellite

#### DirectTV

#### CES 2007

##### Current Satellite Fleet

Orbit in degrees	Service	Bird Name	Status
72.5	Local Broadcast Channels	D1	Existing
95	International Programming	G3C	Existing, Leased from PanAm Satellites
99	Local HD Broadcast Channels	SW2	Existing
101	Core Programming Services and Local Broadcast Channels	D10 D1R D4S D8 D9S	D10 Planned for 07 All Existing
103	Local HD Broadcast Channels	SW1	Existing
110	HD Programming	D5	D11 Planned for 07 Existing
119	Spanish-Language Program. HD Programming Local Broadcast Channels	D7S	Existing

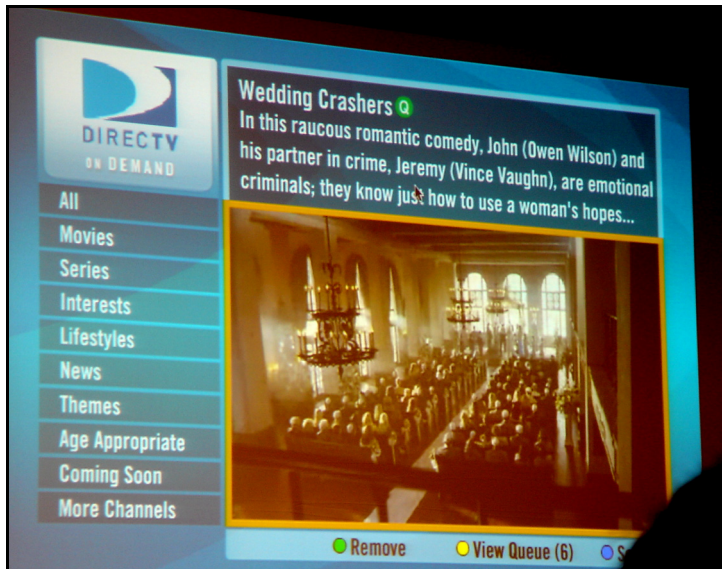
##### More Local HD Channels as Planned

DirectTV confirmed again that the company is on track with the plan to launch over 100 channels of HD programming in 2007, according to president and CEO Chase Carey, with most of those channels expected to be available 3Q07.



DirectTV stated the it has made agreements with 70 hi-def channels, among which are sports networks YES and NFL Network, CNN, USA, The Weather Channel, TBS, Food Network, A&E, Bravo, FX, HGTV, MTV, The History Channel, USA Network.

Comcast Sports Net, New England Sports Network, National Geographic, Cartoon Network, Sci-Fi Channel, Speed, and FOX Sports.



#### Gaming Channel (Although not in HD)

DirecTV announced the launch of a new professional sports league for video gaming on DirecTV 101, and commented that the program will have the best players in the world playing on franchise teams, and those players will be earning a salary in addition to compete for the \$1 million price.

#### NASCAR HotPass HD

DirecTV introduced "The Zone", a NASCAR oriented service to provide exclusive coverage to subscriber fans with a mobile luxury lounge located within the infield at select NASCAR events. The service will debut at the Daytona 500 on February 18 at Daytona International Speedway, and appear at 17 races through out the 2007 NASCAR NEXTEL Cup season. <http://www.directv.com/hotpass>

#### Mobile DirecTV

DirecTV introduced a portable receiver/display system named "Sat-Go", ideal for traveling subscribers, as long as they can carry the 25-pound briefcase. TTM Spring 2007, \$1,500.

The system features a flat DirecTV antenna, built-in 17" display, rechargeable laptop-type battery, and a receiver. The receiver can be detached and put to use in regular receiver applications.

The portable receiver was designed by TV producer Rick Rosner, who licensed the technology to DirecTV.

More details in the HD Tuner/DVR Section.



## Dish Network (EchoStar)

### CES 2007

EchoStar announced their offering of free ViP622 HD-DVRs to new customers starting Feb. 1, 2007, and named the effort "Digital Home Advantage Program".



Please check the HD Tuner/DVR section for the features of this receiver.

EchoStar also introduced a portable DBS system (as DirecTV did) at CES 2007, TTM of the "MobileDISH" system is spring 07.

However this system is not as portable as DirecTV's, it is designed for vehicle applications with a roof-mounted antenna designed by RaySat.



At CES 2007 DishNetwork also showed a ViP 622 with an external expansion Hard Disc Drive (picture below; and back of the unit further below)





## Microsoft Partnership

In February 2007, Dish Network has been reported to be working with Microsoft to offer satellite programming to PCs, one year after DirecTV's deal with Microsoft for direct downloads from DirecTV's STBs.

## Cable

### DOCSIS 3.0

DOCSIS® (Data Over Cable Service Interface Specification), is a CableLabs certified project to define interface requirements for cable modems implemented on cable television systems for high-speed data distribution, facilitating industry compliance with certification and retail sales of cable modems.

One benefit to consumers is a low-cost "always-on" Internet connection, including broadband Internet connectivity, telephony, real-time interactive gaming, and video conferencing, which could create business opportunities to cable companies.

According to James A. Fontaine, President and CEO of Microtune, "DOCSIS 3.0 represents a major technology shift in the cable industry, permitting cable operators to enable faster, scalable broadband Internet services, including movie downloads and other IP video".

"Our new wideband tuner is key to enabling true DOCSIS 3.0, and we have been actively involved in the definition of the DOCSIS 3.0 specification which ensures our compliance with this important standard. As a major supplier to the industry's premier equipment manufacturers, we are providing our customers cost-effective and highly advanced technology to help them accelerate adoption of DOCSIS 3.0 capabilities in their next-generation cable products".



"DOCSIS 3.0 and wideband technologies are part of the cable industry's effort to counter the Telco's capacity advantage, and Microtune's new wideband tuner is a key component that will enable cable operators to deliver new high-bandwidth broadband Internet services".

Microtune announced their new DOCSIS 3.0 wideband tuner chip (MicroTuner™ MT2170) capable to handle a wider (100 MHz) and faster (160 Mbps) cable modem connection to homes, competing with high-powered fiber-to-the-home networks.

The chip was said to be capable to tune between 50 MHz-1 GHz, which would make a cable plant of 750 MHz or 860 MHz to be able to grow to 1 GHz and accommodate for twenty extra 6 MHz channels, which could be used for IPTV services, HDTV, channel bonding, etc.

According with Microtune the spec would also permit the bonding of non-adjacent 6 MHz channels from a 64 MHz spectrum range, which the Wideband tuner can raise to 100 MHz, handling about 16 bonded channels. Please check the HD tuner section for specs.

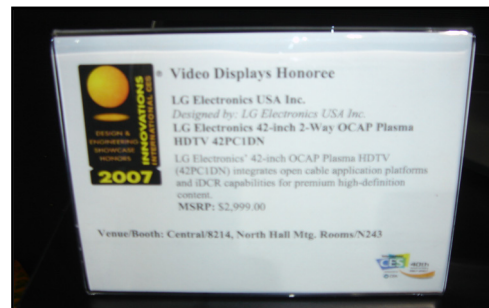
## **CES 2007**

Comcast Cable and Cox Communications are moving forward with their support for OCAP (Open Cable Application Platform) middleware by CableLabs.

Cox and Samsung signed a letter of intent to implement OCAP on several CE devices, such as TVs, set-top-boxes, and DVRs.

On the announcement Cox said, "Our successful trial of the Samsung OCAP solution illustrates Cox's dedication to offering customers additional devices that will operate seamlessly alongside our current leased devices".

CableLabs certified a 42" plasma from LG which implemented bi-directional OCAP middleware.



Comcast and Panasonic agreed to begin testing OCAP-based interactive digital cable-ready software in Panasonic's products in January 2007, with target availability beginning 2008.

Upon the agreement Comcast declared, "The development of OCAP-powered TVs is another example of how Comcast is working with the CE industry to enhance the consumer viewing experience by making it even easier to enjoy new interactive applications combined with the convenience of integrated digital cable services".

Thomson introduced their first OCAP cable HD STB for the US market.

The DCI9000 HD-STB.

Further detail on this subject is included in the Industry Edition.

**The CableCARD Implementation - Current Situation**

Dec 06

According to CED, as of November 2006, there were 216,000 CableCARDS supplied by cable operators as reported by the National Cable & Telecommunications Association (NCTA).

Comcast Corp., Time Warner Cable (and Adelphia), Cox Communications, Charter Communications and Cablevision Systems Corp., deployed 191,000 CableCARDS covering 80 percent of U.S. cable subscribers.

Regarding the effort for the CableCARD deployment the following averages were provided:

Cable Co. / Average	Cablevision	Charter	Comcast	Cox	Time Warner Cable
Truck rolls	1.1	1.3	1.05	1.101	1.73
Monthly lease	\$1.25	\$1.50	None	\$1.94	\$2.05

The same report indicated that 541 products from 29 CE companies implementing Unidirectional Digital Cable Ready Products (UDCPs) were CableCARD verified.

**CableCARD Implementation Analysis**

Those that have followed my coverage of FCC’s mandated integrated ATSC tuners and unidirectional CableCARDS/QAM tuners in HDTVs in my yearly reports, might be familiar with my position on the subject, and what that means to consumers pockets and their power of choice, which is my primary concern.

CableCARD was pushed as a positive feature to consumers, consumers believed cable STBs were not needed anymore, while the real situation was and still is, that CableCARDS into TVs made those sets cost more than they should, and most consumers still have their STBs on the same place they were before CableCARDS.

Cable companies did not implement CableCARD as the FCC has hoped. The CableCARD solution as implemented was only unidirectional, and still is after several years, while waiting for the proper solution. Consumers paid more for their DTVs but there were no (tuner-less) monitors around anymore to compare prices and determine the additional cost.

The idea of a TV being "cable ready" without a set-top box and simply plug the cable and install a CableCARD in the dedicated slot did not work as expected, it was a half-way to get to a final solution.

Many manufacturers have been removing the CableCARD tuners and some even the ATSC tuners from their newer lines since 2006, and label those sets "monitors", going around FCC's integrated tuner mandate by not including the legacy analog NTSC tuner into the sets. As mandated, if it has a legacy NTSC tuner, a display has to have digital tuner (and the CableCARD/QAM tuner went with it).

The main problems I saw since day one was that:

- a) Digital tuners were still expensive at the time of the mandate, and still are,
- b) The consumer did not have a choice, most DTV manufacturers did not produce monitor lines (tuner-less DTVs).
- c) Over 90% of TV viewers would not need terrestrial tuners because they subscribe to cable or satellite, who supply their boxes anyway,
- d) Satellite boxes already have a terrestrial over the air tuner,
- e) Cable boxes are still needed for PPV, VOD, and cable supplied EPG, because CableCARD tuners, implemented as unidirectional, lacked those features.
- f) The consumer is paying for the planned obsolescence of unidirectional CableCARD tuners into new DTVs that would not be able to be upgraded.
- g) The saddest: Proper advice was not provided timely to most consumers and there are now millions of unidirectional CableCARD-ready DTVs in their homes, and still growing.

According to a recent report, Panasonic commented that the "CableCARD effort stalled, as the victim of conflicting business interests, manufacturing costs and a lack of consumer response. Out of six million, CableCARD-ready digital TV's sold only 170,000 sets. Less than 3 percent are actually using a CableCARD device. The rest are receiving digital cable and HDTV programming the more familiar way, through the cable company's rented set-top box."

In December 2006, an update of CableCARD deployments was reported by CED to have reach 216,000-plus, details in the DTV implementation section.

As mentioned above, according to a report made to the FCC in March 2007, more than 259,000 CableCARDS have been deployed by cable companies, among which are Comcast Corp., Time Warner Cable, Cox Communications, Charter Communications, Adelphia (now part of Comcast and TWC), and Cablevision Systems Corp.



Regarding CableCARD suited equipment, the NCTA reported over 548 models available from CE manufacturers, however, and those are unidirectional only.

However, a research from the Envisioneering Group revealed that "80 percent fewer television models with CableCARD are available this year [2006] than in 2005".

According to Sharp Electronics, offering 10 CableCARD sets in 2005, in 2006 did it in only 2 (\$16K+ hi-end models).

Philips Electronics was reported to offer only 3 CableCARD models in 2006 (down from 7 last year).

Sony also reported a reduction to 2, from 4 (\$5K+ models).

Rich Dinsmore, vice president for marketing at TTE Corporation, owner of the RCA brand, declared "As manufacturers, we are disappointed in the CableCARD's rollout, which increased the set's retail price by about \$40, to collect that extra money in today's retail environment is very difficult when nobody talks about the feature in the retail store."

However, I believe Mr. Dinsmore was not considering the overall picture of tuner integration, which have cost consumers much more than those \$40 per tuner.

When I did the first research on the year integrated TVs were mandated by the FCC the average difference between DTVs with digital tuners and their monitor counterparts, was \$704 more. In some cases, plasmas were priced over \$1000 more for that integrated tuner feature. Please read the details at my earlier reports since 2004. The addition of a CableCARD/QAM cable tuner using the mandated digital tuner integration exacerbated that extra cost.

In other words, a mandate could have worked well if a) tuners cost less, b) the bi-directional cable technology intended to replace the cable STB would have been ready and matured, and c) volume would have helped bring TV and component prices much lower than it did.

Those factors were not in place in a timely fashion, and a mandate without having those factors was not respectful of consumers pockets and freedom of choice. Consumers are also implicitly mandated to foot the bill for the planning errors of the DTV transition.

Ross Rubin from NPD group was reported to say "The set-top box offers cable providers a point of control, a presence in the living room, Comcast and Time Warner have had very good success with offering digital video recorders, which require a set-top box."

A research from Kagan Research, said "45 percent of the nation's cable customers used set-top boxes that enabled them to receive such digital services, not offered by CableCARDs, because those services require a bi-directional system, a feature CableCARD does not have as implemented."

Several manufacturers have been working with the cable industry to suit their TVs with two-way CableCARDs and OCAP software technology (mentioned earlier), but

those products are not yet available in volume, and the millions of HDTVs that have already been sold with CableCARDs slots cannot be retrofitted to accommodate for the new technology.

Please read the analysis on the subject on previous reports, millions of consumers and dollars were wasted on this effort for CableCARD products since they were introduced a few years ago, and many millions more will be sold before the complete solution is implemented into DTVs, probably in another year or two.

From another angle, "Some operators have made it difficult for consumers to get a card and encouraged them to take a set-top box instead. The cable operator is in the business of selling services, not hardware," said Neal Goldberg, general counsel for the National Cable and Telecommunications Association.

In addition, he added, "The Federal Communications Commission mandated that consumers be made aware of CableCARD's limitations, and the cable industry is following that mandate by posting information on its Web sites and supplying it when consumers request a card. Once consumers learn that they will not be able to get pay-per-view and video-on-demand with a CableCARD, many opt for a set-top box."

Over the past couple of years I personally did many calls to cable representatives to obtain the kind of information Mr. Goldberg mentions, cable companies never volunteered clear responses unless specifically asking for the issues, and in many cases the responses showed ignorance about the subject, intentionally or not.

Reportedly, "The CableCARD is essentially dead," said Mr. Doherty of Envisioneering. "It will go down in history like the Edsel."

I wonder if that history would also say, "Rodolfo predicted it since day one, over 3 years ago".

### **Multi-Stream CableCARD**

In July 2006, CableLabs® awarded qualified status to Motorola for its Multi-Stream CableCARD™ (M-Card™) that would allow STBs or Cable-ready TVs to tune to multiple programming to watch and/or record simultaneously.

The M-Card, a security component of the cable system, is also backwards compatible with unidirectional devices such as current CableCARD TV slots, but it would perform in a single-stream manner, similar to the current CableCARD.

M-Cards originally planned to become available from MSOs within 2006. They can be tested with a tool (HPNx PRO) made by Digital Keystone together with CableLabs, which would be made available to CE manufacturers to test M-Card related devices.



In November 2006, a "streamlined process" was launched for the testing the M-Card whereby manufacturers would be allowed to perform self-verification of their M-Card-enabled devices.

Support from TiVo Inc., Motorola, Digeo, Solekai, Digital Keystone, and ViXS was given to the process, according to CableLabs.

DVRs would be benefited by the M-Card approach because it would permit a dual channel reception to record one channel while viewing another.

Tivo Series 3 performs a similar feature but by designing the boxes with dual unidirectional CableCARDS (and dual slots in the box), which the M-Card would simplify to only one slot, one card.

The NCTA confirmed that CableLabs has qualified M-Cards from Cisco/Scientific Atlanta and Motorola.

### **Cable STB Integration Ban**

By July 2007, cable service providers are supposed to separate their security functions from the other set-top-box functions; the use of a CableCARD for the security functions is expected to facilitate that split.

Under the plan, the consumer would be able to purchase a cable STB in a retail store and request a CableCARD to the cable company to unenable the security features related to the subscribed service.

Further coverage on the Industry Edition.

### **Congress Support for DCAS**

In November 2006, Congress sent a letter to the FCC to recommend not to implement the "Integration Ban" as planned for July 2007 using CableCARDS on STBs but to rather consider a software downloadable solution such as the one the industry has been working over the past few years, DCAS, Downloadable Conditional Access System, viewed as less expensive and more practical than the CableCARD.

According to CED, "the letter - dated Nov. 27, 2006, and signed by Senate Commerce Committee Chairman Ted Stevens (R-Alaska); House Energy and Commerce Committee Chairman Joe Barton (R-Texas); and Rep. Fred Upton (R-Mich.), Chairman of the House Subcommittee on Telecommunications and the Internet - argued that the FCC has 'ample authority at its disposal' to establish a timeframe for cable operators to develop and deploy downloadable security."

Further coverage in the Industry Edition.

### **FCC Approved DCAS – Some Integrated Ban Waivers**

In January 2007, the FCC agreed that DCAS (Downloadable Conditional Access System) would comply with its rules of separating security from cable tuner functionality, recognizing that the solution was a "more elegant and less expensive" option.

FCC's Media Bureau denied the waiver Comcast filed in May 2006 regarding Motorola DCT700, Scientific Atlanta Explorer 940, and Pace Micro Technology DC501p (Chicago); reportedly, Comcast will pursue their case with the Full Commission.

Other waiver requests from Verizon, RCN, and Charter Communications, were still on hold by the FCC.

However, the FCC granted requests from BendBroadband and Cablevision Systems Corp.

Cablevision's request was granted on the merits that their STBs already had a Smartcard design since 2001, although not performing the kind of security-independence a CableCARD solution would. The FCC granted a temporary grandfather permission to continue using the Smartcard boxes, but they would have to be replaced by July 2009, granting 2 years of extension to the full replacement.

BendBroadband request dated October 2006 was approved; the company's limited capability boxes can be used until digital replacement be done in 2008.

Further coverage in the Industry Edition.

### **Switched Digital Video (SDV)**

Using SDV a cable company can dynamically make available only the channels that are actively requested in a given area, using only the bandwidth required by those, which allows for increased allocation for hi-speed internet and telephone services using the same pipe. It would also allow increasing the number of channels in the cable service without incurring in expensive upgrades.

The dynamic distribution of channels to nodes is triggered by viewers requesting them, once the last viewer on a given channel ceases to view the channel, it is no longer sent to that node.

The system permits the continuous use of existing coax to the home without having to upgrade to Fiber, which is expensive to a cable company.

Please consult further detail on the Industry Edition.

## **Broadcasting**

Please consult the Must-Carry subject in the Industry Edition.

### **3-in-One TV Tuner**

In February 2006, MicroTune announced a chip capable to tune ATSC/NTSC/Digital Cable Ready (DCR) for under \$3, the MicroTuner MT2131.



As you see on the photo the tuner is very small, and it performs the functions of about 100 silicon components, reducing the bill of materials by about 60%, according to the company.

### **Down-Conversion Proposal**

In Aug 06, Broadcasters from ABC, CBS, NBC and Telemundo complained to Senators and leaders of the house about a U.S. House of Representatives plan (H.R. 5252) allowing cable and satellite TV operators to down convert over-the-air HD programming to SD resolution for delivery to subscribers until Feb 17, 2014.

“It would be like allowing a third-party competitor to convert color TV to black and white”, some broadcasters wrote to the legislators.

The complaint did not include down conversion from digital to analog devices.

### **Do You Know Where Your Recording is Tonight?**

In April 2006, Cablevision announced plans to offer for later in 2006 RS-DVR (remote-storage digital video recorder), a service for subscribers to make remote video recording, without a DVR at their homes, with current STBs, at the control of the viewer's remote, in other words, transparent to the user.

The recording would be stored at servers located at Cablevision's facilities, which means no DVR distribution, installation, and maintenance, reduced costs.

Some issues needed to get resolved at the time of announcement such as the expected cost-savings to be passed on to customers, legal issues with program providers.

Cablevision had plans to test the service in its Long Island, NY, market for 60 days, which would require a software download on set top boxes.

### **Broadcasting Industry Preparing for 1080p Production**

In Feb 07, the industry said it was reading the offering of a number 1080-line progressive production products and the implementation of a 3Gbps networking pipe for delivering 1080p HD throughout a station, automatic analog-to-digital conversion of audio and video, and multi-channel solutions, running under the same control and monitoring system.

Harris' Platinum and Panacea are some examples.

Pro-Bel's Cygnus router, 1080p capable, 576x576 routing in a single 26 rack-unit housing.

NVision will introduce their 3 Gbps router at NAB 2007.

## **Chapter 4 - Internet Protocol TV (IPTV)**

The complete coverage of this subject is in the Industry Edition.

### **Introduction**

IPTV is becoming the buzzword used to generally name TV distribution using IP networks. Some IP content distributors that only offer limited services making subscribers believe this is a full service with all the features of legacy digital cable are also using this term very loosely.

There are several camps on this subject, on one side some industry experts firmly believe that the infrastructure of our current IP networks is solid enough and is ready for full-blown HDTV distribution over IP. As you will see below several companies and Telcos have not only started testing IPTV, they have also successfully implemented services for thousands of subscribers.

Other industry experts assert that consumers customarily use more bandwidth than what current networks can support, and the current capacity would not be able to also support real time HD video in addition to the variety of digital activities consumers do every day. These experts say that HDTV distribution using IP would not replace real-time traditional broadband methods such as cable and satellite.

Some actual implementations from manufactures and Telcos offer hardware and services that give the impression that IPTV is ready to handle several HDTVs programs in parallel to having several PCs in the same house downloading movies, music, files, photos, etc. all running over the same IP pipe.

### **What Does IPTV Mean to You?**

IPTV manages TV signals stored as digital files that can be distributed within packets using Internet Protocol (IP) to devices such as video cell phones, iPods, and other portable receivers, in addition to the TVs at home.

One IPTV application is the video service distribution from telecommunications companies such as Verizon, Bell South, Qualcomm, and AT&T Wireless to deliver movies, TV shows and sports highlights to the subscriber's PCs or handsets.

IPTV is also the term used by Telcos to describe sending telephone, high-speed Internet and TV channels over hybrid coax or fiber-optic cable.

Some IPTV services supply only VOD; others include real-time HDTV as well.

One of the virtues of IPTV is the ability to maintain a two-way communication with subscribers, as opposed to unidirectional terrestrial broadcasters. However, with IPTV those broadcasters can generate new revenues from the same content by expanding the distribution via IPTV to destinations other than regular antennas.

According to Broadcast Engineering "ESPN and CNN HD content viewed by consumers at their PCs is distributed using a separate IP routing system that delivers the video over the Internet within IP packets. Tribune Broadcasting, and Sinclair

Broadcast Group use TeleStream's FlipFactory for IP delivery to share content. Leveraging technologies such as these from the Associated Press, CBS News Source, Path 1 and other video resources".

### **Different Methods of HDTV Over IP**

When using standard MPEG-2 compression, an HD channel requires about 19 Mbps of bandwidth to be transmitted. If using DSL or cable modem, although is considered hi-speed for typical Internet services, it currently have the capacity to transmit only a small fraction of what raw HDTV requires.

Even when re-compressing the 19 Mbps with more efficient compression algorithms like MPEG-4 or VC1, and even when using additional transmission-saving techniques to fit HDTV content into those typical hi-speed Internet services, the approach would be a challenge, not to mention that, after making use of this bandwidth for HDTV, there will be little or no room left for Internet downloads of music, files, photos, etc.

Additionally, it becomes less feasible to consider accommodating additional parallel real-time HD channels to satisfy the individual viewing needs of a typical home with several TVs.

Some IPTV advertising campaigns say "we could download any HD program of your choice into the DVR for later viewing", the download could happen while you sleep, the downloading speed would not need to be as fast as the viewing speed from the DVR.

Others say, "we could send the program for real-time viewing" which generally means one selection from a group of options, like a VOD service.

Other IPTV service providers claim to have found a way to send several HD feeds throughout various rooms on the home.

Others advertise having hundreds of channels on the line up, but fail to elaborate on the viewing restrictions, compression artifacts, freeze ups, single TV per home limitations, etc.

IPTV service providers like AT&T and Verizon consider themselves to have an advantage over cable companies because their IPTV services only require just enough bandwidth to send the selected channel.

This means they do not need to send out all the 150 parallel channels like cable and satellite. More specifically, the channel tuning selection is not done the traditional way as with terrestrial, cable, etc, where a viewer chooses from a wide selection of parallel channels arriving to the STB and selects only one from the multi-channel stream.

When using IPTV, you select and request delivery of the specific program to your STB from the line up. Such delivery could be viewed in real-time or be downloaded to a DVR for later viewing, depending of the service and installed hardware.

IPTV is being implemented in different flavors, and part of the reason for the variation is that while some neighborhoods have very limited Internet speed, others have been provisioned with very fast fiber optic networks.

### **Current/Planned IPTV Market Solutions**

A couple of years ago I was contacted by a company that developed an HD-IPTV system. Using this solution, consumers would purchase client STBs for PCs and stand-alone TVs and receive IPTV content even at 1080p quality, as claimed by the company.

MatrixStream is the name of that company, founded in 1999 and headquartered in Vancouver, British Columbia. I included their launched HD 1080p server/client IPTV products on last year's annual HDTV Technology report (March 2006, 2006 HDTV Technology Report).

The interesting part was that the company also offered hardware to enable "anyone" to become a content distributor via IP from a server to clients in a network.

The company adopted MPEG-4 Part 10/H.264 compression which cuts in half the stream requirements to transmit via IP the typical HDTV content compressed with MPEG-2. MatrixStream also implemented techniques to optimize the transport over the Internet by using proprietary buffering and error-correction techniques that compensate for Internet bottlenecks.

MatrixStream claims they can transmit a DVD-quality TV signal requiring only 1.5 Mbps and a high-definition 1080p signal requiring only 2.5 Mbps, both within the limitations of typical DSL and cable-modem hi-speed connections.

If you are interested in further information, please consult the details of companies implementing the IPTV concept as well as some leaning lessons, the hardware, the systems, etc. on the Industry Edition report.

## Chapter 5 - CRT, SED, OLED, FED, NED, 3DTV

In this section, I first cover the technology subject, and then I cover the display manufacturers with their products. However, some technology descriptions are included within the coverage of each manufacturer.

Based on the actual sales of analog CRT direct-view reported for 2006 and the planned sales for 2007, there may be a lack of consumer education regarding the DTV implementation and analog obsolescence. The consumer has not yet abandoned CRT analog and still buys in the millions of units.

You may review the unfortunate situation of Canon and Toshiba regarding their SED plans, and the new efforts by Sony regarding OLED.

### The Technologies

#### LCD vs. CRT in Europe

Nov 06

Europe has shown a turn in the CRT vs. LCD consumer choice, whereby LCD is taking the place of CRT earlier than anticipated.

As reported by CNET News (credit due to Michael Kanellos):

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*"LCD televisions outsold conventional CRTs in Europe for the first time in the third quarter, according to data released Monday by research firm DisplaySearch. And North America is next.*

*Worldwide, shipments of liquid crystal display TVs were up 99 percent compared with the same period last year. During the three-month period, 10.8 million units left factories, according to DisplaySearch.*

*The crossover to digital TVs is occurring earlier than predicted. In part, it comes from the fact that manufacturers continue to drop prices at a rapid rate. The surge can also be attributed to interest among consumers for high-definition TVs and services. Sales of LCDs will outpace cathode ray tubes (CRTs) in North America this quarter, according to DisplaySearch.*

*Among the digital TV standards, LCD is increasing its size over plasma. Plasma TV unit shipments were up 38 percent in North America--slightly faster than the 35 percent growth of LCDs--but down in other regions. LCD TVs traditionally have smaller screens than plasmas, but manufacturers have been upping the size. LCD manufacturers now sell 40-inch TVs--the plasma stronghold--and will try to compete in the 50-inch and larger space next year with technology that will purportedly improve picture quality.*

*In response, plasma manufacturers have been cutting the costs of their products.*

*Overall, Samsung shipped more TVs worldwide and culled more revenue from TVs in the third quarter than its competitors, according to DisplaySearch.*

*Samsung had fallen behind South Korean rival LG in terms of unit shipments in the second quarter. LG accounted for 11.4 percent of shipments in the second quarter, while Samsung accounted for 10.6 percent. In the third quarter, Samsung rose to 11.2 percent, while LG declined to 9.9 percent.*

*Samsung also accounted for 15.2 percent of TV revenue worldwide, widening the gap with Sony, which sits at 10.3 percent.*

*But, the average store price for a TV was \$548, up 25 percent in the period, thanks to interest in flat-panel and high-definition TVs.*

*Analysts, in fact, note that people are spending more on average on flat-panel TVs than they did in the past, though prices of individual sets are going down. The conclusion: consumers are gravitating toward bigger and bigger sets."*

### **3DTV**

#### **Glasses-free 3DTV - Soon a Third Dimension in 1080p**

Jun 06

At the SID conference, Philips and Sanyo showed prototypes for 3D.

Philips has implemented their WOWxv technology expected to become available within 2 years for consumers, and the company is in negotiations with broadcasters, producers, and TV manufacturers.

Sanyo showed a glasses-free 3D monitor used to display two programs at once (for two persons located at angle, such as for car applications where the driver and the passenger are viewing different purpose images).

The 3D technology was said to be independent of the display where it is implemented; it could be applied to plasma as well as to LCD.

The pixels of a display are used half for one image and half for another image the eyes blend them together when viewing both images from the proper distance (a sweet spot) to realize and appreciate the 3<sup>rd</sup> dimension of the perceived image.

Otherwise, the images tend to overlap or appear blurry, unless polarizing glasses are used. Work is under way to increase the viewing sweet spot and to reduce the need to use glasses as much as possible.

A 42" set from Philips (Nov 05) priced at about \$12,000 had a sweet spot of about 12 feet, but a 20" set was said to have the sweet spot at less than 2 feet. The company is working in displaying eight pairs of left/right images to open the sweet spot area sufficiently so the effect can be appreciated from various depths and vertical positions, as well as when the viewers are moving around the projected image.

Various industries have plans for 3D, cell phones, cars, arcade games, and of course, the pornographic industry as well.

Nov 06

Source "Electronic Business", credit to Drew Wilson:

*"LG Electronics, Sanyo, Sharp, Philips Electronics and Toshiba are some of the companies developing 3DTV without requiring the viewer to use special eyeglasses. Large investments are taking place on this effort, like 7.7 million in a four-year R&D project by the European Union involving 200 researchers from 7 countries, or the \$23 million by Korea's government, a project under the direction of Samsung.*

*According to the same source, "Two years into the project, researchers have developed prototype 3D displays and can stream stereo video through the Internet, we are carefully examining all functional building blocks of 3DTV," said project leader Levent Onural, professor at Bilkent University in Ankara, Turkey.*

*Further comments added "3D viewing is nothing new. Stereoscopic 3D is as old as photography and 3D films in cinemas played decades ago. But putting the technology in high-resolution, glasses-free digital form at an affordable price is what the race is about."*

*"3D is a good value-added feature to add to flat screen TV," says Chris Yewdall, president of 3D conversion company Dynamic Digital Depth Inc.(DDD). Manufacturers and Hollywood see a big opportunity with 3D movies that are increasingly appearing in cinemas, Yewdall estimates that 170 cinemas in the U.S. are currently 3D equipped.*

*His company, DDD, developed software that enables realtime conversion from 2D content to 3D. The company has licensed the technology to the top five mobile phone companies, who are expected to launch a product next year, Yewdall says. DDD's technology is already in notebook PCs made by Japan's Sharp Corp. "You can put your DVD into Sharp's laptop, press 'play' and watch it in 3D without glasses," he says.*

*But early efforts target higher-end applications where price is not the key issue and standards don't get in the way. The 3D laptops are mainly for professional applications such as medical imaging. Likewise, Philips has shipped a glasses-free 3DTV known as WOWvx, though it is used in casinos and for advertising applications.*

*Hans Driessen, spokesman for Philips 3D Solutions, says a consumer solution under development will include automatic, realtime conversion of 2D content to 3D and a display to support the image integrated in one box.*

*When 3DTV will arrive in an affordable mass market version depends on who you talk to. Samsung Electronics claims they will market a glasses-free, high-resolution 3D display in 2009; Philips would only say less in than 10 years.*

*"There is no consensus," says Chris Chinnock, president of Insight Media, who puts 3DTV a decade away. "This is the killer app that everyone has their eye on, but there is tremendous work yet to be done in display, conversion technology, formats and standards."*

**Samsung**  
Nov 06

Samsung declared that they were experimenting on how to increase the performance of LCD TVs by adding carbon nanotubes while cutting costs.

The following was reported by CNET News (credit due to Michael Kanellos):

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*"The Samsung Advanced Institute of Technology, the laboratory arm of the South Korean industrial giant, has come up with a 15-inch prototype LCD (liquid-crystal display) screen that employs an array of carbon nanotubes. The nanotubes replace more-conventional light sources, such as bulbs or light-emitting diodes, to illuminate images on the screen, said Jin Taek Han, a senior researcher at the lab.*

*The prototype essentially represents the marriage of two separate avenues of TV technology and could help dramatically lower the cost of LCD TVs in the future. Samsung has already been experimenting with carbon nanotube TVs called field-emitter displays, or FEDs.*

*In such TVs, thousands of nanotubes shoot electrons onto a phosphorescent screen to illuminate images. Carbon nanotubes are hollow molecules of intricately arranged carbon atoms that have fairly remarkable properties. They conduct electricity better than metal, are stronger than steel and can emit light.*

*These nanotube TVs are actually similar in concept to traditional CRT (cathode-ray tube) TVs, and advocates claim that they will provide better resolution and picture quality than LCD TVs or plasma TVs. Toshiba and Canon will bring out a similar nanotube set known as SED TV late next year. (SED stands for surface-conduction electron-emitter display.)*

*SED TVs, however, require new production lines. This means higher prices, at least initially. Some analysts have also said that SED TVs may have a hard time competing in the market because prices on LCD TVs and plasma TVs are dropping so quickly.*

*By combining carbon nanotubes with LCDs, Samsung could leverage its expertise in LCDs. The company is the largest maker of LCD panels in the world.*

*Nanotubes could also help cut LCD costs. Current light sources are costly and have to be carefully placed in a TV. The backlight on a 37-inch LCD currently represents 38 percent of the device's cost, and 50 percent of the cost for a 40-inch LCD, Han said.*

*Companies are trying to reduce the cost of the light source by switching to LEDs and experimenting with lasers as a light source. Carbon nanotubes could work out even cheaper, as it may be possible to grow them in a substrate, the material on which a circuit is created.*

*"We think carbon nanotubes have a strength in cost," Han said.*

*Additionally, the nanotubes could lower energy consumption and improve picture quality, he said. It takes traditional LCD 15 milliseconds to render a picture. It takes the LCD with carbon nanotubes as a backlight just four milliseconds to do so.*

*Samsung's goal is to create an LCD with a carbon backlight that lasts 30,000 hours and puts out 60 to 70 lumens per watt, about the same as for a traditional tube TV.*

*Han added that the work is in the initial stages. For all of their unusual properties, carbon nanotubes remain difficult to mass-manufacture. Tubes grown in the same batch will have different electrical properties, for instance.*

*The Samsung lab, which has an annual budget of \$300 million and employs about 1,000 researchers, is also looking into how the properties of nanotubes can be enhanced or controlled with different dopants--elements added to a semiconductor to modify its electrical conductivity. And in the end, these types of screens might be best suited for small formats, such as cell phone screens.*

*Carbon will also face stiff competition from LED TVs. Several manufacturers, such as Lumileds, are working to reduce the cost of LEDs, which are semiconductors that function as high-powered lamps.*

*Samsung is further ahead on nanotube-based FED TVs. The work on those sets has been transferred from the company's lab to Samsung Display, which will try to figure out if FED TVs can be economically mass-manufactured. The LCD with the carbon backlight, though, is still inside the Samsung lab."*

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## **SED**

Toshiba and Canon have been working together since 1999 in a joint venture for the development of SED panels, expected to be 55 inches and above. Flat panel TV with SED (surface-conduction electron-emitter display) technology is said to be similar than CRT beam-emitting technology to obtain comparable clear images but with a flat panel. SED handles fast images without jagged edges and consumes one-third the electric current of plasma.

SED is formed by two glass plates with vacuum in between, one mounted with electron emitters and pixels similar in number to those of a CRT electron gun, and another glass plate coated with a fluorescent substance. The technology has a very narrow slit (several nanometers wide) made from ultrafine-particle film; reaction to voltage produces a tunneling effect and the emission of electrons, which are accelerated by the voltage applied between the glass plates and collide with the fluorescent-coated glass plate, which emits light.

SED has a wide angle of viewing, similar to CRT. Larger screens can be manufactured increasing the number of electron emitters to match the required number of pixels. SEDs do not need electronic-beam deflection. Wall-mounted large-screen TV displays can be made with only a few centimeters thick.

SED products are expected to perform with 1 millisecond response time and 8600:1 CR, and planned to be offered at a price range of LCD-TV panels of equivalent size, starting with 50" model. The companies expected SED panels to challenge the flat-panel market currently dominated by plasmas and LCD-TVs.

Although the first SED televisions were slated to be available in 2005 and full-production was expected in 2006, Canon stated at CES 2006 that Japan expected the first model to become available for 2007.

SED has been delayed a few times since 2005 for different reasons, but more recently, in March 06, Canon and Toshiba delayed the SED launch of SED TVs to 3Q07 due to cost reasons compared to competitor flat-panel technologies.

#### CES 2007

Texas-based Nano-Proprietary filed a lawsuit with Canon claiming that its 1999 license agreement with Canon did not include Toshiba, who owns half of the joint venture (SED Ltd). At that moment, it was speculated that it might cause Canon to buy Toshiba's stake in the joint effort.

Nano-Proprietary terminated the license under a breach of contract condition, which placed under review the Toshiba plans to build a \$1.49 billion factory this year in Himeji, Japan, for the panels to be produced there. Canon was considering manufacturing the displays on a smaller scale on its own, to meet a launch planned for 4Q07 in Japan.

Under the situation, the planned 55-inch SED television display at CES 2007 was scratched.

Canon said that, regardless of the outcome, they might supply SED televisions to Toshiba for that company to sell them under the Toshiba brand.

#### Feb 07

However, Canon unfortunately lost the license for nano-technology implementation on their planned SED panel manufacturing.

The Texas court decided that Canon has infringed the license agreement with Texas-based Nano-Proprietary who won the \$5.6 million lawsuit on the basis that Canon was not permitted to share the license to use the technology with other companies, like Toshiba, which was not a Canon subsidiary, and "Canon's decision in January to buy out Toshiba's stake in the unit came too late", said Texas Judge Sam Sparks.

A new (more costly) agreement was expected to take place between the two companies, and between Nano-proprietary and Toshiba, and Samsung, and any other companies "if they are interested in licensing the technology in a non-exclusive or exclusive basis" Nano-Proprietary said.

This caused a halt on Canon's plans for mass production SED displays on 4Q07, although it could be limited to a reduced distribution in Japan.

But after months into the litigation, the court ruled that the joint venture with Toshiba was not a Canon subsidiary.

The court has a pending trial decision to make sometime after April 2, 2007 regarding Nano-Proprietary's claims that Canon committed fraud extending the license to Toshiba and possibly other Japanese companies.

#### **Applied Nanotech**

As mentioned in the 2006 report, the Texan company has created a 25-inch prototype TV based on carbon nanotubes, claimed to be brighter and crisper than

today's TV sets. Canon, Toshiba, and Samsung, among others, were testing this slim technology over the last few years.

According with the company, field emission display (FED) TVs, electrons get filtered into an array of thousands of tips only a few nanometers wide, which then deliver electrons to illuminate the screen. Panels using this technology could be as slim as LCDs or plasmas.

#### Mar 06

The company announced that it has signed a letter of intent to enter negotiations for a trial on carbon nanotube TVs with Da Ling, a Taiwanese contract manufacturer, which would invest \$10 million on a pilot manufacturing facility to make carbon nanotube TVs based on Applied's technology. Trials were expected for late 06 or beginning 07, with commercial availability within two years.

As with SED technology, pressure exists on maintaining a low price on the nanotech technology to position carbon nanotubes in a favorable competitive situation against the constant price reductions of LCD and plasma at similar sizes.

## Display Manufacturers

### **Canon**

#### SED

Over the past couple of years, the company demonstrated their SED technology (in partnership with Toshiba), on the right is the 37" prototype panel shown at CES 2006. Canon said that the first unit would be a 55" 1080p model (which will become available in Japan in 2007). Canon could not confirm an estimated price, nor date of availability at that time (over one year ago). The panel is expected to have a life cycle of about 30,000 hrs (similar to CRT, Canon said). Canon and Toshiba were planning to sell similar models under their brand names.



For an update about this joint effort (that failed for non-technological reasons), please see the SED comments in the "technology" beginning of this section.

### **GTT**

Consult the 2006 HDTV Technology Report for details on the model below:

#### FP CRT

Dec 05

GTT HT Reference 9 projector, 9" CRT, offered as a \$48,000 package.

## **JVC**

Consult the 2006 HDTV Technology Report for the model below:

CRT direct-view

30" AV-30W777, \$800, TTM Jun 06

## **Hitachi**

Consult the 2006 HDTV Technology Report for the models below:

CRT RPTV

F710A series

S825 series

Aspect line

2006 line additions

CRT RPTVs

1080i, ATSC/NTSC tuners, Magic Focus Auto Convergence System, HDMI, 0.52mm fine pitch Screen, six Aspect Mode choices for 4:3 expansions to 16:9.

51" 51F59 \$1,300, TTM Apr 06

57" 57F59 \$1,500, TTM May 06

65" 65F59 \$1,800, TTM May 06

Jun 06

RPTV

The company said they would offer a line with three models with an entry level set with 51" for \$1,000 expected street price.

## **LG**

The company abandoned CRT tube TV in Europe (Oct 05), to concentrate in thin TVs. CRT market in Europe was expected to drop 20%, doubling LG expectations beginning 2005.

CRT direct-view

30" \$900, flat-faced, ATSC tuner, NO CableCARD, TTM March 06, HDMI, RGB, 1080i

## **Mitsubishi**

OLED

On December 2005, the company announced their development of new blue phosphorescence Organic Light-Emitting Diode (OLED) material which has four times greater luminous efficiency than currently used fluorescent material, and can be manufactured at lower cost than other OLED processes; it uses a wet-coating process, and could be applied for large panels.

OLED devices emit light when an electric current is applied and do not require a backlight to function. They consume less power, have a wider viewing angle, and display a brighter image with a refresh rate a thousand times faster than LCDs.

According to Mitsubishi, the new OLED device also employs hole blocking material and hole injection material to achieve 30cd/A efficiency at an intensity of 100 cd/m<sup>2</sup> (external quantum efficiency: 13 percent), more than twice that of conventional blue wet-coating type OLEDs.

## **Motorola**

### NED

On May 2005, Motorola introduced its first working nano-emissive display (NED) prototype (five-inch diagonal proto-television) at the Society for Information Display (SID) conference in Boston. The wafer-thin display is one-eighth of an inch thick. If enough interest from large companies is reached manufacturing could be by 2007, and prices could be under \$1000 (Display Search, estimated that a 40-inch NED display could retail for \$800 or less).

Reportedly, NED uses millions of accelerated electrons charged by just 5 to 10 volts of electricity, compared with 5,000 volts for large-screen, high-def LCDs. The electrons shoot toward a phosphor plate, creating the moving image. This technique requires less voltage than a CRT. Unlike LCD, a nano-emissive display, which uses carbon nanotube technology, will be easily viewable from all angles.

Don Bartell, a product director at Motorola, stated that a critical benefit of NED over other display technologies is no limit to the display size. NED could be used by ad agencies erecting monolithic 100-inch roadside billboards and consumers wanting a 42-inch home entertainment centerpiece.

## **Philips**

Consult the 2006 HDTV Technology Report for CRT direct-view models 20-32".

## **RCA**

(please refer to Thomson)

## **Samsung**

### OLED

The company made an OLED prototype 40-inch panel made from a single-sheet organic light-emitting diode (OLED) that consumes less power than traditional flat panels and do not require a backlight, with higher resolution than LCDs. OLED has been implemented in phones and other devices with small screens, but Samsung has implemented it also on larger prototypes, such as a 14.1-inch OLED panel 1280x768 and a 21" HD 1920x1080. The 40" is a 1280x800, brightness of 600 nits, contrast ratio of 5,000 to 1, 2.2 centimeters thick panel to fit TVs under 3 centimeters deep.

### FED

OLED is joined by field emission display (FED) televisions where thousands of carbon nanotubes, or other components, shoot electrons at a screen to create a picture; FED televisions are expected to be thinner than current flat-panel televisions and provide better resolution. A prototype has been developed by Samsung from a sheet of 730x920 millimeters of mother-glass using amorphous silicon processes, as with LCDs.

### CRT

Space-saving CRP (Cathode Ray Panel) technology

Consult the 2006 HDTV Technology Report for specs on the following models:

30" TX-R3079WH

30" TX-R3080WH

CES 2006

CRT Slim Fit with only 16" depth, ATSC/NTSC tuners, and 3-2 pulldown.

30" TX-S3082WH \$1,000, TTM Mar 06, HDMI

30" TX-S3080WH \$1,000, TTM Mar 06, HDMI

27" TX-S2782H \$700, TTM Apr 06, 2 HDMI, 2 component

27" TX-S2783 \$500, TTM Apr 06, SD 480i analog, component 480i DVD input

Samsung discontinued 32" flat-screen CRT in 2006 to concentrate in Slim-Fit models.



CES 2007

Samsung introduced two new CRT model implementing the Slim-Fit concept:



27" TX-T2793 \$550, TTM Apr 07, 16-inch depth and contemporary design, Nano Pigment Screen produces deeper colors, higher contrasts and a wider range of color expression throughout the entire screen, built-in HDTV tuner, progressive scan, 3:2 pull down, 2xHDMI, 2 auto sensing HD/DVD component video inputs, 20-watt side built-in speakers with SRS 5.1 audio processing, 16:9 aspect ratio.

TX-T2793 shown

30" TX-T3093WH \$700, TTM Apr 07, 16-inch depth, contemporary design, 1/3 the depth of traditional CRTs, Nano Pigment Screen produces deeper colors, higher contrasts and a wider range of color expression throughout the entire screen, built-in HDTV tuner, progressive scan, 3:2 pull down mode, 2xHDMI, 2 auto sensing HD/DVD component video inputs, 20-watt side built-in speakers with SRS 5.1 audio processing, 16:9 aspect ratio.



30" TX-T3092 \$700, TTM Apr 97, same as above but with bottom built-in speakers and with standard SRS TruSurround XT™ audio processing).

TX-T3092 shown

According to Samsung, in 2006, the company dominated the CRT HDTV market with a market share above 50 percent in dollars and units, largely driven by the new line of SlimFit HDTVs.

**Sony**

CES 2007  
OLED

Sony Electronics demo a set of OLED small screens (organic light-emitting diodes) and declared "It is not as far off as you might think, perhaps next year", although Sony was not announcing products or a commitment to OLED TVs, mass-manufacturing is depending upon a price consumers are willing to pay.

An OLED display produces light upon the application of an electrical current, and they do not require a backlight, consume less power, and could be thinner than LCD panels.



Samsung also produced larger OLED TVs.

The screens were approximately 3mm deep on the 11-inch model (SVGA 1024x600),

and less than 10mm deep on the 27-inch model (1920x1080), they are considered next generation displays by Sony, with high contrast (1,000,000:1 CR), wide color gamut, and quick response time.



Sony declared "The prospect of mass production of the panels for smaller size OLED TVs is close to be cleared, and development on the panels for middle /larger-sized is currently under

development".



### **Thomson (RCA)**

Consult the 2006 HDTV Technology Report, the company decided to eliminate IEEE1394 and CableCARD on 2006 models to reduce costs.

#### CRT RPTV

Eight new models for June 2006, DVI, component, 480p/1080i

52" R52WH73/74 \$1,150

52" R52WH76/78 \$1,200

56" R56WH76/78 \$1,400

61" R61WH76/78 \$1,500

#### CRT Direct-view 4:3

SDTV 480i, 8 new sets, curve & flat tubes, ATSC tuner, TTM Mar 06 for most models.

27" 5 models from \$369 to \$459 (27V414T, 514T, 524T, 525T, 534T)

32" 3 models from \$549 to \$679 (32V434T, 524T, 654T)

HDTV, 16:9, 1080i, integrated ATSC tuner.

26" HD26W854T \$629, TTM June 06, 16:9 AR

27" HD27F754T \$549, TTM Mar 06, 4:3 AR

### **Toshiba**

Consult the 2006 HDTV Technology Report for the following models and lines:

#### CRT line

#### HF85 TheaterWide

#### Cinema Series

#### CRT RPTV HC85 Custom Series and TheaterWide

At CES 2006, the company declared that it was investing in LCD and SED in 2006, while also carrying plasma as a mainstream product, and abandoning the CRT RPTV line.



At that time the following direct-view CRT models were announced:

#### CRTs direct-view

Eight models for 1Q06, all with integrated NTSC/ATSC/QAM on-the-clear tuners

#### HDTV line

1080i native, two models with FST Pure widescreen, HDMI/HDCP, 2 Colorstream component analog input.

26" 26HF66

30" 30HF66

#### Standard Definition line

480i, FST Pure, ColorStream inputs, silver/gray bezel design

26" 26DF56 widescreen

30" 30DF56 widescreen

27" 27DF46 flat-tube 4:3

32" 32DF46 flat-tube 4:3

Two other curved picture tubes with 480i, Colorstream inputs, silver cabinets, dark-gray cosmetics:

27" 27D46

32" 32D46

#### May 06

##### CRT Direct-View

At the Toshiba dealer show the company announced several direct-view CRT TVs, including analog direct-view models in 13-inch and 19-inch non-flat screen sizes, and 14-, 20- and 24-inch flat-screen sizes.

Digital direct view, four levels

##### Standard definition (SD) 480i models

27" & 32" non-flat screen sizes

27" & 32" flat-screen screen sizes with new cabinet design.

##### New category of digital widescreen CRT direct view models

26" & 30" 16:9 models with SD resolution and a similar pair in HD resolution.

Toshiba declared "We will be No. 1 in the category in 2006".

#### SED line

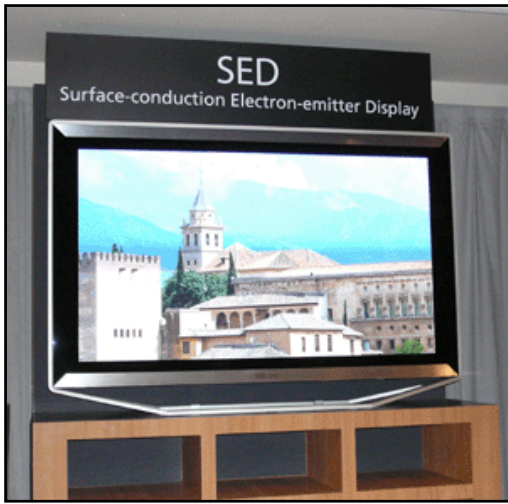
Originally planned for late 06, 36" demo at CES 2006, 1920x1080 50"+ screen sizes were in the plans.

In March 06, Toshiba and Canon announced their postponement of the launch of SED televisions until July 2007 and availability until 4Q07; Beijing Olympics in 2008 was viewed as an important factor for SED. The low prices of competing technologies, such as LCDs and plasma displays, forced Toshiba and Canon to evaluate ways to make SEDs cheaper, although in their opinion, the better SED picture should justify the differences in price.



In October 2006 (CEATEC), Toshiba/Canon showed several 55" SED panels, and declared that have found how to manufacture SED 55" TVs at a more competitive price than anticipated, although they said there should be premium over LCD competitors justified by the better viewing experience, CR in the order of 50,000:1, 450 nits of brightness, one millisecond response time that would eliminate the image

blur and ghosting known in LCD, 30,000 hours of life expectancy, half power consumption of plasma and lower than LCD, etc.



Toshiba and Canon estimated a production level of 65,000 SED TVs per month when their plant becomes fully operational, a level that was said to be increased to meet their goal.

In December 2006, after a series of delays Toshiba anticipated that "the company will not be showing SED at CES 2007", it is uncertain how this cancellation and the legal situation with the license would further postpone the introduction, but judging by the accelerated drop in price of LCD and plasma panels during 2006 the prospective of introducing SED as competitor technology has become more difficult.

This time the delay has been caused by other reasons, not by a technical issue, but rather a legal issue between Canon and Nano-Proprietary regarding the licensing for the development of Canon's SED TVs. Please see the legal situation covered at the start of this section.

## Chapter 6 - Digital Light Processing (DLP)

### Texas Instruments

CES 2007

New DLP HDTVs from Samsung, Mitsubishi, NuVision, Panasonic, RCA, Toshiba, etc were shown at CES. Some of those with "slim designs" of about 10 inches deep, some with LED based engines like Samsung.

TI made no announcements regarding the implementation of a full 1920x1080 chip for RPTVs, as the 1080p chip used for front projectors.

Considering that DLP RPTVs are targeted to a section of the market that generally looks for economical solutions to large screens, true 1080p (rather than using a 960x1080 chip and a mirror switching technique, as they do now), might be a feature that would probably be implemented if it could be done at a low cost.



TI mentioned that the 1080p chip used for front projectors is possible to be used in rear projection sets but it costs a little more and apparently TV manufacturers might not be willing to pay for the extra cost. Additionally, the chip for FP has a surrounding back area needed for front projectors but is not necessary for RPTV applications because of the frame of the TV, and TI would have to make one chip without that black surrounding for such purpose.

TI also mentioned that for such chip, the manufacturer would have to make a light engine that operates differently than the 960x1080 chip, and TI would have to supply the software for that application.

According to TI, this is a decision manufacturers have to make.

Regarding HP dropping DLP RPTV manufacturing, TI commented that it might have been a decision based on not making sufficient volume and decided to concentrate on other lines, however TI stated that no other manufacturer has shown signs of moving away from DLP.

TI is concentrating its efforts in helping the manufacturers and in the development of new technologies. No comments were made about any chips higher than the 1080p resolution.

True 1080p chips are very successfully being implemented in a number of new front projectors by various DLP supporting manufacturers, such as Optoma, BenQ, SIM2,

Sharp, Marantz, etc., at prices now reaching the <10 thousand dollar range in some cases, and producing high quality images.

Slim DLP RPTVs, with about half the weight of plasma televisions, provide consumers with flexibility for installations anywhere in the home, including shelf and wall mounting.

Texas Instruments demonstrated the first HDTV with hang-on-the wall slim design featuring solid-state LED illumination and full-HD 1080p resolution, implementing a new .65" 1080p DLP® chip-set optimized to drive solid-state LED arrays to high contrast performance beyond 100,000 to 1.

New Samsung 2007 products implementing the LED technology were demoed (demo comments below), with the potential to increase color saturation to nearly 140 percent of the NTSC TV standard, while showing a color refresh rate of up to 48x the standard TV frame rate, and providing "Instant On/Off" functionality replacing the conventional lamp with a lifetime solution, according with Samsung.

Although it could have been an isolated TV-set problem, ironically, the much promoted LED based Samsung new models were demo with a 50" RPTV that had an apparent focus error on the right part of the image. The problem was not on the left part of the image, and it was not consistently detected on all the displayed content. TI's personnel at the booth could not notice the problem at first, until I pointed it out to them.

I invited two more people from this magazine who attended the show (Mr. Campbell and Mr. Mack) to witness the experience and they noticed the same problem.

The disappointing part was that after returning to TI's booth several times during the show the problem was still uncorrected, and the set was continuously showing the same content and image problem.

Not replacing or not removing the set from the floor shadows the presentation of the technology, the set, and the manufacturer, in a show with 140,000 attendees, many of whom do not ask about the image and leave CES with the impression that the set/technology is unacceptable.

#### TVP9010 HDTV Processor

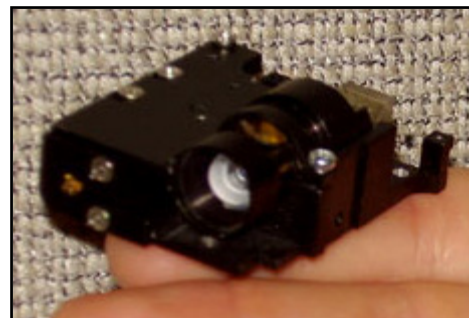
TI announced the TVP9010, an integrated video processor, and development platform, designed with a system-on-a-chip style for full 1080p images, intended to fulfill the broadcast requirements for ATSC and DVB-T standards. The video processor includes TI's-supplied 8-VSB/QAM demodulation, audio processing, and power management functions, TTM now.

#### TVP9007 Converter Box

To support the DTV transition TI developed the TVP9007 ATSC to NTSC converted processor with integrated 8-VSB/QAM demodulator and HDTV processor, TTM now.

#### Mar 07

Texas Instruments unveiled a mini-projector that fits in a cell phone, the projector features three





lasers, a DLP chip, power supply, 1.5 inches long, capable to beam SDTV quality on a screen larger than what the LCD panel can display in the phone.

### **Akai**

#### RPTV

3-RGB LED based 1080p DLPs  
20,000 hrs – 50,000 hrs, fast turn on time  
46" PT46DV27L \$1,800, TTM Mar 06  
52" PT52DL27L \$2,200, TTM May 06

### **Barco**

RLM H5 Performer  
Consult the 2006 HDTV Technology Report.

### **BenQ**

#### FP, current models

Consult the 2006 HDTV Technology Report.

#### Mar 06 (Cebit introduction)

BenQ W10000  
15,000:1 CR, 1,200 lumens, TTM 4Q06,  
€10,000

#### CES 2007

BenQ introduced four new models:

MP721	\$1,500
MP721C	\$1,000
MP611	\$900
MP611C	\$750



Featuring, cross-functional units, MyScreen, presentation timer, power alert tone, "Q" hot-key, blackboard mode, panel-key lock, built-in unobtrusive on-screen timer, PC/ laptop connection with a common RS-232 cable, 25dB noise level, 2100 ANSI Lumens to 2500 ANSI Lumens, 2000:1 CR, all accept analog RGB, component video, (the MP721 and MP721C also accept DVI-I input), handle 480p, 576p, 720p, and 1080i, optional LinkPro wireless connectivity module available for the MP721 and MP721C, five-segment golden-ratio color-wheel, 5.9 pounds, 10.9" x 8.7", TTM mid-Jan 07, glossy-black finish.

### **Christie**

From the 2006 HDTV Technology Report.  
Roadie \$25,000, 2048x1080, 1500:1 CR, 25000 ANSI, 2:1 AR



## **Digital Projection International**

### FP

dVision HD 720p \$17,000, two 250watt lamps, 2500 lumens, DarkChip3 DMD, 1600x1200 computer input, 120kHz horizontal, 2000 hrs lamp life, 6000:1 CR, VGA 15 pin, DVI-D digital RGB, BNC RGBHV, component.

iVision HD-7 720p, 2<sup>nd</sup> generation, 1000 ANSI lumens, 3000:1 CR, 1.75-2.25:1 zoom lens.

### FP

#### Jun 06

dVision 1080p, TTM May 06

\$30,000, 500-2500 ANSI, lens shift 0.55 vertical +/-, 0.45 horizontal +/-, 6000:1 CR, 2x250w UHP dimmable to 2x200W, lamp life 2000 hrs, DVI-D digital RGB, RS-232 9-pin, D-sub, 1 USB-B, 1 LAN RJ-45, 1 remote, 2 x 7-segment color wheel, 5x speed, 1920x1080 single chip 0.95" Dark Chip3 DMD, VIP1000 video processor, NO 1080p Input, 10 meter fiber optic DVI cable to projector.

True 1080i to 1080p de-interlacing, SD/HD multidirectional diagonal filter; HQV video enhancement, DNR, 16 to 1024 tap Adaptive Scaling; true 10-bit processing; audio delay, geometry, e-Warp vertical/horizontal keystone for cylindrical, spherical, and asymmetric displays.

Inputs: 1 comp YPbPr, 3 BNC, DVI-D digital RGB, HDMI, analog 15-pin VGA, analog RGB BNC, 1 S/PDIF audio, 1 toslink, 1 SDI (Pro only) BNC.

Outputs: DVI-D, HDMI, analog RGB 15-pin VGA.

Control: RS-232 9-pin D-sub, 1 USB 2.0, 1 Ethernet RJ-45, 1 IR remote.

Continuous adjustable motorized iris, practical as the projector lamp ages, reducing the CR as iris size increases and the lamp ages. 54dB fan noise (I hope this spec is an error in a world of 30-40db noise level projectors, otherwise start thinking in a separate room just to mount the projector), 900 watts consumption (2 lamps), 4000 hrs at 80 % life on the lamp, 2000 hrs at 100% lamp power, \$650 replacement x module.

#### Sep 2006 (CEDIA)

The company showed the 1080p 3-chip DLP projectors – the TITAN 1080p-250 and the ultra-high-end HIGHlite Reference 1080p projector, along with their video image processor and source switcher, VIP 2000. DPI also announced the addition of the TheaterScope Premier lens system to their line of home cinema projectors and system accessories.

### TITAN 1080p-250

3x 0.95 1080p DarkMetal DMDs, 59.5 pounds, noise level lower than 35dB, 2000 ANSI lumens, 5000:1 CR, enhanced seven-point color correction for expanded color space and super-accurate end-user color alignment, user-selectable Xenon Color Mode, accurate colorimetry control for accurate white point definition with extensive control over gamma, color and grayscale tracking, seven user-selectable inputs, including DVI/HDCP and HD/SD-SDI, Constant-height screen implementation possible with DPI's optional TheaterScope Premier System with specially designed large precision anamorphic lens mounted in a motorized lens sled triggered via contact closure or RS 232 control, to slide the anamorphic lens into the projector's light path which optically stretches the projected image to fill the full width of the 2.35 screen surface.

### HIGHlite Reference 1,080p

2048x1080 native resolution, world's lightest and smallest 2K by 1K three 1.26-inch DLP DMD chips, 5000 up to 14,000 ANSI lumens, 2000:1 CR, TTM October, \$106,000 MSRP, liquid cooling for quiet operation, medium-to-very large home cinema environment installations.

### Dwin

Consult the 2006 HDTV Technology Report.

### Hitachi

Consult the 2006 HDTV Technology Report.

### HP

#### RPTV

#### 1080p line

xHD4 wobulated chip

Consult the 2006 HDTV Technology Report.

#### 2006 line

HP Visual Fidelity technologies w/patented wobulation, CableCARD, TTM summer 06

#### 1080p model with LED

52" ID5280n, super-bright LEDs that replace a traditional bulb and provide a broader range of colors as well as instant on/off.

#### 720p

52" ID5220n

#### May 06

#### RPTV

58" md5883n replaces the 5880, 1080p input,

52"

65"



### InFocus

#### FP

PlayBig line, TTM Feb 06  
 IN72 \$1,200, 480p  
 IN74 \$1,700, 576px1024  
 IN76 \$3,000, 720p, CES demo did not impress me as advertised.



ScreenPlay 777, TTM now, 720p, details at CES 2005 report.

RPTV

ScreenPlay, 6.85" deep (specs on CES 2005 report).  
 50" 50md10  
 61" 61md10

CES 2007

InFocus made several announcements:

InFocus celebrated the company's 20-year projection history.

The Play Big SP777 (shown) home theater projector was announced to have a reduced price, \$10,000 from Jan 1, 07. The SP777 is a 720p DarkChip3™ DLP® projector with 5000:1 CR, 2000 video-optimized lumens, and is a current model.



A new projector was previewed, Play Big IN1 instant home theater and gaming projector, with a built-in DVD player and speakers, optional ceiling mirror for bed viewing, TTM 1H07.



Two new meeting products, Work Big IN24+ and IN26+, 30% brighter with 2,200 lumens.

Work Big IN24+ IN26+ below:

Two next versions of Work Big IN32 & IN34 for 1Q07, and the introduction of the Work Big IN36 with 3,000 lumens.

**LG**

**RPTV**

Consult the 2006 HDTV Technology Report.

**FP**

AN110, first wall mounted projector, 2500:1 CR, 1280x768 DMD, 1000 ANSI lumens, max 100 inches screen, 24 db noise level, HDMI.



**Marantz**

Previously released models:  
VP8600 \$6,000, TTM now, for lower cost installations, HD2+ chip, 720p, 650 ANSI lumens, 4000hrs bulb life, 10-bit gamma processing, VGA, component, analog RGB, DVI/HDCP, 3:2 pull-down, right.



VP-12S4 \$15,000, TTM now, 720p, upgraded version for image enhancement over current model done via firmware, uses Gennum GF9350 fully programmable architecture, details and specs at CES 2005 report, left.



VP-10S1 \$38,000, TTM now, HD2 720p, right.



VP-11S1 1920x1080p new projector was shown as a prototype (left), 700 ANSI, 5000:1 CR, 2

HDMI, 2 component, Gennum video processing, \$TBA (estimated between \$15K-\$20K), TTM mid-06 (left).

#### Jun 06

In New York Marantz announced that it was the first to market an HD DLP front projector using TI's new native 1080p DarkChip III .95 DMD, controlled by TI's newly developed DDP3021 dual drivers, claimed to provide precise mirrors control, the Model VP-11S1, introduced as prototype above at CES 2006, now confirmed to be \$20,000 MSRP, sold thru Marantz's 500 dealer network, accepts 1080p, up-converts non-1080p sources with a next-generation Gennum Visual Excellence Processing (VXP) video processor. According to Marantz, "It was mission critical to us at Marantz to only build products that will resonate with the most fastidious and meticulous videophiles".

The projector uses an improved three-primary color wheel spinning above 10,000 rpms, powered by a new Quiet Fluid Dynamic Bearing motor to reduce the visible rainbow patterns some people see in motion scenes.

The 12-bit processing implemented in this projector claims to produce image gradations that are four times richer than previous systems; the Gennum VXP processor de-interlaces, scales, reduces noise, enhances detail, and performs color correction, which Gennum says is the first consumer application of the same processor used in two thirds of commercial cinema projector lines.

CR 6,500:1, brightness between 600 to 700 lumens, dual HDMI, component video, and analog RGB, RS-232 serial control port, vertical lens shift.

Marantz declared that they will introduce a long-throw lens feature in a next model later in 2006.

#### **Mitsubishi**

For earlier models, please consult the 2006 HDTV Technology Report.

In February 2006, Mitsubishi announced their use of laser as a source of light instead of mercury lamps used on projection sets. The use of laser offers a higher picture quality with greater color range according to the company. At that time, there was no announcement regarding availability or pricing.

#### Apr 06

##### Laser technology

Mitsubishi showed a prototype of slim big-screen TV (52 inches and larger) expected to be available late next year (TTM Nov 07), using colored lasers to display bright, deep images on large, thin, lightweight screens.

Traditional DLP TVs use white-light mercury lamps as the television's light source; laser television uses separate red, green and blue lasers in conjunction with an HDTV chip, for greater range and intensity of colors (1.8 wider than LCD), deeper black levels, lighter cabinets because the screens would be advanced



plastics rather than the glass used in plasma flat-panel units.

Laser television is expected to use about a third the power of conventional, large-screen models using high-power lamps, required to be on at full power while the TV set is on, lasers, which are based in semiconductors, turn on and off when needed (such as for the reproduction of better blacks than plasma panels), and would last longer. Consumption is claimed to be even better than LED-light based sets.

#### Sep 2006 (CEDIA)

The company presented two 73" microdisplay RPTVs as part of the company's new lines, which have the following features:

Mitsubishi's proprietary 6-Primary Color System claims to provide brighter colors over a wider range and whiter whites, the light engine generates yellow, cyan and magenta without mixing combinations of red, green and blue to create them, as others do, delivering a broader color palette and a brighter picture more efficiently, includes a six-color control for further color accuracy.

The new models use BrilliantColor™ technology for improved overall picture brightness. The new sets also use TurboLight180™, Mitsubishi's patented lamp system technology, to focus light more efficiently and creating an image 10 percent brighter than standard 180-watt lamp systems, without increasing the consumed power or produced heat.

The sets implement PerfectTint™, for independent tint or hue adjustment of six separate colors, rather than shifting the color of the entire picture. 12-bit video signal processing for a sharper picture, 4D Video Noise Reduction technology to filter video noise without removing picture detail, all 1080p HDTVs accept 1920 x 1080p inputs at 24 and 30fps from broadcast sources and 24/30/60 fps from HDMI, the Tru1080p feature claims to maintain the signal path as 1080p.

Additional features include ClearThought™ Easy Connect, for components recognition when plugged in, NetCommand®, for the management of the home theater system with a single remote control. 2xHDMI, IEEE1394, DVI-I for analog RGB or digital DVI, CableCARD tuner, and multi-format card readers to display digital photos and videos. The company added that they will announce delivery dates and suggested pricing later.

#### New DLPs 1080p

Turbo Light150 system, Dark Detailer, Plush 1080p, Tru1080p processing, 4D Video Noise Reduction, 12-bit signal processing, PerfectColor, ClearThought, Easy Connect (all TM), 2 HDMI, DVI-I, 2 component, 732 models include 3 component inputs, Diamond series include front 1394 with DV Decoder input, and for high-bandwidth real-time audio, video and data networking between the TV and other consumer electronics products, such as camcorders and HD-DVRs, additional simple remote Model below 73" include 6-primary Color System (yellow, cyan, magenta added to the color wheel for brighter colors and whiter whites)

52"	WD-52631	\$2800
57"	WD-57731	\$3100
57"	WD-57732	\$3300

Diamond line

57"	WD-57832	\$3,800
65"	WD-65731	\$3,800
65"	WD-65732	\$4,000
65"	WD-65831	\$4,600
73"	WD-73732	\$6,000
73"	WD-73831	\$6,500

FP

CES 2007

HD1000      \$1000, TTM Aug 06, 720p, 2500:1 CR, 1500 lumens, Darkchip2, 25db noise, HDMI, RGB, 7 segment color wheel



HC3000U      \$1,700, TTM Oct 05, 720p, 4000:1 CR, 1000 lumens, 6 segment color wheel, DarkChip 2, 25 db noise, HDMI, RGB, component.

HD4000U      \$2,000, TTM Jan 06, 720p, 2000 ANSI lumens, 2500:1 CR, 4000 hrs lamp life, digital keystone, 3yr warranty, 5 segment color wheel, 31db noise.



**NEC**

Consult the 2006 HDTV Technology Report.

**LT30**



**Nuvision**

Oct 06

RPTV

Deep Black LED 1080p DLP

52" 52LEDLP \$4,400, TTM Oct 06, individual red, green, and blue super-bright LEDs, <10ms response time, 500cd/m2 brightness, 5000:1 CR, ATSC, NTSC and clear QAM tuners, xHD4 1080p DLP chip, two HDMI/HDCP inputs, two auto detect multi-scan component video inputs, bi-directional RS-232 port.

The NuVision LED illumination system is based on the "PhlatLight" light source, developed and manufactured by the Luminus Devices, and uses a semiconductor RGB LED chipset that produces high color fidelity, a refined gray scale and deeper black levels, NuVision said.

## Optoma

FP

For Movie Time DV10 and H78 models

Consult the 2006 HDTV Technology Report.

HD72 \$4,000, TTM 2Q06, DarkChip2 DMD, 720p, 10-bit color, 7-segment color wheel, 5000:1 CR, 1300 lumens w/220w lamp, 3000 hrs lamp life, 10-bit color per channel, 7-segment BrilliantColor color wheel, DVI-I/HDCP, RGBHV BNC, component, RS-232.

### CES 2006 advanced introduction

HD81, \$7,000 (originally \$10,000), TTM 4Q06 (originally 2Q06)



True 1080p single chip, 6000:1 CR, 1400 lumens with 300watt lamp and five step output control, BrilliantColor from TI, 0.95 Dark Chip 3 DMD, 7-segment color wheel, 10-bit color per channel, TrueVivid, 3 HDMI plus external HDMI expansion, VGA (RGB/YPbPr/SCART), 2x RS-232, IR port, 2xRGBHV, 2 component

analog, Gennum VXP, 10-bit 480i/576i/1080i motion adaptive deinterlacer using the included VX3000 video control unit shown, software upgradeable from web site, connects to FP using HDMI.



Aug 06

HDT100 \$3500, 720p, 0.8 inch chip, Darkchip3, 1.25x zoom, 4 way vertical/horizontal optical lens shift capability, 1000 ANSI lumens, 5000:1 CR, 32dB fan noise, TTM now.

#### Sep 2006 CEDIA

The HD81 has started to ship to dealers for \$7000 MSRP, 6000/10000:1 CR, 17-step auto-iris function, 1400 ANSI lumens, 300w lamp, 10-bit color processing, 7-segment color wheel, 2xRGBHV/component BNC, 2xcomponent, VGA (RGB/YPbPr/SCART), two RS232, two 12V triggers, and one IR port extension.

The HD70 for \$1000 MSRP shipped by the end of Sep 2006 to dealers, 1280x720, Dark chip 2, 1000 ANSI lumens, 4000:1 CR, VGA.

#### CES 2007

##### Anamorphic Lens Kit for 2.35:1 presentation

Optoma introduced its anamorphic lens kit for 2.35:1 widescreen images from projectors, such as Optoma's HD81 1080p.

The BX-AL133 anamorphic lens converts a native 16:9 image to 2.35:1 cinema widescreen image, eliminating the black bars commonly visible on a 16:9 screen when playing a DVD formatted to the 2.35:1 aspect ratio.

Optoma's anamorphic lens is fully layered with optical coatings that minimize chromatic aberrations and astigmatism, and is made up of 100% glass, and generates a brighter image – up to 30 percent – than without the lens, because all the light energy and pixels of the projector chip are used for the entire 2.35:1 image.

The BX-AL133 anamorphic lens is fully motorized and works with the HD81's 12V trigger control. The HD81 scaler's Auto235 mode automatically detects between 16:9 or 2.35:1 content and format the image while moving the lens to the correct position in a few seconds, or it can be manually triggered by using the BX-AL133 IR remote control.

The complete kit includes the anamorphic lens, a bracket for the lens, ceiling mount adapter plate, a motorized, remote-control sled for the lens, as well as upgradeable firmware, and will be available in February 2007, estimated price of \$6,000 through authorized Optoma dealers. Optoma is also offering an HD81/BX-AL133 bundle for an estimated street price of \$10,000.

HD81 as introduced in production at CES 2007:





RPTV

CES 2006

BigVizion

1080p, TTM late 1Q06, customizable and modular 80 to 100-inch rear-projection display that can be either installed or built-into a wall, single-mirror system by TI, ISF 3C codes, light engine can be accessed from the front of the optical screen, 10000:1 CR, IR pass-through for system integration, component, DVI and HDMI, VGA, RGB, support 480i, 480p, 720p, 1080i and 1080p inputs, targeted for the professional installer market, customizable color scheme, bezel color to match a customers' décor.



- 80" HDBV3080 \$17,000, TTM Mar 06
- 90" HDBV3090 \$18,000, TTM Apr 06
- 100" HDBV3100 \$20,000, TTM Apr 06, 30" deep

CES 2007

Optoma showed their new oversized 1080p 120-inch BigVizion™, part of a line of DLP®-based rear-projection displays that can be installed or built-into a wall with an estimated 40-inch depth, and is available through Optoma's network of key distributors and dealers, \$50,000, TTM 2H07.



Current BigVizion displays are still available in 80-, 90-and 100-inches, and come with Optoma's proprietary video enhancement processor and light engine, accessible from the front of the optical screen



for installation and future upgrades.



The models were announced at a higher price this time (CES 2007), TTM now:

HDBV3080 (80-inch) \$23,000  
HDBV3090 (90-inch) \$25,000  
HDBV3100 (100-inch) \$30,000

Optoma also introduced the portable:

Movie Time DV11 \$1,000, TTM Feb 07, compact design, slot-in DVD drive, 480p EDTV resolution, enhanced audio with larger 5-watt speaker drivers, updated cosmetic design, shorter profile, white cabinet with black accent trim.

The Optoma MovieTime DV11 is a pure digital DVD projector and accepts direct digital signals from a DVD to the projected image. There is no analog to digital conversion in the signal processing.

Features:

Display Technology DarkChip2™ DLP® technology by Texas Instruments  
Brightness 1300 lumens  
Contrast Ratio 2500:1  
Throw Ratio 1.26 – 1.41  
Aspect Ratios 4:3, 16:9 and 5:4 compatible  
Image Size 36 to 335 inches  
Projection Distance 4.9 to 32.8 feet  
Weight 7.8 pounds

DV10 (below) \$1,000, 1000 lumens, 480p, 4000:1 CR, 28dB fan, 200-watt lamp.





HD73            \$2,000 street price, TTM Feb 07

Optoma also introduced the HD73 home theater 720p projector, 0.65-inch DarkChip3™ DLP® DMD chipset, Optoma's proprietary ImageAI™ technology, Texas Instruments' BrilliantColor™, Optoma's proprietary TrueVivid™, Faroudja's DCDi™ image optimization, dual digital inputs, digital horizontal and vertical keystone correction, 27dB noise level, 1300 lumens, contrast ratio: 4500:1 (Full On/Full Off); 6000:1 in ImageAI™ mode, video compatibility: NTSC, PAL, SECAM, HDTV (720p, 1080i/p), SDTV (480i/p, 576i), aspect ratio: 16:9 native, 4:3 compatible, LBX support, I/O Connectors: HDMI, DVI-I w/HDCP, Component, RS-232, IR Receivers and 12V Trigger Relays, lamp life: 3000 Standard, weight 7 pounds, sales through authorized Optoma dealers and retailers.



HD70            \$1000, TTM now.

The company's new portable 720p resolution home theater projector. Featuring screen support up to 300-inches (diagonal), single 0.62-inch DarkChip2™ DLP® DMD, digital horizontal and vertical keystone correction, 28dB operation, Texas Instruments' BrilliantColor™ color processing, 1000 lumens, CR: 3000:1 (Full On/Full Off); 4000:1 in ImageAI™ mode, uniformity: 95 percent, video compatibility: NTSC, PAL, SECAM, HDTV (720p, 1080i/p), SDTV (480i/p, 576i), aspect ratio: 16:9 native, 4:3 compatible, LBX support, I/O Connectors: HDMI, Component Video, VGA with Component & SCART, IR Receiver, 12V trigger relay, lamp life: 3000 hours



(standard), 5.6 pounds.

Other FPs below:

- EP716
- EP719
- EP749

EP770  
 EP771  
 EP910  
 EP7150  
 HD3000  
 HD70  
 HD72  
 HD73  
 HD81  
 HD81VL (new HD81 for later 2007)  
 HD7300  
 TX773  
 TX775  
 TX780

HD7300 below:



TX773 \_\_\_\_\_ \$2,500 street price, TTM Jan 07

Multimedia data projector, lightweight, 3500 lumens, 2200:1 contrast ratio, Express on/off function, native XGA (1024 x 768) projector, IR sensors, RS-232, 6.5 pounds, built-in 3-watt speaker, DVI-D w/HDCP, single 0.7-inch DLP® chipset, max. resolution: PC: SXGA+ (1400 x 1050), video compatibility: NTSC, PAL, SECAM, HDTV (720p, 1080i/p), EDTV (576i/p), aspect ratio: 4:3 native, 5:4 and 16:9 compatible, VGA-in, USB, Audio-In, Audio-Out, VGA-Out, RS-232.

CES 2007

New HD81- LV \_\_\_\_\_ estimated at \$8,000, TTM 3Q07

2500 lumens, 12000:1 CR, optional 2.35:1 anamorphic lens/transport system announced by PR as \$4,000 (BX-AL133), although that price may actually be around \$6,000 MSRP, still has no lens shift for facilitating installation with the odd projector offset design, still no motorized zoom nor motorized focus, 2.35:1 automatic recognition for lens transport operation, includes separate



scaler/controller, controller to be offered also separately, package of projector/scaler/lens/transport to be offered for HD81-LV as for the HD81.

## Panasonic

For 720p and earlier sets, please consult the 2006 HDTV Technology Report.  
1080p sets (DLX76), as announced at CES 2006

56" PT-56DLX76 (below)

61" PT-61DLX76 (below)



ATSC/QAM/NTSC tuners, CableCARD, SD Card and Photo Viewer, RGB PC input, HDMI, TV Guide On-Screen™ Electronic Program Guide, 30W audio system that includes a 15W sub-woofer, TTM June 06, \$TBD, 13000:1 CR.

Later, it was reported that the sets on the DLX76 line accept 1080p.

DL500D line, 720p

TC-52DL500D, TTM now, 2500:1 CR

TC-61DL500D, TTM 06, 2500:1 CR

CES 2007

FP

AE1000, designed for savvy home theater enthusiasts, AV professionals, and gaming aficionados, 11000:1 CR, new optical system with spherical glass lens system for crisper, more vivid images.

## Philips

Consult the 2006 HDTV Technology Report.

## Projectiondesign

FP

F1+ 2500:1 CR, 1400x1050, 2500 ANSI lumens, 28db quiet operation.

Action! Model 3 1080

True 1080p single DC3 DMD 0.95", Crystalio II (according to them the world's most technologically advanced video processor) with 4<sup>th</sup> generation broadcast quality algorithms for superior SD and HD video image quality, dual 7 segment color wheels and light formatters, DuArch illumination architecture featuring dual lamps, TI's BrilliantColor SLR technology, 24/7 operation warranty, Gennum's VXP Visual Excellence Processing, adjustable output brightness from 550 to 2500.



## Dec 06

The company announced that it has added the feature of Brilliant Color technology into its Action! Model Three 1,080 above, now available for \$25,000, adding cyan, magenta and yellow filters to normal red, green and blue filters to improve the capability of displaying those 3 colors naturally, and enhancing color rendition in saturation and gamut using the existing lenses and Projectiondesign's current proprietary DuArch illumination architecture with dual lamps, dual seven-segment color wheels and light formatters.

Projectiondesign has available a variety of bayonet mount lenses, and features horizontal and vertical lens shift capability to facilitate installation.

## **Radio Shack**

Consult the 2006 HDTV Technology Report.

## **RCA (see Thomson)**

## **Runco**

### FP

Please consult the 2006 HDTV Technology Report for details and specs on the following equipment:

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VX-2 Series 3-chip 720p HD-2 DMD projectors.

*CineWide™ and CineWide™ with AutoScope™* technology optional on all models to obtain full capability of their DMD chips, displaying movies formatted in the 2.35:1 aspect ratio with increased resolution and brightness, and motorized anamorphic lens assembly via RS-232 commands.

### Reflection Series 720p

CL 610/610LT, 1150 ANSI lumens, 2200:1 CR

CL-810, 1250 ANSI lumens, 3100:1 CR

CL-810Ultra

SDC-1 Controller is an optional, stand-alone component controller specifically designed as a unique interface solution for both the CL-610 and CL-810 projectors.

CL-420          affordable 720p, implements *Enhanced GEN 3* technologies

Signature Cinema SC-1 2048x1080, 40 feet wide screen max, 9000ANSI, 1500-2800 CR.

Video Xtreme VX-80d 3-chip 1400x1050, 375" screen width, 8000 ANSI, 1500-1800:1 CR, DVI, RGB, 1000 hrs lamp (or 6 months).

Runco also introduced the CineWide with AutoScope technology for widescreen reproduction of movies originally filmed in the CinemaScope™ 2.35:1 format, maintaining constant vertical height on the screen while the image gets wider. The system uses a combination of software, electronics and remote controlled motorized

anamorphic optics. A projector is then able to use the full pixel array on its DMD™ chips for a 2.35:1 image having enhanced resolution and increased brightness.

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Sep 2006 (CEDIA)

Video Xtreme 3-Chip 1080p projectors

Runco claims to be the first to achieve THX certification

VX-22d           \$45,000

VX-44d           \$80,000

VX-55d           \$100,000 (\$115,000 when equipped with the CineWide with AutoScope option and Runco's most advanced McKinley anamorphic optics).

Claimed by Runco to offer the "industry's best black level and contrast performance. Runco has engineered Imaging Science Foundation (ISF™) calibration standards into every model for the purest video performance."

*"Our Video Xtreme portfolio of 3-chip 1080p projectors takes video projection to the next level with dazzling picture quality and extensive options to deliver unprecedented cinematic realism,"* said Runco President Bob Hana. *"These flagship projection systems are created for the very finest home theater applications, and are designed for true connoisseurs of big screen picture perfection who will accept no compromise."*

Offered with CineWide™ and CineWide with AutoScope™ technology to reproduce 2.35:1 CinemaScope™ movies with vertical screen image height, eliminating useless black bars, 3 1080p 16:9 SuperOnyx™ DMDs, Runco's award-winning Vivix II™ video processing, CinOptx™ lenses for a range of different throw distances, AxiShift™ technology with a motorized horizontal and vertical lens shift system, DHD controller with HDMI connectivity, optimized for 1080p performance for the new projectors.

<http://www.runco.com/>



CES 2007

Runco International announced that it 'is now' shipping its Video Xtreme™ line including the new THX Certified VX-22d, VX-44d and VX-55d 3-chip 1080p DLP™ projectors mentioned above, and the new THX Certified VX-2000d and VX-6000d single-chip 1080p DLP projectors.

VX-44d below



VX-22d below



According to Runco:

"The VX 1080p models are offered with numerous configuration options and prices, for a broad and versatile lineup that will easily meet the needs of any high-end installation requirement."

"For the ultimate in viewing flexibility and enjoyment, each model is available with Runco's exclusive award-winning CineWide™ and CineWide with AutoScope™ technology. This ground-breaking option can transform a superb home theater system into a true home cinema experience, reproducing 2.35:1 CinemaScope™ movies with unparalleled accuracy and full vertical screen image height, eliminating useless black bars."

Vx-2000d below:



Vx-6000d below:



All Video Xtreme projectors come with a re-engineered DHD controller, now with HDMI.

### **SAGEM**

#### RPTV

720p AXIUM line

Consult the 2006 HDTV Technology Report.

### **Samsung**

Consult the 2006 HDTV Technology Report for the following lines:

HL-R 68 Series

HL-R 78 Series

HL-R 88 Series

SP 720p line current (China)

L3HR sub-line

L6HR sub-line

L7HR sub-line

2006 models

720p line

HL-S 86 Series

Pricing was said would drop \$200-\$300 from 2005 models, Game mode as above, USB 1.1 input for JPEG and digital music files, TTM Mar 06, 2500:1 CR.

50" HL-S5086W \$2,300

56" HL-S5686W \$2,700, HDMI

61" HL-S6186W \$3,100

In 2006, all 1080p RPTVs were announced to drop the premium of 1080p price (over 720p sets) from \$1000 in 2005 to \$500 in 2006.

#### 1080p line

TTM 2Q06, HDMI inputs will be capable of accepting 1080p, LED light engine will replace the conventional Ultra High Pressure (UHP) lamp and extend bulb life from 6,000 hours to 20,000 hours maintaining consistent brightness levels throughout the life of the bulb, increase color gamut reproduction >100 percent of NTSC, turn-on time shortened from 30 seconds for UHP to seven for LED. The 56" 1080p LED set will be \$1,000 higher than similar UHP models.

#### HL-S 87 Series

TTM Apr 06, 1080p, 10000:1 CR, hidden speakers, ATSC/NTSC/CableCARD tuners, 2 HDMI inputs, PC input, 1080p input capability, 15-wattx2 audio, DNIE, 10000:1 CR.

50" HL-S5087W \$2,900

56" HL-S5687W \$3,200 (shown)

61" HL-S6187W \$3,600

67" HL-S6787W



#### HL-S 78 Series

TTM 06, 1080p, 10000:1 CR

50" HL-S5078W

56" HL-S5678W

61" HL-S6178W

71" HL-S7178W

#### HL-S 66 Series

TTM Mar 06, 720p, 2500:1 CR, ATSC tuner, floating bezel, DNIE.

42" HL-S4266W \$1,900

46" HL-S4666W \$2,100

67" HL-S6768, TTM 06, 10000:1 CR (mentioned at CES 2006 but not confirmed by press release)

#### LED based DLP RPTV



56" HL-S5679W \$4,200, TTM Apr 06, 1920x1080p, LED light replaces current UHP bulb, 20,000 hrs life, 7 seconds turn-on time, ATSC/NTSC/CableCARD tuners, 10000:1 CR, IEEE1394, 2 HDMI 1080p inputs, quieter, black glossy finish (above).

On July 2006, Samsung announced their shipment to dealers of the above set, at the MSRP price originally announced at CES 2006 above. According to Samsung, the set was back-ordered since CES 2006.

The LED system claims to use a postage-stamp-sized LED lighting array of 6 LEDs per each of the 3 colors, red, blue, and green, lifespan rated at 20,000 hours, extends the color gamut of traditional DLP rear projection TVs without the use of a color wheel, and uses less electricity than conventional micro-display RPTVs and most flat-panel TV displays.

FP

SP-H710AE \$4,000, TTM now, HD2+ DMD chip, 1280x720, 250w lamp, 6-segm-color wheel, 29db in theater mode, DVI-D/HDCP, 2xcomponent, PC input.

SP-H800BE \$12,000, TTM now, HD2+ Dark-chip 3, 1280x720, 250w lamp, 8-segment color wheel, 10-bit processing, 28db in theater mode, DVI-D/HDCP, 2xcomponent, PC input.

SPH-700AE \$12,000, 700 ANSI, 2800:1 CR, 720p.



CES 2007

RPTV

Samsung introduced two new Series:  
87S Series



1080p Slim LED DLP eliminates the need of a color wheel to minimize moving parts, TTM Apr 07, single chip DLP LumiLit light engine, long life time (approximately 20,000 hours) without sacrificing brightness, 1920 x 1080 (1080p) resolution, 3D ready technology, integrated HDTV ATSC/QAM tuners, side A/V pack, 3xHDMI inputs, WiseLink™ (USB 1.1) with Picture Viewer, RS-232C input to

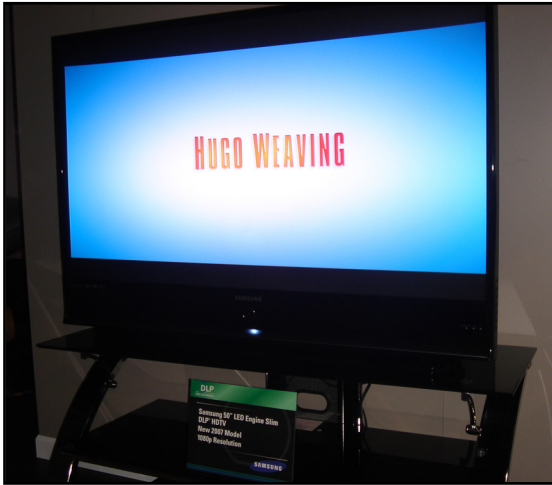
browse photos or MP3s on-screen, mercury free for environmental friendliness, short turn-on time (less than 10 seconds).



- 50" HL-T5087S \$2,400
- 56" HL-T5687S \$2,800
- 61" HL-T6187S \$3,200 (right)

According to Samsung "with LED powered DLP HDTV line, Samsung removes the

traditional rear projection TV UHP lamp and color wheel and replaces them with powerful LED technology whereby, red, green and blue LEDs sequentially fire to produce smooth, stable color, offering consumers the opportunity to enjoy a captivating cinematic experience with improved color reproduction. The exclusive Cinema Smooth LED light engine provides a dramatic improvement in reliability and longevity many times longer than that of lamps. Furthermore, the LED technology can save users hundreds of dollars a year in electricity and lamp replacements.



These new LED based DLP HDTVs for 2007 are equipped with a wide-angle lens system that allows them to take on a super sleek cabinet, reducing the height by 2.5-inches, depth by 2.0-inches and width by 2.0-inches compared to the previous Samsung LED based DLP TV."

#### 79W Series

1080p LED conventional design  
56" HL-S5678W \$4,000

#### 76S Series

Lamp-based, Ultra-Slim 1080p DLP HDTVs, sleek ultra-slim cabinet, Samsung's Cinema Smooth™ Light Engine, TTM Apr 07, 3D ready for enhanced gaming, movie viewing, television viewing and more, ultra-slim depth of only 10.6", 10,000:1 CR, Samsung's Brilliant Color™ II and Cinema Smooth™ Gen 8 Exclusive Light Engine, integrated HDTV ATSC/QAM tuners, side A/V pack, 3xHDMI inputs, WiseLink™ (USB 1.1) with Picture Viewer, RS-232C input, PC-input.

50" HL-T5076S \$2,100  
56" HL-T5676S \$2,500  
61" HL-S6176S \$2,900

HL-T7288W below:



HL-T6779 below:



#### **Sanyo**

Wireless Projector System  
CES 2007



**SANYO Wireless Projector**

Can you imagine? Delivery the Wireless HD for Projector. SANYO can.

- Supports video data rates of up to 1.5 Gbps, including 720p and 1080i
- 20 MHz bandwidth, conforming to worldwide 5 GHz regulations
- Wireless HDTV anywhere within the room and beyond (a range of 20-30 meters)
- Less than 1 millisecond latency
- Animon's WIDE™ Wireless High-Definition Interface Technology - Uncompressed and Unorganized
- MIMO wireless modem operating in the 5 GHz unlicensed band
- Robust system - independent frame by frame transmission
- Graceful adaptation for all channel conditions

SANYO wireless HDTV demo showcases a new concept for a projector with a wireless uncompressed HDTV link that supports wireless delivery of uncompressed high-definition video signals with videodata rates of up to 1.5 Gbps (including 720p and 1080i) at wire-equivalent quality.

**Demo Setup**

WIDE™  
DVI / HDMI / Component  
SANYO Wireless Projector AVX LINK  
High-Definition DVD  
SANYO

## Sharp

### FP

For models:

DT-100, portable entry level,

XV-2000, mid-level

XV-Z12000 MARK II (former top-of-the-line 720p)

Consult the 2006 HDTV Technology Report.

XV-Z3000, \$3,500, TTM Apr 06, latest 720p chip, 6500:1 CR, 1200 ANSI lumens, 30dB fan, dual iris system, 3-2 pull-down, HDMI, 6-segment color wheel, demo with Studio Tech 130 by Stewart 123 screen diagonal, (right photo).



DT-500, \$3,300, TTM July 06, 1280x768, 4000:1 CR, 1000 ANSI lumens, 8.6 lbs, powered optical iris, 6-segment 5x speed color wheel, I/P conversion, 3-2 pulldown, color management system, 3-step bright boost, HDMI (left photo).

### 1080p model (advanced announcement at CES 2006)

XV-Z20000, \$12,000, TTM 3Q06, 1920x1080p resolution, Sharp's CV-IC III Video Scaling Circuitry, DVI/HDCP and 2xHDMI 1080p-capable inputs, 1000 ANSI, 10000:1 CR. Excellent demo with Blu-ray at CES 2006, will accept 1080p when released.

Sharp announced at CEDIA (Sep 2006, that the projector would be available in October 2006 for the \$12,000 originally disclosed MSRP.

### CES 2007

Sharp finally introduced the XV-Z20000 above, using the latest 0.95" single DMD from Texas Instruments, high-gloss black, 1080p, Sharp's CV-IC III Video Scaling Circuitry, 12000:1 CR, 1000 ANSI lumens,



DVI/HDCP, 2xHDMI, TTM now, \$12,000, RS 232, Minolta optics, 1:1.35 manual zoom lens with vertical lens shift function (above).

Model DT-510 \$2,500, TTM Feb 07, 720p, gloss-white design, 8.8 pounds, 1280 x 720, 4000:1 CR, 1000 ANSI lumens, powered optical iris system, 6 Segment 5 X Speed color wheel, I/P conversion, 3-2 pull down, Color Management System (C.M.S.), 3-step Bright Boost and an HDMI™ interface, 0.62" DMD 1280 x 720 TI chip, BrilliantColor™ Technology and TrueVision™ Image Processing, HDMI, powered optical iris system, whisper-quiet operation.

Model XV-Z3100 \$2,700, TTM Feb 07, 720p, 1000 ANSI Lumens, 6500:1 CR, low fan noise of 29dB (in economy mode), I/P conversion, 3-2 pull down, Color Management System (C.M.S.), 3-step Bright Boost, a 12-volt trigger and an HDMI™ interface, 720p, 6 Segment 5 X Speed color wheel, dual iris system, high-gloss black casing, 12-volt Screen Trigger, 0.62" DMD 1280 x 720 chip, BrilliantColor™ Technology and TrueVision™ Image Processing.



## **SIM2 USA**

FP

### Grand Cinema Line

C3X LINK \$24,000, TTM now, 3-chip 720p DLP, with 2<sup>nd</sup> generation remote DigiOptic Image Processor DOIP, connected through a single glass-fiber optic cable with the DOIP Image processor up to a distance of 1600 feet away, 2 HDMI/HDCP, ALPHA Path light engine, 6500:1 CR, multiple lens options, RS232, USB, 20lbs.



C3X LITE \$16,000, TTM now, 720p 3-chip, 2 HDMI, 5500:1 CR, lens included, 150-watt lamp, SIM2 ALPHA™ Path 3-Chip Light Engine.

C3X \$20,000, TTM now, 6500:1 CR, 720p x3 chip, 2 HDMI, multiple lens options (T1 and T2), Hi-Brite lamp.



### Domino

D35 \$5,500, TTM now, 720p, HD2+ DarkChip2, improved version of the 30H model, 3200:1 CR (Full ON/Full OFF), 150W lamp, 6000 hrs life, RGBHV, HDMI, BNC component, RS-232, dual 12-volt.  
D35 below:

HT3000 1080p 0.95" single chip, TTM spring 06, 10-bit DSP, 2 HDMI, 4000:1 CR.

The HT3000 was actually released at \$16,000, TTM updated as October 2006, 1080p 0.95 inch DMD Dark3 chip DLP projector, 10 bit DSP on all analog inputs, 4000:1 CR, mentioned in 2006 report but with no price.



Sep 06 CEDIA was used by the company to introduce new Home Cinema "Scope" anamorphic lens options to display projected source material in a variety of aspect ratios up to 2.35:1, designed for any SIM2 projector, and with a motorized version for the 1080p HT-3000 projector, and 3-chip 720p C3X projector family, enabling HT installations to maintain the height of the image frame when shifting between sources with 16:9, 4:3 and 2.35.1 aspect ratios. \$9000 for the lens and \$12000 for the lens/motorized sled version.

SIM2's proprietary Alpha Path light engine, new seven-segment (RGBRGB + Neutral Density Filter) color wheel, 200-watt high output lamp rated at 4,000 hour lifespan, 5,000:1 CR (full on/ full off), live color management and gamma control functions, new Dynamic Noise Reduction, Spatial Noise Reduction processing, two HDMI/HDCP inputs, VGA, component, RS-232, IR input jacks, two 12V trigger outputs to control motorized screens and other support equipment.

Includes a high quality lens with a throw ratio of 1.5-2.0:1, but is also available with an optional long-throw 2.0-3.0:1 ratio lens, TTM Oct 06, \$17,000.

HT300 E-LINK, 720p, HDMI, HD2+ Dark chip 3 DMD.

HT300E, 720p, HDMI, 3500:1 CR, HD2+ Dark chip3 DMD.

Domino 55M (included in the CES 2005 report).

#### Sep 06 CEDIA

Grand Cinema HT305 E

\$9,000, TTM Sep 06, 720p, replaces HT300E, 150 watt lamp, HD2+ Dark Chip3, 3500:1 CR (Full ON/Full OFF) 20%+ light output, 1.8-2.4:1 long-throw, RS-232, dual 12v trigger, HDMI/HDCP, RGBHV, BNC component video

HT305 E below:



#### Nov 06

FP

D80 1080p, \$10,000



SIM2 announced the reduction in price of their 1080p DLP™ Home Theater with D80 Projector on the Domino line.

According to the company "The D80 delivers much of the core performance of the company's single-chip flagship HT3000, including true 1080p resolution, full 10-bit processing, and SIM2's proprietary Alpha Path™ light engine, all at an under-\$10,000 price point."

The SIM2 D80 implements TI's 0.95-inch 1080p DarkChip3™ DMD chipset, features a new seven-segment color wheel (RGBRGB + Neutral Density Filter), end-to-end 10-bit video processing, 160-watt high output lamp, >4,000:1 CR (Full ON/Full OFF), 14" x 12-1/2", HDCP-compliant HDMI input, VGA, component, high-quality internal deinterlacing/scaling engine, capable of 16:9, 4:3, and Letterbox formats, three custom user settings for each input and additional aspect ratio adjustments, rear-panel RS-232 port, dual 12V trigger outputs, Matte Black or Matte White cabinet colors.

#### CES 2007

#### Also introduced at CEDIA 2006

Grand Cinema HT5000 \$50,000, TTM Jan 07, 3x1080p chips  
3 x 0,95" 1080p DLP® DarkChip3™ by Texas Instruments, 1920 x 1080 pixels HDTV resolution, 6 HDMI™ HDCP inputs, Contrast ratio >5000:1, Lamp: 300W, Choice of 6 lenses(1), SIM2 Live Colors Management and Gamma Functions (36 predefined adjustments), Intelligent memory functions, New Dynamic Noise Reduction and Spatial Noise Reduction.

#### Lens options:

Lens Type L0: Throw ratio 0.67:1 (Fixed wide angle)

Lens Type L1: Throw ratio 1.12:1 (Fixed wide angle)

Lens type L2: Throw ratio 1.39 - 1.87:1

Lens type L3: Throw ratio 1.87 - 2.56:1

Lens type L4: Throw ratio 2.56 - 4.16:1

Lens type L5: Throw ratio 4.16 - 6.96:1

#### Installation:

Lens shift: V+/-100%; H +/-64%

Digital keystone adjustment: V+/-22°

Picture size (inches diagonal): 50-300

Aspect ratio: 4:3, 16:9 Anamorphic, LetterBox, panoramic, pixel to pixel + 3 custom-user adjustments

#### Electronics:

Horizontal & vertical scan freq.: 15-80kHz/48-100Hz

Video and Graphic standards: PAL (B,G,H,I,M,N,60); SECAM; NTSC 3,58; NTSC 4,43 automatically selected; HDTV: ATSC (480p, 720p, 1080i, 1080p); EU 576p + 1080i 50Hz; PC graphic: VGA, SVGA, XGA, SXGA, UXGA

Contrast ratio (Full ON/ Full OFF): >5000:1

Format Board: 10 Bit

Video processor: built in

Special video adjustments: Dynamic Noise Reduction, Spatial Noise Reduction, Fleshtone Regulation  
Other special adjustments: Memories/Overscan, Live Colors Management (LCM) and Gamma Functions

Inputs/Outputs:

- 1 x Composite Video (RCA)
- 1 x S-Video (mini Din 4 pin)
- 1 x RGBS/YCrCb (4x RCA)
- 1 x RGBHV/YCrCb (5x BNC)
- 6 x HDMI – HDCP compliant (6x HDMI)
- 1 x OUT Digital Audio (Toslink)
- 1 x DVI (1x DVI-D)
- 1 x HD-SDI (1x BNC)
- 2 x VGA (DB15)
- 1 x RS232 (DB9)
- 1 x USB connector (USB)
- 1 x LAN (RJ45)
- 2 x OUT 12V 100mA (via Jack)



General Specifications:

Software control: upgradable via RS232 serial interface, USB and LAN  
Mains voltage range: 100-240Vac ±10% (48/62Hz)  
Power consumption: approx. 400W  
Weight: approx. 45 Kg (99.2 lbs)  
Dimensions (WxHxD): 570x260x730mm (22.4"x10.24"x28.7")

CinemaScope System

\$9,000 manual lens, \$12,000 lens and motorized sled. TTM now.

Very high quality anamorphic lens attachment, with and without a motorized sled that allows remote and automated activation of the lens for 2.35:1 image presentation.



According with Sim2 "While most high-end home theater displays feature 16:9 "widescreen" aspect ratios, these systems are still significantly narrower than the 2.35:1 aspect ratio

preferred for the finest cinematic releases. In order to display the full frames of these films, the video system must display black bars on part of the top and bottom of the screen in a process commonly known as "letterboxing".

Not only does this result in an image that is "shorter" than the screen height, it also fails to make full use of the resolution capabilities of the unit, as the pixels

associated with the "letterboxed" portions are essentially unused. As a result, nearly 1/3 of the projector's resolution capabilities are wasted, and there is decrease in brightness of as much as 20%.

SIM2's Home Cinema "Scope" System corrects these deficiencies through a combination of internal image processing and external optical adjustment. By adjusting one of the projector's custom user settings, installers can set the unit's scaling to stretch 2.35:1 images vertically, cutting off the unused "letterbox" portions and using the full DMD chip resolution for image reproduction.

Letterboxed for a 16x9 screen



Reformatted for a 2.35:1 screen



When this image is projected through Home Cinema "Scope" lens, the image is then stretched horizontally in the exact ratio needed to restore the original 2.35:1 aspect ratio of the source material".

Sim2 adds "When displaying source material created in other common aspect ratios, such as 1.85:1, 1.78:1 (16x9), or 1.33:1 (4x3) the projector processing is restored to its normal setting, and the anamorphic lens is removed from the projector output.

When used in conjunction with the company's top-of-the-line C3X or HT3000 projectors, the Home Cinema "Scope" system is available with an optional motorized sled, which is capable of inserting or removing the anamorphic lens when triggered by IR remote commands, or a whole-home control system. For other projectors, the lens is added and removed from the output manually."

PROC3            \$18,000, TTM Mar 07  
SIM2 Pro Cinema Division introduced their first projector for professional digital theater applications, the Three-Chip PROC3.



Featuring 3 HD2+ DarkChip™3 DMD 720p chips, 4000 ANSI Lumens, designed for E Cinema, pre-show advertising, and post-production applications, proprietary ALPHA™ Path light engine, 2800:1 CR (Full ON/Full OFF), for screen sizes of up to 300 inches.

17" square footprint, 1280 x 720, 10-bit video processing, high-quality internal deinterlacing/scaling engine, capable of 16:9, 4:3, and Letterbox formats, three custom user settings for each input for additional aspect ratio adjustments to suit any screen geometry, RS-232 interface, 12V trigger outputs, warranty program for parts, labor, and lamp.

Mar 07

SIM2 introduced the Home Cinema "Flex" system, a lower cost 2.35:1 widescreen theater projection option to the Home Cinema "Scope" system, \$3,200 (6,000 with optional sled), TTM Mar 07.



The system consists of an anamorphic lens with an optional motorized sled to allow remote and automated activation of the lens, and is compatible with the D80, Grand Cinema HT3000, and C3X projectors.

The SIM 2 projector's custom user settings can be set stretch 2.35:1 images vertically, while the anamorphic lens system stretches the

image horizontally for a full 2.35:1 presentation.

According to SIM, "When displaying source material created in other common aspect ratios, such as 1.85:1, 1.78:1 (16x9), or 1.33:1 (4x3), the projector processing is restored to its normal setting, and the anamorphic lens is removed from the projector output.

Both the "Flex and "Scope" systems are available with optional motorized sleds that are capable of inserting or removing the anamorphic lens when triggered by IR remote commands, or a whole-home control systems. Each lens system is also available as a standalone unit that is inserted and removed manually.

SIM2's Home Cinema "Scope" System, which employs higher quality optics than the "Flex" system, is compatible with the Grand Cinema HT5000 and C3X three-chip DLP projectors only. It is currently available at a suggested retail price of \$8,995 for a static lens system, or \$11,995 for motorized system."

### **Thomson**

#### From CES 2006

Thomson discontinued the ultra-thin RPTV line (co-developed with Infocus)

#### RPTV

Six new 720p models (one RCA brand), TTM summer 06, CableCARD/ATSC tuners.

#### RCA Scenium

2 HDMI/HDCP inputs, component, VGA, wired IR

50" M50WH185, \$2,000, TTM June 06, 4 models as 185/6/7/8

61" M61WH185, \$2,500, TTM June 06

#### RCA brand

50" M50WH72S \$1,800, TTM Apr 06, HDMI, 2 component

#### CES 2007

TTE Corporation introduced three new RPTVs, a pair of 50-inch 720p sets and a 51-inch 1080p model:

#### 1080p model

51" M51WH200 \$2,000, TTM Jun 07, featuring two antenna inputs, two rear component, two rear HDMI, audio system 20-watts with digital audio output.

#### 720p models

50" M50WH92S \$1,300, TTM Jun 07, HD5 DLP® technology, Enhanced Natural Vision – EN-V picture processing, two antenna inputs, 2xcomponent, 2xHDMI, 20-watts audio, digital audio output, 7 band graphics EQ.

50" M50WH197 \$1,500, TTM Jun 07, RCA Scenium, same features above plus Amplified Resolution Contrast & Color – ARC 2 advanced picture processing, adaptive spatial/temporal noise reduction, dynamic contrast enhancement, multi-axis color space correction, Audio SRS TruSurround XT™ sound, CableCARD™ slot, VGA input, rear wired IR port, 6-device backlit learning remote.

Continuing in the line are two RCA Scenium 185 Series models (TTM now):

50" M50WH185 \$1,600

61" M61WH185 \$2,100

Featuring ARC 2 advanced picture processing and SRS TruSurround XT™ sound, two antenna inputs, 2xcomponent, 2xHDMI, Onboard sound 20-watts, digital audio output, 7 band graphics EQ, CableCARD™ slot, VGA input, rear wired IR port, 6-device backlit learning remote.

## Toshiba

For the TheaterWide HM95 and HM195 (1080p) lines, and the Cinema Series HMX95 and MX195 (1080p) lines Consult the 2006 HDTV Technology Report.



At CES 2006, as mentioned on the LCD section, the company decided to use the CES show to make announcements that usually are done at their dealer show in spring. The company said it was investing in LCD and SED in 2006, while also carrying plasma as a mainstream product. Toshiba abandoned the CRT RPTV line in 2006.

## RPTVs

### 720p line

Talen 5 light engine, HD5 chip, Brilliant Color 2 technology, Hi-Bright Radiance 150-watt lamp, PixelPure Pro 12-bit video processing (333 MHz) that produces real speed progressive scanning, increased dynamic range and sharpness, improved video noise reduction and dynamic gamma, new cosmetic look with SoundStrip speaker technology, small cabinet design (front dimensions smaller than same size plasma sets), silver finish for Theater wide, black for Cinema Series models.

50" 50HM66, TTM Apr 06, pictured above

56" 56HM66, TTM May 06

### Mar 06 (Germany)

#### FP

Et20 \$1900, integrated DVD player, super close lens system for up 2 meters diagonal image from 1 meter distance (or 1.5 meter image from 70 centimeters away), Realta HQV video processor for pixel-by-pixel noise reduction and advanced multi-



cadence detection, 'Anyplace' 2D keystone, integrated 5.1 surround sound system,

#### May 06

Nine 9 DLP RPTVs on the 2006 line up at the company's dealer show ranging in price from \$1,700 to \$4,800 between 42 and 72 inches. All suited with ATSC/QAM digital tuning, for terrestrial and digital cable-in-the-clear broadcasts, 2xHDMI.

50" and above sets include a CableCARD slot or digital cable compatibility (DCR) and RJ-45 network capability, for a PC connection to back MP3 audio files and JPEG pictures, PixelPure Hi-Bit 12-bit digital video processing technology, compact Scoop Design cabinetry, and "SoundStrip" speaker system.

60" and larger screen sizes use Toshiba's XHD 1,080p TALENX light engine with Texas Instruments' new xHD5 (1920x1080p) DMD, Xtreme BLACK aperture control technology claimed to have twice the pixel resolution and contrast of previous models.

#### 720p

TALEN 5 light engine using the HD5 DLP chip, Radiance 150-watt lamp.

42"	42HM66	\$1,700, TTM Jun 07
50"	50HM66	\$2,200, TTM now
56"	56HM66	\$2,500, TTM now

#### Cinema Series 720p

50"	50HMX96	\$2,500, TTM now
56"	56HMX96	\$2,800, TTM Jun 07

#### XHD 1080p

Four new models with aperture control, window picture over picture (POP) and TV Guide on screen. The two "Cinema Series" 1080ps are available in black cabinet with a high-gloss black bezel, PC input and Virtual Dolby Digital.

62"	62HM196	\$3,200, TTM Jun 07
72"	72HM196	\$4,500, TTM Jul 07

#### Cinema Series XHD 1080p

62"	62MX196	\$3,500, TTM Jul 07
72"	72MX196	\$4,800, TTM Aug 07

#### CES 2007

Toshiba introduced a mobile projector for multimedia performance

TDP-T45U \$1,200, 2,500 ANSI Lumens, Multimedia Capabilities, and Dual Computer Connectivity for Mobile Presentations, 2000:1 CR, XGA 1024 x 768 resolution, lightweight design, 2xcomponent, 1-watt speaker, 6.6 pounds, TTM Sep 07, 0.55" DMD DLP™, No. of pixels 786,432 (1024 x 768), standard Lens 1.2x manual zoom/manual focus, F/f (mm)  
F = 2.0 - 2.2, f = 19.41 - 23.32 mm,  
190W lamp, 16.7 Million Colors, 2000:1 CR, 36 - 300 inches diagonal screen size, distance 11.5 ft/100-inch,  
Frequency Horizontal (kHz) 15.7 - 106.25kHz, vertical (Hz) 50 - 85Hz.

RGB 2 x D-sub 15-pin, Video NTSC,



PAL, SECAM, Color Difference HDTV/DTV  
 Input Signal Format (480p/480i/576i/576p/720p/1080i), RGB VGA, SVGA, XGA (true), SXGA (compressed), UXGA (compressed), MAC (MAC 16, 19), Output Terminals Audio 1x stereo mini-jack (variable output), RGB 1x D-sub 15-pin, Digital Keystone Correction Manual +/- 15°, Internal Speaker 1.0W Monaural, PC Interface RS232C (mini DIN-8 pin), External Dimensions (WxDxH) 11.2" x 10.0" x 3.8" Weight 6.6 lbs., Power Source 100 - 240V, 50/60Hz.



Toshiba announced another mobile projector, this one with wireless networking capabilities:

TDP-TW100U \$1,700, Digital Zoom, 2,700 ANSI lumens, integrated IEEE 802.11g wireless2 functionality, 6.8 pounds, 2000:1 CR, XGA 1024x768, Natural Color Enhancer2 (NCE2), automatic vertical keystone correction (plus or minus 30 degrees), 33 dB fan noise, 0.55" DMD DLP, 1.6x Power Zoom/Auto Focus, F/f (mm) F = 2.23 - 2.82, f = 20.5 - 32.8mm, 275W light, 16.7 Million Colors, Screen Size (Diagonal) 30 - 300 inches, Projection Distance 3.5 ft - 36.4 ft, Throw Ratio 1.8 - 2.9:1, Compatible Scanning Frequency Horizontal (kHz) 15 - 120kHz, Vertical (Hz) 50 - 150Hz, RGB 2 x D-sub 15-pin, Input Signal Format 480p/480i/576p/576i/720p/1080i), RGB VGA, SVGA, XGA (native), SXGA (compressed), UXGA (compressed), Digital Keystone Correction Automatic vertical +/- 30°, Noise Level 36dB (33dB in low mode).

The company also introduced another multi-function projector for large-scale venues:

TDP-TW350U \$2,339, 3,500 ANSI lumens, Network Management, wireless capabilities, 2,000:1 CR, 1,024 x 768 XGA resolution, integrated IEEE 802.11g wireless2 functionality, Toshiba's proprietary Natural Color Enhancer color correction circuitry, PC card slot, automatic two-way digital keystone correction system, 29dB fan noise, 12.1 pounds, 3xcomponents (shared with computer inputs), two four-watt stereo speakers, one type A USB port, 0.7-inch DMD DLP, Projection Lens Standard Lens 1.5x power zoom /auto focus, F/f (mm) F = 2.4 - 3.0, f = 21 - 31.5mm, Light Source



300W, screen Size (Diagonal) 33 - 300 inches, Distance 4.8 ft - 36.4 ft, Scanning Frequency Analog RGB fH: 15 - 120 kHz, fV: 30 - 150 Hz, 2 x D-sub 15

RGB 1 x 5 BNC (R,G,B,H,V), 1 x DVI-I, USB 1, keystone correction Auto Vertical/Auto Horizontal.

### **Vidikron**

Consult the 2006 HDTV Technology Report for models:

Model 10

Model 12

Model 30

Model 90

Model 100

All other models could be found at the 2005 Report or earlier.

### Apr 06

Vidikron introduced the Vision™ Model 90 a direct descendant of their flagship Vision "LightAmp™" Model 100, with many of the same technologies and performance advantages, including Vidikron's proprietary built-in Imagix™ video processing, 3-chip, 1280 x 720 (720p), engineered to meet the exacting standards of the Imaging Science Foundation (ISF).

Available with a choice of four precision lenses for use with multiple screen widths and in rooms of varying sizes, electronic horizontal and vertical shift, Vidikron's IntelliWide™ technology, CineWide™ with AutoScope™ technology options for CinemaScope™ 2.35:1 aspect ratio, 2xDVI/HDCP, RS-232, Light output rated at a CSMS™ home theater calibrated level of 45.3 Foot-Lamberts (fL), with a CSMS calibrated contrast ratio of 258:1 (atypical ANSI contrast 3000:1).

Vision 90      \$20,000, available in Classic White or a stylish Graphite Gray cabinet.

CineWide with AutoScope technology option is \$13,000.

Model Vision 30 720p

Model Vision 50 \$10,000, 720p

Vision 90 below:



Additionally, Vidikron offered their VDP-80 digital video processor/controller, originally offered exclusively with the Vidikron Model 80 D-ILA projector, now available for integration with other Vidikron displays.

The VDP-80 features Vidikron's exclusive Imagix™ video processing, video switcher that process the selected input, and output in the appropriate format and resolution required by the connected video display, Standard definition (SD), enhanced definition (ED) and high definition (HD) video inputs supported (and PC formats), custom-programmed to maximize the performance of its partner display, IR remote control, RS-232 interface, engineered to maximize the Imaging Science Foundation™

(ISF) standards, up to 10 separate video components can be connected with video signals from 480i to 1080i

VDP-80 video processor \$6,000, TTM now.

#### Sep 06 CEDIA

Vidikron introduced the Vision Models 70, 85, 110 and 120, featuring CineWide and CineWide with AutoScope, 1080p, THX certified, joining models 90 and 100 (which have been upgraded to Vision Model 90t and 100t to reflect their new THX status), Vision 70 and 85 are single chip, Vision 110 and 120 are 3-chip projectors, Vidikron's exclusive all-digital Imagix™ video processing integrated into the Models 70 and 110, while the Vision Models 85 and 120 offer an outboard video processor/controller, HDMI, Vision 85 offering the fixed CineWide option, and the 70, 110 and 120 each available with both the fixed version and the motorized AutoScope option.

The Vision Models 110 and 120 offer a range of precision lens options, are equipped with generous electronic horizontal and vertical lens shift, have substantial light output capabilities making them suitable for larger screen sizes and applications where higher ambient light levels are present.

- Vision 70 \$12,000 (shown), integrated Imagix video processing, fixed and motorized lens option
- Vision 85 \$17,000, outboard video processor/controller, fixed Cinewide optional lens
- Vision 110 \$40,000
- Vision 120 \$45,000



CineWide lens option and CineWide with AutoScope motorized anamorphic lens system are priced separately. All models in Classic White or the optional Graphite Gray chassis.

Vidikron announced the availability of the CineWide™ and CineWide™ with AutoScope™ option on the Vision Model 30 and Vision Model 50 DLP™ 720p projectors, the latest Vidikron projectors to incorporate CineWide and CineWide with AutoScope (now four models with five different CineWide options).

The projectors incorporate a Vidikron's DualV Stage Illumination (DVSI™) system that provides for selectable lamp intensity levels for enhanced dynamic range performance, Vidikron's proprietary Imagix™ video processing technology, component and digital HDMI inputs, discrete IR, RS-232 control, rated at a Cinema Standard Measurement System (CSMS™) home theater calibrated levels of 19.0 and 21.5 Foot-Lamberts (fL), with CSMS calibrated contrast ratios of 203:1 and 218:1 (a typical ANSI contrast 2150:1 and 3000:1), respectively, engineered to meet the exacting standards of the Imaging Science Foundation (ISF).

- Vision Model 30 new MSRP \$6,000
- Vision Model 50 new MSRP \$8,000

Fixed CineWide (\$3,000) lens optional on both.

Vision 50 available with the ultimate CineWide with AutoScope (\$12,000) motorized anamorphic lens system, both available in Classic White or the optional Graphite Gray chassis.

The Vision 30 offers two different lenses based on desired throw distances.

The Vision 50 adds motorized power zoom and focus control, as well as comprehensive electronic lens shift capabilities.

#### CES 2007

Vidikron announced that the projectors above are now shipping and introduced the new flagship projector THE VISION MODEL 150 LIGHTAMP™, 3-CHIP 1080p, featuring new 3-chip light engine, advanced Xenon LightAmp™ illumination system with 1.2 kW Xenon lamp, Vidikron's exclusive V2™ technology, multiple aspect ratio control, Vidikron's proprietary IntelliWide™ mode, optional wide range of high precision zoom lenses, motorized horizontal and vertical lens shift, all-digital VHD controller featuring exclusive Imagix™ video processing and advanced aspect ratio control system, DVI/HDCP, Discrete IR, RS-232 control, superb scaling and brilliant color reproduction no matter the source, engineered with ISF™ calibration standards, THX certified.

As with the other projectors Vidikron offer CineWide™ and CineWide™ with



AutoScope™ technologies for the Vision Model 150 for true 2.35:1 widescreen movie projection preserving every pixel of resolution and eliminating distracting black bars on the top and bottom of the screen.

Vision Model 150 \$100,000, TTM Jan 07, pricing for the fixed CineWide lens option and the ultimate CineWide with AutoScope motorized anamorphic lens system vary,

available in Classic White or optional Graphite Gray.

#### **Viewsonic**

##### CES 2007

PJ258D iPod below:



#### **Vivitek**

Consult the 2006 HDTV Technology Report for earlier RPTV models

**Yamaha**

FP

Consult the 2006 HDTV  
Technology Report for earlier  
models:

- DPX-830
- DPX-1200
- DPX-1100
- DPX-1200
- DPX-1300



**Zenith**

(Please see **LG**)

## Chapter 7 - Liquid Crystal on Silicon (LCoS)

### Canon

#### CES 2007

#### Realis

SX6 1400x1050, 1.7 power zoom, 3500 ANSI lumens, 1000:1 CR, DVI/HDCP

SX60 1400x1050, 1.7 power zoom, 2500 ANSI lumens, 1000/2000:1 CR, DVI/HDCP

SX50 1400x1050, 1.7 zoom, 2500 ANSI lumens, 1000:1 CR

X600 1024x768, 1.7 power zoom, 3500 ANSI lumens, 1000:1 CR, DVI/HDCP



### Cinetron

#### Sep 06

#### FP

HD-900 1080p, \$6000, TTM Oct 06, three 0.7" Liquid Crystal on Silicon (LCoS panels), each with 1920x1080 pixels of resolution, 6000:1 contrast ratio, integrated Realta HQV(R) processing, MSRP \$6000.

According to the company the HD-900 is the world's first 1080p projector to feature built-in Realta HQV (Powered by Teranex) 10-bit video processing as the famous \$60,000 Teranex Xantus box, full-resolution four-field, pixel-based, motion-adaptive video deinterlacing for SD and HD signals.

Temporal-recursive and codec noise reduction; automatic film-based and advanced cadence detection; and pixel-based detail enhancement, the patented Full HD CRYSTAL Light Engine(TM), available in the U.S. through custom-installation and A/V equipment dealers, with a two-year limited warranty on parts and labor, and a 1000-hour warranty on the lamp.

### DreamVison



DreamBee \$7,800, 3x1080p 0.7" D-ILA chips, 15,000:1 CR, internal cooling system, 2xHDMI, horizontal/vertical lens shift, GF9351 video processor featuring VXP™ technologies, 1000 ANSI lumens, 170w lamp (200W in bright mode), 1080p

50/60/24 inputs, 22dB noise (left).

CinemaTen 80 3x1080p 0.82" D-ILA chips, external video processor Dream Scaler 2 powered by ABT, 10-bit video processing,



800 lumens, 3500:1 CR, 200 watt lamp (200 hrs), 1080p 48/50/60 inputs, 4xHDMI v 1.1.

### **ELCOS**

Consult the 2006 HDTV Technology Report.

### **Faroudja**

Consult the 2006 HDTV Technology Report for the DILA 1080p front projector with DVP1080 HD video processor.

CES 2007 projector shown, check Meridian/Faroudja for more information.



### **Hitachi**

Consult the 2006 HDTV Technology Report for the following models:

RPTV

T925 Series

X927 Director's Series (hi-end line)

### **JVC (D-ILA)**

Consult the 2006 HDTV Technology Report for background regarding RPTV demos (70" and 56" slim line prototype, FH96 line, and R1U Professional Series).

At that time, JVC was exploring the use of LEDs as the light source for both HD-ILA RPTVs (replacing the current high-pressure mercury lamp) and flat panel LCD sets (replacing the current CCFL light source).

According to JVC, LED backlighting offers faster response time for detailed fast motion images, and deliver more vivid color images, and. reduced hold time for less blurring and ghosting. JVC also demo a Quad HD-ILA for presentation and commercial applications.

### FP

DLA-HX2E projector specs, consult the 2006 HDTV Technology Report.

### 2006 lines

Optical Iris, 5<sup>th</sup> generation DIST, JVC's Genessa 32-bit CPU video processing, dynamic auto iris, ATSC/QAM/NTSC tuners, 2 HDMI, 2 component, PC input. RPTV 1080p series (right)

TTM July 06, planned with NO 1080p acceptance, 3 x 0.7 inch 1920x1080 chips

56" HD-56FN97 \$3,500

61" HD-61FN97 \$3,800

70" HD-70FN97 \$5,500



### RPTV 720p series

TTM Mar 06, 3 x 0.7" 1280x720p chips

52" HD-52G787 \$2,800

56" HD-56G787 \$3,200

61" HD-61G787 \$3,500

I mentioned on my CES 2005 report that in my opinion the 70" 1080p DILA showed a better image compared to the SONY SXR D and Samsung DLP 1080p sets of that CES, when they were all just introduced at that time. However, at CES 2006 (and still at CES 2007) I noticed an effect that the more I looked at it the more it bothered me. Apparently, the lenticular screen produces the effect of an artificial pixel movement that interacts with the movement of the image itself, more noticeable in large images of a consistent color (like a blue sky).

To make sure, I did the same type of viewing on the set installed on a dedicated darker room, the effect was less obvious, but the effect was still there. I would suggest to the prospective buyer to perform the viewing test on both types of room lighting to make sure is not an issue of concern, as it was to me.

After being aware of the effect, if I have to live with the set, I would end up paying attention to the pixel movement rather than enjoying the content.

Fortunately, JVC's plan for no 1080p inputs was revised by the time the units were released.

### FP

Introduced Feb 06

DLA-HD10K \$25,000, TTM now, 3-chip D-ILA 'non-moving' mirror reflective technology, 1920x1080p, accepts 1080p 48/50/60 fps over DVI-D, high-resolution lenses with motorized zoom and focus with a 0-60% vertical offset, two models: a long throw with a lens throw distance of 2-3.8:1 (placement of the projector at the back of the theater), for a 10-foot screen, the projector could be placed anywhere from 20 to 38 feet from the screen, and a short throw model with lens throw distance of 1.5 - 2.0:1 to facilitate projector to be used for CRT

replacement or rear screen applications, 2500:1 CR, 27db quiet fan noise, user-replaceable lamp with 2000 hrs life at \$500, Faroudja, Silicon Optix, and Anchor Bay Technologies are planned to supply three different external digital signal processor packages with this model.

### June 2006

#### FP

A total of 10 D-ILA front projector packages offered by the company, priced from \$6,995 to \$21,995, three new 1080p systems introduced with DVDO high performance video processor in partnership with Anchor Bay Technologies, developer of the DVDO.



DLA-HD2K \$13,000, TTM now, with DVDO processor.  
DLA-HD10K, the successor of the HD2K, with both long and short throw lens options  
DLA-HX2U price lowered to \$7000(from \$9000)

#### Sep 06

JVC Professional Products announced their decision to pair their DLA-HD10K projector with an external Realta HQV(R) video-processing box from Silicon Optix, named the HR1080Pro, with true 10-bit video processing, full four-field, pixel-based, motion-adaptive video deinterlacing for both SD and HD signals, temporal-recursive and codec noise reduction, automatic multicadence detection, and pixel-based detail enhancement.

#### Oct 06 CEATEC

JVC introduced a working prototype of a 110-inch H-DLA television as a technology statement, although the company also showed a 58-inch version that will be available at a price and time not determined at the introduction.

The product is targeted to consumers that might not be satisfied with LCD blurring when playing back high-speed motion and plasma's problem with showing black, according to JVC.

JVC also demo a 4K2K 3D projector of 3D images when used in conjunction with special 3D goggles, showing its ability for "super-high" resolution images of 4096x2190 or about four times the resolution of HD. TTM Feb 07 worldwide, pricing was not available.

#### CES 2007

##### RPTV

The company unveiled two 1080p HD-ILA RPTVs implementing a new light-engine design for wall mounting slim cabinet depths of 10.7 and 11.6 inches, side heat dissipation, side-mounted inputs/outputs, alternative placement on stands, concave mirror for wider projection angle of 138 degrees, reducing projection distance approximately 40 percent, three JVC D-ILA micro devices, 10000:1 CR.

The new sets also feature JVC's Genessa 32-bit CPU video processing, fifth generation of JVC's D.I.S.T. (Digital Image Scaling Technology) to up-scale any video source to display at full high definition 1080p, SD signals are improved through better IP conversion, scaler performance and a new PLL system, Digital Noise Suppressor that detects and eliminates "block noise", a Mosquito Noise Suppressor that eliminates noise without degrading the image, a 3D Y/C comb filter with DTV Cross Color Eliminator that uses



an advanced 10-bit 3D Y/C separation process to eliminate cross color and dot interference that is imbedded in older source material.



58" HD-58S998 \$3,300, TTM Jan 07, 1080p, 10.7 inches deep

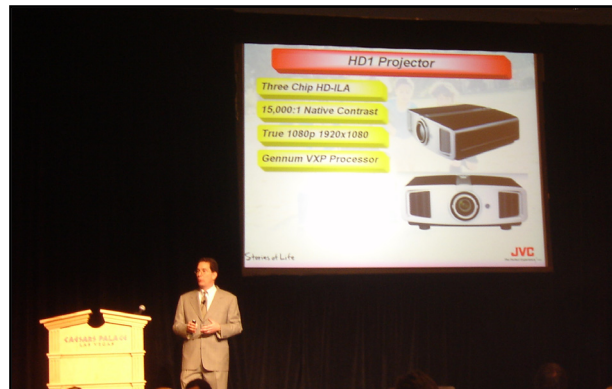
65" HD-65S998 \$4,200, TTM Mar 07, 1080p, 11.6 inches deep

A matching stand (RK-CSLM8) and wall mount adapter (TS-CP01WG) are available separately.



FP

The company also introduced a 1080p D-ILA front projector, the first for the company's consumer electronics division (according to JVC), implementing a new .7-inch D-ILA panel and light engine design not using an iris, for high black levels without impacting brightness, 2x Fujinon zoom lens, ceiling or tabletop mounting, lens shift 80 percent vertical/34 percent horizontal.



DLA-HD1 \$6,300, TTM Feb 07, 15,000:1 CR



According to JVC, the new projector features the following:

Native contrast ratio of 15,000:1; true black reproduction without an iris mechanism. New 0.7-inch full HD D-ILA device with a device contrast ratio of 20,000:1. Combined with a new optical engine, the projector achieves a contrast ratio of 15,000:1, the industry's highest without the use of an iris.

The new 0.7-in. full HD D-ILA device exhibits a significant reduction in stray light caused by, among other factors, the dispersion, and diffraction of reflected light. JVC decreased orientation irregularities by flattening the gaps between pixels, adopted improved liquid crystals, and used new orientation technologies. This enabled the device to achieve a device contrast ratio of 20,000:1.

At CES 2007, the projector was demonstrated side by side with the Sony Pearl (with the dynamic Iris in auto) and the JVC looked superior in picture quality, the blacks were much deeper and color depth was also better. On the left is the team that performed the demonstration.

The new optical engine uses wire grid polarizers to improve the precision of light polarization, preventing light leakage into the projection lens, thus allowing the closest to true black reproduction.



Flexible setup enabled by high performance 2x zoom lens and front fan intake and exhaust, the projection lens features a large diameter, all-glass lens with 16 elements in 13 groups made by Fujinon Corporation that significantly reduces chromatic aberration and ensures a high resolution picture, with every point on the screen perfectly in focus.

The projection system features a  $\pm 80\%$  vertical and  $\pm 34\%$  horizontal lens shift function, allowing a wide range of placement

flexibility for either ceiling, tabletop or on a shelf.

Using a front fan intake and exhaust for the cooling system allows placement options. The simple and clean design leaves only interface connections on the back panel, giving users flexibility in deciding where to put the projector. The lamp is easy to access and replace from the side panel wherever the projector is located, ceiling mount or tabletop.

Genum Corporation video processor reproduces high quality images faithfully, with the GF9351, with high-precision scaling, and four VXP™ technologies:

- a. FineEdge™  
Edge correction technology that gets rid of the jaggy artifacts so common to diagonal lines, creating instead smooth outlines.
- b. FidelityEngine™  
Imaging technology that improves detail while reducing noise. This technology ensures a clear, detailed playback picture even for video sources with lower resolutions.
- c. TruMotionHD™  
De-interlacing technology that supports HD signals (1080i), converting them to high-quality 1080p signals for playback.
- d. RealityExpansion™  
10-bit image processing technology. This technology can upsample 4:2:2 (Y:Cb:Cr) video signals to 4:4:4 format, and delivers outstanding image processing at a level comparable to that of broadcast masters.

Additionally, JVC introduced a number of HD-ILA new technologies, stated by the company as follows:

#### Cinema Wide HD-ILA

With an aspect ratio of 2.35:1, JVC's prototype Cinema Wide HD-ILA offers enhanced viewing of DVDs and high definition movies. Most widescreen movies are distributed in this 2.35:1 aspect ratio, while current widescreen TVs have a 16:9 (approx. 1.78:1) aspect ratio. JVC's Cinema Wide HD-ILA displays 2.35:1 content properly without letterboxing.

#### LED HD-ILA

Replacing the current high-pressure mercury lamp in JVC's rear projection HD-ILA televisions with LEDs would provide quick start and extremely long product life. The wide color range allows for flexible color management. Combined with the latest wire grid-based optical engine and latest D-ILA devices, it achieves a startlingly high contrast ratio.



#### 110-Inch HD-ILA Rear Projection TV

JVC has built a prototype 110-inch rear projection TV using the company's HD-ILA technology. The full HD set, like currently available HD-ILA televisions, uses three 0.7-inch 1920x1080 pixel full HD D-ILA (LCOS) devices. Power consumption is a green 230 watts (shown).

Jan 30, 07

JVC Professional Products introduced two new HD-ILA RPTV slim-design 1080p models for the commercial, professional, and custom installation markets.

61"	HD-P61R2U	\$3,200
70"	HD-P70R2U	\$5,000

Featuring three-chip D-ILA technology, HDMI, RS-232C, D65 color temperature standard, ATSC digital TV tuning and CableCARD slots, Waves' MaxxBass technology to enhance audio performance, dynamic iris, cabinet depth around 20 inches.

## **LG**

Consult the 2006 HDTV Technology Report.

In March 2006, LG announced the withdrawal of the products due to "certain part procurement issues" VP Bob Perry said.

## **Meridian-Faroudja**

CES 2007

A new projector was shown at CES, with three D-ILA chips for smooth, flicker-free high-resolution images 3-chip D-ILA (Direct Drive Image Light Amplifier) technology produces clear, natural images without the flicker or 'strobed rainbow' artifact effect that plagues other projectors, the company said. This projector was optimized by William Phelps™.

### D-ILA1080MF1 1080p Digital Projector

According to Faroudja, images are as smooth as film, boasting incredible detail, thanks to the chips' native 1920 x 1080 resolution, which is based on a reliable, precision mirror reflective technology with no moving parts to produce the full-spec 1080p High Definition resolution you need to enjoy movies and HD video sources at their very best.

*Emission Method:* D-ILA (Direct drive Image Light Amplifier) (Reflective Active Matrix Principle).

*Display Panel/Size:* D-ILA Device / 0.82in (1920 pixels 1080 pixels) x 3 (Total # of pixels: Approx. 6,220,000). D-ILA devices are manufactured using extremely high-precision technology. Pixel effectiveness is 99.99%. Only 0.01% or less of the pixels will either not illuminate or remain permanently illuminated.

*Projection Lens:* Normal Throw version 1.9x power zoom lens (2.0:1 to 3.8:1) (Power zoom/focus adjustment) Short Throw version 1.4x power zoom lens (1.5:1 to 2.1:1) (Power zoom/focus adjustment).

*Light-source:* 200 W Ultra-high pressure mercury lamp [Part No.: BHL5008-S].

*Screen Size:* Approx. 60in to 200in (Aspect ratio: 16:9) Projection Distance Normal Throw Approx. 2.5 m to 15 m Short Throw Approx. 2 m to 10 m.

*Input Signal:* 1080/60p or 1080/50p.

*Resolution:* 1920 pixels x 1080 pixels.

*Input Sync Frequency:* Horizontal 56.25 kHz, 67.43 kHz, 67.5 kHz Vertical 50 Hz, 59.94 Hz, 60 Hz.

*Video In:* DVI input via DVI-D (Single-24pin) connector, HDCP-compatible.

*Control:* RS-232C I/O via D-sub 9 pin.

*Service:* 3.5 mm diameter, tip/ring/sleeve mini-jack.

*Screen Trigger:* 3.5 mm diameter, tip/sleeve mini-jack.

*Power:* AC 100 V - 240 VAC, 50/60 Hz Rated Power 3.5 A (100 VAC)-1.4 A (240 V AC).

*Environment Temperature:* 41°F to 95°F (+5°C to +35°C).



*Environment Humidity:* 20% to 80% (No condensation)

*Weight:* Approx. 37.5 lbs (17.0 Kg)

#### D-ILA1080MF2 1080p 3-chip D-ILA:

Featuring separate Gamma curves for SD and HD sources, 2100:1 CR, light output 500 lumens typical, very small pixel spacing (pixel aperture), high precision imaging Look-Up-Tables (LUT), optimized by William Phelps utilizing proprietary software and optical equipment in the UK factory, D65 color balance calibrated to 128 levels of white, D65 calibration error less than .003 from 0-100IRE, exact gamma curve based on light characteristics of human eyesight, film and the projector.



The projector also features improved contrast ratio with excellent shadow detail, superior White Field uniformity, excellent lens optics for corner-to-corner focus, 1.3x zoom lens (1:8–2.35:1, manual zoom and focus), 250 watt, NSH bulb for accurate and stable output, replaceable without de-mounting the projector, Optional DVP1080MF digital video processor converts all SD/HD

sources to 1920x1080 DVI, DVI input, HDCP compatible, 3-chip D-ILA® (0.82-inch diagonal), screen size/Throw: 40in to 200in (16:9)/1.6m to 10.5m (16:9), resolution: 1920 x 1080 pixels (16:9) x 3 chips, projection, wide conversion lens attachment option, 250 W Ultra-high pressure mercury lamp [Part No. BHL5006-S], contrast ratio: 2100:1, color temperature: D65/user selectable 1/user selectable 2, gamma control: Normal, A, B, and Custom, serial control: RS-232C x1, power input: 100V-240V AC, 50/60Hz, rated power: 3.5 A (100 V AC) – 1.4 A (240V AC).



### **MicroDisplay Corporation**

Nov 06 and CES 2007

The company announced that “will soon begin manufacturing HDTVs for well-known brand names (such as Akai and Memorex), powered by its unique and proprietary 1080p Liquid Crystal on Silicon (LCOS) digital projection imaging devices.

The single-chip design of MicroDisplay Corporation’s proprietary technology will allow major partner brands to sell an exceptionally high-quality HDTV picture at a much lower manufacturing cost.

As a result, large-screen 1080p HDTVs will soon be available to a much larger group of consumers. MicroDisplay Corporation is the first company to mass-produce LCOS devices with the fast response times necessary for use in a single-chip design. As a result, this technology sets a new cost/performance standard for the industry.

MicroDisplay Corporation made its debut at CES 2007.

The company added “With our technology, TV manufacturers will now be able to offer bigger screens and impressive 1080p picture quality to their customers at much lower price points”, said VP of Marketing for MicroDisplay, Marty Zanfino.

“This stands to revolutionize the industry and bring the market price for a 50-inch plus, 1080p rear-projection HDTV down below \$1500. That’s an extraordinary value.”

“MicroDisplay is partnering with major HDTV brands to develop and distribute rear-projection HDTV models with screen sizes of 52” to 62”. The new MicroDisplay single-chip, LCOS-powered, rear-projection HDTVs are expected to hit stores in summer 2007.”

Some of the above models were shown at CES.

### **OMT**

CES 2007

Mini Projector <\$300, single LCoS panel, 800x600, 20-60 inch screens, 200 lumens, D-sub, YPbPr, 145x190x74 mm, 65w

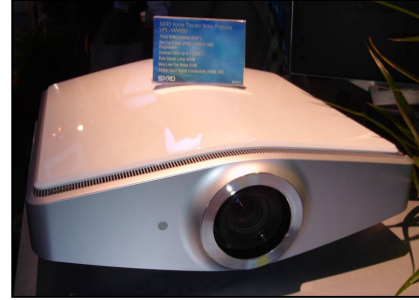


<http://www.omtdisplay.com/Minien.htm>

### **SONY (SXR)**

Consult the 2006 HDTV Technology Report for the following models:

Grand Wega RPTV XBR1 line  
VPL-VW100 (Ruby) FP (shown right)



4K Digital Cinema SXR projector (below), specs



included in the 2005 report, SRX-R110, introduced first at Digital Cinema Laboratory in Hollywood, CA; resolution of 4096x2160, compatible with 2K projectors of 1920x1080, judged as with a picture quality of at least 35 mm, 10000 ANSI lumens, 3000:1 CR (expected at 2000:1 in the production units), expected in movie theaters by 2005, dual-

screen mode for the projection of dual 1920x1080 images, and quad-mode for four 1920x1080 images, \$80,000, \$15,000 extra for lens, TTM Jan 05, suitable for up to 40 feet wide screens.

Shown again at CES 2007 with spectacular images on local-theater-size screen.



SRX-R105, \$60,000, 5000 lumens, smaller version, suitable for up to 25 feet screens.

### June 2006

#### RPTV

Sony Introduced five new 1080p Grand WEGA models with 1080p inputs from 50 to 70 inches based on Silicon X-tal (Crystal) Reflective Display (SXR™)

#### XBR line

Two new models TTM fall 2006, with the following features:

Three 0.61-inch SXR chips (one each for red, green and blue color reproduction), delivering more than 2 million native pixels (1920 X 1080) for a full high-definition picture, video signal process enhancements include Sony's WEGA Engine HD™ system.

Digital Reality Creation® Multi Function Version Two Point Five (DRC-MFv2.5), enabling digital mapping of not only



conventional NTSC sources, but also 1080i HD signals, Cinema Black Pro mode for up to 10,000:1 CR, digital cable-ready with integrated CableCARD™ slot and TV Guide® on screen program guide, 2xHDMI inputs with 1080p capability, front HDMI HDV camcorder connection, PC input, and side speakers (removable on the KDS-R70XBR2 model).

60"	KDS-R60XBR2	\$5300, (3800 on Feb 07, 4 months after introduction)
70"	KDS-R70XBR2	\$7800, (\$6000 on Feb 07, 4 months after introduction)

A2000 Line

Three new models, TTM summer 2006, with the following features:



New compact, bottom speaker cabinet design; same WEGA Engine system, 0.61-inch SXRD chips, and Cinema Black Pro for 10,000:1 CR (based on overall light levels of the original source) found in the above XBR line; 2xHDMI inputs with 1080p capability, front component input for HDV camcorder and PC input.

50"	KDS-50A2000	\$3500
55"	KDS-55A2000	\$4000
60"	KDS-60A2000	\$4500 (shown)

<http://www.sony.com/2006TV>

Sep 06 CEDIA

Sony introduced the VPL-VW50 (Pearl) front projector, \$5,000, TTM Sep 06, added to the existing line of front projectors, the QUALIA 004 and the VPL-VW100, using three 0.61-inch SXRD chips (one each for red, green and blue color reproduction), delivering a 1920 x 1080 full high-definition picture, high response times (2.5ms rise and fall), 200-watt Ultra High Pressure Lamp, 900 lumens, 1-chip video processing engine using a fully digital chassis, eliminating signal noise caused by analog to digital or digital to analog conversion.



Dual HDMI inputs for 1080p/60 and 24p frame rates, processes at a direct multiple (96fps) of 24p to avoid artifacts like judder or flicker when viewing next generation high-definition formats like Blu-ray disc, component video, RGB, RS-232C connection, new All Range Crisp Focus (ARC-F) lens, optimized for high resolution 1080 images, with 16 elements, flexible throw distances, Advanced Iris 2, which produces

accurate blacks and helps to deliver a dynamic contrast ratio of up to 15,000:1 when "auto" Iris mode is selected, and with a variable setting for user optimization, 1.8x powered lens zoom, powered focus, powered vertical lens shift, advanced cooling structure for a low fan noise of 22dB.

#### CES 2007

Sony displayed a 55" laser projection TV using SXRD with a wider color gamut and high contrast. The monitor model was only 273mm deep and 1920x1080p. The laser durability would be a welcome feature regarding customers not needing to replace light source over time (shown at left).

#### Apr 07

Sony introduced the CineAlta, a 4K digital cinema projector with 4 times HD quality on a screen 20 meters wide, it measures about 1.5 meters high, 1.4 meters deep and 74 centimeters wide, weighs 300Kg, uses a 4.2kW bulb, light bounces off a 1.55in flat-panel display based on Sony's SXRD, 4096x2160 pixels of resolution (8 million pixels versus 2 million of HDTV), about \$126,000.

The projector sits on top of a 'media block' bay containing a RAID HDD storing the movie encrypted in JPEG2000 format, which could be decrypted when it is shown by using a key that is deleted if someone tries to remove the 'media block' from the projector, and the HDD would still be encrypted.

### **Syntax/Brilliant**

Consult the 2006 HDTV Technology Report for earlier models, such as the 6580i 1080p RPTV below:



Read the complete coverage of how this company implemented LCoS 1080p video processing on the dedicated section within the 1080p subject. The HDTV included an installer with the purchase (an ISF calibration for two inputs using the calibrator's ISF equipment).

Sep 06 CEDIA  
Olevia 5 Series  
RPTV

Features award-winning Brilliant UltraContrast LCoS(TM) Light Engine Technology with true 1920x1080p resolution and Pixelworks DNX video processing, preconfigured for home theater installations, able to be integrated into home automation systems with its RS232 control, accepts 480i up to 1080p native resolution input via HDMI and DVI inputs, 4000:1 CR, fast 4ms average response time, was said to become available through custom installation specialists plus select regional retailers.

65" 565H \$4,300, TTM Oct 06

## Chapter 8 - LCD Projection (FP and RPTV)

### Canon

Feb 07

Canon announced the availability of 3 LV series projectors.

Featuring XGA (1,024 by 768), UXGA (1,600 by 1,200) and SXGA (1,280 by 1,024), short throw distance using a 1.6x Canon wide-angle seven-group zoom lens, component through VGA with optional cable, VGA in, audio in.

LV-X7            \$1,000, 1500 ANSI lumens, 500:1 CR  
LV-7260        \$1,200, 2000 ANSI lumens, 600:1 CR  
LV-7265        \$1,500, 2500 ANSI lumens, 600:1 CR, DVI-I, VGA out, audio out

### Epson

For the models below, consult the 2006 HDTV Technology Report.

-----  
RPTV

Two CrystalPRO™ HD Displays 1080p, TTM Jan 06  
55" and 65"


FP

MovieMate™ 25 Projector-DVD/Music Player

Pocket Projector

800x600, 3 LCD, LED source, 1.1 lbs,  
technology exhibition



**Postcard-sized Projector** 

**Technology Exhibition**

**Feature**  
The smallest projector with 3LCD  
High Color Reproduction  
Instant Power On/Off

**Specification**

Display Devices	0.55" 3LCD
Light Source	LED (R,G,B)
Resolution	800x600 (SVGA)
Brightness	Over 20 lm
Weight	1.1 lbs
Size	138x103x40 mm
Power Consumption	Under 20W
Life Time (LED)	Over 20000 hours

PowerLite Home 20  
PowerLite Cinema  
PowerLite Cinema 800

-----

Sep 06 (CEDIA)

The company showed their LCD projectors, two of those, the models 30 and 33, are offered with a dual-aspect ratio (4:3 and 16:9) projection screen that folds into a travel-friendly case, standard on the model 33, offered separately on the 30. They both have VGA, 854x480, 1200 ANSI lumens, 1.5x optical zoom lens, short-throw lens to project an 80W-inch image from 6.6 feet away or up to 300W inches from 24.8 feet, offset lens shift.

MovieMate 30            \$1,000, TTM Oct 06, 3-LCD, for mass retail distribution, integrated JVC DVD/CD player, built-in stereo speakers, illuminated remote control.

Moviemate 33            \$1,200, TTM Oct 06, 3-LCD, for mass retail distribution, integrated JVC DVD/CD player, built-in stereo speakers, illuminated remote control.

Additionally two other projectors complete the introduction:

Cinema 400 3LCD model, 720p, \$1,600, TTM Sep 06, 5,000:1 CR, 1,500 ANSI lumens, Cinema Filter and Dynamic Eye Iris, seven color modes, vertical and horizontal optical lens shift, 1xHDMI.

PowerLite Pro Cinema 800 HQV \$7,000, for custom installer distribution. It features Silicon Optix's HQV video processing technology using pixel-based (rather than frame-based) motion adaptation and detail enhancement.

The TX3 was said to be "specifically tailored with true 10-bit video processing, distribution through the custom installation channel, advanced three-chip 3LCD 720p light engine, Cinema Filter and Dynamic Eye Iris technology, 5,000:1 CR, 1,600 ANSI lumens, vert/horiz optical lens can be moved up to 100% horizontally and 50% vertically.

Nov 06

Epson introduced a new top-of-the-line 1080p LCD projector, the Epson PowerLite Pro Cinema 1080 distributed thru custom installation dealers, TTM Jan 07, \$5,000, C<sup>2</sup>Fine 3LCD chips, OptiCinema optics, E-TORL lamp, 1080Perfect video processing, Absolute Black technology, ISF-certification, AccuCinema Lens designed for high picture integrity from corner to corner, 1080Perfect video processor, 12,000:1 CR.

CES 2007

Epson announced the development of a Next-Generation HTPS Panel for LCD Projection TVs, a new high-temperature polysilicon (HTPS) 0.7 inch liquid crystal panel to increase the performance of 3LCD front projectors and large-screen 1080p LCD projection TVs, and obtain a greater than 20 percent aperture ratio improvement over conventional TN (\*) panels to improve luminance with current lamps or use lower-watt lamps for same levels of luminance. (\*) Twisted Nematic, a type of LCD that uses a nematic liquid crystal, where light rotates 90 degrees as it passes through the LC layer.

The sample products are now being shipped. The new technology enables the use of smaller panel size to achieve the same resolution, True-HD (1080p) resolution for

large-screen LCD projection TVs previously required a 0.9 inch panel that now it can be achieved with a 0.7 inch panel for cost savings in TV manufacturing.

Sample specifications (compared with preceding product):

	Existing L3D09U-61G00	Newly-developed L3D07U-81G00
LCD type	TN organic alignment layer	TN organic alignment layer
Technology	D5	New series
Effective pixels	1920 x 1080 (1080p)	1920 x 1080 (1080p)
Panel size (diagonal)	0.9 inch (2.3 cm)	0.7 inch (1.9 cm)
Pixel pitch	10 $\mu\text{m}$	8.5 $\mu\text{m}$
Aperture ratio	51%	55%

(source Epson)

Epson selects either C2FINE (VA LCD + inorganic alignment layer) or conventional (TN) technology for each product category, depending on the performance required. For example, the C2FINE technology first marketed in September 2006 is used for products requiring high image quality with sharp contrast and reproduction of jet black, while conventional TN technology is used for products requiring a balance between image quality and cost.

Related information regarding Epson's HTPS and other imaging technologies:  
[http://www.epson.co.jp/e/technology/technology\\_HTPS.htm](http://www.epson.co.jp/e/technology/technology_HTPS.htm)

3LCD: [http://www.epson.co.jp/e/technology/technology\\_projection.htm](http://www.epson.co.jp/e/technology/technology_projection.htm)

#### Oct 06

PowerLite EMP-TW1000 3LCD 1080p Projector with HDMI 1.3.

The company introduced the EMP-TW1000 in Japan, capable of 1080p, 2.1x optical manual zoom lens, 48-bit color depth, lossless audio streams, 12,000:1 CR with a 1200 lumen lamp, 26dB fan noise, ¥350,000 (\$2,900 US), TTM Dec 06 in Japan.



#### Apr 07

Epson introduced to market two new 3LCD 1080p front projectors, 12,000:1 CR, 1200 lumens:

PowerLite Home Cinema 1080 \$3000, TTM Apr 07

PowerLite Pro Cinema 1080 \$5,000, TTM current (advanced introduction Nov 06 above)

Featuring horizontal/vertical lens shift, C2Fine system, 2.1x zoom lens using Fujinon optics, 100-inch screen size from 2-22 feet, up to 120 inches image size, HDMI 1.3, 14-segment lens design, capable of x.v.YCC when sources become available.

## Hitachi

For the following models and lines, consult the 2006 HDTV Technology Report:

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FP  
PJTX100  
UltraVision®  
HD-PJ52  
ED-PJ32  
RPTV  
VF820 Series  
CineForm VG825 Series  
2006 line additions  
-----

### UltraVision LCD RPTVs

720p 3-LCD panels, 11-Element Lens System, ATSC/NTSC tuners, Cable CARD, HDMI, 2 component, multiple color temperatures, Virtual HD 1080p video processor  
50" 50VS69 \$2,300, TTM Jul 06  
55" 55VS69 \$2,600, TTM Apr 06  
62" 62VS69 \$3,000, TTM Apr 06

### Jun 06

#### RPTV

New LCD-based rear-projection models were offered in the 62W-inch, 55W-inch and 50W-inch screen sizes, they feature reduced cabinet width and depth, charcoal styling with silver accents, the 62W-inch size is a new size:

50" \$1,800, TTM Jul 06  
55" \$2,300, TTM now  
62" \$2,700, TTM now

### CES 2007

3-LCD 1920x1080, PictureMaster™ IV processor, new compact industrial design, bottom speakers, gloss black finish.

50" M50P801 TTM May 07  
55" M55P801 TTM Jun 07, D7 panel, 2xHDMI, bottom speaker, gloss finish  
62" M62P801 TTM Jul 07, D7 panel, 2xHDMI, bottom speaker, gloss finish



## **Mitsubishi**

April 06 (Dealer Line Show)

RPTV

The company introduced a new line of LCD HDTVs with three-chip LCD technology, pricing, and availability not disclosed at the event.

According to the company, the new models feature new compact, high-style designs with thin bezels, 1280x720, Plush720p(TM) technology that scales and upconverts analog TV signals and deinterlaces 1080i to 720p with precision.

New and improved light engines with 132-watt lamps (producing 20 percent more light than last year's models), light engine featuring SmartShutter(TM) to improve contrast ratio by four times for blacker blacks and more shades of dark gray.

The sets also feature large aperture optics, wider vertical viewing angle, 3D Video Noise Reduction system that analyzes multiple frames to identify and remove video noise or snow caused by distortions in the video signal, keeping detail in the foreground and eliminating background noise, even in fast moving scenes.

Includes three video modes (Brilliant, Bright, and Natural) for optimum viewing in different lighting environments, from bright florescent light to sunlight to low light. Each mode has two color temperature settings, high and low, and is accessible via remote control, 2xHDMI(TM) inputs, 2xcomponent inputs, ClearThought(TM) Easy Connect technology.

52"	WD-52531	\$2,400
62"	WD-62531	\$3,100

Sep 06

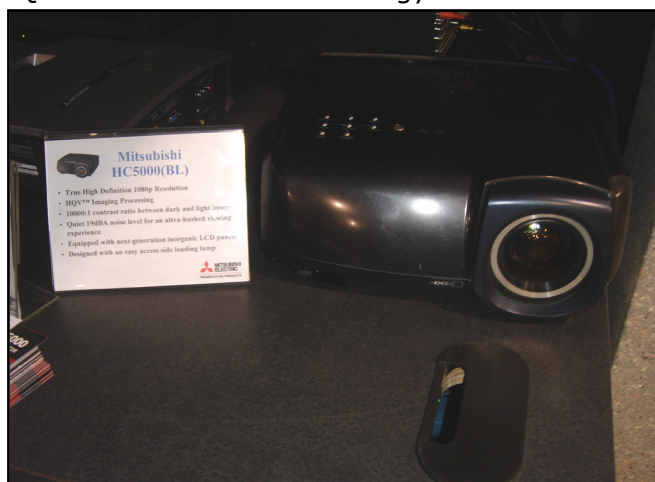
FP

HC5000BL \$4,500, TTM Oct 06

1080p, in black (HC5000U in white by special order)

Integrated Reon-VX HQV® video processing from Silicon Optix, providing true HQV four-field, motion-adaptive, per-pixel, HD deinterlacing, multi-directional diagonal filter to remove any "jaggies" and/or stair-step artifacts from deinterlaced video sources without blurring the image, HQV noise-reduction technology removes the noise and artifacts caused by compression.

The HC5000BL uses new inorganic more durable LCD panels, to render a more color-consistent, even-toned image than previous generation LCD panels. Enclosed anti-dust LCD optical engine, exclusive algorithms to control its dynamic iris, 10,000:1 CR, new algorithms to detect and maximize color information as well as luminance, up to 5000 hours of



lamp-life (in Low mode), HDMI and DVI connectors, standard black or optional white, 1000-ANSI-lumens, powered lens shift, powered zoom, two-year limited warranty on parts and labor, plus a 90-day warranty on the lamp, 19dB noise in low mode (24db in high mode), horizontal/vertical lens shift, side loading lamp design, auto iris.

Shown at CES 2007 (above).

## **Panasonic**

RPTV

LCX66 Series

ATSC/NTSC/QAM tuners, 720p, optical output, SD memory card, RGB PC input, HDMI, 2 component, VGA/SVGA/XGA, \$ TBD, TTM May 06.

52" PT-52LCX66

56" PT-56LCX66 (right)

61" PT-61LCX66

Sep 06 (CEDIA)

The company showed their first LCD 1080p projector:

PT-AE1000U, \$ N/A

Features a 2x optical zoom lens with lens-shift function capable to project a 100-inch image at 10 to 20 feet

away from the screen, 1,100 ANSI lumens, 11,000:1

CR. 14-bit dynamic gamma correction, 2xHDMI, D-sub 15, YPbPr.



The company also demo its new:

PT-AX100U \$3,000, TTM Sep 06, 720p, designed as "an affordable luxury for entertainment enthusiasts that desire a rich home theater viewing experience," the company said, 1280x720p, 220 watt UHP lamp, 2,000 ANSI lumens, 6,000:1 CR, Panasonic's new Light Harmonizer image technology, which measures ambient light and adjusts the screen brightness so that images remain bright, crisp and vivid even in well-lit rooms, according to Panasonic.



The projector also features a new Pure Color filter that uses optical adjustment to achieve more accurate color reproduction, Cinema Color Management to control approximately 1,070,000,000 colors, Smooth Screen

technology with crystal double refraction to arrange pixels on a screen with no gaps in between, for a smoother appearance.

### CES 2007

#### RPTVs

LIFI light source backlighting for 3LCD.

A LIFI lamp does not use filaments but rather sends plasma radio frequencies through the lamp itself to emit a glow and it does not wear out, according to Panasonic.

Two series of sets will be available in April/May 2007.

#### LCX Series

720p, new floating panel design, TTM May 07

New 0.69" 720p LCD Panel, all black cosmetics, 3,000:1 CR, 400cd/m2 brightness, full range speaker system (20W output), HDMI (front 1, rear 2), PC input, SD card slot, EZ Sync™.

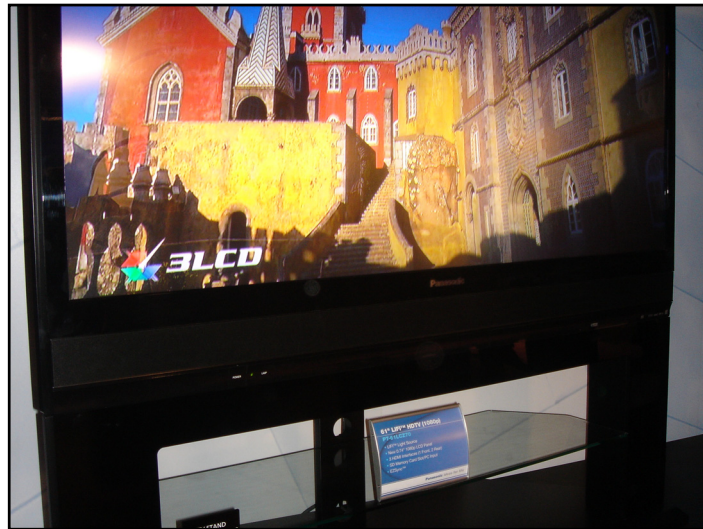
50"	PT-50LCX70	
56"	PT-56LCX70	\$1,700
61"	PT-61LCX70	\$2,000

#### LCZ Series

1080p, TTM May 07, similar features as LCX line but with 0.74" 1080p LCD panel and piano black cosmetic.

50"	PT-50LCZ70	\$1,800
56"	PT-56LCZ70	\$2,000
61"	PT-61LCZ70	\$2,400

shown



### Mar 07

Vertical/horizontal lens shift, 2x powered zoom, Auto Rolling Filter (to detect and remove filter sections with accumulated dust), 3000/5000 hours lamp, Panasonic's Daylight View 3 for color/brightness/contrast room optimization, NTU models feature built-in wireless and wired network capability.

PT-F100U	\$5,300	TTM Apr 07	4:3 AR	3200 lumens
PT-F100NTU	\$5,500	TTM Apr 07	4:3 AR	3200 lumens
PT-FW100NTU	\$6,000	TTM Jun 97	16:9 AR	3000 lumens, 1280x800 LCD panel

### **Sanyo**

#### RPTV

720p, 150-watt / 10000 hrs lamp, 10-bit video processing, TTM 3Q06, \$TBA, HDMI, 1000:1 CR, ATSC/QAM tuners.

55"	PLV-55WHD1
65"	PLV-65WHD1

FP

For the PLV-Z4, please consult the 2006 HDTV Technology Report.

Oct 06

FP

Sanyo introduced:

PLV-Z5           \$1,700  
1280x720, 10,000:1 CR, twin-iris system, 1100  
ANSI lumens, TopazReal Technology, 2xHDMI,  
2xcomponent, D-sub 15 input, 3D-color  
management, 100" screen from 9.8 feet (up to 20  
feet),12-bit digital video processing of RGB color.



TopazReal Technology said to combine the lamp brightness level and newly designed LCD panels for a sharp picture in scenes with a wide range of brightness levels, with "crisp, bright high-contrast images, even in well-lit environments" as stated by Sanyo.

3D-color management to adjust and save the hue, gamma curve, and level of colors and fine-tune the image settings, lens protected from dust by a motor-operated sliding shutter that can be opened or closed automatically by remote control, three-year warranty, \$200 rebate between Oct. 20, 2006 and Jan. 31, 2007.

CES 2007

Cinema

PLV-HD2000N (2K) projector

1080p

PLV-HD150   7000 ANSI Lumens, 1000:1 CR, 4x300w UHP  
lamp, no ceiling mount, 24p/60p capability.



PLV-HD100   5500 ANSI Lumens, 1000:1 CR, 4x250 w UHP lamp, ceiling mount,  
24fps thru SDI.

**Sony**

Mar 06

RPTV

Sony announced that new 3LCD microdisplay  
RPTVs will be offered:  
1280x720p, dual HDMI inputs, front component  
input for HDV camcorders, compact frame  
design, below-screen mounted speakers.  
Grand WEGA

42"	KDF-42E2000	\$1,400
46"	KDF-46E2000	\$1,500
50"	KDF-50E2000	\$1,700
55"	KDF-55E2000	\$1,900, shown



Feb 07 (Annual Dealers Show)

Sony announced to dealers the expansion of the BRAVIA line to include a "high-performance" sub-brand of microdisplay RPTVs and front projectors, named Best Resolution Audio Visual Integrated Architecture, TTM Spring/Summer 07, \$TBA.

"When you see the BRAVIA brand, you know you're not only getting the exceptional quality, but also the distinctive elegance that Sony is known for delivering," said Randy Waynick, Sony home products division senior VP, according to TWICE.

The new BRAVIA Internet Video Link module mentioned at CES 2007 (LCD panels section) for \$300, TTM Jul 07, will be compatible with all new BRAVIA 3LCD RPTVs.

RPTV 3-LCD  
KDF- BRAVIA line

The BRAVIA name will replace the Grand Wega trademark.

E-Series

1080p

Reduced cabinet depths.

46" KDF-46E3000

50" KDF-50E3000

720p

Designed for tight places.

37" KDF-37H1000

FP

Mar 07

Sony introduced two new BRAVIA 3LCD projectors replacing Cineza trademark, TTM Jun 07.

Both featuring 1280x720, 165-watt UHP Lamp, 1,100 lumens, short focal-length lens with 1.6 times zoom, 20dB fan noise (in low lamp mode), HDMI 1080/24p, which is downscaled to native 720p and displayed at a native multiple of 24, RS-232C, component, composite and S-video.

VPL-AW10 \$1,000, Sony's Advance Iris for 6,000:1 CR in "auto" iris mode.

VPL-AW15 \$1,300, Advanced Iris 2 technology, which together with the High Contrast Plate device claims to produce deep, accurate blacks and a dynamic contrast ratio of up to 12,000:1 when "auto" iris mode is selected (variable setting is also available), lens shift, Sony's All Range Crisp Focus (ARC-F) lens for flexible throw distances to facilitate installation, color palette adjustable with Sony's Real Color Processing function, HD15 input for analog PC.

**Toshiba**

CES 2007

TLP-XD2000U \$8,500, XGA resolution, for mobile professionals, 6.2 pounds, 2,000 ANSI lumens, 1024 x 768, 600:1 CR, digital zoom function on the remote, automatic vertical keystone correction (plus or minus 30 degrees), 29 decibels (dB) (in low mode).

1.2x manual zoom/manual focus, projection lens F/f (mm) F = 1.6 - 1.881, f = 18.6 - 22.3mm, light source 180W (160W in low mode), diagonal screen size 33 - 300 inches, projection distance 3.9 ft - 30.0 ft.

TLP-X3000U \$1,800, 3000 ANSI lumens, 1024x768, 400:1 CR, 33dB.



### **Viewsonic**

FP

CV100, \$1,000, 480p, 1000 ANSI lumens, 2000:1 CR, 16x9, DVI/HDCP, motion adaptive de-interlacing with 3-2 pulldown, reduced noise output, 4000 hrs lamp life.

### CES 2007

The company introduced the three-pound PJ358 LCD projector.

## Chapter 9 - Plasma Panels

### **Audiovox**

TTM Apr 06, ATSC tuner, DCDi, 2-2 & 3-2 pulldown, DVI/HDCP  
37" FPE3706 \$2,500  
50" FPE5006P \$3,500

### **Cinemateq**

Consult the 2006 HDTV Technology Report.

### **Daewoo**

DVI/HDCP, IEEE1394  
42" DTV-4220EA EDTV 480p, \$1,500, TTM Mar 06  
42" DTV-4230HA 1280x720, \$1,800, TTM Mar 06

### **Dell**

Consult the 2006 HDTV Technology Report.

### **Dwin**

May 06

50" HD-250 PlasmaImage, processor connected via DVI, with 10 digital/analog inputs (2 DVI/HDCP inputs, 2 RGB, 2 component).

### **Fujitsu / Hitachi**

#### **Fujitsu**

Feb 07

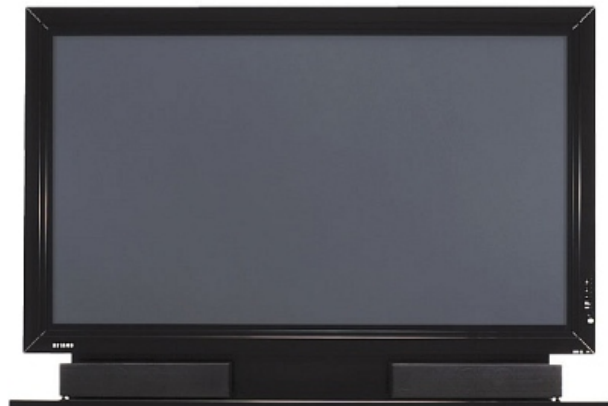
AVIAMO line 1080p

**AVIAMO**™ (Full HD Flat Displays & Projectors)

Featuring Advanced Video Movement (AVM) III technology to process 1080p natively, 1920 x 1080p, 2xHDMI, Night listening mode, CableCARD.

37" P37FT05AUB \$5,000

65" P65FT00AUB \$18,000



## **HISENSE**

One of China's top five electronics manufacturer

Consult the 2006 HDTV Technology Report for 42", 50", and 63" earlier models.

### Aug 06



42" PHD-4220US \$1,800, TTM now, added to current LCD TVs (20", 32", 37", and 42"), distribution through Tiger Direct, Hisense panels distributed also by Kohl's department stores and select online dealers, 1024x768, 10,000:1 CR, brightness 1,500 cd/m<sup>2</sup>, built-in ATSC/NTSC/QAM tuner, HDMI, 2xcomponent, VGA input.

### CES 2007

50" PHD5039US 1366x768, 10,000:1 CR, 1000cd/m<sup>2</sup>, 8ms, NTSC/ATSC/QAM tuners

## **Hitachi/ Fujitsu**

### **Hitachi**

Consult the 2006 HDTV Technology Report for the following models:

UltraVision® HDS52 Plasma HDTV Series

UltraVision® CineForm(TM) HDT52 Plasma HDTV Series

UltraVision® CineForm(TM) Director's Series(TM) models

### 2006 line

Dual HDMI, ATSC/NTSC/QAM tuners

42" P42XTA51US \$6,000, TTM early 06, 1024x768

50" P50XTA50US \$8,000, TTM early 06, 1366x768

### Jun 06

Black frame styling with black side-mounted speakers, ATSC/NTSC CableCARD tuners; day/night picture memory modes; six-speaker, 36-watt audio systems, manual tabletop swivel stand (optional for 55W-inch).

42" 42HDT79 \$3,000

55" 55HDT79 \$4,800

### Ultravision S Series

42" \$2,500

55" \$4,300

42" 42HDF39 \$2,300, 1024x1024, one HDMI input, ATSC/NTSC tuners, Wal-Mart distribution and all dealers.

More 1080p plasma displays are planned for 2007 when pixel density can be increased and power consumption reduced. A 50" model is expected for 2007.

### Ultra-Vision Director's series

Four-model line (2 LCDs) under limited distribution to A/V specialty dealers and installers, feature three HDMI inputs, 3 component video inputs, ATSC/NTSC/CableCARD tuning, TV Guide On Screen electronic program guides, IEEE-1394 inputs, extended color reproduction capabilities.

42" 42HDX99 \$3,500, TTM Aug 06, 1024x1080, Alternate Lighting of Surfaces (ALiS) technology using one addressed electrode in between each pixel, smallest pixel pitch in the industry for plasma, power efficiency, 17 percent brighter than last year, consumes 16 percent less electricity.

55" 55HDX99 \$5,300, TTM Aug 06, 1365 by 768.

### Sep 06 (CEDIA)

Hitachi demo what they called "full HD" prototypes expected to become available in 2-3Q07, which will be produced at their third FHP plasma factory in Kyushu, Japan, in October when it opens to meet 200,000 units per month.

### Director Series

42" 1920x1080i, 3,000:1 CR

60" 1920x1080p, 5,000:1 CR

Another 50" model was said to be planned for 2007.

Current UltraVision models:

42" 42HDS69 \$2,100

42" 42HX99

Both 1024x1080i, Alternate Lighting of Surfaces (ALiS) technology for 1080i.

### CES 2007

Hitachi introduced a \$2,500 50-inches '1080' plasma (but with a catch, see below):

### 401 Series

1080p PictureMaster™ IV video processor, 3xHDMI  
Simplex certified inputs,

42" P42H401 \$N/A, TTM Apr 07

50" P50H401 \$2500, TTM Feb 07 (picture)

55" P55H401 \$N/A, TTM Jul 07



Features Alternate Lighting of Surfaces (ALiS) technology, called "HD 1,080", however, it only has 1,280 pixels horizontally out of the 1,920 of the 1080i/p standard, netting only 1.3 million pixels of the 2+ million of the 1080 format.

According to Bill Whalen, senior product marketing manager of Hitachi "ALiS uses interlacing techniques because we are sharing electrodes between the vertical pixels, and by addressing them very rapidly we are firing each cell from above, below and behind; we have over 1,300 patents in plasma technology, we have kind of locked up the ability to share those electrodes."

The panel has 3xHDMI inputs accepting 1,080p certified by Simplay HD, new industrial design with black bezel/silver/gray trim, speakers recessed below the screen, fourth-generation 1,080p video processing engine named Picture Master IV.

Other H series models

55" 768p

42"

CES 2007



### Motion Estimation for Frame-Rate Conversion

**Hitachi provides superior picture quality**

- Adapting Film Contents for TV**  
While the frame rate of film is 24fps (frames per second), television (Japan) is 60 fps. In legacy technology, additional frames are duplicated (fig. 1), and this produces noticeable motion judder.  
**Fig. 1 Legacy Technology**
- Performance Improvement**  
In order to provide smooth motion, new technology (Motion Estimation Technology) attempts to determine the correct position of moving objects at 60 fps.  
**Fig. 2 New Technology**
- Motion Estimation Technology**  
Hitachi succeeded in improving the motion-picture quality of film movies with Motion Estimation Technology, interpolating the intermediate frames by detecting the motion vectors of each frame.  
**Film Frame** → **Motion Vector** → **Frame-Rate Conversion** → **Intermediate Frame**

Feb 07

Hitachi in Japan announced a delay (from March 07 to year-end) in deciding the building of their next plasma display factory, due to market demand, prices falling and LCD competition, however, Hitachi indicated that they would meet demand by doubling capacity to 4 million panels by December within two existing plants in Miyazaki, southwest Japan.

This news follow a similar announcement made by Pioneer a few days before (Hitachi is the # 5 plasma maker, Pioneer is number 6<sup>th</sup>).

**HP**

2006 line

10,000:1 CR, ATSC/NTSC tuners

42" PL4260N

50" PL5060N

CES 2007

HP announced their plans to introduce new 720p plasmas, TTM spring 07, \$TBA.

The new panels feature 6.87 billion colors, low-reflection phosphors, black walls around pixels to reduce reflection and enhance detail, brightness and contrast, integrated speakers.

42" PL4272N  
 50" PL5072N

**LG**

I am including all 2006 models because some were slated for late 2006, although the information is as they were announced.

CES 2006

LG announced 8 integrated plasma models for 2006 using their new XD Engine video-enhancement circuitry with 14-bit color processing for 4.4 trillion colors. Four models with 160 GB HD DVR capabilities and dual ATSC tuners, others with CableCARD tuners, nine-in-two flash-memory card readers, IEEE-1394, TV Guide On Screen EPG, all models have 1366x768 resolution, HDMI, Image Sticking Minimization mode.

50" 50PC1DR \$5,000 (now \$3,600), TTM 1Q06, 768p, HD DVR, 2 HDMI, TV Guide On Screen EPG, CableCARD and ATSC tuners, black/silver gloss (50PC1DRA model in black gloss finish, \$5,200).

Three 42" integrated models, TTM 1Q06

42" 42PC1DA \$3,500 (now \$2,500), ATSC/Digital Cable ready, dual HDMI/HDCP, shown right  
 42" 42PC3D \$3,000, ATSC only tuner, PSIP EPG  
 42" 42PC3DV \$2,000, EDTV, ATSC tuner, PSIP EPG, HDMI and PC inputs



50" 50PC3D \$4,000 (now \$2,900), TTM Mar 06, NON-HD DVR model, TTM March, ATSC tuner, but NO CableCARD tuner, HDMI, PC input, 768p

PB2DR series

\$TBD, TTM 3Q06, 768p, 160 GB DVR, 14 color processor, 10000:1 CR, 2 ATSC tuners, dual HDMI, IEEE1394, component, RGB.

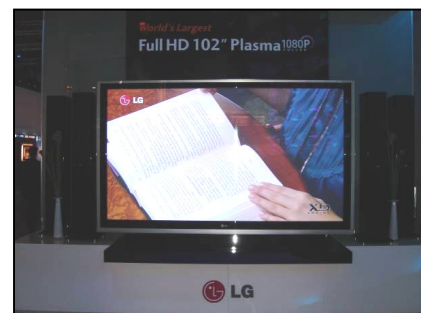
50" 50PB2DR  
 60" 60PB2DR

47" 47LB1DRA \$TBD, TTM Aug 06, 1080p, HDMI, component, RGB  
 50" 50PB2DW wireless plasma panel  
 71" MY-71PY10 \$70,000, 1920x1080p, 2005 model



continues, now reduced in price check below, shown left, check 2005 report for complete specs.

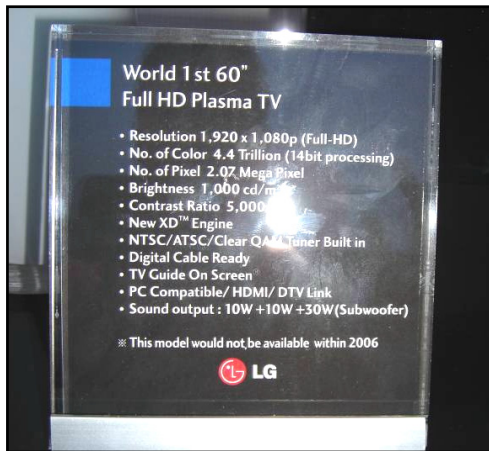
Shown also at CES 2006 the following technology (right) statement of a 1102" plasma:



102" 1920x1080p, 5000:1 CR, 1000 cd/m2 brightness, NTSC/PAL/SECAM tuners, TTM N/A, \$ N/A.

LG announced in Feb 06 that their DVR suited TS will have 250GB HDD drives (rather than the current 160GB), the new models will be released by the end of the year.

Also shown was the world's first 60" 1080p plasma (at CES 2006, according to LG) 60" \$N/A, TTM after 2006, 1920x1080, 5000:1 CR, 1000 cd/m2 brightness, NTSC/ATSC/clear QAM tuners, PC compatible, HDMI, DTV Link (below).



#### Apr 06

LG announced the availability of their 71" monitor MW-71PY10 with 1920x1080p display resolution, \$70,000, featuring LG's proprietary XD Engine technology, for upconversion of low resolution of analog signals, implementing six distinct processes to improve brightness, enhance detail, and apply more accurate color and noise reduction with film-like high- resolution.

The set also features HDMI and DVI inputs (w/HDCP), multiple HD component inputs, RGB, PC connectivity, flexible PIP, split-zoom and twin- picture features allows sub-windows to be moved, resized, swapped, and split into multiple windows (up to nine), 1200:1 CR, image retention minimizing circuitry, two-year limited warranty on parts and labor.

#### Jul 06 (Product Review Announcements)

60" 60PC1D \$5,900 (now \$4,900), 1366x768, TTM Sep 06, same design as the previously released 50PC1DRA included below, latest XD Engine, 7,000:1 CR, ATSC/NTSC/QAM tuners (fifth-generation VSB digital TV reception chipset), 2xHDMI inputs.

50" 50PC1DRA \$4,500 (now \$3,700), TTM now, 1366x768, built-in HD-DVR, 160-gigabyte HD-DVR, ultra-thin cabinet, up to 15 hours of digital high-definition programming or more than 66 hours of digital standard-definition programming, digital cable-ready (CableCARD), TV Guide on-screen® interactive program guide, eight days of program information.

50" 50PY2DR \$5,400 (now \$4,700), TTM now, 1366x768, integrated HD-DVR, glossy, black cabinet, record, pause and playback live TV on its 160-gigabyte

hard drive, stores up to 13 hours of HDTV, or 63 hours of SDTV, TV Guide on-screen interactive program guide which displays eight days of program information, Digital Cable Ready, digital photos or music from digital cameras, or MP3 player onto the hard drive and listening.

60" 60PY2DR \$8,400, 160GB DVR, 1366x768, IEEE1394, HDMI, 5000:1 CR, ATSC/NTSC/QAM tuners w/CableCARD.

Oct 06 Dealer Show

LG announced planned releases of new plasmas, featuring HDMI-CEC standard, "LG Simple Link", integrated ATSC/QAM/NTSC tuners and LG's proven fifth-generation "VSB" circuitry.

PC3D Series

HDMI, 10000:1 CR, ATSC/NTSC/QAM clear tuners.

- 42" 42PC3DV \$1,200, 852x480 ED, shown right
- 42" 42PC3D \$1,900, 1024x768
- 42" 42PC3D-H \$1,900, 1024x768, high altitude up to 6562 ft
- 50" 50PC3D \$2,900, 1366x768
- 50" 50PC3DH 1366x768, for altitude up to 9514 feet.



PB4D Series

160 GB DVRs for 13 hrs HDTV or 63 hrs of SD, DVR can also record from an external high-definition source such as a cable box or satellite tuner in 480p resolution via component inputs.

- 42"
- 50"
- 60"

Panel from PB4 series shown at right:



PC5D Series

Clear Filter Pro technology replaces the front glass filter with a thin film filter which reduces reflection and double imaging, Extreme Contour Compensation (XCC) which minimizes color contouring to display more natural color transitions, LG's exclusive XD Engine™ technology, 1366x768, 15000:1 CR, 2xHDMI. Panel from PC5D Series shown at left.



- 42" 42PC5D \$1,700
- 50" 50PC5D \$2,500

These models supplement the carry over models 60PC1D and 42PC3DV.

PY3D Series - 1080p

Added 60" and 50" to its current 71", accepting 1080p at 24/30/60 frames per second over HDMI and component, 3xHDMI, USB, shown right.



CES 2007

LG announced a reduction of the price of their 71" plasma as follows:

"Reflecting manufacturing efficiencies and marketplace realities, LG repositioned its flagship 71-inch Plasma Full HD Monitor (71PY1M), one of the largest plasmas available for consumer purchase. The new price of \$14,999.95 is an amazing 80 percent decrease from the unit's introduction price in early 2006. "

71" 71PY1M on right:



**Marantz**

May 06

61" PD6150D \$18,000, 1366x768, monitor, no tuners

**Maxent**

For current and earlier models, consult the 2006 HDTV Technology Report.

CES 2007

The company introduced 3 new panels, the 42-, 50- and 58-inch plasma televisions, featuring standard RS-232 and RJ-45 ports for remote network control, advanced audio processing, DVI, RGB input, loop-out, SD/HD component video inputs, discrete audio inputs, and audio and subwoofer outputs, subwoofer outputs, picture-in-picture and side-by-side picture, and built-in audio amplifiers.

42" MX-42HPT51 \$1,300, WXGA, ATSC tuner, TTM 1Q07, below and side (angle and front)



50" MX-50HPT51 \$1,800, WXGA, ATSC tuner, TTM 1Q07

58" MX-58HPT51 \$2,500, WXGA, ATSC tuner, TTM 3Q07

**Mitsubishi**

Consult the 2006 HDTV Technology Report for earlier models.

**NEC**

Consult the 2006 HDTV Technology Report for earlier models.  
63" 61XR4 \$14,000, TTM Nov 05 (\$11,500 Feb 06), right.



**NIKADA**

Consult the 2006 HDTV Technology Report for earlier models.

**Norcent**

CES 2006

VION line

42" PT-4291 \$2,100, 1024x768, black, ATSC/NTSC tuners, 2x component, 1100 cd/m2 brightness, 1000:1 CR.

42" PT-4210 \$1,900, TTM Mar 06, 720p, DVI

42" PT-4242HD \$2,200, TTM Mar 06, 720p, DVI

CES 2007

Norcent introduced two new HD plasma televisions featuring:  
Built-in ATSC and NTSC tuners, HDMI, component, and PC with audio inputs, 3D digital comb filter, 160-degree side-to-side viewing, 480i/480p/720p/1080i signal compatibility, trilingual (English, French, Spanish) on-screen menu, sleep timer, parental control, SRS audio enhancement.



42" PT-4246HD \$1,200, TTM now, 1024x768, 1200cd/m2 brightness, 8,000:1 CR, Clear-QAM tuner.

50" PT-5045HD \$1,900, TTM Feb07, 1366x768, 1000cd/m2 brightness, 10,000:1 CR.

**Panasonic**

Consult the 2006 HDTV Technology Report for earlier models.

PX500 line  
PX50 line  
ONYX Series  
8-Series

CES 2006  
600 Series  
ATSC/NTSC/CableCARD tuners, HDMI/HDCP,  
PC inputs, SD card slot, TV Guide On Screen  
EPG, TTM spring 06.



42" TH-42PX600U \$3,200, 1024x768  
50" TH-50PX600U \$4,200, 1366x768  
65" TH-65PX600U \$TBD, 1920x1080p, TTM Aug/Sep 06, expected to be at \$8000  
when released in the US), 1080p acceptance expected for later in the year (upon



HDMI 1.3 later release they said, although 1080p is actually not exclusive on the 1.3 version), PC input, NTSC/ATSC/QAM CableCARD tuners, HDMI version 1.2 inputs with HDAVI control, TV-Guide EPG, left, good blacks, skin color very nice, all natural colors, pixel structure viewable from 3 feet away, best plasma on that size at CES 2006.

Future 1080p models would start from the 42" size. 58" model mentioned but not confirmed at CES 2006, later added at CES 2007.

60 Series  
ATSC/NTSC tuners, HDMI/HDCP, SD card slot, NO CableCARD, TTM spring 06

37" TH-37PX60U \$2,200, 1024x720  
42" TH-42PX60U \$2,600, 1024x768  
42" TH-42PD60U \$2,000, 852x480p EDTV  
50" TH-50PX60U \$3,700, 1366x768  
58" TH-58PX60U \$5,500, 1366x768 mentioned  
but not confirmed at CES 2006, see below for  
details.

103" 1080p plasma panel prototype was shown  
as a technology statement, picture on the  
right:



Mar 06

As promised at CES 2006 above, Panasonic launched two 58-inch, 1366x768, models capable of displaying nearly 29 billion colors with a 10,000:1 contrast ratio, TTM summer 06.

Panasonic added "Now that we've increased the number of our panel's displayable colors from eight billion to nearly 29 billion with 3072 shades of gradation and upped our maximum contrast range from 3,000:1 to 10,000:1 to achieve the blackest blacks and whitest whites in the industry, we feel very confident of retaining our top ranking with both HDTV plasma buyers and the consumer electronics media."

Panasonic announced a new plasma panel factory, the company's fourth, scheduled to go online in 2007 at Amagasaki, Japan. The new facility will increase Panasonic's production capability by 170,000 panels a month, bringing the company's total capacity to 592,000 42-inch-equivalent panels per month.

The models feature HDAVI (EZ-Sync) technology for single remote/one-button HT system control, integrated SD Memory Card slot for digital images and slide shows, PC input, integrated NTSC/ATSC/QAM tuners, state-of-the-art video noise reduction, motion-adaptive digital comb filter, 3D color management, motion pattern noise-reduction technology. BBE(R) ViVA HD3D Sound with four speakers plus passive radiator (600), single-tuner split- screen display, 2xHDMI.

58"	TH-58PX600U	\$6,000, CableCARD, TV Guide EPG
58"	TH-58PX60U	\$5,500

#### Jun 06

The company introduced the 9-series of professional plasma displays featuring 16-bit digital signal processing, improved sub-field driving technology for 3072 gradation steps, 10,000:1 CR, enhanced video capabilities, thin/lighter design, Real Black Creation color-enhancing for high-contrast and rich, deep blacks, Motion Pattern Noise Reduction circuit for consistent sharpness across the entire image during fast-paced scenes, improved burn-in resistance, 60,000-hour service life.

The panels also feature three multi-function input back slots for optional terminal customization boards (37in model with two), the new PC board PLUG-VC251 can be inserted to run applications and presentations or receive updates, compatible with Windows XP, XP embedded operations systems, and Windows-based applications software. Another new feature is a new CAT 5 transmitter with a switcher function (model KE811CT) to receive signals from a separate command center to control up to 128 plasmas in parallel from a single location.

Built-in image-enlarging function for use with up to 16 multi-screen display systems (4 x 4 construction, for 1 x 4, 2 x 3, up to 4 x 4 construction), Advanced Dual Picture Mode to combine video clips with textual information from a PC, the 50in and 42in models can also be displayed vertically without any adjustments, TTM Jul 06.

37"	TH-37PH9UK
42"	TH-42PH9UK
50"	TH-50PH9UK

#### Jul 06

Matsushita announced in Japan their launch of four new models of high-definition plasma TVs, including the world's largest with a 103-inch panel, in Sep 06 in Japan, and overseas shortly after. Some models already mentioned above under other announcements.

50"		
58"	TH-58PX600U	1366x768, 10000:1 CR, 2HDMI, HDAVI tech, CableCARD
65"	TH-65PX600U	\$10,000, TTM Sep 06, 1080p,
103"	TH-103PZ600U	\$70,000, TTM Dec 06, (\$50,000 in Japan), 1080p, (7 ft 10.5 in by 4 ft 7 in), 474 lb, 5,000 units planned per year globally, manufactured in limited quantities build-to-order, through select high-end A/V specialty dealers, three-year in-home limited warranty, 4000:1 CR.

### Sep 06

Panasonic's announced price reductions between \$500 and \$200, as follows:

#### \$500 reduction:

58" TH-58PX600U from \$6,000 to \$5,500

58" TH-58PX60U from \$5,500 to \$5,000

#### \$200 reduction:

37" TH-37PX60U from \$2,000 to \$1,800

#### \$400 reduction:

42" TH-42PX600U from \$3,000 to \$2,600

50" TH-50PX600U from \$4,000 to \$3,600

42" TH-42PX60U from \$2,500 to \$2,100

50" TH-50PX60U from \$3,500 to \$3,100

#### Price unchanged for:

65" 1080p model, still at \$10,000

Additional price reductions were applied to prices above by several retail chains, such as Circuit City and Fry's.

Panasonic was not alone at announcing price reductions:

HP (42" PL4260N reduced \$100, 50" PL5060N reduced \$200), and

Hitachi (42" 42HDS69 reduced \$300, 55" 55HDS69 reduced \$300).

### Oct 06 CEATEC Japan

Panasonic introduced their existing 103" and 65" models, and two new models in 50" and 58" all in 1080p, all HDMI 1.2 and with SD Card slots and Viera Link, TTM Sep 06 in Japan, the 103" (\$70,000) and the 65" (\$10,000) models planned to become available in Oct 06 in the US.

### CES 2007



Panasonic announced its full line of Plasmas for 2007, including a 50-inch and 58-inch 1080p high definition model, added to the current 65-inch and the world's largest Plasma, the 103-inch, for a total of 7 plasmas for 2007.

Panasonic also unveiled a prototype 42-inch 1080p that Andrew Nelkin, Panasonic Vice President, Display

Group, quoted it as "demonstrates Panasonic's technological expertise in Plasma

development". The prototype uses smaller ribs and phosphor materials, and improved the aperture ratio, having the same high brightness as the current 42-inch Panasonic HD model, TH-42PX600, incorporates the 1080p HD high-speed pixel drive Panasonic developed for its 1080p HD plasma TVs to ensure stable light emission from all the pixels.

Plasma sales increased 138 percent in 2006 and are expected to almost triple in 2007. Panasonic has two new PDP factories in Amagasaki, Japan, to meet the planned 11.5 million-unit production schedule for 2008.

The new line of both 720p and 1080p plasmas feature a new sleek cosmetic design - a piano black bezel, improved EZ-Sync™ remote to link Panasonic consumer home entertainment and video products, SD Memory Card slot with Photo Viewer.

1080p 700 Line

1920x1080p, NTSC/ATSC/QAM tuners, SD Memory Card slot, 3xHDMI inputs EZ-Sync, New Cosmetic, TTM Apr 07, 4000:1 CR, Ethernet port.

42"	TH-42PZ700	\$2,500
50"	TH-50PZ700U	\$3,500
58"	TH-58PZ700U	\$4,800

1080p 750 Premium Line

TTM May, H.264 MOEG4 playback from SD card slot, Studio reference Mode (exact color reproduction as studio), Pro Setting Mode for calibration, 3xHDMI, black chrome ornament cosmetic.

50"	TH-50PZ750U	\$4,000
58"	TH-58PZ750U	\$5,500



PX77 Line

TTM Apr 07, new cosmetic, Anti-Glare coating, side firing speakers.

42"	TH-42PX77U	\$1,800
50"	TH-50PX77U	\$2,800

PX75 Line

TTM Mar 07, gloss black frame, bottom-mounted speakers, new cosmetic.

42"	TH-42PX75U	\$1,600
50"	TH-50PX75U	\$2,500
58"	TH-58PX75U	

Carried over from 2006

65" TH-65PX600U \$10,000 (\$7,000+ on street) 1920x1080p, NTSC/ATSC/QAM tuners, CableCARD slot, SD Memory Card slot, HDMI inputs with HDAVI-Control, TV-Guide, TTM now.

103" TH-103PZ600U \$70,000, 1920x1080p, TTM Dec 06



**Philips**

According to Philips, AmbiLight 2 further refines the backlighting system by adding separate systems for each half of the screen. This gives a stereo effect to the synchronized backlighting technology.

CES 2006

42" 42PF9631D \$2,500 TTM June 06



50" \$3,500, TTM June 06, AmbiLight 2

50" 50PF9731 \$4,000, TTM July 06, AmbiLight full-surround for rear illumination on all four sides of the panel (below)



63" model to be introduced, specs N/A

### **Pioneer**

Consult the 2006 HDTV Technology Report for the following models:

43" PDP-4360HD

50" PDP-5060HD

#### Elite models

PRO-930HD

PRO-1130HD

Pioneer demo their first 1080p 50" plasma model Elite PRO-FHD1 at CES 2006, announced as MSRP \$10,000, TTM June 06. Up-scales video to 1080p, and features HDMI, DVI, component, optional tabletop stand and wall-mount bracket. The demo was done with their new Blu-ray player. Accepts 1080p.



The panel uses Pioneer's Pure Crystal Emissive Layer and First Surface PureColor Filter technology for the efficient use of smaller pixels in plasma cells, and Deep Encased Cell Structure to improve brightness and image accuracy, according to Pioneer. In addition the panel uses PureDrive III signal processing system to reduce the noise and obtain high contrast and natural color images.

The PRO-FHD1 1080p model was released as announced above, and is now at \$8,000 MSRP, 2xHDMI, DVI-D, RS-232, RGB-HB, 120 Hz display, accepts 1080p/24Hz.

#### Mar 06

##### PureVison Black Plasma Display in Europe

Pioneer confirmed the upcoming arrival of model PDP-5000EX, a 50" 1080p panel said to be available on June 06, implementing a technology that doubles pixel density and resolution, and Deep Waffle Rib Structure, making each cell deeper to increase overall phosphor area for a brighter image and casing each cell with horizontal ribs, diminishing light leakage from neighboring cells for sharper, more accurate images.

The panel also features a new T-shaped electrode to prevent misfiring of individual cells, PUREBLACK Crystal Layer sandwiched between the plasma glass and the individual light cells, High Quality Up Conversion to 1080p, minimizing interlacing



motion artifacts of 1080i and increasing the resolution of a 720p signal, PURE Drive 2 HD Signal Processing for low noise, high contrast and natural color images, Direct Color Filter to reduce ambient light reflection, enhanced ISF C 3 capability with detailed gamma selection with eight steps, 2xHDMI, DVI (HDCP), component, optional tabletop stand, and wall mount bracket, 3000:1 CR, Brightness of 1000 cd/m2.

#### May 06

Cable CARD/ATSC tuners

Two piece models:

43" PDP-4350HD \$5500

50" PDP-5050HD \$7500

One-piece models

43" PDP43A5HD \$5500

50" PDP50A5HD \$7500

#### Jun 06

Three new Elite plasma models were introduced in Urushi gloss-black bezel finish, new seventh-generation glass technology; the 42 and 60 sizes the panels implement network connectivity supporting Windows Media Connect and DLNA compatibility to share photos, music and movie downloads from a connected PC, TV Guide™ OnScreen® electronic program guides with eight days of programming. dual NTSC/single ATSC tuner built in, Digital Cable Ready (DCR) w/CableCARD™, 2xHDMI, two viewing modes for both day and night viewing, fully integrated one-body design on the 42" plasma and side-mounted, detachable speakers on the 50" and 60" televisions use SRS(WOW)™ technology, TruBass® and Focus™, SRS (WOW) with 3 surround sound modes, sub-woofer connection.

42" PRO-940HD \$4,000

50" PRO-1140HD \$5,500

60" PRO-1540HD \$8,000 (below)



Pioneer declared they were planning to introduce more 1,080p models in 50 and 60 inches screen sizes, in addition to their 768p panels, due to the lower incremental cost for 1080p on those sizes.

Although the company has previously mentioned their plans to scale back plasma production (after acquiring NEC) the company now stated their intention to increase plasma display output by the 2008 Beijing Olympic Games.

According to TWICE the company also stated that "because of cost and efficiency we shut down some of the older lines we used to produce plasma and are now reworking them for future production of the larger screen sizes and 1,080p," Meyhoefer said, adding, "We would like to double our capacity [from 1.2 million units per year] in the next couple of years."

And according to a report in daily newspaper Asahi Shimbun, Pioneer plans to spend more than \$178 million to build in Japan a new plasma panel production line that would help increase capacity by up to 40 percent. Construction is expected to begin in March.

#### CES 2007

Pioneer introduced technology at the show that was described to be the most advanced plasma high-definition television, to become available summer of 2007. The panel has richer colors, deeper shades of black, better contrast than competing plasma panels, liquid crystal display panels, and even better than SED, according to Pioneer.



"We have to find our own balance and not simply follow the competition," Katsunobu Shioda, general manager of Pioneer's home entertainment business group, told Reuters at CES. Shioda added that the new panel may "cost more than its rivals' products, but will deliver better picture quality and performance". Prices and sizes would be known in May.

Black levels exceeding previous Pioneer plasmas, dark scenes are darker while maintaining clarity of detail, reducing luminance by 80 percent. The test equipment typically used to determine the variance between peak white and peak black does not have great enough range to measure Pioneer's new display so a contrast ratio specification is not yet determined.

Rich colors in dark scenes are a second benefit of the lower luminance levels and deeper blacks. The new display reproduces colors with greater richness and accuracy even in dark scenes.

Performance in bright rooms is significantly improved with a newly engineered filter that minimizes the effect of ambient light so the display is able to maintain deep black levels regardless of lighting conditions.

I attended this demo and there was a remarkable improvement in picture quality, black level with clear distinction of different black textures on the content used for the demonstration. Frankly, I was not expecting anything less from a plasma company such as Pioneer, which consistently has brought to market the best quality plasmas for years with the Elite line. 8G prototype shown.



Additionally, Pioneer showed itself very motivated, and the only manufacturer, to provide the best 1080p 24Hz picture performance with the Pioneer Elite® PureVision™ 50" 1080p plasma display, Blu-ray Disc® player and A/V receivers that work together to handle the 1080p 24Hz rate needed to preserve a feature film's original sequence.



According to the company "The majority of feature film titles are mastered on discs at 24 film frames per second (fps or Hz) with a 1080p signal. Since most televisions are unable to accept the 1080p 24Hz format, many employ a technique known as Inverse Telecine.

Also known as 3:2 pulldown, this process converts 24fps into 30fp by inserting six additional film frames per second. While an improvement in the playback

performance, the scene sequence is compromised and a slight judder may appear during motion action. Pioneer delivers a new dimension in high definition with its high end audio video products that resolve and improve feature film playback”.

The PRO-FHD1 panel implements exclusive Advanced PureCinema or 3:3 pulldown, whereby each film frame is shown three times every 24th of a second for a smooth picture at 72 frames per second.

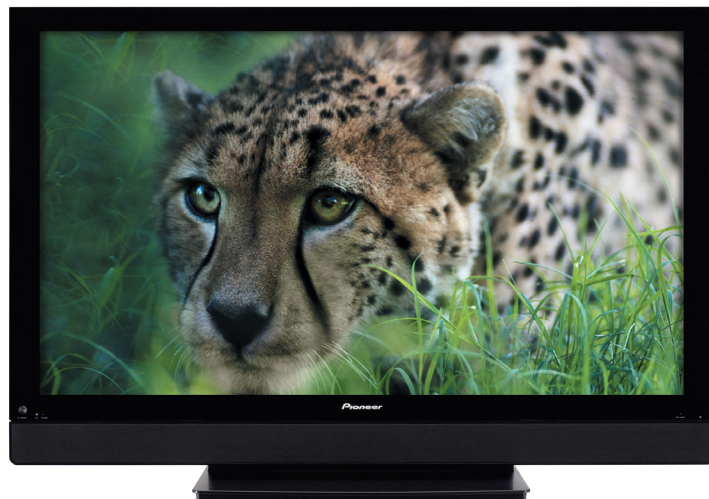
Additionally Pioneer introduced three new plasma televisions (TTM now):

Featuring 4-inch slim, one-body design, New First Surface Pure Color Filter to improve contrast ratio with ambient light by 10 percent for enhanced detail, Deep Encased Cell Structure to prevent light from leaking into adjacent cells, new Red and Blue Phosphors, improved phosphor gases that deliver images with an expanded color spectrum and wider color palette, Crystal Emissive Layer between the plasma glass and individual light cells to allow the cells to charge and discharge more efficiently, making the transition between color and black much smoother for improved detail in dark scenes, and an overall reduction in energy consumption.

TV Guide™ On Screen® eight days of programming, SRS(WOW)™ - SRS Surround, TruBass® and Focus™, 3 surround sound modes, 42” with fully-integrated speaker, 50” and 60” with detachable speakers, 2xHDMI that accept a 1080p/24Hz signal for technology such as Blu-ray Disc, dual standard (NTSC)/one high definition (ATSC) tuners, Digital Cable Ready (DCR) with a CableCARD™ slot, Home Gallery USB connection.

42”	PDP-4270HD	\$3,500
50”	PDP-5070HD	\$4,500
60”	PDP-6070HD	\$7,000

PDP-6070HD showing



**Runco**  
CES 2007



Runco launched the new XP-65DHD plasma display monitor, 1080p, 16-bit digital video processing for 4096 steps of gradation to eliminate primitive "solarization" and "stair stepping" characteristics plaguing entry level plasma displays, according to Runco.

Outboard DHD with HDMI Digital Video Controller/Processor, compatible with all ATSC HD

resolutions, including 1080p 24, 30 and 60, discrete multiple aspect ratio control including Runco's VirtualWide™ for viewing 4:3 content in widescreen without appreciable picture degradation, RS-232 control, included Imaging Science Foundation (ISF™) calibration standards into every model, less than 4 1/2 inches thin, high altitude regions model XP-65DHDx compliant to over 9000 ft., \$20,000.

Additionally Runco introduced six new plasmas from 42" to 60" (three each to the PlasmaWall and CinemaWall lines), TTM now, achieving ISF™ (Imaging Science Foundation) certification for day and night settings, and featuring high-gloss black frame, RGB, DVI/HDCP, RS-232, 4-inches thick, wall/ceiling/desktop installation:

#### PlasmaWall 1365x768

Featuring the latest generation Runco's DHD Digital High Definition Video Controller/Processor with advanced Vivix II™ processing external modular controller.

42" SP-42DHD  
50" SP-50DHD  
60" SP-60DHD

#### CinemaWall 1024x768

Featuring the latest generation of Runco's plasma technology and advanced integrated Vivix II processing.

42" SP-42  
50" SP-50  
60" SP-60 (shown)

#### **Samsung**

Consult the 2006 HDTV Technology Report for earlier models, such as: 72 Series

I include below some background about Samsung's 80" model from last year report:

In October 05, Samsung announced that the 80" HP-R8082 panel is in production and will be released for sale in Feb 06, for \$150,000 (not \$39,000 as originally disclosed at CES 2005).



I discussed the price discrepancy issue with Samsung representatives at CES, I was told that four units were already delivered, but no official clarification was given for the price discrepancy.

For that reason, I requested Samsung to issue an official statement. Mr. Bill Dickey, Sr. Marketing Manager, Plasma Displays, Samsung Electronics America submitted the following statement for this report:

*"When we first introduced the product in 2005 the pricing provided to the media was based on production/sales levels of 1,000 units per month, as well as utilization of a new mass-production line at Samsung Display and Digital Interface (SDI), our sister company.*

*After introducing the concept TV, the required order volume did not materialize and SDI chose not to invest in a new line to build the 80" PDP. Because of these dynamic market conditions, the 80" displays produced today are essentially hand-made on a pilot production line with a current capacity of 3-4 modules per month.*

*Because of this limited production capacity, we are unable to achieve any economies of scale in procuring the components necessary for manufacturing this large panel. Compounding this is the additional manpower required to achieve the extremely high quality levels required of Samsung flagship products, due mainly to the lack of automated production processes.*

*Finally, because we are shipping these massive TVs singly, rather than in container quantities as planned, the transportation costs have skyrocketed.*

*For these reasons, Samsung has had to increase the market price of the HP-R8082 to the current \$150,000 level. If demand increases enough to justify the investment in plant and personnel, SDI will invest in a new production line and the price would be expected to drop to the previously proposed levels."*

On March 07, Samsung indicated that "The 80-inches plasma is not at retail, therefore there is no pricing available".

Samsung demonstrated a 102" prototype plasma panel that has not been made available for retail yet.

#### CES 2006 lines

##### 73 Series

2 HDMI, 2 component, anti-reflective film, 175 degrees angle, ATSC/DCR tuners.

42" HP-R4273 \$3,300, TTM Jul 06

50" HP-R5073 \$4,300, TTM Jul 06

63" HP-S6373F \$N/A (but \$11K was estimated), TTM N/A, (right), 1920x1080p panel, 3000:1 CR, 1000 cd/m2 brightness, ATSC & NTSC tuners, digital cable ready, 2 component inputs, HDMI, PC input.

##### 53 Series

ATSC/NTSC tuners

42" HP-R4253, \$3,000, TTM Apr 06

50" HP-R5053, \$4,000, TTM Apr 06



#### May 06

Following the early announcement at CES 2006 (above) Samsung confirmed the release of the panels.

The company declared (according to TWICE) "Today, our entry 40W-inch LCD TV is slightly below the price of our entry 42W-inch HD plasma", said Tanenbaum. "We are testing that right now. We do not have any magic crystal ball that can say which display type consumers are ultimately going to want, but right now, both products are high in market share, and demand for our plasma product remains very strong. We see that continuing at least for the near- and midterm."

The company showed two series of models implementing FilterBright anti-reflective technology for improved contrast in bright room conditions.

#### 53 Series

TTM Jul 06, ATSC/NTSC tuners, "invisible speaker" cabinets, 2xHDMI inputs.

42" \$3,000

50" \$4,000

#### 73 Series

TTM Jul 06, "invisible speaker" cabinet design, swivel stands, 2xHDMI inputs, 175-degree viewing angles, built-in ATSC/CableCARD tuners, 9 in 2 memory card slots.

42" \$3,300

50" \$4,300

#### Current model

63" HP-R6372 \$10,000, built-in HD/CableCARD tuners, DNIE image enhancer

#### CES 2007

Samsung introduced the following new plasmas featuring FilterBright2 Plus™



Technology, Samsung's first full HD 1080p resolution plasma HDTV with FilterBright2 Plus technology that helps enable greater contrast in bright rooms, a powerful anti-reflective film which absorbs external light and transmits internal light, increases contrast levels and prevents unwanted reflection. In bright daylight, FilterBright2 Plus creates high contrast with pure black to show clearer image details and generate powerful dark area representation.

#### 94 Series

Wireless 1080p, Advanced wireless A/V center using the latest 802.11n standard (150Mbps transfer speed with a range of 300 feet), 1920 x 1080 (1080p) resolution, 10,000:1 CR, NTSC / ATSC digital cable ready tuners built-in, Side A/V pack, 3xHDMI 1.3 with CEC inputs for added home theater connectivity, 9-in-2 memory card slot, USB 2.0 input, RS232 input, Auto Wall-Mount Ready, and neck type swivel stand, 175-degree viewing angle. Bluetooth technology for use with wireless headphones.

58" HP-T5894W \$5,700, TTM Sep 07

84 Series

1080p, 10,000:1 CR, NTSC / ATSC digital cable ready tuners built-in, 3xHDMI 1.3 with CEC inputs, 2xComponent inputs, PC input, USB 2.0 input, Stylish TrueWide 16:9 cabinet design with 15W x 2 "hidden" speakers, Auto Wall-Mount Ready, and neck type swivel stand.

50" HP-T5084 \$4,200, TTM May07

58" HP-T5884 \$5,200, TTM Sep07

HP-T5084 shown:



64 Series

720p, Auto Wall-Mount capability, 13bit signal processing and 549 Billion colors, 10,000:1 CR, NTSC / ATSC digital cable ready tuners built-in, 2xHDMI inputs (although also specified as 3xHDMI 1.3 inputs), PC input, TrueWide 16:9 cabinet design with 15W x 2 "hidden" speakers, neck type swivel stand, advanced digital connectivity with Anynet+ (HDMI-CEC) to enable a single remote control unit to operate a BD player, home theater system and other A/V products that are also CEC compliant, Wise Link™ (USB 2.0).

42" HP-T4264 \$2,300, TTM Mar07, 1024x768, 1,500cd/m2 brightness

50" HP-T5064 \$3,200, TTM Mar07, CES 2007 "Honoree award", 1365x768, 1300 cd/m2 brightness.

HP-T4264 below:



HP-T5064 below:



54 Series

A new series enhancing the previous 53 series, 13bit signal processing and 549 Billion colors, 10,000:1 CR, 1,300:1 cd/m2 brightness, NTSC / ATSC digital cable ready tuners built-in, 2xHDMI inputs, USB 2.0, PC input, TrueWide 16:9 cabinet design with 15W x 2 "hidden" speakers, round base swivel stand.

42" HP-T4254 \$2,100, TTM Jul07

50" HP-T5054 \$3,000, TTM Jul07, CES "Honoree award"

HP-T5054 below:



Samsung's new auto wall mount system for the plasmas above provides remote control of the angle of the TV view, by tilting from 15- to 20-degrees in multiple directions. The system has a safety sensor preventing the panel from touching the wall or objects while in motion, TTM Mar07, \$1000 (U.S. Market).

### **Thomson**

2006 line TTM Apr 06

42" P42WHD500 \$1,800, 3 models in this size, DVI and HDMI, VGA for PC  
50" \$2,100

### **Toshiba**

Consult the 2006 HDTV Technology Report for the following models:

Cinema Series

720p True HD HPX95 panels

TheaterWide line

HP95 panels

Custom Series

42" 42DPC85

May 06

The company announced the release of two new models, with ATSC/QAM tuners, 2xHDMI inputs, PC input, new cosmetics, and improved contrast ratios.

42" 42HP66 \$2,300, 8,000:1 CR  
50" 50HP66 \$3,300, 10,000:1 CR

### **Vidikron**

CES 2007

Vidikron introduced PlasmaView™ VP-6500VHD 1080p 65" panel complementing the company's current lineup of 42, 50, and 60-inch plasma monitors.

Features 16-bit digital video processing for 4096 steps of graduation to minimize the "solarization" or "stair stepping" previously plaguing digital flat panels, according to

Vidikron, IntelliWide™ mode, separate VHD controller's Imagix™ video processing allows viewing of all 4:3 content in a 16:9 widescreen format, filling the entire 65-inch screen without appreciable picture degradation, compatible with all ATSC HD resolutions, including 1080p 24, 30 and 60 frame rates, higher altitude model VP-6500VHDa edition for over 9000 feet above MSL, finished in pewter, brushed anodized aluminum frame, elegant anodized black plasma framing option is also available, \$20,000, TTM mid-Jan07.



Plasmaview line

Two new 60" monitors to the current 42, 50, 60 and 65 inches line. TTM now.

VP-6000 \$15,000  
 VP-6000VHD \$17,000



Less than 4" deep, 1365x768 (720p), replacing current VP-60 and VP-60VHD, 3:2 film detection circuitry, Imagix™ processing technology, VP-6000VHD equipped with external VHD controller, multiple aspect ratio control, IR and discrete RS-232 controls, Vidikron's Dynamic Pixel Protection™ to help prevent stationery image burn, finished in pewter, brushed anodized aluminum frame, an elegant anodized black plasma framing option is also available.

**VIZIO Inc.**

Consult the 2006 HDTV Technology Report for earlier models.

2006 line

42" P42HDTV \$1,800, TTM Mar 06, HDMI/HDCP, 768x1024  
 50" P50HDTV \$2,700, TTM Jun 06, HDMI/HDCP, 1366x768, DCDi

2007 line

42" VP42HDTV in 2007 it was reduced to \$1,100  
 50" P50HDTV in 2007 it was reduced to \$1,700  
 50" VP50HDTV in 2007 it was reduced to \$1,500

60" VM60P \$2900, 1366x768, 7000:1 CR, ATSC/NTSC/QAM tuners, 4xHDMI, 4.8-inches deep, input formats 1080i/p, 720p, 480i/p, 1200 cd/m2 brightness, 2xcomponent, <http://www.vizio.com/products/detail.aspx?pid=23>



## Chapter 10 - LCD Panels

In January 2007, according to Electronics Weekly, Market watcher iSuppli predicted a slower growth of the LCD-TV market this year. 62.5 million units would be shipped in 2007, a 57 % increase from the 39.7 million in 2006, but only 95% of the 2006 growth.

Although worldwide LCD-TV factory revenue is expected to increase by 20% in 2007 (\$53.5 billion, from 2006's \$44.7 billion), the prediction of the revenue slowdown was said to be a larger impact than the units sold, with about 56% decrease in growth compared to 2006 (which was 76%).

According to the Electronics Weekly news "The number of LCD-TV units shipped in 2007 will increase dramatically for sets that are 40-inches and larger, iSuppli predicted. For LCD-TVs in the 40-inch to 41-inch range, iSuppli said manufacturers will ship 2.3 million units by Q4 2007, up 60.3 percent from 1.4 million in Q4 2006".

### **Akira**

46" HLT460W

Consult the 2006 HDTV Technology Report.

### **Asus**

22" MW221U

Consult the 2006 HDTV Technology Report.

### **BenQ**

Dec 06

The company launched a new LCD monitor lineup with widescreen aspect ratio, HDMI, HDCP, D-Sub and DVI-D, VISTA ready, TTM now, the 24-inch models have component inputs.

19"	FP94VW	\$300, 1,440x900, 2ms response time, 700:1 CR
22"	FP222WH	\$549, 1,680x1,050, 6ms response time, 700:1 CR
24"	FP241VW	\$1,500, 1920x1080, 6ms response time, 1000:1 CR, silver and black chassis
24"	FP241VW Z	\$1,300, same as above but with black chassis

### **Hisense**

Consult the 2006 HDTV Technology Report.

### **Hitachi**

For the HDL52 Series and the UltraVision® CineForm(TM) Director's Series(TM)

Consult the 2006 HDTV Technology Report.

Jun 06

Hitachi introduced new panels:

### Director's Series

32" 32HLX99 \$2,500, TTM Nov 06  
37" 37HLX99 \$3,000, TTM Oct 06

### Ultravision T Series

Features include 120Hz refresh rates, black-finish trim frames with titanium gray lower speaker panels and matching swivel stands, side-panel menu controls, preprogrammed illuminated remote control, day and night memory by input with timer, new day dynamic picture memory, three-language onscreen display, parental locks, on/sleep timers, auto link input sensor, discrete IR codes, 3xHDMI, 3xcomponent inputs.

32" \$2,200  
37" \$2,700

### CES 2007

#### H201 Series

PictureMaster™ IV 1080p processor, Quickstart seamless ATSC, QAM and NTSC tuners, black and titanium gray ID, 3xHDMI 1080p compatible/Simplay™ certified, separate day, day dynamic and night picture memories, customizable timers.

32" TTM Jun 07  
37" TTM May 07

#### T301 Series

Hitachi's IPS-PRO 120Hz technology doubles the frequency of images from 60Hz to 120Hz and inserts a black frame between each normal frame, refreshing images twice as fast, all black industrial design.

32" TTM Jun 07  
37" TTM May 07

## **HP**

### Advanced Digital Media Television

6000:1 CR, 6ms refresh rate, 176-degree viewing angle, the LC3760N includes a digital media receiver for a home network.

### Sep 06

HP announced price reductions:

32" LC3260N \$1,100 (-\$200), and later another \$100 to \$1,000 MSRP.  
37" LC3760N \$1,500 (-\$200)  
32" SLC3760N \$2,500 (-\$200)

### CES 2007

HP introduced new flat-panel TVs with improved Visual Fidelity Engine (VFE) video-processing technology, MediaSmart fully networked LCD TVs, three Simplay-HD-certified HDMI inputs supporting 1,080p signals, 2xcomponent, thin screen bezels with polished piano black finish, RS-232, PC input, ATSC/NTSC/QAM tuners, TTM Spring 07, 720p and 1,080p resolutions, \$TBA.

#### 72N 720p Line

32" LC3272N  
37" LC3772N  
42" LC4272N

### 78N 1080p Line

Featuring 1,200:1 CR, 6ms response times, fully networked TVs to access digital media, Internet services through wired or 802.11a,b,g,n wireless connections to PCs, three antennas embedded in the TV bezel, improved user interface, enhanced content integration software to simplify the selection of PC-stored entertainment files for playback over the network.

Supporting AAC (non-protected), MPEG-1/MPEG-2/MPEG-4, DivX HD, AVI and WMV (SD and HD) video formats; MWA, MP3 and WAV audio formats; JPEG, PNG, GIF and BMP photo formats; and XP and Vista operation systems.

42" LC4278N

47" LC4778N

### **H&B**

Aug 06

#### BRAVO line

Gloss black plastic bezels, in addition to the step-up Aluminum Series (solid aluminum bezel designs), integrated ATSC/NTSC tuning, 1366x768, HDMI, component video, LG Grade A sourced panels, TTM now.

32"LCD-32WS \$1,300, 1,600:1 CR, 8ms response time, side-mounted speakers and stand

42"LCD-42WS \$2,000, 1,600:1 CR, 8ms response time, integrated bottom-mounted speaker design and integrated stand

Two additional models on the BRAVO series by Oct 06:

37" LCD-37WS \$1,700

47" LCD-47WS \$3,000, 1080p

### **Humax**

Consult the 2006 HDTV Technology Report.

32" LP32-TR1, 1366x768, ATSC tuner, HDMI, 2xScarts RGB inputs, 160GB HDD DVR. Right:



### **JVC**

For the 776 line of LCD panels 1366x768 WXGA  
Consult the 2006 HDTV Technology Report.

40" LT-40FH96, TTM fall 05, 1080p, ATSC/CableCARD, dual HDMI, dual IEEE-1394, memory card for Microdrive, universal remote.

### 2006 lines

#### 1080p

1920x1080p, 5<sup>th</sup> generation DIST, Genessa 32-bit CPU video processing, 2 HDMI, PC input, 2 component, new ATSC/DRC/QAM/NTSC tuning system, 2 IEEE1394, parametric equalizer.

40" LT-40FN97 \$3,800

46" LT-46FN97 \$4,600

768p

1366x768, 5<sup>th</sup> generation DIST, Genessa 32-bit CPU video processing, new ATSC/QAM/NTSC tuning system, HDMI, 2 component (except 26"), PC input.

26" LT-26X787 \$1,400

32" LT-32X787 \$1,900

37" LT-37X787 \$2,500

A new LCD capable to display at 120Hz high-speed was announced, TTM end-06.

Apr 06

JVC Professional Products announced the introduction of a new panel:

40" GM-H40L2GU \$5,000, TTM May 06, LCD monitor, which accepts multi-format signals including 1080p 24/24sF and is compatible with all video formats such as analog, DVI-D, and optional HD-SDI.

The panel uses state of the art LCD technology to eliminate screen burn-in, and it features an automatic sleep function that turns the monitor off after a specified time when no signal is detected. This feature increases screen life and saves energy consumption.

The slim design of the GM-H40L2GU allows this LCD monitor to be mounted in a variety of locations and positions either flush against a wall or mounted from the ceiling using standard VESA compliant mounting brackets.

Other features include easily replaceable bezel, built in Eco sensor that adjusts brightness for various ambient light conditions, and front control lock to prevent unauthorized tampering in public areas. The GM-H40L2GU is also compatible with a variety of external control interfaces such as RS-232 and RS-485.

Jun 06

JVC introduced two new LCD panels implementing 120Hz refresh rate, 1366x768, fifth-generation Digital Image Scaling Technology and Genessa 32-bit CPU video processing.

The sets use Clear Motion Drive technology, first announced by JVC last fall in Japan, to display images at least twice as fast than other competitors LCD TVs, additional interpolated frames are inserted on the frame sequence reducing blurring or ghost images, common in fast action scenes on many LCD TVs.

Response times on both sets are claimed at 6ms, expected to help the clarity of the image. JVC commented: "there are diminishing returns when increasing LCD response times further"

ATSC/QAM/NTSC tuning, digital 3D Y/C comb filter with DTV cross color elimination, digital noise reduction, and MPEG noise reduction, 2xHDMI, two HD component video, 15-pin D-Sub for PCs, new black cabinet with a narrow black frame around the screen, 20-watt amp, oblique cone speaker design, MaxxBass technology & DSP.

32" LT-32X987 \$2,000, TTM Oct 06

37" LT-37X987 \$2,700, TTM Aug 06

Oct 06 (CEATEC)

JVC indicated their plans to expand its LCD line in 2007 beyond the two panels currently available of 42-and 47inches, although at that time there were no plans for distribution into the U.S. market.

JVC also announced a "new mathematical algorithm that cleans up the sometimes blurry image delivered by LCD when displaying fast moving images" It was not disclosed when this technology would be incorporated into any released product.

In other words, the announcement did not confirm that neither the panels nor the technology would be appearing in the US market.

CES 2007

JVC introduced their new line of 1366x768 WXGA flat panel LCDs available in black or black and silver.

Featuring JVC's Genessa 32-bit CPU video processing, Natural Progressive IP conversion, new PLL system, 178-degree viewing angle, Digital Video Noise Reduction that reduces the "graininess" for both analog and digital video source, Block Noise Suppressor, Mosquito Noise Suppressor, 3D Y/C comb filter with DTV Cross Color Eliminator, 10-bit 3D Y/C separation process.

The panels also feature four picture modes – standard, dynamic, theater and game, four 16:9 aspect modes – cinema zoom, panorama zoom, full and slim – and four 4:3 aspect modes – panorama, cinema, full and regular, 2xHDMI, 2xcomponent, USB input for viewing digital photos, 10-watts-per-channel amplifier, Advanced Hyper Surround for simulated surround sound, Smart Sound feature to maintain constant volume level as content changes, LT-37E478/488 and LT-42E478/488 add twin oblique cone speakers.



78 Line

Silver cabinet, TTM Mar 07		
32"	LT-32E478	\$1,100
37"	LT-37E478	\$1,500
42"	LT-42E478	\$1,700

88 Line

Black cabinet, TTM Apr 07		
32"	LT-32E488	\$1,100
37"	LT-37E488	\$1,500
42"	LT-42E488	\$1,700

The new technologies shown at CES 2007 were, as presented by JVC:

120Hz Clear Motion Drive: JVC introduced its 120Hz Clear Motion Drive LCD TV technology last year in a 720p set. The company has since applied the technology to full HD



displays. Clear Motion Drive uses a frame doubling driver and a motion interpolation technique to boost LCD image quality, improving resolution, motion detection, and color.

**32-Inch Super Slim LCD TV:** This concept is an LCD TV that measures just over one-inch deep (1-2/5 inches) with a very thin frame for a TV that virtually disappears, leaving just the image. The set weighs a mere 17.6 pounds.

**37-Inch LED Backlight LCD:** An LED light source offers several advantages – long life, durability, quick start-up and stable operation. Compared to a conventional CCFL light source, LEDs also offer vivid color reproduction and faster response, especially when combined with JVC's 120Hz Clear Motion Drive technology.

Mar 07

JVC/Victor announced four new EXE LCD TVs 1366x768, HDMI, ATSC/NTSC tuners, four different colors.

20-inch model shown at right (pink!).

- 20" LT-20LC8
- 26" LT-26LC8
- 32" LT-32LC8
- 37" LT-37LC8 (below)



New models to be available 3Q07, as follows:

898 Series (top of the line)

1080p, TTM Sep 07, HDMI 1.3a, 120Hz (\$500 above the MSRP of 60Hz models).

42" \$2,700 (tentative MSRP)

47" \$3,300

688 Series

1080p, TTM Jul 07, 60Hz, black frame.

37"

42"

788 Series

Same features above adding gloss-black styling, higher contrast panel, \$100 extra

42"

47"

720p models

1080p models are \$300 over the MSRP of 720p models.

- 32" \$1,100
- 37" \$1,500
- 42" \$1,700

**LG**

(The lines from 2006 are still mentioned because some were recently introduced)  
The company announced seven fully integrated HD models, all at 8ms response times, Super In-Plane Switching with 178 degree viewing angles and XD Engine video processing.

Two 37" HD, TTM Mar 06, component, RGB, HDMI, 768p

37" 37LB1DA \$3,300, ATSC tuner, Digital Cable Ready (DCR), TV Guide On Screen

37" 37LC2D \$2,700, Non-DCR, ATSC tuner, PSIP guide

One 37" under the Zenith name brand

37" \$2,300, TTM Sep 06, ATSC tuner, NO CableCARD tuner.

32" 32LC2D \$2,000, 768p, TTM 06, HDMI, component, RGB

Three 42" models TTM Mar 06, 1366x768, XD Engine, HDMI, component, RGB:

42" 42LB1DRA \$4,500, 160GB DVR, ATSC/CableCARD tuners

42" 42LB1DR \$4,000, 160GB DVR, ATSC/CableCARD tuners

42" 42CD2D \$3,500 TV/appliance channel distribution, ATSC tuner, NO DVR, NO CableCARD

47" 47LB1DRA, \$ TBA, 1920x1080p, TTM

Aug 2006, dual ATSC tuners/Digital Cable Ready, dual HDMI, IEEE-1394, 160GB HD-DVR, 14-bit video processing, TV Guide On Screen (shown above).



55" 55LP1M, \$15,000, TTM 4Q05, monitor, 1080p, 2006 XD engine, HD-DVR, dual HDTV tuners, 1200:1 CR, 500 cd/m2 brightness, Super In-Plane-Switching (Super IPS) for fastest response time, 178 degrees angle view, DVI/HDCP (shown).

In 2006, LG made a demonstration of a pair of 3-D 42" LCD panels



Jul 06 (Product Review Announcements)

LG unveiled the 47" model mentioned at CES 2006:

47" 47LB1DA \$4,000, TTM Aug 06, 1080p DCR, LG's fifth-generation VSB chipset, is equipped with ATSC/NTSC/QAM tuners CableCARD compatible, TV Guide On-Screen electronic program guide, 2xHDMI/HDCP inputs, swivel stand, VESA compatible for convenient installation, 14-bit color processor, 1600:1 CR.

World's first LCD TV to incorporate an HD-DVR

42" 42LB1DRA 2,800, TTM now, up to 15 hours of HDTV or 66 hours of SDTV, Digital Cable Ready (CableCARD), Gemstar Digital TV Guide on-screen interactive program guide, Super In-Plane-Switching (Super IPS) technology for 178-degree viewing angles without loss of color or image.

26" 26LC2D \$1,050, fifth-generation VSB circuitry, 1xHDMI/HDCP

Nov 06 (LG's dealer show)

LG introduced four series with over 20 LCD TV models (11 of them are 1080p). Pricing was not made available at the announcement. The panels feature improved contrast performance, a "TruWide Viewing Angle", HDMI-CEC "Simple Link" to control other LG Simple Link compatible equipment, such as DVD players or home theater systems, connected with a regular HDMI cable using the HDMI-CEC standard and on-screen menus, 2xHDMI/HDCP inputs (step-up models x3), many models w/USB Media Host to play digital music and photo files.

The LC7, LB5, and LY3 Series incorporate a wave-design at the bottom of the panel, providing a high-end look and simple accent design. 2007 models feature overall depth reduction with some models as slim as 3.1-inches.

LC7 Series

1080p, 5000:1 CR  
26" to 47"

LB4D Series

With 1080p in some models, TruMotion Drive, 3xHDMI inputs, USB Media Host (USB 2.0) for photo and music, media card input discontinued.

32"  
37"  
42"  
47"

LB5D Series

All 1080p, USB Media Host, 3xHDMI inputs, 0.3mm micro-perforated speaker grills, shown at right:

37"  
42"  
47"  
52"

LY3D Series (below)



All 1080p, TruMotion Drive, wide color gamut backlight to extend color coverage over 92% of the NTSC spectrum.

47"  
52"  
57"

LS7D Series

ATSC/NTSC/QAM clear tuners.

20"  
23"

CES 2007

LG demonstrated their 100" LCD 1080p panel and introduced the full line of 20 LCDs mentioned above (Nov 06 Dealer's show).

LG also demo in their Low-Power Technology Zone a 42" LCD TV panel consuming 30 percent less power than conventional models, as well as a 26" LCD TV panel that consumes 35 percent less power while



increasing the brightness by adding a white subpixel to each pixel.

The company also demonstrated the complete line of 37, 42, 47, and 52-inch 1080p LCD panels, with 5,000:1 CR, 180-degree viewing angle, 500 cd/m(2) brightness, and improved response time and color gamut. Other panels for the information market were on display (42, 47, and 55-inch sizes), RoHS-compliant.

LG.Philips also demo new technologies for LCD in several prototypes, including:

- 15-inch monitor LCD panel with controllable viewing-angle (178 degrees, 80 degrees) with a single cell
- 32-inch HDTV LCD TV panel with 65-watt low-power consumption using an external electrode fluorescent lamp (EEFL)
- 42-inch HDTV LCD panel with improved response time (MPRT)

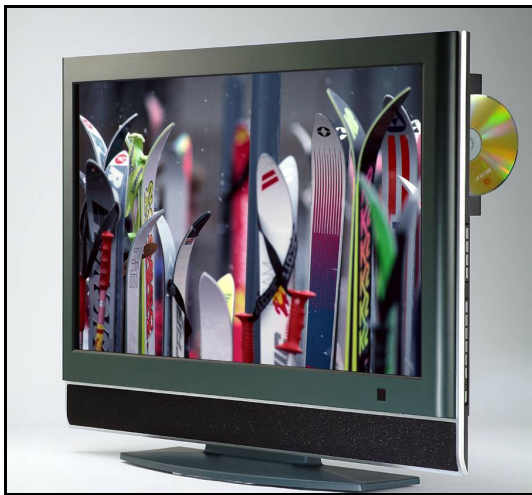
### **Maxent**

#### Jan 07 (CES)

The company announced the expansion of its line of feature-rich flat panel digital televisions with the addition of the 22- and 32-inch WXGA LCD TV/DVD combination televisions (ML-2251HLT, ML-3251HLT), a high-performance LCD television with a full-function DVD player with bottom-mounted speakers, compact, ultra-sleek design, 1366x768, 4H filters, 3:2 and 2:2 pull-down, adaptive motion de-interlacing, variable aspect ratio and an IIS™ (Intelligent Image Scaling) Engine.

NTSC and ATSC tuners, infrared pass through, image shift burn-in protection, advanced audio processing, HDMI picture-in-picture, RGB input, dual HD component video input, discrete audio inputs, and advanced black level extension, standard RS-232 and RJ-45 ports for remote network control. DVD player also plays CD/R, CD/RW and DVD-R/DVD-RW, DVI, loop-out.

- 22" ML-2251HLT \$900, TTM TBD in 2007
- 32" ML-3251HLT \$1100, TTM 1Q07, below



37" ML-3731HLT \$1,200, WXGA, ATSC tuner, TTM TBD in 2007, below



42" ML-42ULT51 \$1,400, WXGA, ATSC tuner, TTM 2Q07

47" ML-47ULT51 \$1,900, WXGA, ATSC tuner, TTM 1Q07

### **Mitsubishi**

#### Jun06

The company announced four new 1080p panels at their annual dealers show: Full Spectrum Color, 12-bit digital processing, 4D Video Noise Reduction, 2 HDMI, 1394, DVI-I, component, Tru1080p processing bandwidth.

37" LT-37131 \$3300

37" LT-37132 \$3500, Guide on Screen, Net Command

46" LT-46131 \$4900

46" LT-46231 \$5200 Diamond, Guide on Screen, Net Command, 2<sup>nd</sup> remote, gloss black finish

#### Sep 06 CEDIA

The company further introduced the sets above with the expected prices.

Four fully integrated 1080p LCD panels designed, engineered and built in North America, featuring Mitsubishi's exclusive third-generation upconversion system, Plush1080p®, which has been updated to include the latest 1080i to 1080p de-interlacing techniques, 2xHDMI™ inputs, 1xIEEE1394 interface, DVI-I, component, Mitsubishi's ClearThought® Easy Connect, which recognizes when a component is connected.

37" LT-37131 \$3,300

37" LT-37132 \$3,500, TV Guide On Screen®, NetCommand®

Both models above come on remote controlled, motorized swivel bases

46" LT-46131 \$4,900

#### Diamond line

46" LT-46231 \$5,200, TV Guide On Screen®, NetCommand®, deluxe, high style black gloss finish, second simple remote control

Models employ Mitsubishi's Full Spectrum Color™ enhanced CCFL backlighting technology, which reproduces over 90 percent of the NTSC color gamut, compared with 72 percent in standard LCD panels.

Full Spectrum Color™ delivers images that are more intense, more vivid, and more real to life, according to the company, Mitsubishi's latest signal processing improvement, 4D Video Noise Reduction. Mitsubishi's 4D Video Noise Reduction adds an extra dimension to picture performance by using advanced algorithms to filter video noise more efficiently, Tru1080p™ process 1920 x 1080p inputs without downconversion.

Mar 07

Diamond Engine PRO line

1920x1080, ATSC Tuner, 2000:1 CR, 2xHDMI 1.3 inputs.  
40" LCD-H40MZ70  
46" LCD-H46MZ70



**NIKADA**

Consult the 2006 HDTV Technology Report.

**Norcent**

CES 2006

VION

TTM Jan 06, 1366x768, 1000:1 CR, 550 cd/m2 brightness, 8ms response time

20"	LT-2090	\$700, NTSC tuner, component
27"	LT-2790	\$1,000
32"	LT-3290	\$1,500, ATSC/NTSC tuners, HDMI
42"	LT-4290	\$3,000

CES 2007

Norcent introduced a newer panel on the VION LCD-TV series, the 37" LT-3790, a 16:9 widescreen model has 1366 x 768 resolution, built-in ATSC NTSC tuners, Clear-QAM tuners, 1xHDMI input, component video, PC with audio inputs, SRS audio enhancement for virtual surround-sound, 1000:1 CR, 500 cd/m2 brightness, nearly side-to-side 176-degree viewing, 480i, 480p, 720p, and 1080i signal compatibility, wall-mounting capability.

37" LT-3790 \$1,200, TTM 2Q07

Additionally, the company introduced a 22" new monitor targeted for corporate executive, small office, or home application:

22" LM-2265W \$380, TTM 1Q07, fast 5ms response time, energy efficient VESA and DPMS approved, horizontal viewing angle of 150 degrees and a 130 degree vertical viewing angle, brightness of 300cd/m2, contrast ratio of 700:1, WXGA panel resolution of 1680 x 1050, 16.2-million colors, two 2-Watt internal speakers, DVI, 14.2 pounds.

## NUVISION

Five models on HVU line, Consult the 2006 HDTV Technology Report.

## Panasonic

Some 2006 LCD televisions still listed

ATSC/NTSC/QAM tuners, 1366x768

LX60 series

23"	TC-23LX60	\$1,000, TTM May 06 (NTSC Tuner)
26"	TC-26LX60	\$1,400, TTM Mar 06
32"	TC-32LX60	\$1,800, TTM Mar 06

LX-600 series

2x HDMI, TTM Mar 06, HDAVI

26"	TC-26LX600	\$1,500
32"	TC-32LX600	\$1,900



CES 2007

Panasonic unveiled 3 new models, the TC-32LX700, the TC-32LX70, and the TC-26LX70.

Featuring Alpha IPS Technology And Smoother Picture, Motion Picture Pro technologies, intelligent Scene Controller, SD card, 178° viewing angle, 120 frames per second image interpolation between frames to produce a cleaner, smoother picture, backlight control and gamma correction, HDMI inputs with EZ-Sync HDAVI-Control.

26" TC-26LX70 \$800, 720p, 1080i, 480p, 480i video in HDMI with HDAVI Control, 1366x768, TTM Mar 07

32" TC-32LX70 \$1,000, 720p, 1080i, 480p, 480i video in HDMI with HDAVI Control, 1366x768, TTM Mar 07

32" TC-32LX700 \$1,200, 720p, 1080i, 480p, 480i video in, HDMI with HDAVI Control, 1366x768, Alpha IPS, Motion Picture Pro, SD card slot, TTM Mar 07

**Panasonic**

**Motion Picture Pro**

Offers a 50% reduction in ghosting (MPRT basis) **clear** motion images

**Frame creation**

120 frames/sec  
Approx. 8 msec (MPRT basis)

Image interpolation between frames using motion vector detection technology

Smoother expression of motion

**Dramatic reduction of ghosting to achieve clear motion images!**

Standard System

Motion Picture Pro

## Philips

2006 line at CES

The company announced their next generation AmbiLight equipped HD LCD panels that emit ambient light around their frame using colors that match the dominant colors appearing at the screen to reduce the eyestrain and expand the scene/image improving perceived picture detail and contrast (AmbiLight Surround at left/top/right, AmbiLight Full Surround on all sides). Philips is also featuring this on their new plasma line. Clear LCD backlighting technology designed to speedup response



time, reduce motion blur, improve contrast, and boost light output, strobes LCD hot cathode florescent backlighting, and fire pixels only as needed to eliminate motion smear.

37"	37PF9631	\$2,300, TTM Jun 06 (shown)
42"	42PF9731	\$3,000, TTM Jul 06
42"	42PF9831	\$4,000, TTM Jul 06, flag-ship, 4-side AmbiLight full surround

#### MiraVision

32" and 42" LCD panels that feature a reflective mirror when not in use, hides electronic wires



#### Mar 06

Philips announced: "Philips Electronics to medical systems company cannot meet demand for its top-of-the-range LCD television sets because of production problems with display panels coming from LG.Philips LCD, a joint venture with LG Electronics".

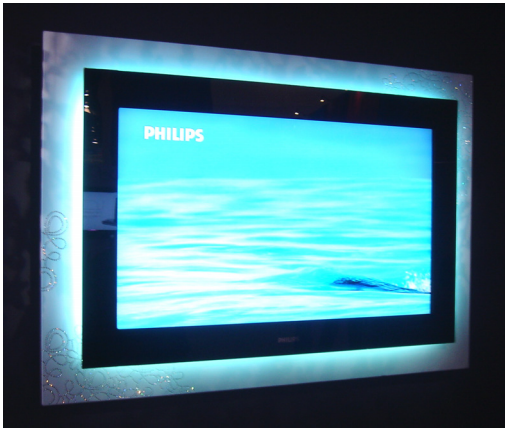
The shortages apply to the 9830 series that come in 32-, 37- and 42-inch sizes, with MSRP between 2,300 and 5,000 euros (\$2,740-\$5,970). By April, the 9830 series was planned to be replaced by the successor series called 9831 built partly on the same chassis.

#### Sep 06

The company announced and displayed a prototype of a 100" LCD panel at IFA 2006 in Berlin (Sep 1), the panel implements Ambilight Full Surround, the new, four-sided version of Philips' ambient lighting technology. TTM N/A, estimated price N/A.

#### CES 2007





Mar 07

Philips announced they will discontinue the use of stroboscopic fluorescent backlights for flat TVs, and instead implement LED backlights, which are already in use in some higher-end panels.

LED backlights are based in solid-state technology, do not use a bulb, last longer and consume less energy per lumen.

**Prima**

Sep 06 (CEDIA)

A Xococo company. The Prima line is known in China and is for controlled distribution thru custom installers and A/V dealers, the Legend line is known in Canada for open distribution.

27"

32"

37"

All above planned to become available within 60 days

New 1080p series, TTM Feb/Mar 07

37"

42"

47"

55"

**Proton**

Purity premium line

ATSC/NTSC tuners (except the 32" with only NTSC tuner), HDMI, antiglare screen, 176 degrees viewing angle (horizontal/vertical), 1366x768.

32" LX-32B6C2(B) \$1,700, TTM now

37" LX-37A6C2(B) \$2,800, TTM now

42" LX-42A6C2(B) \$TBD, TTM 1Q06

47" \$TBD, TTM 2Q06

55" \$TBD, TTM 2Q06

Proton planned to have the larger screen models also in 1080p by special order.

Sep 06 CEDIA

Two 1080p panels were introduced at the show under the Puriti line, featuring 1200:1 CR, 500 nits of brightness, 6.5 milliseconds response time, both use Proton's exclusive Puriti video processing technology that the company claims to deliver "reference standard picture quality" (Puriti processing is said to convert analog signals to digital filtering out noise artifacts).

The panels also featured viewing angles of 176 degrees, 3D de-interlacing and edge enhancement, anti-glare screens, built-in NTSC and ATSC tuners, and a package of video enhancement circuitry to compliment the Puriti system, including a Motion Lagging Correction Engine for smooth screen action, 3D color management, 3-2 pull down, adjustable color temperature, PIP and POP functions.

42" LX-42P7C2 \$2,500, built-in surround sound circuitry, two 30-watt speakers  
47" LX-47P7C2 \$4,000

CES 2007

The company introduced their first premier panel line with the P47D5 and P42D5.

1080p HD resolution, built-in digital and analog tuners, HDMI inputs, conventional 4:3, 16:9 Zoom, and Panoramic display modes, dual-picture functions (PIP/POP), 1200:1 CR, brightness level of 500 nits, built-in 5-watt speakers, HDMI inputs.

The panels use sixth generation of Proton's exclusive Puriti™ video enhancement technology for a claimed wider color range than conventional LCD or CRT displays using built-in artificial intelligence system to analyze color frequencies and intensity for natural skin tones and improved blacks by compensating for picture detail lost to poor contrast, the company said.

The Puriti processing converts analog signals to digital and filters out noise artifacts, and offers horizontal and vertical viewing angles of 176 degrees. Additional functionality includes Puriti's 3D De-interlacing and Edge Enhancement processing to reduce jagged edges from interlaced video formats, fast refresh rate to eliminate delay or ghosting effects, Motion Lagging Correction Engine, 3D Color Management, 3-2 Pull Down for film content, adjustable color temperature, an aluminum frame with a thin silver outer edge and a black inner frame.

42" P42D5 \$2,000, TTM now  
47" P47D5 \$3,000, TTM now

Three new models, 720p, HDMI, sixth generation of Proton's exclusive Puriti™ video enhancement technology. horizontal and vertical viewing angles of 176 degrees, Motion Lagging Correction Engine, 3D Color Management, 3-2 Pull Down, and adjustable color temperature, high-gloss, piano-quality finish, a pair of 30-watt/channel speakers enhanced by Proton's RealAcoustic audio technology. including 5-inch woofers and 1.5-inch tweeters, and a class A/B amplifier.

32" P32D4 \$1,000  
37" P37D4 \$1,300  
42" P42D4 \$1,600

Additionally, Proton previewed at CES 2007 the next generation of flat-panel displays with an early display of its innovative LED BLU High-Definition LCD Televisions.

The company's new light-emitting diode (LED) backlight unit (BLU) replaces the cold cathode fluorescent lamp (CCFL) backlight solution typically used in LCD TVs, providing wider color range, longer lasting, greater translucency, no mercury, less weight and power consumption, as follows:

Premier Line

ATSC tuner, HDMI, 4:3, 16:9 Zoom, and Panoramic display modes, 10-bit processing technology for up to 1.07 billion colors (64 times more than conventional 8-bit processors) and a gray scale eight times more expansive, Picture-in-Picture, Picture-on-Picture, the 32-inch P32L1 does not use a fan for cooling (it maintains a low internal temperature under 122 degrees Fahrenheit).

176 degrees horizontal/vertical viewing, fast response time (not specified), Motion Lagging Correction Engine for seamless screen action, 3D Color Management, 3-2 Pull Down, frame of extruded aluminum with a thin silver outer edge and a black inner frame, TTM 2Q07.

32" P32L1 720p (1366x766 WXGA)  
 42" P42L1 1080P

INTERMIX Project

Proton also showcased at CES 2007 one-of-a-kind artist-enhanced LCD TVs from the International INTERMIX Project, "brightly patterned, graffiti-style sets displaying dazzling high-tech product interpretations from youthful, urban-oriented artists and designers", according to the company.

**Proview**

32" RX-326  
 Consult the 2006 HDTV Technology Report.



**Runco**

CR-40HD \$7,000, 1366x768, 4.5 " deep.

CES 2007

Runco introduced new LCD panels under the new Crystal Series™ name, TTM now, featuring Runco's exclusive Vivix II™ video processing, integrated ATSC/NTSC/Cable tuners, two 10W two-way detachable speakers, aspect ratio control, 1000:1 CR, grayscale tracking, Runco's exclusive VirtualWide™ mode which converts 4:3 aspect ratio images to 16:9 without losing any image integrity, Imaging Science Foundation (ISF™) calibration suite, 4.5-inches thick.

32" CR-32Hdi \$2,000, 1366x768 (right)



1080p models

40" CX-40HD \$4,000  
 46" CX-46HD \$6,000

CX-46HD below:



CX-40HD below:



### **Samsung**

(Some 2006 models are listed because they were recently released)

Two HDMI, Game Mode feature eliminates image delay by bypassing video processing circuitry, enhances sound and boosts detail in dark areas, Super-Patterned Vertical Alignment (S-PVA) panel increases horizontal viewing angle to 178 degrees and improves color gamut reproduction from 72 percent to 92 percent. The technology will add about a \$200 price premium to unit cost.

#### 92 Series

TTM Apr 06, 1366x768, 5000:1 CR, 2 HDMI

32" LN-S3292D \$2,300

40" LN-S4092D \$3,500

46" LN-S4692D \$4,500

#### 96 Series

1080p, USB 1.1, 6000:1 CR, IEEE1394, ATSC/Cable tuners

32" LN-S3296D \$2,500, TTM Apr 06

40" LN-S4096D \$4,000, TTM Aug 06

46" LN-S4696D \$5,000, TTM Aug 06

#### 51 and 52 Series

4000:1 CR, ATSC tuner, 170 degrees, 2 HDMI

26" LN-S2651D \$1,700, TTM Mar 06, black (52D in white)

32" LN-S3251D \$2,100, TTM Mar 06, black (52D white)

40" LN-S4051D \$3,300, TTM Apr 06, piano black (52D pearl white)

82" LN-S8297DE (right), 1920x1080, DNIE chip, 7000:1 CR, with LED backlight, 8ms response time, HDMI, factory statement LCD panel.

#### Jun 06

The 82" panel at CES 2006 mentioned above is



now listed as model # LN-S8212D  
Samsung added the following models:

32" LN-S3251D \$2,000, TTM Jun 06  
46" LN-S4697D \$10,000, TTM Jun 06, 1080p, 8ms, integrated CableCARD

#### May 06

The company has introduced the series of panels announced at CES above, although now with lower prices, 10 of those new panels are offered as 1080p resolution in 2006.

Some new features include Super Pattern Vertical Alignment (S-PVA) panel that allows 178-degree off-angle viewing, and Samsung said "Special attention has also been given to cosmetic styling".

#### 96 Series

Gloss-black bezel and base, down-firing below-screen speaker ports, distribution primarily to A/V specialty stores and Pro Group members.

32" \$2,300 TTM Jul 06  
40" \$4,100 TTM Aug 06, 1080p, Cold Cathode Florescent back lighting (CCFL), digital CableCARD slot, USB input, nine-in-two memory-card reader  
46" \$4,800 1080p, Cold Cathode Florescent back lighting (CCFL), digital CableCARD slot, USB input, nine-in-two memory-card reader

#### 92 Series

1366x768, 5,000:1 CR, dual HDMI, component, 178-degree viewing angle.

32" \$2,200  
40" \$3,300  
46" \$4,000

#### 52 Series

All-white high-gloss lacquer cabinets with rounded contour edges, designed for kitchen and bathroom placement.

26"  
32"  
40"

#### 51 Series

Dubbed Bordeaux, black lacquer cabinets to appeal to consumers looking for living room or family room placement.

#### Aug 06

Samsung introduced a 70" 1080p LCD TV panel at the International Meeting on Information Displays (IMID) 2006 in Daegu, Korea, which the company says quoted as the largest available considering that the largest LCD TV panel is 65" of diagonal.

The panel features a viewing angle of 180 degrees in the four directions, 120Hz display rate (60Hz for conventional full HD LCD panels), production was said to start the first half of 2007, 600 nit of brightness, 2000:1 CR, color saturation of 92 percent, response time less than 8ms.

#### Nov 06

Samsung announced that LCD panels could soon take over Plasma panels on the 50" size, taking into consideration the capabilities of the new plant expected to be in production in late 2007 in Tangjeong, South Korea, an eighth-generation (8G) factory, using sheets of glass that measure approximately 6.5 by 8 feet to produce 52" LCD panels in volume, which would enable prices to be more competitive than today in that size range.

A current advanced plant produces 1 million panels for LCD TVs per month, 40-inches panels in volume, and larger sizes up to 70-inches in smaller quantities.

#### CES 2007

Samsung introduced a double-sided 2.2 inches mobile LCD screen targeted for mobile phones that is capable to show two different pictures simultaneously on the front and back of the same screen.

The technology implements a new pixel design for separate control of the LCD on each side of the display, whereby two gates control each pixel in a way that each single pixel is made capable to be used for two different screens using one single backlight, which according to the company, the system actually expects external light sources for the second screen to operate. Mass production is planned by 2H07.

#### 42 Series

Entry-level from 23, 26, 32, 37, 40, to 46-inches, advanced game mode, 7000:1 dynamic CR, 32" includes 3xHDMI, TTM Mar 07.

23"	\$750
26"	\$1,200
32"	\$1,500
37"	\$2,000
40"	\$2,100
46"	4662 \$3,000 (shown at right)



#### 53/54 Series

Featuring USB 2.0, glossy piano black or pearl white finish (23" and 19" - 54 Series, same price), TTM Mar07, 7000:1 CR, Super Patterned Vertical Alignment (SPVA) panel with 92% wide color gamut (40", 32" models), Enhanced Game Mode, 8ms response time, RS232 port, 3xHDMI (2 rear, 1 side).

19"	LN-T1953H	\$530
23"	LN-T2353H	\$850
26"	LN-T2653H	\$1,300
32"	LN-T3253H	\$1,700
40"	LN-T4053H	\$2,300, shown at right:



#### 65F Series

1080p, HDMI 1.3, chrome accents and glossy black finish, SuperClear panel with 12,000:1 contrast ratio, 550cd/m2 brightness, 92% color gamut, 178 degrees viewing angle, USB 2.0, 3xHDMI 1.3 inputs (2 rear, 1 side), Anynet+ (HDMI-CEC) to enable a single remote control

unit to operate a Blue-ray disc player, home theater system and other HDMI-CEC compatible A/V products, WiseLink™ supports USB 2.0, remote-controlled wall mount (vertical up to 25- degrees and horizontal up to 60-degrees).

40" LN-T4065F  
46" LN-T4665F  
52" LN-T5265F

Samsung showed a new technology using LED lights for a wider color gamut and shorter startup times, implemented in the 81D line below.

#### 81D LCD 1080p TV Series

TTM Jul 07, \$TBA, 50000:1 CR, 105 percent wide color gamut, Super Clear Super Patterned Vertical Alignment (SPVA) panels, WiseLink with Bluetooth wireless, 3xHDMI, initially planned with OCAP interactive cable-card system but withdrawn, LED backlighting, 120Hz motion blur reduction system, Bluetooth wireless connection technology.

40" LN-T4081D  
46" LN-T4681D  
52" LN-T5281D  
57" LN-T5781D

#### 71D LCD 1080p Series

Cold Cathode Fluorescent (CCFL) backlighting. 120Hz motion blur reduction system, Bluetooth wireless connection technology, TTM Jul 07, \$TBA.

40"  
46"  
52"  
57"

#### 61D LCD 1080p TV Series

TTM Mar 07, \$TBA, 8000:1 CR, 92 percent wide color gamut, SPVA panels.

40"  
46"  
52"

#### 53D LCD TV Series

TTM Mar 07, \$TBA, 7000:1 CR, 92 percent wide color gamut, gloss black cosmetics.

23"  
26"  
32"  
40"

#### 54D LCD Series

Featuring similar options, pearl white cosmetics.

#### **Sanyo**

TTM 3Q06, ATSC, QAM clear tuners, HDMI, 1366x768

26" SLT-2676S  
32" SLT-3276S

## CES 2007

Sanyo introduced an outdoor weatherproof 42" panel, the CE42LM4WPN, meeting the international IP-56 rating (Ingress Protection, or IP, ratings were established by the European Committee for Electro Technical Standardization (CENELEC, described IEC/EN 60529) and specify the environmental protection an enclosure provides.

According to Sanyo "The first number in the IP rating specifies the protection against solid objects where larger numbers indicate protection against increasing smaller things. The Sanyo CE42's first number of five indicates protection against dust, meaning no harmful deposits will form inside the monitor. The second IP number specifies the protection against liquids. The Sanyo CE42's second rating number of 6 indicates protection against low pressure jets of water so it would be ideal to be used onboard ships."

The frame and cabinet were constructed from marine grade anodized aluminum and designed with a "no holes" ventilation system for the LCD monitor to stay cool while being protected from dust and the weather at the same time. In addition, Sanyo said that the CE42 was fitted "with a tough, tamper-resistant anti-reflection cover glass which makes this large LCD monitor highly suitable for use in well-trafficked public areas as well as in almost any kind of unprotected outdoor area. Designers and decorators who've been

searching for a weather-tough display that they can put onboard a yacht or in a crowded public garden are now in luck with Sanyo's CE42."



Features 1366x768, 500 cd/m2 on-screen brightness, 178 degree V/H viewing angle, 800:1 CR, 8 ms response time, compatible with Sanyo's PJ-Net Organizer (POA-LN01) so it can be controlled over the internet, 3-year warranty, \$7,500, honored by the CES 2007 Innovations award in the Visual Display category.

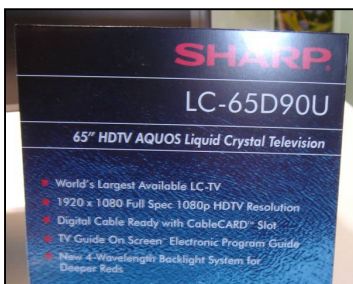
## **Sharp**

(Some 2006 models are still listed because they are still current)

### D4U and D6U series

Consult the 2006 HDTV Technology Report.

### D90U Series



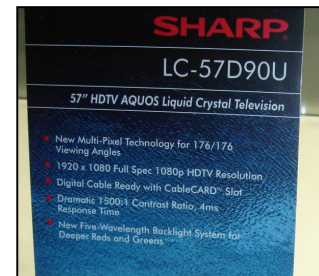
65" LC-65D90U, originally released at \$21,000 (right), TTM Nov 05 but still current in 2007, AQUOS 1920x1080p, ATSC & Cable CARD tuners, four-wavelength backlight system, 1200:1 CR, 450 cd/m2 brightness, HDMI 1.2, DVI-I, IEEE-1394, Quick Shoot video circuitry, 6 ms response time, TV Guide On Screen

free interactive programming guide, titanium finish, detachable stand and bottom speakers..

57" LC-57D90U, originally released as \$16,000, TTM Mar 06, AQUOS 1920x1080p, ATSC & CableCARD tuners, new five wavelength backlight system, multi-pixel technology that produces a contrast ratio of up to 1,500:1, enhanced Quick Shoot video circuitry for 4ms response time, wider viewing angles (176 degrees), dual HDMI, HD component, DVI-I, DTVLink, titanium finish, detachable bottom speakers (57" LCD shown).



Multi-pixel technology for 1200:1 CR, 6ms response time, 176 degrees viewing angle, 4-wavelength backlight system, HDMI, HD component, DVI-I for PC, DTVLink, titanium



finish, TTM May 06.

32" LC-32D50U \$2,300, 1366x768

37" LC-37D90U \$3,500, 1080p

45" LC-45D90U \$5,000, 1080p

#### PT90 AQUOS Series

TTM May 06, multi-pixel technology for 1200:1 CR, <6ms response time, 176 degree viewing angles, CableCARD tuner, dual HDMI, HD Component, DVI-I for PC, DTVLink inputs, detachable stand and bottom speakers (37" and 45" only).

32" LC-32PT50U \$2,300, 1366x768, fixed bottom speakers

37" LC-37PT90U \$3,500,

1920x1080p, new four-wavelength backlight system

45" LC-45PT90U \$5,500, 1920x1080p, new four-wavelength backlight system



#### D40U AQUOS Series

TTM Mar 06, 1366x768, ATSC/CableCARD/NTSC tuners, widescreen, 1200:1 CR, 6ms Quick Shoot video circuitry, 176 degree viewing angle, piano black finish, detachable table stand for wall mounting, fixed bottom speakers.

26" LC-26D40U \$1,300

32" LC-32D40U \$2,000

37" LC-37D40U \$3,000

45" LC-45D40U \$4,000

#### SH20U Series

TTM 2H06, affordable line, 1366x768, 800:1 CR, 12ms response time, 170 degree viewing angles, HDMI, HD component, NTSC/ATSC/QAM tuning.

26" LC-26SH20U \$1,100

32" LC-32SH20U \$1,800

37" LC-37SH20U \$2,700  
42" LC-42SH20U \$TBA

82" 1080p factory statement panel shown at CES 2006; very limited distribution starting Summer 06.

At CES 2006 Sharp also demonstrated Two-way viewing angle LCD 45" commercial panels and 7" for automotive applications (in production) as technology statement (right):



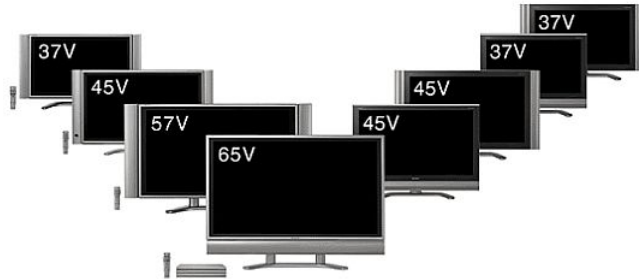
In January 2006, Sharp introduced two new lines of LCD panels in Japan the G and B Series with HDMI/HDCP, DVI/HDCP, iLink, 176 degrees of viewing angle.

#### B Series

37" LC-37BE1W  
37" LC-37BE2W  
45" LC-45BE1W, 1080p  
45" LC-45BE2W, 1080p

#### G Series

37" LC-37GE2  
45" LC-45GE2  
57" LC-57GE2  
65" LC-65GE1



Early in 2006, Sharp announced that the company was ready to introduce into the Japanese market a 65-inch LCD monitor, the PN-655, with native resolution of 1920x1080 pixels.

According to the company "The screen employs a 'dual fine engine' which enables the display of both PC digital data and audio-visual images in full-spec high-definition. It uses 'picture in picture' and 'picture by picture' functions to display various image sources simultaneously. It also sports functions for commercial use, such as a fan-less design and remote control functions.

It has a screen brightness 400cd/m2, contrast ratio of 700:1, and 170-degree viewing angles. Sharp planned to start selling the PN-655 on March 24 in Japan. No pricing information was disclosed upon the announcement."

#### Aug 06

The company introduced just before CEDIA three new LCD TVs to be available in October 06, one is the 42" below:

42" \$2,300

The other two are 1080p panels manufactured at Sharp's new Kameyama II Gen 8 LCD TV plant, which processes eighth-generation glass sheets of 7x8 feet, which could produce six 52-inch LCDs at once, while the 6th and 7th gen plants can produce smaller glass sheets that handle only two and three 52-inch panels. The plant was said as primarily targeted to the production of large-screen products for the US.

The new two panels feature 1080p HDMI acceptance, built-in ATSC/NTSC/QAM tuners, Advanced Super View panels for high contrast performance, deep black levels, and sharp detail.

They also feature Enhanced Quick Shoot video circuitry for faster pixel response time of 4ms, and wider viewing angles of 176 degrees, 2,000:1 CR that can dynamically increase to 10,000:1 with enhanced picture control technology, four-wavelength backlight system for a wider color spectrum to achieve deeper reds than was previously possible.

46"	LC-46D62U	\$3,500
52"	LC-52D62U	\$4,800

#### Sep 06 (Japan)

Sharp announced the development of "the world's first liquid crystal display (LCD) panel that allows the viewing of three different images on one screen at the same time".

According to the company the panel would allow the driver of a car to view a navigation system, the passenger to look at shopping and restaurant information and a person in the back seat to watch a movie.

As mentioned above, at CES 2006 Sharp unveiled a panel that allowed the viewing of two different images ([http://news.com.com/2300-1041\\_3-5790363-1.html?tag=nl](http://news.com.com/2300-1041_3-5790363-1.html?tag=nl)), and is now being used in car navigation systems, according to Sharp.

#### Oct 06

Sharp introduced in Japan at CEATEC a 64" LCD monitor capable to resolve 4096x2160 pixel-lines (right), double the number of vertical and horizontal pixel lines offered by a normal HD screen, approximately 9 million pixel points. The monitor can also show four high-definition videos at once, is in development phase, and, according to Sharp, is expected to attract film and television producers as well as medical researchers.



#### CES 2007



Sharp Introduced a new 8th Generation AQUOS® HD LCD TVs of 108" made on their factory in Kameyama No. 2, Japan, the world's largest LCD panel according to Sharp, which measures 93.9-inches (W) by 52.9-inches (H) in size, and features Sharp's Advanced Super View LCD Panel 1920x1080p, enhanced contrast ratios, response times and more inputs.

According to Sharp, they offer the most comprehensive flat-panel LCD TV selection, with more than 50 models in screen sizes ranging from 13- to 108-inches, and , "has met the demand for superior image quality by achieving a resolution that is four times higher



than that of current HD (4096 x 2160), the world's highest contrast ratio (1,000,000:1) and the ultimate in fast-motion image processing with 120 Hz frame rate conversion and an incredible pixel response time of 4ms."

The development for mobile use in automobiles announced in Sep 06 above was shown at CES 2007. A three-way viewing angle display that lets three or more users watch three different programs that occupy the full screen of a single display simultaneously, a user sitting on the screen's right side can view, one program while the screen's left side displays different programming, and the viewer facing the center view of the screen will see a third program or image (navigation for the driver, a movie on DVD for the passenger, and a third video for those viewing from the back seat).



AQUOS D92U 1080p line  
Featuring the top-of-the-line version of Sharp's proprietary Advanced Super View panel, the most advanced LCD panel in the world,



15,000:1 Dynamic CR, 450 cd/m<sup>2</sup> high brightness, Fine Motion Advanced technology for 120 Hz Frame Rate Conversion, enhanced Quick Shoot video circuitry for faster pixel response time of 4ms, wide viewing angles of 176 degrees, proprietary 5-wavelength backlight system, 3xHDMI 1.3, 2xcomponent, 1xDVI-I, compatible with 1080p signals from Blu-ray and other new devices, RS-232C, piano black finish, detachable bottom speakers, detachable table stand, 60,000-hour lamp

life.

42" LC-42D92U \$3,500, TTM Apr 07  
46" LC-46D92U \$4,200, TTM Jan 07  
52" LC-52D92U \$5,300, TTM Jan 07

LC-42D92U below:



LC-46D92U below:



LC-52D92U below:



65" LC-65D93U \$11,000, TTM Mar 07, has the same features as above, with fixed bottom-placed speakers.

AQUOS D82U 1080p Line:

Produced at the new 8th-generation Kameyama plant, 10,000:1 Dynamic CR, Fine Motion Advanced technology for 120 Hz Frame Rate Conversion, enhanced Quick Shoot video circuitry for faster pixel response time of 4ms, wide viewing angles of 176 degrees, Sharp's proprietary 4-wavelength backlight system, 3xHDMI, 2xcomponent, all 1080p compatible, piano black finish.

46" LC-46D82U \$3,700, TTM Mar 07, shown



52" LC-52D82U \$4,800, TTM Mar 07

AQUOS D62 Line additions:

2xHDMI, 1080p inputs over HDMI and component, 10,000:1 CR, 6ms response time

32" \$1,600

37" \$1,900

In addition to current 42" and 56" models

AQUOS D43U 720p Line:

Featuring Sharp's proprietary Advanced Super View LCD panel enables a Dynamic CR of 6000:1, 450 cd/m2 high brightness, enhanced Quick Shoot video circuitry for fast pixel response time (6ms), 176 degrees viewing angles, piano black finish, fixed bottom speakers, detachable table stand for wall-mounting flexibility, 1366 x 768, built-in ATSC/QAM/NTSC tuners, 60,000-hour lamp life, D-sub, 15-pin input for PC compatibility, HDMI, HD Component Video.

26" LC-26D43U \$1,100, TTM Feb 07

32" LC-32D43U \$1,400, TTM now

37" LC-37D43U \$1,700, TTM now

42" LC-42D43U \$TBD, TTM May 07

46" LC-46D43U \$2,700, TTM Mar 07

52" LC-52D43U \$4,000, TTM Jun 07, shown



AQUOS D42 720P Line

Featuring 1366x768, Advanced Super View panels, Dynamic CR of 6,000:1, thinner bezels with piano black finish, hidden speakers.

26" \$1,100, TTM Feb 07

32" \$1,400, TTM now

37" \$1,700, TTM now

42" \$2,200, TTM Feb 07

AQUOS HDTV Game Players Series

The new models features enhance the game-playing experience, including a "game mode", custom-designed remote control for quick "jump" into the game mode, "Vyper Drive" feature, which can handle the highest frame rates of even the most punishing video games and reduce lag time between game console and TV.

The 32" panel is suited with 10,000:1 Dynamic CR, 37" 8500:1 CR, enhanced Fine Motion video circuitry for faster pixel response time of 6ms, built-in ATSC, QAM and NTSC tuners, 450 cd/m2 brightness, wide viewing angles of 176 degrees, Sharp's proprietary 4-wavelength backlight system, 3xHDMI, 2xHD component, all 1080p compatible, 10Wx2 audio, piano black finish, detachable bottom speakers and detachable table stand, long-life backlight system provides 60,000 viewing hours.

32" LC-32GP1U \$1,700, TTM Mar 07 (below)

37" LC-37GP1U \$2,000, TTM Mar 07 (right)



### Feb 07

Sharp introduced in Japan (not for US distribution) an "R" line with five AQUOS LCD TVs, from 42" to 65" featuring Double-Speed Advanced Super View (to prevent motion blur on fast scenes), 1920x1080, 450cd/m2 brightness, 3000:1 CR, DTV tuner, HDMI.

42" LC-42RX1W  
46" LC-46RX1W  
52" LC-52RX1W  
57" LC-57RX1W  
65" LC-65RX1W



### **Sony**

(Some 2006 models are still listed because retailers still sell them as current models)

### CES 2006

The company demo and announced a variety of BRAVIA LCD panels

Two series with ATSC integrated tuners, redesigned remotes and direct-input access, 1366x768, HDMI, component, PC inputs.

### BRAVIA U series

32" KLV-32U100M \$1,700, TTM Feb 06

40" KLV-40U100M \$2,800, TTM Mar 06

### BRAVIA S series

With S-PVA technology for improved video angles

32" KDL-32S2000 \$2,000, TTM Mar 06

40" KDL-40S2000 \$3,000, TTM Mar 06

46" KDL-46S2000 \$4,500, TTM May 06 (1080p)

26" and 23" models as well

#### BRAVIA XBR

Advanced Wide Color Gamut-Cold Cathode Florescent Light (WCG-CCFL) backlighting system, 1366x768, ATSC/CableCARD tuners, HDMI, component, PC input, USB.

26" KDL-V26XBR1 \$2,000

32" KDL-V32XBR1 \$2,700, SPVA

40" KDL-V40XBR1 \$3,500, VGA, SPVA, 1300:1 CR

82" BRAVIA LCD panel prototype was demo as a technology statement using Triluminous LED backlighting (right):



#### Technology within the 82" model (CES 2006)

The 82" LCD panel above implemented the world's first color range (the area that shows existing color, using Red, Green and Blue as axis of graph) that is "xvYCC" compliant. xvYCC is an extended international standard based on the sYCC standard used in still pictures and conventional color gamut standards used for video and broadcast. The standard was accepted by the International Electrotechnical Commission (IEC) in October 2005. The technology implements a high-resolution signal processing system to enable a wider color reproduction capability of TVs.

According to Sony "This standard will expand the current color data range by approximately 1.8 times more based on "Munsell Color Cascade" (provided by Dr.Pointer, and measured by NPL, UK, is a color chart that defines all natural object colors. It is used to evaluate color expression of displays), and it was successfully reached due to the newly developed high-resolution signal processing system.

Video cameras complying with this standard will be able to record a color variation that is very close to what human eyes can recognize, and TVs complying with this standard will be able to reproduce visual images almost in the same picture quality as it was recorded. In addition, LCD TVs will be able to show the detailed color variation of movie scenes, the different shades of a color, e.g. the red color of paprika or a tomato, as well as numerous color tones of petal."

Sony added: "Sony promotes the concept of "Full HD World", as it enables consumers to enjoy a wider variety of high resolution video sources at home via digital high definition broadcast, HDV-ready digital camcorder and new optical discs such as Blu-ray. This "xvYCC" standard realizes the reproduction of truly natural and high resolution picture images in a wider color range, which represents a step further towards the new display era."

More updates on the above subject are included further down.

#### Mar 06

Sony introduced its new series of BRAVIA LCD TVs:

#### BRAVIA S Series

Integrated ATSC tuning, graphite bezel finish, 1366x768, new enhanced digital picture processor.

26" \$1,500  
32" \$2,000  
40" \$3,000  
46" \$4,500

#### BRAVIA U Series

Fully integrated, silver bezel finish, 1366x768, new wide-viewing angle technology, redesigned remotes with direct input access.

32" \$1,700  
40" \$2,800

Sony indicated plans to introduce additional BRAVIA panels, including 1080p, for later 2006.

#### Jun 06

Sony introduced in the Home Entertainment Show six new LCD panels:

#### BRAVIA 1080p line

Featuring the BRAVIA Engine Pro full digital high-definition video processing system with Sony's Digital Reality Creation Multi Function Version 2.5 (DRC-MFv2.5) processor designed to upconvert standard NTSC up to 1080i high-definition signals.

#### XBR3 line

1080p, TTM Sep 06, 3xHDMI accepting 1080p, floating glass-encased, high gloss, piano black bezels with side speakers, built-in ATSC tuning, PC input, two HD component.

40" KDL-40XBR3 \$4,300  
46" KDL-46XBR3 \$5,300

#### XBR2 line

32" KDL-V32XBR2 \$2,400, TTM Sep 06, 1366x768, Sony's BRAVIA Engine and Live Color Creation, narrow two-tone black and silver bezel incorporates invisible bottom speakers with SRS TruSurroundXT and BBE Digital Enhancement technology, ATSC tuner, single HDMI, PC inputs, 2xcomponent.

#### 1080p line within XBR2

Featuring BRAVIA Engine Pro processing, and HDMI inputs with 1,080p capability, TTM Sep 06, silver bezels that can be replaced by one of five optional colored bezels for custom integration into any décor, including red, white, blue, black and brown, same audio package, built-in ATSC tuner, PC input, two high-definition component.

40" KDL-40XBR2 \$4,000  
46" KDL-46XBR2 \$5,000

#### BRAVIA V2500 Series

Featuring 1,080p resolution, 2x1080p-capable HDMI inputs, the BRAVIA Engine and Live Color Creation technologies, black bezel, space-saving bottom speaker design optimized for placement in existing AV cabinets, digital amplifier with SRS-TruSurround XT and BBE Digital Audio Enhancement technologies for high-quality sound, PC input, 2xHD component.

40" KDL-40V2500 \$3,500  
46" KDL-46V2500 \$4,500

#### Jul 06

Sony introduced the BRAVIA X line in the UK, 1080p:

46" KDL-46X2000U, accepts 1080p, improved red and green colors by using improved light-emitting phosphors. 1300:1 CR, wider viewing angle than the traditional 170 degrees, integrated power speakers, Dolby Pro Logic II Virtual Surround digital signal processing, DTV broadcast tuner, three Scart, two component inputs.

#### Sep 06 CEDIA

Sony introduced two extra 1080p models on the XBR2 and XBR3 lines on the 52" size, the 52XBR2 is similar to the already introduced 46" but it does not feature interchangeable bezels, it will have a fixed silver bezel. The 52XBR3 is delivered with a high-gloss piano black bezel.

Both models have 3xHDMI, floating glass styling designs, wide-color gamut Cold Cathode Fluorescent backlighting, and Sony's BRAVIA Engine Pro video processing, DRC Multi-Function version 2.5 circuitry to enhance both standard and high definition signal sources, built-in ATSC tuner, PC input; 2xcomponent. Sony's Advanced Contrast Enhancer (ACE), with real-time image processing, and optimization of backlight levels, 1300:1 CR (7000:1 dynamic CR) for deeper blacks and better shadow detail.

Sony said that specs are very similar to the models introduced this summer; availability was planned for Nov 06 at prices said to be announced:

52" KDL-52XBR2 \$6,500  
52" KDL-52XBR3 \$6,800

Additionally, Sony added two new BRAVIA panels with 1366x768p resolution, suited with ACE technology for optimized dynamic contrast ratio of up to 5,000:1 (on-screen contrast ratio is 1,300:1), narrow frame black bezel with invisible bottom speakers with SRS TruSurroundXT, and BBE Digital Enhancement technology, built-in ATSC tuner, HDMI and PC inputs, 2xcomponent.

32" KDL-32S2400  
40" KDL-40S2400

#### CES 2007

Sony unveiled a 70" BRAVIA 1080p LCD with x.v.Color, the world's largest x.v.Color set.

70" KDL-70XBR3 \$33,000, TTM Feb07, available for pre-order at select Sony Style stores and select authorized retail outlets including Video Audio Center, Home Theater Store, ABT Electronics, Little Guys, Myer-Emco, Bjorn's, and Listen Up.

The new set features Motionflow™ 120 Hz technology with motion compensation, 10-bit panel (which increases gradation level by 64 times from 8-bit panels), Triluminos™ LED backlight, xvYCC technology, which Sony has branded x.v.Color.

x.v.YCC is a technology established as an industry standard by the International Electronics Commission in January of 2006 that expands the current color data range of video by approximately 1.8 times. It is based on the "Munsell Color Cascade" a universal color chart defining the colors of natural objects and is used to evaluate color expression capability of displays, which provides the ability to display more natural and vivid colors similar to what the human eye can actually see.



The set has 178-degree viewing angle, BRAVIA Engine Pro circuitry with Digital Reality Creation-MultiFunction v2.5 and Advanced Contrast Enhancer (ACE) for dynamic contrast ratio of 7000:1, 3xHDMI 1.3, PC input, all 1080p compatible (looks as 24fps possible but not confirmed), 2xcomponent, piano black floating glass design (also available on other XBR3 models).

Sony also implemented x.v.Color in four new high-definition Handycam® camcorders, shown at CES 2007.



The BRAVIA LCD line is now of 70, 52, 46, 40, 32, 26 and 23 inches.

The 82-inch LCD TV was again demonstrated at the CES 2007 show, 1920x1080, 120Hz motion compensation technology and 10-bit panel, increased gradation level, eliminating image blurring, LED backlight, HDMI 1.3, no Deep Color, implements x.v.Color (x.v.YCC).

#### Internet Video system

Sony introduced their future add-on behind-the-TV module to connect some 2007 BRAVIA LCD TVs with HDTV over Internet broadband connections implementing proprietary digital connections without the use of a PC, \$TBA, no subscription fee. AOL, Yahoo!, Grouper, Sony Pictures Entertainment, and Sony BMG Music would provide Internet video, music videos, movie trailers, streaming music, user generated videos and RSS feeds.

The module will use Sony's Xross Media Bar (XMB) user interface and Internet Video Link that will first appear in the new S3000 line:

#### S3000 Line

TTM Spring 07, \$TBA, 3xHDMI, 178 degrees, HD-ready, 2 SCART sockets.

26" KDL-26S3000

32" KDL-32S3000

40" KDL-40S3000

46" KDL-46S3000

#### Feb 07 (Annual Dealers Show)

Sony announced to dealers the expansion of the BRAVIA line to include a "high-performance" sub-brand of microdisplay RPTVs and front projectors, named Best Resolution Audio Visual Integrated Architecture, TTM Spring/Summer 07, \$TBA.

"When you see the BRAVIA brand, you know you're not only getting the exceptional quality, but also the distinctive elegance that Sony is known for delivering," said Randy Waynick, Sony home products division senior VP, according to TWICE.

Seven new LCD TVs are offered, compatible with the new BRAVIA Internet Video Link module mentioned above (CES 2007) for \$300, TTM Jul 07, which will be compatible with all new BRAVIA LCDs, and 3LCD RPTVs.

#### KDL-V LCD Series

1080p

Live Color Creation with WCG-CCFL backlight, 10-bit panel display for increasing the gradation level by 64 times from 8-bit panels.

40" KDL-40V3000

46" KDL-46V3000

KDL 46" shown:

#### KDL-S LCD Series

(mentioned above)

1366x768, Sony's Love Color Creation with cold cathode fluorescent backlighting, 10-bit video processing.

#### KDL-XBR4 Series

New Motionflow technology to reduce image blurring and image "judder" by adding 60 frames in the 60fps cadence (total of 120fps), Live Color Creation circuitry with cold cathode fluorescent backlighting, 10-bit video processing, 120Hz motion compensation, 3xHDMI with 1,080p/60p and 1,080p/24p capability, PC connectivity via a 15-pin D-sub connector and HDMI port.

32" KDL-32XBR4 1366x768

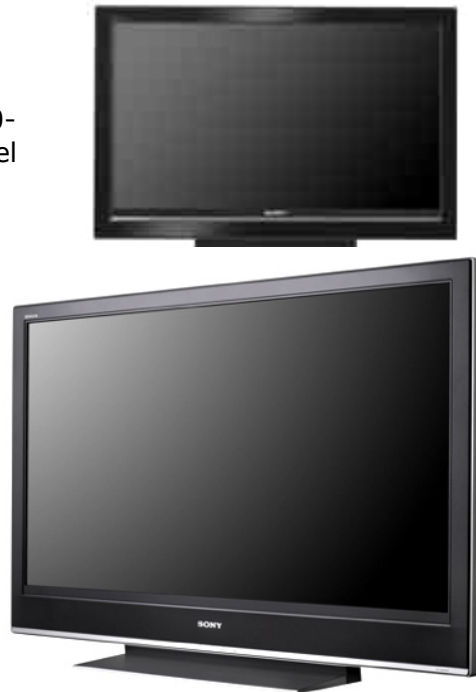
#### **Syntax/Brilliant**

Oleiva

CES 2006

Three new families of LCD panels on 20"-47" sizes, TTM 1Q06:

1) Syntax Select LT-HVN entry line with 20, 23, 26, 27, 32, and 40 inches



2) Oleiva HVX and HVE classic line with same sizes and a 42"

3) Oleiva Signature 1080p LT-HVi Ultra premium line with 37, 40, 42, and 47 inches, using HQV Silicon Optix Realta chip, ATSC/NTSC tuners, 2xHDMI, 3xcomponent, VGA, all glass front with antireflective coatings, 1600:1 CR, 800cd/m2. The 42" (LT42Hvi \$3,500) and 47" (LT47Hvi \$4,000) are expected by 2Q06, and are said to support 1080p inputs.



#### Jul 06

The company introduced 3 new lines of Oleiva LCD panels:

Firmware upgradeability via USB, Director's Image technology to "recreate the director's intended image through calibrated 6500K color temperature, gamma, optimized gray scales and adjustable black levels," the company said, Big Picture Technology, which "shows without distortion up to 11 percent more of digital broadcast images and up to 37 percent more of analog images," the company said.

Series 3 monitors, intended for consumers with HD-STBs, 1366x768.

Series 5 integrated, TTM Jul 06, integrated ATSC/NTSC tuners, 1366x768, 8ms response time, 1600:1 CR, 178 degrees viewing angle, PC compatibility at 60Hz via HDMI and VGA, HDMI, component.

27" 527V \$800, side mounted speakers  
32" 532H \$1,000, below-screen speakers  
37" 537H \$1,500, below-screen speakers  
42" 542I \$1,900, interchangeable speaker locations



#### Series 7 integrated

TTM Sep 06, 1080p, Silicon Optix HQV video processing, integrated ATSC/NTSC tuners, 2xHDMI, 8ms gray-to-gray response time, SiliconOptix Realta Hollywood Quality Video (HQV(TM)) video processor powered by Teranex technology with an ATI Xilleon RF front end, native 1080p input, Dynamic contrast ratio of 1600:1, 178-degree viewing angle, PC compatibility 1920 x 1080 @ 60Hz through HDMI and VGA, video compatibility through multiple HDMI with HDCP (2), HD/SD component (2) and VGA (1), D2Audio's DAE-1 (Digital Audio Engine™) intelligent digital amplifier and SoundSuite™ audio enhancement software, high-quality speakers can be side-mounted, bottom-mounted or removed.

42" 742i \$4,000  
47" 747i \$5,000

#### Dec 06

The company announced that it has extended its supply agreement with LCD panel manufacturer LG.Philips LCD for 2007 for the purchasing of 700,000 panels mainly in the 37" and 42" sizes, and agreed for the efforts and collaboration for future

research and development efforts in Nanjing, China, a new site to open early in 2007.

LG.Philips LCD will supply Syntax-Brilliant 26W-inch, 32W-inch, 37W-inch, 42W-inch, 47W-inch, 52W-inch, 55W-inch, 57W-inch and 65W-inch screen sizes.

### **Thomson (RCA)**

#### 2006 line

Eleven new models under RCA brand, 26" and larger, ATSC tuner, HDMI, component, 1366x768.

26" 4 models (entry model L26WD12 \$900 TTM Apr 06; top of line w/DVD player L26WD131D \$1,200, TTM May 06)

32" (entry model L32WD12 \$1,100, TTM Apr 06; top of the line w/integrated DVD player L32WD131D \$1,500 TTM May 06)

37" (entry model L37WD12 \$1,600, TTM June 06; top of line w/integrated DVD player L37WD132D \$2,000, TTM July 06)

Monitors on 15", 20", and 23" will continue (no tuners).



#### CES 2007

37" L37WD23 NTSC/QAM/ATSC tuners, 2xHDMI



### **Toshiba**



For earlier models, such as HLX line, HL line, etc. please consult the 2006 HDTV Technology Report (or earlier years).

From 2006 CES: The company decided to use the CES show to make announcements that usually are done at their dealer show in spring. The company is investing in LCD and SED in 2006, while also carrying plasma as a mainstream product. Toshiba

is abandoning the CRT RPTV line this year (2006). For an SED 2007 update please review the current SED situation on the corresponding section.

In February 2006, Toshiba announced in Japan "REGZA" their new brand name to be used on all of Toshiba's flat-panel TVs that incorporate the company's proprietary "PixelPure" high-bit image processing technology. Initially the name would be applicable to LCD panels (which use PixelPure, plasmas do not).

In the plan, 11 LCD panels will be introduced on March 1 in Japan between 26" and 47" using the REGZA name. The use of the "Cinema Series" naming for selected products does not interfere with using REGZA naming for PixelPure products.

SED, using the PixelPure technology, would be expected to also use the REGZA naming when the first SED products are out later in 2006, but it was not confirmed by Toshiba.

Four new models on the new WLT66 series (shown) TTM Apr 06, 2 x HDMI/HDCP inputs, 2 x SCART and a Component video input, integrated digital tuner, "Active Vision LCD picture processing technology for increased detail, color, contrast, and movement.



32" and 37"  
42" 1920x1080  
47" 1920x1080, slim-line speaker system on the bottom

#### May 06

The company announced their REGZA models in five levels, including REGZA, REGZA LCDVD, REGZA XHD, Cinema Series REGZA LCD and Cinema Series REGZA XHD. All REGZA models have 176 degree viewing angles, ATSC/QAM digital tuning, jack packs with PC and HDMI inputs, and black and silver cabinet designs.

Toshiba's 2006/07 TV line includes 20 LCD TVs, including the new REGZA models with sizes from 26W inches to 47W inches, TheaterWide and protected step-up Cinema Series, said Scott Ramirez, Toshiba television marketing VP. The REGZA term applies also to the "LCDVD" series — combination LCD TV/DVD products.

Top-of-the-line REGZA "XHD" sets are 1920 by 1,080p, have CableCARD slot, TV Guide On Screen program guide, dual HDMI inputs, "HD Window" picture-out-of-picture function and Toshiba's "Native Mode 1,080p," which turns off scaling or over-scanning processes.

42" 42HL196 \$3,000, TTM Jul 06

Cinema Series REGZA models offer special high-gloss black finish cosmetics with SoundStrip speaker technology for reduced cabinet size, and a ColorMaster color management system which provides hue, saturation and brightness control of six individual colors, and a new six-item home theater remote control.

37" 37LX196 \$2,600, TTM Jul 06  
42" 42LX196 \$3,300, TTM Jul 06, REGZA XHD 1080p  
47" 47LX196 \$4,500, TTM Aug 06

REGZA HD LCD TVs include:

26"	26HL66	\$1,200, TTM now
32"	32HL66	\$1,600, TTM now
37"	37HL66	\$2,200, TTM Aug 06

REGZA LCDVD models include:

26"	26HLV66	\$1,300, TTM Jun 06
32"	32HLV66	\$1,700, TTM Jun 06
37"	37HLV66	\$2,300, TTM Jul 06

RealSteel line

Stainless-steel cabinet designed to match stainless-steel kitchen appliances.

20"	20HLK86	\$800, TTM Jul 06, and white version 20HL86 \$700, TTM Jul 06
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LCD TV monitors (no tuners)

26"	26HLC56	\$1,100, TTM Aug 06
32"	32HLC56	\$1,400, TTM Jul 06
37"	37HLC56	\$2,000, TTM Jul 06

Sep 06 CEDIA

Toshiba introduced two Cinema Series Pro REGZA models:

42"	42LZ196	\$3,400, TTM Sep 06
47"	47LZ196	\$4,600, TTM Sep 06

Both models feature Toshiba's latest PixelPure Hi-Bit 12-Bit digital video processing with 4,096 levels of gradation for 16 times the gradation levels of standard 8-bit systems, new CineSpeed LCD panels at 8ms response time, 176 degree viewing angle, new ColorMaster Pro color management system for hue, saturation and brightness control of six individual colors, plus three user-selectable colors.

The panels also feature new Native Mode for 1080p pixel-for-pixel images without any scaling or overscanning, new high-gloss black cabinetry, ATSC/QAM digital tuning, CableCARD slot, 2xHDMI, PC input, Discrete IR codes with IR pass-through port, IR Input port for system integration, TV Guide On-Screen program guide, HD Window POP, THINC RJ-45 network capability, to access JPEG picture or MP3 audio files using the TV remote, SoundStrip speaker technology for quality sound within compact cabinetry.

CES 2007

Toshiba announced a new LCD flat panel line of 13 new REGZA models from 26" to 57", the 52" and 57" screens were displayed at CES, with high-gloss black cabinetry implementing Toshiba's slim SoundStrip™ speaker technology, ATSC/QAM digital tuning, SRS WOW™ sound, PC input, 3xHDMI.

New technologies introduced on the sets included PixelPure3G™ advanced 14-bit digital video processing for 4,096 levels of gradation (16 times the standard 8-bit systems) for cleaner natural images with the new enhanced MPEG noise reduction technology, DynaLight™ dynamic backlight control for 5x contrast level improvement, ColorBurst™, ClearFrame™ and CE-Link .

REGZA 720p

### HL67 & LV67 Series

Six 720p models from 26" to 42", TTM Mar/Apr 07

26HL67  
32HL67  
37HL67  
42HL67  
26LV67  
32LV67

### REGZA LCDVD

26" to 32" same features, built-in DVD player, upconversion to 720p for HD display.

### REGZA 1080p

#### HL167 Series

Added a 52" model to the current 42" and 47", accept 1080p, ColorBurst, CE-Link (HDMI – CEC) for two-way control between TV and source devices, such as HD DVD, through the HDMI cable, IR Pass-Through jack.

42HL167      TTM Mar/Apr 07  
47HL167      TTM Jun/Jul 07  
52HL167      TTM Jun/Jul 07

### Cinema Series® REGZA 1080p

#### LX177 Series

TTM Jun/Jul 07

Added four new models in 42", 46", and new 52" and 57" sizes, new ClearFrame 120 Hz anti-blur technology that doubles the frame rate from 60 fps to 120 fps using Motion Vector Frame Interpolation, eliminating motion blur without adding flicker or reducing image brightness, HDMI, Deep Color, x.v.YCC technology for enhanced color space, premium cabinet design with new SoundStrip2 technology with an acoustic chamber for rich bass, natural voices and crisp highs, target high-end home theater applications, IR input, THINC™ RJ-45 connection, Virtual Dolby® sound.

42LX177  
46LX177  
52LX177  
57LX177

### Apr 07

Toshiba announced the:

#### REGZA H3000 Series

300GB HDD, eSATA port for external HDD, 2xHDMI, D4 input, Ethernet port.

32"    32H3000, 1366x768, TTM Apr 07  
37"    37H3000, 1080p, TTM Jun 07  
42"    42H3000, 1080p, TTM Jun 07  
46"    46H3000, 1080p, TTM Jun 07  
52"    52H3000, 1080p, TTM Jun 07

### **VIZIO Inc.**

Consult the 2006 HDTV Technology Report for earlier models

### Jan 07

The company announced a new 47W-inch 1,080p Vizio LCD TV on the Gallevia series currently having 20, 32, 37, and 46 inch screen sizes:

47" GV47LF \$1,900

Features include translucent black/silver cabinet, touch-sensitive control keys, 500 cd/m(2), 800:1 CR (1,600: 1 dynamic), response time 8ms, unique zero bright-pixel defect guarantee, free 1-year onsite service, PIP/POP, closed captioning, V-Chip, 3D comb filter, motion adaptive de-interlacing, 3:2 or 2:2 reverse pull-down, ATSC/QAM/NTSC tuner, selectable color temperatures (6,500K, 5,400K and 9,300K), independent red, green and blue color fine tuning adjustments, 2xHDMI, 2xcomponent YPbPr, RGB PC VGA-type, 5.1 optical audio output, removable speakers, stand.

### **Vidikron**

#### CES 2007

Vidikron introduced two new 1080p LCD monitors within the DView™ line of flat panels, featuring Vidikron's exclusive Imagix™ video processing and proprietary IntelliWide™ technologies, multiple aspect ratio controls, ATSC tuner, DVI/HDCP, component, RGB, RS-232, complete Imaging Science Foundation (ISF™) calibration suites, less than 5-inches deep, wall-mounted/tabletop stand included, detachable 10 Watt, 2-way detachable bottom firing stereo speakers.



40" VL-40 \$4,000

46" VL-46 \$6,000

### **Viewsonic**

#### 2006 line

32" N3260w \$1,300, TTM Jan 06, 1366x768, HDMI, RGB, ATSC tuner, component 37"

40" N4060w \$3,300, 500 nits, 800:1 CR, 1366x768, 170 degrees viewing angle, 10ms response time, HDMI/HDCP, ATSC/NTSC tuners, PC input via HDMI and VGA.

#### Aug 06

1366x768, 1000:1 CR, DVI/HDCP, component, ATSC tuner.

27" N2751W \$800

32" N3251W \$1000

#### Nov 06

The company introduced 3 new models as part of their plan to unveil a total of 25 new products in 4Q06.

The models are now available and feature a new bezel design, integrated speakers and power supply to help eliminate wires.

19" VX1935wm \$200, 1440x900, 700:1 CR

20" VX2035wm \$350, 1680x1050, 800:1 CR

22" VX2235wm \$400, 1680x1050, 700:1 CR

### CES 2007

ViewSonic introduced new LCD TVs, the NextVision® 61 Series with 46-inch N4661w and 42-inch N4261w, 1080p resolution, advanced video and audio processing technology, and smaller LCD TVs (for kitchens for example) such as the 20-inch N2652w.

### **Westinghouse**

PC monitors, the 37" and 42" LCD are tuneless monitors and comply with the FCC ATSC tuner mandate because they omit NTSC tuning, they are true monitor products. All include DVI, and component video.

30" LTV-30w2     \$1,200, NTSC tuners (June 05)  
32" LTV-32w1     \$1,600, NTSC tuners (June 05)  
37" LVM-37w1     \$2,300, 1080p panel, accepts 1080p on DVI and VGA, no tuners  
37" LTV-37w2HD   \$1,700, TTM Feb 06, 1366x768, ATSC/NTSC tuners  
40" LTV-40w1HDC \$2,100, TTM Mar 06, component, ATSC/NTSC tuners, 1366x768  
42" LVM-42w1     \$N/A, monitor no ATSC no NTSC tuners,  
42" LVM-42w2     \$2,800, TTM Jan 06, 1080p, DVI, component, no tuners  
47" 1080p

### CES 2006

The company demonstrated the world's largest ultra high resolution LCD with 8 million pixels. I could not witness the demonstration.

56" 3840x2160, 8 ms response time, 600-nit, 1000:1 CR

### Mar 06

The company announced the latest addition to its HD 1080p line:

37" LVM-37w3     \$1,900, bright flat panel, 8ms response time, high contrast ratio, six HD inputs, 43 pounds, 176 degree viewing angles (vert/horiz), 16.7 million True Color display, 550 cd/m2, 1000:1 CR.

This model was introduced in addition to the current 42" model LVM-42w2 mentioned earlier.

### Nov 06

Westinghouse introduced a new 42" model:

Considered a step-down alternative model, priced to compete against HD plasma displays for the holiday selling season, 3D comb filter 1600:1 CR, 8ms response time, HDMI, component, VGA, 768p, monitor only, TTM 4Q06-1Q07.

42"    W4207            \$1,500

### Anticipated in Nov 06 for CES 2007:

Westinghouse said to introduce an expanded 2007 product line from 19W- to 52W- inches, with ATSC tuners in most models, and new 26" and 52" screen sizes, the 26 to replace the successful 27" size, adding a DVD within the set.

All 1080p sets will be integrated with NTSC/ATSC/QAM tuners, Monitor-only (LVM line) for business-to-business purposes will continue.

The panels also feature HDMI (version 1.1 initially), enhanced color gamut CCFL backlighting, dynamic contrast ratios of up to 5,000:1, 6.5ms response times, updated more upscale-looking brushed aluminum detailing in many models. Some of the new models are:

Two 32W-inch TVs  
One 32W-inch TV-DVD combo  
37W-inch TVs  
40W-inch TVs

Three new 1080p models  
With HDMI 1.2

42" TX-42F430S \$1,500 (originally 2,000), TTM Apr 07, 1080p, 5000:1 CR, 8ms response time, Integrated ATSC/NTSC/ClearQAM tuner, 4 HDMI, 2 Component, 1 VGA, 1 SPDIF out, VESA compatible wall mount interface, built-in stereo speakers and subwoofer.



46" (current)  
47" TX-47F430S \$1,800 TTM Aug 07, (originally \$2,500 and TTM Apr 07), 1080p model, 5000:1 CR, 8ms response time, Integrated ATSC/NTSC/ClearQAM tuner, 4 HDMI, 2 Component, 1 VGA, 1 SPDIF out, VESA compatible wall mount interface, built-in stereo speakers and subwoofer.

52" TX-52F480S \$2,500, TTM Aug 07 (originally May 07), 1920 x 1080 resolution, HDTV 720p, 1080i and 1080p, 5000:1 dynamic contrast ratio, 500 nits brightness, 6.5-millisecond response time (gray to gray), Integrated ATSC/NTSC/ClearQAM Tuner, 4 HDMI, 2 Component, 1 VGA, 1 SPDIF out, 1 stereo out, VESA compatible wall mount interface, Built-in stereo speakers and subwoofer.



Models shown at CES 2007:

Non-1080p models (1366x768)

SpineDesign intelligent cable access, DayBright™ panel technology for daytime or nighttime viewing and Autosource technology, automatic switch to the external source that is activated. HDTV 720p, 1080i, 8-millisecond response time (gray to gray), 2 HDMI, 2 component, 1 VGA, RF Tuner (ATSC, NTSC, CATV and clear QAM), 1 SPDIF out, VESA compatible wall mount interface, built-in stereo speakers and subwoofer.

42" models (SK-42H240S / SK-42H360S)  
\$1,700, TTM Apr 07, 3000:1 CR, 500 nits,  
model 240 shown:



32" models (SK-32H520S / SK32540S)  
\$950, TTM Apr 07, 1200:1 CR, 400 nits

32" SK-32H590D \$1,050, TTM Apr 07,  
built-in front slot loading DVD player,  
wall-mountable, sleek stylish design,  
Advanced Calibration Menu, Preset Video  
Modes for customized viewing styles for  
movies, games and sports, 1200:1 CR, 400 nits brightness, no subwoofer.

26" SK-26H240S and SK-26H520S, \$700, TTM Apr 07, designed to replace CRTs,  
800:1 contrast ratio, no subwoofer.

26" SK-26H590D \$800, TTM Apr 07, built-in front slot loading DVD player, wall-  
mountable, sleek stylish design, designed to replace a current CRT TV, Advanced  
Calibration Menu, Preset Video Modes for movies, games and sports, 800:1 contrast  
ratio, 400 nits brightness, no subwoofer.

19" SK-19H210S \$450, TTM Mar 07, ATSC (HD) tuner for 720p, 1080i resolution,  
"personal" LCD TV design, 1440 x 900 resolution, 5-millisecond response time (gray  
to gray), 700:1 contrast ratio, enhanced brightness, 1 HDMI, 1 component, 1 VGA, 1  
SPDIF out, 1 stereo headphone out, tilt adjustable stand, VESA compatible wall  
mount interface, built-in stereo speakers, no subwoofer.

#### LCD Computer Monitors:

24" L2410NM \$700, TTM Jan 07, 16:10 aspect ratio, multifunction monitor,  
beyond 1080p quality with its super-high 1920 x 1200 resolution, 700:1 contrast  
ratio, AllGlass design that incorporates a minimal bezel, HD-Grade panels with high-  
quality HDTV glass, DayBright™ panel technology for daytime or nighttime viewing,  
6.5-millisecond response time (gray to gray), ultra wide viewing angle at 175/175,  
HDMI-HDCP, YPbPr with audio, CVBS/S-Video with audio, PC with Audio In.

22" LCM- 22w3 \$450, TTM Mar 07, DVI-HDCP inputs, built-in speakers, 1680 x  
1050 resolution, wide viewing angle, 5-millisecond response time. AllGlass design  
that incorporates a minimal bezel, HD-Grade using high-quality HDTV glass,  
DayBright™ panel technology for daytime or nighttime viewing, 700:1 contrast ratio,  
e-WV compensation film, PC VGA input with audio, DVI-HDCP digital input .

20.1" L2046NV \$350, TTM Mar 07, 4:3 aspect ratio, 1400 x 1050 resolution, 5-  
millisecond response time, wide 170/160-degree viewing angles, AllGlass design with  
minimal bezel, HD-Grade panels using high-quality HDTV glass, DayBright™ panel  
technology for daytime or nighttime viewing, 650:1 contrast ratio, 5millisecond  
response time (gray to gray), wide viewing angle with e-WV compensation film (170-  
degree horizontal/160-degree vertical), dual PC inputs, VGA and DVI-D.

19" L1975NW \$300, TTM Mar 07, 16:10 aspect ratio, 1440 x 900 resolution,  
5-millisecond response time. AllGlass design with minimal bezel, HD-Grade panels  
using high-quality HDTV glass, DayBright™ panel technology for daytime or

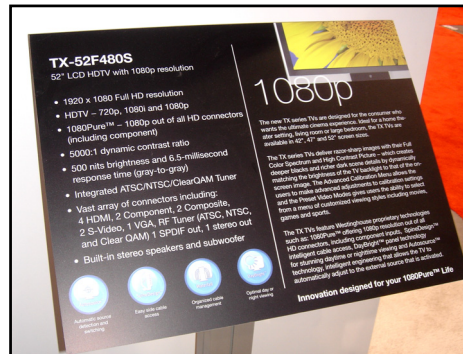
nighttime viewing, 700:1 contrast ratio, wide viewing angle with e-WV compensation film, MS Vista concept design, dual PC inputs: VGA and DVI-D, integrated audio.

19" L1928NV \$319, TTM Mar 07, 5:4 aspect ratio, 5-millisecond response time, 1280 x 1024 resolution, dual PC inputs, AllGlass design with minimal bezel, HD-Grade panels using high-quality HDTV glass, DayBright™ panel technology for daytime or nighttime viewing, 650:1 contrast ratio, wide viewing angle with e-WV compensation film (170-degree horizontal/160-degree vertical), dual PC inputs, VGA and DVI-D.

As mentioned on CES 2006 (above) the company showed again the **world's first LCD monitor with 3840 x 2160 (greater than 8 megapixel) resolution**, a 56" LCD Quad Full HD monitor, that the company says "offers stunning, never-before seen picture reproduction."

The company also announced their 82" LCD monitor, one of the world's largest, at CES 2007 and stated that "LCD will overtake plasma as the display technology of choice in 2007", and actually showed the model TX-52F480S anticipated above:

52" TX-52F480S 1080p, 1080 Pure, 5000:1 CR, 500 nits, ATSC/QAM/NTSC tuners, 4xHDMI, 2xcomponent, VGA.



## Chapter 11 - HDTV Tuners / DVRs

Many HD DVR and STB (set-top-box) tuners introduced before 2006 are still current, please review these products with their features, specifications, price, and availability in earlier reports from the <http://www.hdtvmagazine.com/> web site.

Regarding STB converters for the DTV transition please also consult the background on the section "DTV Implementation".

### **AMD**

#### CES 2007

AMD unveiled their ATI TV Wonder™ Digital Cable Tuner, the industry's first and only device that enables users to watch and record premium HD digital cable content, such as HD ESPN and HD HBO, on their PC, which turns into PVR using the HDD with Microsoft Windows Vista Media Center menus and interfaces.

TTM Jan 30, 07, inside desktop and notebook PCs from the industry's top PC manufacturers, certified by CableLabs®, able to stream to Xbox 360™, if permitted by the content provider, powered by AMD Avivo™ image technology.

Pricing will vary depending on the OEM manufacturer and the level of hardware included.

<http://www.amd.com/>

### **AverMedia**

The logo for AverMedia, featuring the word "AverMedia" in a bold, blue, sans-serif font. The letter "A" is significantly larger and more stylized than the other letters, and a registered trademark symbol (®) is located to the upper right of the "a".

#### CES 2007

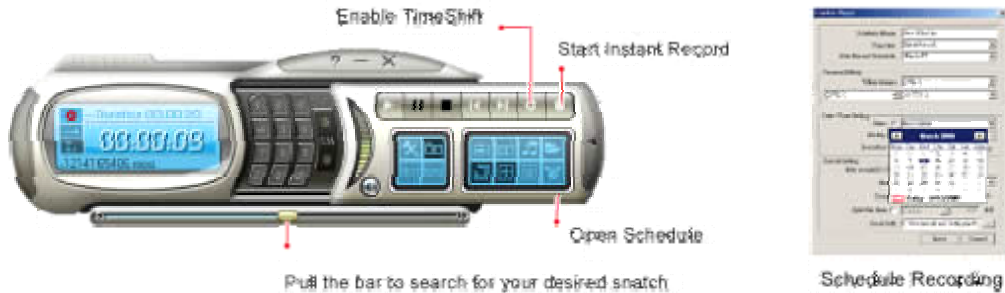
#### AVerTVHD MCE A180

ATSC/cable tuner for Windows XP Home/Professional or MCE 2005 PC, and is Microsoft Vista ready, supports 480p, 720p, and 1080i, multiple aspect ratios including 4:3 and 16:9, connects to multimedia devices such as DVD players, camcorders, or game consoles, includes AVerTV 6 application designed for PC multimedia lifestyle. Watch TV or use the PVR and TimeShift features to pause, rewind, and replay live digital TV.

Additional features include Image Snapshot, sleep timer, 16-Channel Preview, full screen and PIP/POP, 32/64 bit driver support, composite and S-Video input, unencrypted QAM support (digital cable), 75 Ω TV antenna input, TimeShift, schedule recording into MPEG-2 formats, recording into MPEG-4 formats (\*), channel management, fast channel switching, PIP (Picture-in-Picture) / POP (Picture-out-of-Picture), EPG<Digital Subtitle, multi-snapshots, consecutive snapshots, save captured image in several format, wallpaper snapshot, file management, multi-user settings, channel remapping, video quality enhancement, audio effect adjustment, auto power off, wake-up from S3 (Stand By) /S4 (Hibernate) mode, sleep timer

\*(Only for Analog TV via S-Video or Composite Input) To encode MPEG-4 format, Aver suggests to download DivX codec from [www.divx.com](http://www.divx.com) or XviD codec from

<http://www.xvid.org/>. The codecs are not developed by AVerMedia. Therefore, AVerMedia could not guarantee the function of MPEG-4 recording.



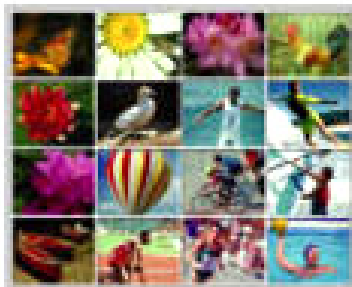
**System Requirements:**

Intel Pentium 4 2.4GHz (Hyper-Threading) or Equivalent AMD Processor  
 (Recommended CPU for TimeShift and Record: Intel Pentium 4 2.8GHz (Hyper-Threading))

- VGA card supports DirectX 9.0c or above
- 512 MB RAM or above
- PCI slot
- Sound Card
- Windows XP/ XP MCE 2005

**For HDTV (MPEG-2) only**

VGA card supports DirectX 9.0c and DxVA (HDTV)  
 HDTV will only function when the TV signal is in HDTV format



**16-Channel Preview**



**PIP**



**POP**

EPG below:



### AVerTVHD Hybrid Express card

A hybrid analog worldwide standard TV and ATSC Hi-Definition receiver card certified with ExpressCard™ Interface solution for laptop PCs to watch analog and over-the-air HD TV programs anywhere, MPEG-2 hardware encoder built-in, PVR features such as instant recording, playback, and TimeShift functions, high quality TV tuner, Recording Scheduler, Snapshot, AVerTV 6 software application, Multiple-user setting, Fast Channel switching and scanning, Wake-Up Recording from Hibernate (S4) / Stand By (S3) Mode.

#### Major Features:

- ExpressCard logo Certified
- Worldwide Analog TV
- ATSC Digital TV
- EPG
- MPEG-2 Hardware Encode
- FM Radio
- Clear QAM Support (Digital Cable)
- 64-Bit driver support
- Microsoft Vista Compatible
- Small Form Factor



#### Specifications:

- Input Signal
- 75 Ω TV Antenna
- FM Input
- Composite (RCA)
- S-Video

#### Package Includes:

- AVerTVHD Hybrid Express
- Quick Installation Guide
- Installation CD
- AVerTV 6 Application Software
- Remote Control
- FM Radio Antenna
- S-Video/Composite (RCA)

#### System Requirements:

- 256 MB RAM or above
- ExpressCard™/54mm Slot
- VGA card supports DirectX 9.0c
- Sound card
- Windows XP/XP MCE 2005 Compliant, Vista Ready

#### SDTV

- Intel Pentium® 4 2.4GHz (Hyper-Threading)
- Intel Pentium® Mobile 1.3GHz
- AMD AthlonXP® 2400+

#### HDTV

- Intel Pentium® 4 2.8GHz for Record in MPEG-2

- Intel Pentium® 4 3.0GHz for TimeShift
- VGA card supports HDTV, DxVA and with 256MB or above
- HDTV will only function when the TV signal is in HDTV format

#### AVerTV 6 Application Software Features:

##### Personal Video Recorder (PVR)

- TimeShift
- Schedule Recording
- Recording into MPEG-1/2/4\* formats

##### Channel Management

- Fast Channel Switching
- PIP (Picture-in-Picture) / POP (Picture-out-of-Picture)
- 16-Channel Preview

##### Information Management

- i-EPG
- Closed Caption

##### File Management

- Multi-User Settings
- Channel Remapping

##### Power Management

- Auto Power Off
- Wake-up from S3 (Stand By) /S4 (Hibernate) mode
- Sleep Timer

##### Multi-Snapshots

- Consecutive Snapshots
- Save captured image in several format
- Wallpaper the Snapshot

##### Quality Management

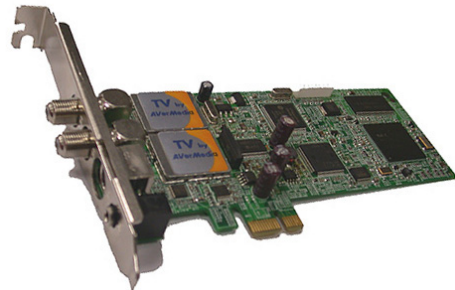
- Video Quality Enhancement
- Audio Effect Adjustment

#### AVerMedia AVerTVHD Combo PCI-E

Combination World Wide Analog and High-Definition TV receiver module, for standard or over-the-air HD TV, or Unencrypted QAM support (Digital Cable) for PCs, records and captures music and TV programs in original MPEG-2 format, straight to the hard disk, Picture-in-picture for simultaneous analog TV and HDTV, AV equipment connectivity(camcorder, DVD player, or game for audio/video capturing), built-in MPEG-2 hardware encoder lowers the consumption of CPU process and guarantees high-quality video content editing, such as instant recording, playback, and TimeShift features, new AVer MediaCenter application software included, 10-foot UI, supports dual tuners or multiple TV tuner cards. User can watch several live programs simultaneously on one monitor (depend on CPU load).

#### Major Features:

- World Wide Analog TV
- Over-The-Air ATSC Digital TV
- Unencrypted QAM support (Digital Cable)
- Advanced 3D Comb Ghost Filter
- Worldwide stereo sound
- High Definition quality support up to 1080i/720p
- 32/64-Bit driver support



- MPEG-2 hardware encoder
- Windows XP / XP MCE 2005
- Windows Vista Ready
- Bundle AVer MediaCenter software
- PCI Express x 1
- Low profile

#### Specifications

- 75  $\Omega$  Digital TV Antenna Input
- 75  $\Omega$  Analog TV Antenna Input
- S-Video
- Audio In L/R

#### Package Includes

- AVerTVHD Combo PCI Express
- Dimension:138(L) x 69(W) mm
- Weight:89g
- Quick Installation Guide
- Installation CD & Application Software
- L/R Audio Cable
- Low Profile bracket (optional)

#### System Requirements

##### For TimeShift and Record in MPEG-2

- Intel Pentium® 4 2.8GHz (Hyper-Threading) or Equivalent AMD Processor
- Intel Centrino Mobile 1.6GHz
- VGA card supports DirectX 9.0c or above
- 512 MB RAM or above
- PCI-Express x 1 slot
- Sound Card
- Windows 2000 / XP / XP MCE 2005 / Vista Ready

##### For Dual Tuners Recording

- Intel Pentium® 4 3.0GHz (Hyper-Threading) or Equivalent AMD Processor
- Intel Centrino Mobile 2.0GHz
- 1G RAM or above

##### For HDTV (MPEG-2) only

- VGA card supports DirectX 9.0c and DxVA (HDTV)
- HDTV will only function when the TV signal is in HDTV format

#### AVer MediaCenter Application Software Features:

##### Personal Video Recorder (PVR)

- TimeShift
- Schedule Recording
- Recording into MPEG-1/2/4\* formats

##### Channel Management

- Fast Channel Switching
- PIP (Picture-in-Picture) / POP (Picture-out-of-Picture)
- 16-Channel Preview

##### Information Management

- i-EPG
- Closed Caption

##### File Management

- Multi-User Settings

- Channel Remapping
- Power Management
- Auto Power Off
  - Wake-up from S3 (Stand By) /S4 (Hibernate) mode
  - Sleep Timer
- Multi-Snapshots
- Consecutive Snapshots
  - Save captured image in several format
  - Wallpaper the Snapshot
- Quality Management
- Video Quality Enhancement
  - Audio Effect Adjustment

### AVerMedia AVerTVHD Hybrid USB

USB TV Tuner/PVR to view both analog and high-definition TV programming on any PC or laptop. Compatible with Microsoft Windows XP Home/Professional, Media Center Edition 2005 and is Vista ready.

#### Major Features:

- ATSC Digital TV
- NTSC Analog TV
- FM Radio
- Windows XP / XP MCE 2005
- Portable USB 2.0 TV Box
- High Definition quality support up to 1080i/720p
- Composite and S-Video input
- MPEG-2 hardware encoder
- 32/64-Bit driver support
- Windows Vista & MCE Compatible
- Clear QAM support (Digital Cable)



#### Specifications

- 75 Ω TV Antenna Input
- S-Video
- Composite (RCA)
- Audio In (L/R)
- RF Radio Antenna Input

#### Package Includes

- AVerTVHD Hybrid USB
- Dimension: 112.3 x 91.5 x 17.5 mm
- Weight: 118.8g
- Quick Installation Guide
- Installation CD & Application Software
- USB Cable
- Remote Control (Batteries Included)
- FM Antenna

#### System Requirements

- CPU

- Intel Pentium 4 2.4GHz (Hyper-Threading) or Equivalent AMD Processor
- VGA card supports DirectX 9.0c or above
- 512 MB RAM or above
- USB 2.0 port
- Sound Card
- Windows XP/ XP MCE 2005

For HDTV (MPEG-2) only

- VGA card supports DirectX 9.0c and DxVA (HDTV)
- HDTV will only function when the TV signal is in HDTV format

AVerTV 6 Application Software Features:

Personal Video Recorder (PVR)

- TimeShift
- Schedule Recording
- Recording into MPEG-1/2/4\* formats

Channel Management

- Fast Channel Switching
- PIP (Picture-in-Picture) / POP (Picture-out-of-Picture)
- 16-Channel Preview

Information Management

- i-EPG
- Closed Caption

File Management

- Multi-User Settings
- Channel Remapping

Power Management

- Auto Power Off
- Wake-up from S3 (Stand By) /S4 (Hibernate) mode
- Sleep Timer

Multi-Snapshots

- Consecutive Snapshots
- Save captured image in several format
- Wallpaper the Snapshot

Quality Management

- Video Quality Enhancement
- Audio Effect Adjustment

In April 07, the company released the AVerTV Hybrid Ultra USB High Definition and Analog USB TV Tuner for laptops and desktops with a hybrid world-wide Analog and ATSC tuner. Features, certified for Windows XP, XP Media Center Edition 2005 and Windows Vista Premium Certified 32/64 bit, hi-speed USB2.0, watch and record NTSC & HDTV through the bus-powered USB design, hardware compression for sharp, clear video while reducing CPU resources, TTM Apr 07, \$130 for the Media Center Upgrade Kit, including Windows Media Center Remote Control and Receiver.

## **AutumnWave**

Oct 06

OnAir GT \$180, HD tuner for laptop, requires antenna for OTA broadcasts, USB 2.0 connection, the HD tuner within the GT is made by LG Electronics, sells on AutumnWave's Web site, light and highly mobile, SD tuning for analog or digital, could be connected to an HDTV cable box to record programming on a PC hard drive.

## AV Toolbox

Feb 07

ATSC-100 \$200, TTM now

OTA ATSC tuner, component, composite, multiple image profiles, closed captioning, V-Chip parental content control, automatic channel scan, adjustable audio levels, favorite channel list, On-Screen Display, Electronic Program Guide (EPG), aspect ratios 4:3 or 16:9, infrared remote control, output resolution 480p, 720p or 1080i in the YPbPr mode, optional (\$29) indoor antenna, the ATSC-A50, is available for within 25 miles with no line of sight obstructions, antenna powered by included DC power supply, built-in high gain amplifier.



NO DVI, NO HDMI

<http://www.tvone.com/>

## CodexNovus

Feb 07

HDcodex

DML-1000 (1,000 GB)

DML-1600 (1,600 GB) standalone server/digital media player \$7,000, TTM Jan 07

Featuring 1.6 terabytes of memory, supports SD and HD up to 1920 x 1080p, multi-channel 5.1, and 7.1 audio formats, HDcodex user interface allows for quick media control, with all source information and metadata, no keyboard, no mouse, ISF-certified, incorporates All Media Guide's (AMG) LASSO media recognition system, totally remote-control driven with included infrared remote control or by RS-232, and compatible with most popular home control systems.

Supports MPEG, AVI, TS, VC-1, MP2, MP3, AC3, WAV, AAC, HTML, SWF, BMP, PNG, TIFF, GIF, and JPEG media files.



Powerful memory access and streaming systems for simultaneous streams of different media to different rooms, expandable with additional disk storage, supports the latest compression technologies, conserving disk space while still maintaining video and audio quality.

Particularly useful for showroom and trade show applications.



Video Output: DVI or HDMI  
 Video Modes Supported: 480p, 720p, and 1080p

Audio Output:  
 Digital (SPDIF): Coaxial and Optical (Toslink)  
 Analog: Stereo

Networking:  
 Gigabit Ethernet: Static or dynamic IP addressing  
 Heterogeneous, peer-to-peer, or server-based  
 Import/Export: Two USB 2.0 ports, one back panel and one front panel  
 Compatible with USB 2.0 compliant hard drives, and DVD Drives

Codec Support:  
 Video Codecs: MPEG-1, MPEG-2, VC-1, TS, MPEG-4, FFMPEG, XVID, LIBAVC, DIVX (compatible)  
 Audio Codecs: PCM, MP2, MP3, AC3, AAC, FLAC

File Compatibility:  
 Video: MPEG, AVI, TS  
 Audio: MP2, MP3, AC3, WAV, AAC  
 Rich Media/Text: HTML, SWF  
 Imagery: BMP, PNG, TIFF, GIF, JPG

Control:  
 RS-232 for remote operation by Crestron, AMX, etc. via 9-pin sub-miniature D connector, IR control: Internal

Storage Capacity:  
 DML - 200 - 250 Gigabytes Internal Storage  
 DML - 1000 - 1 Terabyte Internal Storage  
 DML - 1600 - 1.6 Terabyte Internal Storage

Data Entry:  
 IR remote control (included)  
 Networked PC via compatible Internet browsers

**Contemporary Research**

Dec 05

IP-HDVR HD Tuner-DVR



Ethernet controllable, RS-232, IR, ATSC/NTSC tuners and cable RF inputs (at the same time), decode clear-cable digital QAM channels, controls an external analog cable box

for subscription-based programming, 120 GB hard drive, TV Guide On Screen™, record and display digital video from IEEE-1394 ports, Component, RGB, DVI, Dolby 5.1 surround sound over optical output, variable and fixed-level stereo audio ports, pauses live programming.

**Digeo**

Moxi

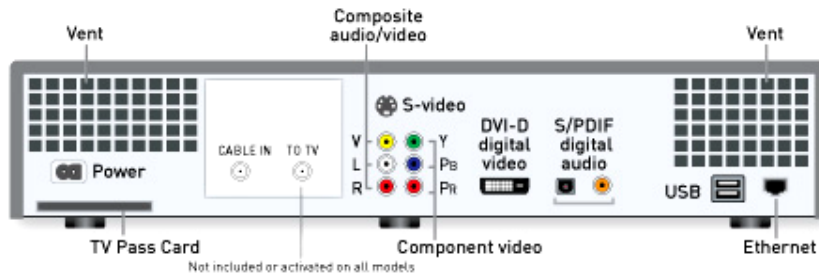
(Implemented by Motorola)  
 2 HDTV tuners, DVR, right



Moxi Media Room and Moxi Mate (below)



**Moxi Back Panel Connections**



CES 2007

Since 2004 Moxi Media center has deployed about 400,000 units exclusively through cable companies, it is available in 100 cable markets nationwide from 8 cable operators.

The company announced that it will begin to sell new versions of Moxi directly to consumers in 2007 through consumer-electronics retailers.

Moxi demonstrated 2 prototypes of planned products for consumers, with Moxi interface, integrated CD/DVD player, watch/record/play HD, stream content from PCs, support web scheduling.



One prototype featured Moxi Multi-room HD DMR, multi-room recording and playback with an integrated multi-stream CableCARD (M-Card), TTM 2H07 (below).



A second prototype featured Moxi Home Cinema Edition HD DMR, Linux based system, AMD LIVE!™, advanced audio features, TTM 2H07.

The Moxi STBs to be released after mid-year will have CableCARD capability, but unidirectional features only, and no OCAP yet (they are working on it). They will be sold to consumers separately from the cable companies.

### Digital Stream

HD 1150 \$190, ATSC OTA tuner, component, no DVI, no HDMI, no 1394, RGB and YPbPr output, coax/optical digital audio, 1080i/720p/480i/p output.

HD 3150 (Pro Brand) \$229, ATSC OTA tuner, 720p/1080i/480p output, component, RGB, simultaneous 480i via composite and S-Video, 16 days Guide, signal strength reading by remote, wide, narrow, and Zoom AR controls, freeze frame, coax/opt audio, stereo analog out, No DVI, No HDMI, No IEEE1394. A product of Pro Brand International, 770-423-7072.



<http://www.pbigroup.com/>

## **DIRECTV**

H10 \$300, Discontinued

HR10-250 HD DVR, TTM 2Q06, discontinued, \$600 as of 1Q07, MPEG-4, records 2 different programs from either DIRECTV or ATSC while watching a pre-recorded program at the same time, record one watch another, pause and rewind live HDTV up to 90 minutes, instant replay, slow motion, 30 hrs MPEG-2 HD recording, or 50hrs on MPEG-4, or up to 200 hrs of SD. First receiver with interactive capabilities, size of HDD not revealed but said could be similar of current HD DVR, outputs 480i/p, 720p, 1080i, 2 DIRECTV inputs, 2 ATSC tuners, 1 satellite in, HDMI, component, composite, digital/coax out, 2 Ethernet ports, 2 USB 2.0 for future connectivity.

H20 \$200, MPEG-4, offered for free by DirecTV

Aug 07

HR20 HD-DVR \$300, TTM now, MPEG-4, pause rewind live HDTV for 90 minutes, instant replay, 30hrs of HD recording, 200 hrs of SD, records 2 shows while plying a pre-recorded program, ATSC tuner.

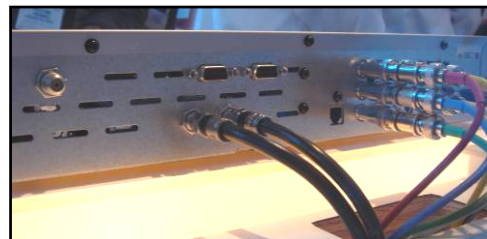
## **THE FUTURE OF TELEVISION HAS ARRIVED**

### **DIRECTV Plus® HD DVR**



After much criticism about delays, DirecTV announced the new deadline for the introduction of new HD DVRs (HR20), initially in Los Angeles and to other major markets in subsequent weeks, DirecTV representative Robert Mercer said.

In 2004, DirecTV announced plans to depart from Tivo plans and switch to the NDS Group, but their STBs were delayed several times, after their original plan for last fall.



### CES 2007

DIRECTV announced that the DIRECTV Plus(R) HD DVR is able to allow access to pictures and music from Intel Viiv technology-based PCs, functionality that is already available in beta to all DIRECTV Plus HD DVR customers, later in 2007, the streaming video functionality will be added.

### Sat-Go portable receiver

<http://www.directv.com/DTVAPP/global/contentPage.jsp?assetId=P4130026>



Featuring:  
Integrated 17-inch LCD monitor and satellite receiver with two speakers  
Compact and portable flat antenna and satellite receiver  
DIRECTV® programming accessed through a platform based on DIRECTV's D11 set top box  
Small profile IR remote  
Component and composite A/V inputs  
Composite A/V out  
Satellite in connection



Phone Jack

USB connection

AC and DC capable (cigarette lighter adapter included)

Rechargeable, replaceable, laptop-style battery

The built-in DIRECTV Receiver can be separated from the DIRECTV Sat-Go antenna casing, and be connected to a DIRECTV Satellite Dish.

"DIRECTV Sat-Go is specifically designed to be compact and highly portable for a variety of outdoor and indoor settings, including camping and hiking trips, RVing, tailgating, college dormitories, hospital rooms, hotels/motels, emergency response, and in-home as a second TV set."

### **Dish Network**

Consult the 2006 HDTV Technology Report for the portable video players and other older models, such as AV402E, AV500E, AV700E, etc.



### 2006 line of MPEG-2/MPEG-4 models

VIP622 DVR, Originally \$300, now offered free to new customers (CES 2007)

One-time upgrade for new lease customers which includes a dish and installation, TTM 1Q06, multi-room HD STB that supports 2 TVs simultaneous, one HD at 480i/p/720/1080i and one SD 480i (HD down-converted), stores 180hrs of SD, or 25hrs HD, or a combination of both, 2 satellite tuner inputs, ATSC

tuner, 1 UHF Pro remote control antenna input for included antenna, USB 2.0 port, Ethernet port, HDMI, YPbPr component, optical digital audio out, records Dolby Digital, 9 day Picture in Guide widescreen EPG, records two simultaneous programs in HD.



VIP211  
MPEG-4  
Originally \$50 for new lease customers, TTM now; supports 1 TV, ATSC tuner, 480i/p/720p/1080i



outputs, USB 2.0. 1 satellite tuner input, 1 Ethernet port, HDMI, YPbPr component out, optical digital audio out.

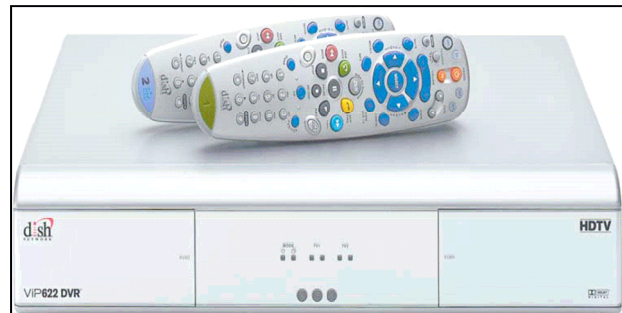


VIP222 TTM 1H07  
Supports 2 TVs, one HD at 480i/p/720p/1080i, one SD at 480i down-converting HD, 2 satellite tuners, ATSC tuner, USB 2.0 port, Ethernet port, optical digital audio out, HDMI, YPbPr component out.

### CES 2007

DISH Network announced their new offer for free ViP622 HD DVR™ Receiver at no additional cost starting February 1st, 2007 to new DISH Network customers as part of the Digital Home Advantage Program, making the ViP622 DVR the first HD DVR in the satellite industry offered free to new subscribers.

The STB offers true 30-second skip feature, supports two televisions in two separate rooms, and is suited with streamlined user-friendly menus and Electronic Program Guide (EPG) and extensive recording capacity.



ViP612 DVR TTM 2H07  
Similar features of the 622 but without the "one receiver/two rooms", "picture in picture", "1 Agile modulated Output", and has only one set of RCA Audio/Video outputs.

**Ezneo**

TR-100 \$189

**Gefen**

CES 2007

Gefen announced a solution that records television programming or video from a digital camcorder using any USB storage device, allowing it to travel and be viewed on different computer displays.

The PVR was released in two versions, one that supports high definition video resolutions up to 1080p, and a low definition version; both use the MPEG 4 format, and deliver preferences and access through an on-screen menu, allowing for easy selection and control.

**Hisense**

USDTV            \$199 (USDTV service has been discontinued).

**HP**

For specs and details about older models DEC Media Center, z540, and z545-b check the 2005 report.

**Humax**

Humaxusa.com (866) 486-2987

HFA100 OTA ATSC HD receiver \$229, HDMI, VGA, component.

**JVC**

Consult the 2006 HDTV Technology Report for:  
TU-VIP622RU DVR with 320 GB.

**Key Digital**

KD-FIRE1080P \$3000, 1394

**LG**

The company is doing efforts in building D/A converter boxes to facilitate the transition to DTV, see details of how LG is teaming with **Thomson** further below.

In October 2005, LG announced that the company is also launching DirecTV STBs as a leading manufacturer of MPEG-4 STBs; the units are being sold under the DirecTV brand name, have advanced program guide, advanced security, and protected digital outputs (HDMI/HDCP) with simultaneous component/composite output, a general-purpose LINUX-operating-system, and an USB port, are built around Broadcom's MPEG chipset and LG's fifth-generation "VSB" chipset to view MPEG-4 HD satellite broadcasts, current MPEG-2 standard- definition programming, and OTA ATSC (Advanced Television System Committee) digital HDTV and SDTV broadcasts.

CES 2007  
Terrestrial HD STB



MPEG-2 ATSC tuner, Dolby 2 channel, Energy Star Compliance, 480i out only via composite, RF channel 3 or 4, stereo L/R audio.

The agreement also plans for LG to develop a MPEG-4 HD-DVR model as well as a Home Media Center STB.

For specs and details on older models LST-3410A and LST-3510A check 2004 and 2005 reports.

**MatrixStream IPTV Technologies**

The company introduced the world's first VOD and IPTV HD-STB using H.264 AVC (advance video codec) adapted for 1080p, with 80GB of HDD, to receive SD and HD IPTV signals over broadband.

The STB allows high bandwidth users (1.5 Mbps+) to view videos in real time via live streaming. For users with lower bandwidth, the IMX Set Top Box (STB) has the proprietary video preload feature that preloads videos to the STB cache before viewing.

IMX 1020HD IPTV HD STB

Available for trials since Jan 06, TTM 1Q06, supports HD 720P, 1080i and 1080P formats, H.264/MPEG 4 Part 10, streaming video, download and push VOD, 1080p over HDMI, component analog able to output 1080i subjected to downrez if the content protection requires it, HDCP over HDMI is activated depending on the content provider contract and STB (the boxes are offered world wide so it varies by location).



According to the company, the IPTV signal will always be protected by encryption, it is up to the service provider to decide if they want to turn HDCP on or off depending on the contract agreement for content they have made for IPTV delivery. Usually a customer will get the set-top box from the service provider directly, however, some service providers might choose to provide it over retail, i.e.: Best Buy.

IMX 1000 IPTV STB

Designed to support Windows Media/VC-1 video codec, fully supports push VOD, download VOD, and streaming VOD in Windows Media format over the Internet.

### IMX 1100 PC Player

Available since Jan 06 from <http://www.movie99.tv/>, at which it offered over 300 free channels from around the world and 150 free DVD and HD quality movie clips.

### Deployment Diagram

The following is an example of how an IMX 1000 STB is deployed in a VOD environment.

Each STB is connected to a TV through standard RCA output, S-Video output, component video output, or DVI output. Each STB fully supports Dolby Digital 5.1 Surround Sound via the optical PCM output.

### PLAYER SOFTWARE REQUIREMENTS

#### Standard Definition

Pentium 4, 2.4Ghz or higher  
512Mb Ram, 256 MB video card or better  
1.5 Mbps or better  
Windows 2000/Windows XP or Vista

#### High Definition (720p)

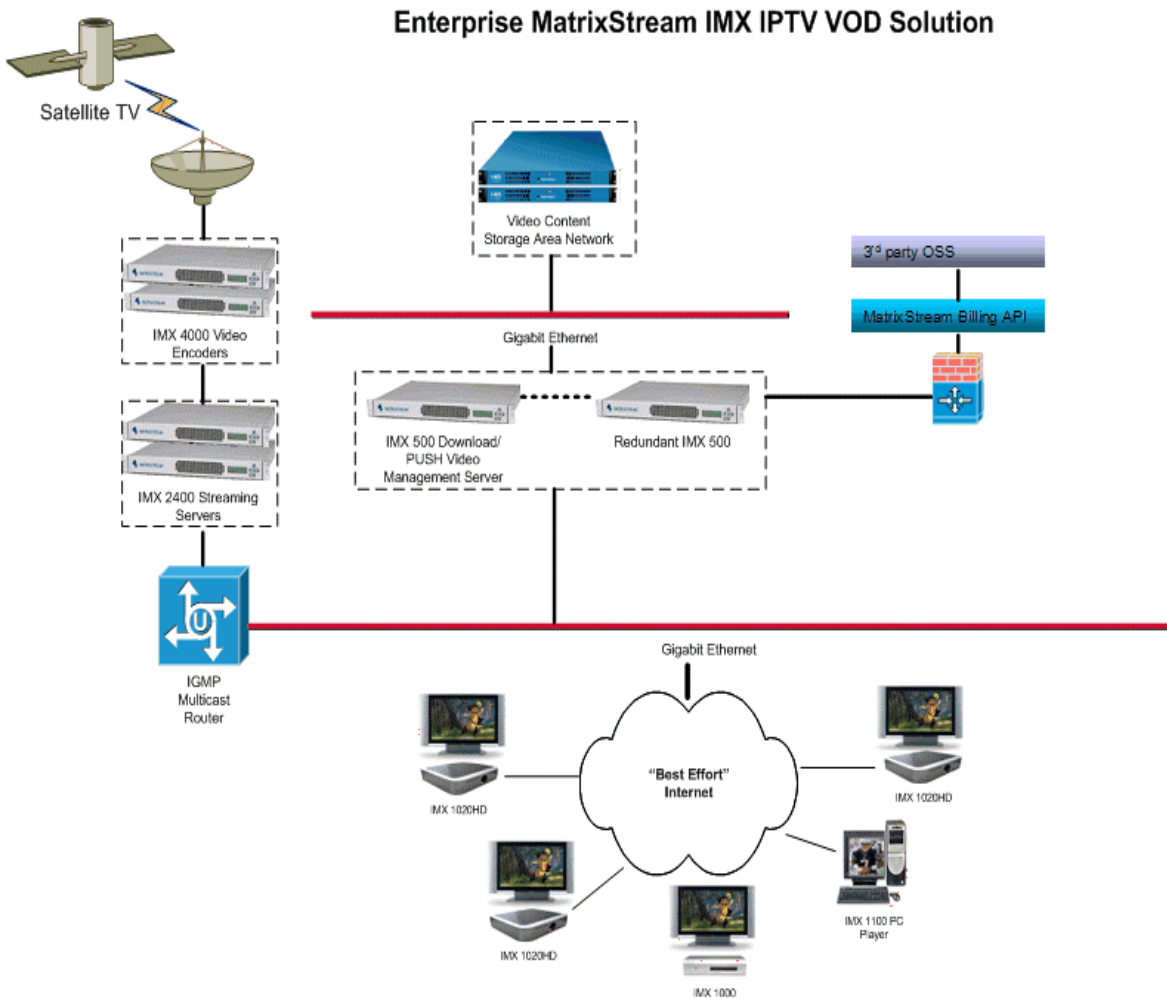
Dual Core 1.6ghz or higher  
512Mb Ram, 256 MB video card or better  
2.5 Mbps Minimum requirement (3mbps or better for best result)  
Windows XP or Vista

#### High Definition (1080p)

Dual Core 2.0ghz or higher  
1Ghz Ram, 512 MB video card or better  
5 Mbps Minimum requirement (6mbps or better for best result)  
Windows XP or Vista

**(Streaming is only available in North America only, if you are outside North America, please use the download)**

Source MatrixStream:



According to the company, "MatrixStream's solution is generally marketed to broadband providers seeking an opportunity to increase ROI by deploying video over their networks. On the back-end, broadband providers have access to one of the most cost-effective, scalable VOD systems available, complete with billing, management, subscriber management, channel management, and digital rights management. MatrixStream's solution supports industry standard video codecs like MPEG4, VC-1, and H.264 and is capable of supporting all future video codecs".

"MatrixStream's IPTV solution is automatically programmed with features currently available on DVDs, including interactive menus, subtitles, multiple audio tracks and video chapters."

- High Definition Video Support – MatrixStream's video viewing clients display DVD and HD videos.
- Video Content Security – MatrixStream offers extensive security measures, including built-in Microsoft DRM (Digital Rights Management) support with the option to add any 3rd party DRM system. Dynamic watermarking management technology is also utilized to protect content from piracy.
- Advanced Video Codec Support – MatrixStream fully supports multiple industry standard advance codecs such as H.264, MPEG 4 Part 10, and VC-1. MatrixStream designed its IPTV system to support all existing and future subsequent video codecs.
- Dynamic Advertising Module – MatrixStream allows IPTV operators/broadband providers complete control over dynamic ad insertion, targeting viewers based on personal preferences and interests.
- Flexible Viewing Options – MatrixStream supports video viewing on both PC and the IP STB clients. STB clients can be remotely upgraded with new releases and additional options. MatrixStream viewing clients can also be ported to third party platforms and OEM STBs.

#### Video Formats

NTSC/PAL composite

NTSC/PAL s-video

Analog YPbPr / RGB

150 MHz YCbCr / RGB digital video output interface

- 8-bit 4:2:2 YCbCr data

- 16-bit 4:2:2 YCbCr data

- 24-bit 4:4:4 YCbCr data

- 24-bit RGB data (888)

- BT.601, BT.656, or VIP 2.0, "video valid" output signal

- Master or slave timing

#### Resolution / Frame Refresh Rates

704/720 x 480i 30Hz

704/720 x 480p 60Hz

704/720 x 576i 25Hz

704/720 x 576p 50Hz

1280x720p 50/60Hz  
1366x768p 50/60Hz  
1024x1024p 50/60Hz  
1920 x 1080i 25/30Hz  
1920 x 1080p 50/60Hz

#### Audio Formats

- 16-bit linear PCM with HDCD support
- MPEG-1 and MPEG-2 Layers I, II and III (MP3) 2.0
- MPEG-2 BC multi-channel Layers I, II and III 5.1
- MPEG-2 and MPEG-4 AAC-LC 2.0
- MPEG-2 and MPEG-4 HE-AAC 2.0
- MPEG-4 SBAC 2.0
- Dolby Digital 5.1
- DTS 5.1

#### Back panel connections

- WMA9@L3 2.0, WMA9 Lossless 2.0, WMA9 Pro@M2 5.1, LAN: 10/100 BaseT, RJ 45
- Connectivity: Two USB 2.0 ports
- Video: HDMI/DVI, S-Video, RCA composite, Y/Pb/Pr
- Audio: S/PDIF, Left/Right channel audio output

In September 2006 MatrixStream released a new HD IPTV package featuring video on demand (VOD), an IPTV basic IMX500 middleware server, an IMX 2410 XMS streaming server, and an IMX 4010 video encoder, capable of handling up to 500 concurrent users, <\$70,000, XMS streaming technology, H.264 compliant, fully integrated, end-to-end solution, including billing management, subscriber management, channel management and digital rights management.

According to MatrixStream the package can be implemented in a very short time, with minimum cost of deployment. The system performs over any broadband network with no QoS.

<http://www.matrixstream.com/>

#### **MicroTune**

##### 3-in-One TV Tuner

In February 2006, MicroTune announced a chip capable to tune ATSC/NTSC/Digital Cable Ready (DCR) for under \$3, the MicroTuner MT2131.

As you see on the photo is very small, and it performs the functions of about 100 silicon components, reducing the bill of materials by about 60%, the company said.



Mar 07

MicroTuner™ MT2170 (chip)

The company announced a new DOCSIS 3.0 wideband tuner chip capable to handle a wider (100 MHz) and faster (160 Mbps) cable modem connection to homes, competing with high-powered fiber-to-the-home networks.



The chip is capable to tune between 50 MHz-1 GHz. A cable plant of 750 MHz or 860 MHz would be able to grow to 1 GHz, and would allow the addition of about 20 6 MHz channels, which could be used for IPTV services, HDTV, channel bonding, etc.

According with Microtune the spec would permit the bonding of non-adjacent 6 MHz channels from a 64 MHz spectrum range, which the Wideband tuner can raise to 100 MHz, handling about 16 bonded channels.

Featuring:

Equivalent functionality of four DOCSIS 2.0 tuners,  
RF footprint shrinking by 75%,  
Power consumption cut by 75%,  
Reduced BOM costs for DOCSIS 3.0 cable equipment manufacturers,  
First 1-gigahertz (GHz) input DOCSIS® 3.0 compliant,  
Integrated miniature package,  
Radio frequency (RF) bill of materials costs reduction,  
Optimized to work with radio frequencies in the 50-MHz to 1-GHz range of the cable spectrum,  
Supports DOCSIS 3.0 channel bonding technology (a bandwidth expansion technique that combines four DOCSIS channels to significantly increase data rates),  
Accepts bonded channels within bandwidths up to 100 MHz when paired with a DOCSIS 3.0-capable demodulator, engineered to function in a much more hostile signal environment than that experienced by conventional cable modem tuners,  
Able to process wideband bonded channels in the presence of multiple interfering signals, while meeting stringent DOCSIS 3.0 sensitivity and adjacent channel interference requirements.

Sampling expected for 2Q07 to select customers, <\$5.00 in volume quantities.

### **MIT (Micro Image Technology)**

MDR-200 ATSC / NTSC tuner – Scaler \$500, TTM now  
2x1394 Firewire outputs for D-VHS recording capability



Scale interlaced video signal user selectable output of 480p/720p/1080i  
4 video inputs for switching  
HDTV Tuner with 2 RF inputs

Firewire ports for use with D-VHS  
 VGA or Y-Pb-Pr output



**Mitsubishi**

HD6000 \$2200, DVR, CableCARD, QAM, 1394, (check 2005 report for details)



**Motorola**

DCT6412 III

Built-in home media networking capabilities,  
 120GB DVR, dual tuner, MoCA, uses existing  
 coax, QAM tuners, video-over-IP, Verizon is  
 first customer with their FiOS TV service in TX,  
 VA and FL.



BMC9012 HD STB, interactive, 80GB, Moxi

DCT6200 HD STB

BMC9022 HD interactive STB, 160 GB DVR, Moxi, multi-room, broadband Media  
 Center (below)



DCT3400 Series, all digital HD STB, dual tuner DVR.

Follow Me TV: DVR remote from/to, program DVR from mobile device, TTM Fall 2006

QIP6416 HD, dual tuner DVR

QIP6200 HD, single tuner

QIP2500 SD, single tuner

HDT101 \$299, ATSC tuner (right)



DSR470 Digital STB non-interactive

DCT2500 Digital STB, interactive, VOD

DCT700 Mini-digital STB with only digital cable services

DCT3080 All digital SD, dual tuner DVR

CES 2007

DCH Series

Six new models of digital STBs, compliant with FCC's separable security mandate with CableCARD™, support Motorola's Linux-Java™ software platform and the Open Cable Application Platform (OCAP)™ initiative, "Motorola Follow Me TV" feature for shift video, pictures, and music throughout the home and their compatible mobile devices, HDMI, optical/coaxial digital audio outputs, IEEE 1394a, USB, and Ethernet, 720p/1080i outputs w/upscaling.

Motorola DCH100 , a SD STB with integrated MoCA™ home networking interface.

Motorola DCH200, an interactive STB for SD digital/analog services.

Motorola DCH3200, an HD interactive STB.

Motorola DCH6200, an HD interactive STB w/analog support.

Motorola DCH3416, an HD DVR interactive STB, 160 GB HDD.

Motorola DCH6416, an HD DVR interactive STB w/analog support, 160 GB HDD.

### **MovieBeam**

Video-on-demand service for standard- and high-definition catalog and new movie releases for playback at any time from a 160GB hard drive. The service includes DVD releases and subscription-free model for movie rental for 24-hour viewing periods for \$1.99 for catalog titles and \$3.99 for new releases, an extra \$1 fee is charged for HDTV titles.



The HDD STB caches 100 movies and sells for \$199 after a \$50 rebate; \$29.99 activation fee, needs periodic connection to a telephone jack, no need for a broadband connection, uses PBS OTA datacasting tuned with OTA antenna.

Movies are sourced from major Hollywood studios, including Disney, 20<sup>th</sup> Century Fox, Lions Gate Entertainment, Universal Pictures, New Line Cinema, Paramount Pictures, and Warner Bros. Studios (Sony is not a participant).

Ten movies are delivered to the HDD each week, while 10 titles are removed at the same time. Of the 100 downloaded titles to the HDD, at least 10 are 720p HD with Windows Media 9/VC-1 compression at one time, for viewing on HDMI/HDCP-enabled HDTV displays. The other 90 titles are in standard definition, which are upconverted to 720p over HDMI/HDCP for HDTV viewers.

Connections other than HDMI support component video, S-video, composite and audio connection ports including digital coaxial, SP/DIF, HDMI and left/right stereo audio, the service also supports Dolby Digital 5.1, widescreen formats and closed captioning, spending limit, and parental controls.

### **Moxi**

(see Digeo)

### **MyDTV45.com**

ZAT-600HD \$159, TTM now, ATSC tuner, 16:9 and 4:3 AR, Dolby Digital decoding, HD and SD



output simultaneously component, coax audio out, RS-232.



CHO4006 \$155, TTM now, ATSC tuner, component, NO HDMI, selectable output 480i/p/720p/1080i, stereo output (no digital multichannel), 4:3/16:9 Aspect ratio control.

<http://www.mydtv45.com/a24f3d1510bddf1503178e274a7e911e.item>

### **Netgear** **CES 2007**

Digital Entertainer HD (EVA8000) Media Receiver, TTM Feb 07, \$349.

Downloads HD content from BitTorrent and streams it to HDTVs and connects to a home-theater system to stream digital media from computers, network storage and USB media players.



The EVA8000 automatically discovers, organizes and plays high-definition movies, TV shows, music files and personal photos - as well as Internet-based video, news feeds, weather reports and radio programs.

Features 1080p capable HDMI, optical digital audio output (TOSLINK), compatible with MP3, WAV, WMA, FLAC, M4A, AAC, AC3, purchased music from iTunes on Windows (M4P), video formats (MPEG-1/2/4, WMV, XviD, H.264), and image formats (JPEG, BMP, PNG, TIFF).

Connects to 10/100Base-T Ethernet controller, two USB 2.0 ports (front and rear), iPods or other portable music and video players, supports Universal Plug-and-Play (UPnP AV), Digital Living Network Alliance (DLNA), Microsoft® Windows Media DRM 10 for Network Devices, WEP, WPA-PSK and WPA2-PSK.

Includes an onscreen TV wizard, installation software, Windows PC software.

Access to music from iTunes, YouTube videos, and access to a PC desktop from the living room. An optional TV tuner installed on a PC, enables the EVA8000 to perform DVR functionality, to schedule recordings and pause or rewind live broadcasts.

Multiple EVA8000 units can interface with "Follow Me" to pause video in one room and resume it in another, or "Party Mode" for music playback in the whole house.

EVA8000 accepts USB flash drives, MP3 players, or other USB storage devices.

Connects to a home entertainment system and to a router, such as a NETGEAR RangeMax™ NEXT Wireless-N Router with draft 802.11n-compliant technology (WNR834M, WNR834B, WNR854T, DG834N). PCs connected to the network with devices such as the NETGEAR Powerline HD Ethernet Adapter (HDX101) are assured of the smoothest content streaming, according to Netgear.

<http://www.bittorrent.com/> , <http://www.netgear.com/>

### **Onair Solution**

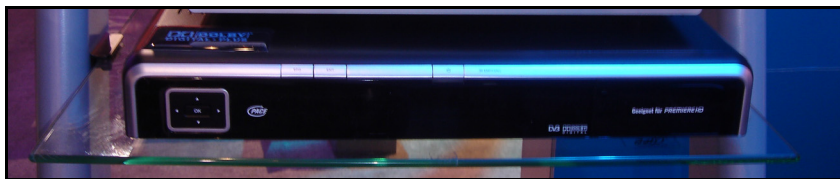
OA-STB1 \$299, TTM now, ATSC/NTSC/QAM on-the-clear tuners, selectable 480i/p/720p/1080i outputs, 16:9/4:3 ARs, DVI, RGB, component, coax/optical digital audio,

[http://www.copperbox.com/lite/popinfo.php?lc\\_code=OA-STB1&uneek=107728640](http://www.copperbox.com/lite/popinfo.php?lc_code=OA-STB1&uneek=107728640)

### **Pace**

#### CES 2007

A Dolby Digital Plus suited STB for broadcast tuning from Pace was introduced at CES 2007 below:



### **PrimeDTV**

PHD-101 \$159 ATSC/QAM in-the-clear tuners  
PHD-200 \$150, TTM now, replaces the 101.

### **Pro-Brand**

See Digital Stream

### **PX Digital Multimedia**

ATSC-1000 OTA HD-STB for HDTV and SDTV packaged with DA-5100 compact outdoor/indoor antenna

<http://www.px.com.tw/>



### **RCA**

For the following models consult the 2004 and 2005 HDTV Technology Reports:

ATSC10	\$549
DTC-210	\$600
ATSC11	\$449
ATSC21	\$499

#### CES 2007

RCA introduced a range of products to complete the digital broadcast transition, addressing the needs of time shifters, analog TV owners, and road warriors.



DRC8335 combo VCR/DVD recorder w/NTSC/ATSC tuners \$250, TTM Apr 07:  
 Featuring the ability to record standard analog cable TV, analog broadcast TV, and digital broadcast TV, it can connect to cable and satellite STBs, one-touch copy control to easily archive home movies from VHS to recordable DVD, records on multiple disc formats (DVD+R/RW, DVD-R/RW), DV-in port, "TV Guardian," a foul language filter.

DTA800 DTV adapter for the Analog Set:

Receives digital OTA and converts for display on a conventional analog TV, remote control unit, TTM 2007, several million Digital TV Adapters are expected to be necessary by February 17, 2009 for viewers that would still need to use their analog sets.



MPC4000 Laptop Teleceiver for digital portability \$200, TTM Apr 07:



CES 2007 Innovations Award Winner, plugs into the laptops's USB port and makes it into a PVR to record OTA and NTSC, provides EPG, pause "live" broadcasts, schedule recordings, scan through in forward or reverse at up to 16X speed, preview up to eight "live" channels at a time, create a favorite-channels list, analog NTSC and digital ATSC tuners, smaller than a deck of playing cards, less than 2 ounces, removable cover, docking station/stand, high-gain reception antenna included, laptop minimum processor speed 1.5 GHz and 256MB of RAM, high-speed USB 2.0, supports Dolby Digital sound, video resolutions up to 1920 x1080.

**Samsung**

SIR-T451 \$250, TTM now, ATSC 5th generation high-definition terrestrial tuner, includes an LCD display and a DVI output, Dolby Digital 2.0 Stereo or Dolby Digital 5.1 surround audio, selectable outputs for 1080i, 720p, 480p and 480i, outputs 480i simultaneously, allowing connection to an analog TV or standard VCR.



For details and specs of older models SIR-T351, SIR-TS360, SIR-TS160, SIR-T165, check the 2005 report.

DTB-H260F \$179, TTM Oct 06, ATSC /QAM on-the-clear tuners,



HDMI, component optical digital audio output, output options including 1080i, 720p or 480p/i.

### CES 2007

DVD-AVR950- ATSC Combo / DVD Recorder

TTM Jun 07, \$320, full multi-format recording to DVD RAM/-R/-RW/+R/+RW and Dual Layer formats, HDMI 1.3, DVD up conversion to 720p/1080i HD resolutions, Cable Box control, HDMI CEC for simple home entertainment system control, progressive scan DVD, EZ Record for start recording in one quick step, DivX file playback, front DV input for digital camcorders and other devices, high quality 4 head HI-FI VCR.

### Mar 07

Samsung announced their plans for a D/A TV converter to be offered in time with the NTIA coupon program for the DTV transition to help consumers with terrestrial tuning of DTV signals.

### **Scientific Atlanta**

The STB introduced at CES 2005 with HD recording ability on the HDD DVR / internal DVD format, was introduced again at CES 2006, check page 93 of the CES 2005 report.

The unit has now a model number:  
MCP-100



DVR with DVD Recorder/Player is being tested in MSO labs and is expected to enter beta testing soon. The recording abilities are designed to respect key content protection flags including 'copy freely', 'copy once', and 'copy never' tags, Dual DVR recording, Multi-Room™ DVR, High-Definition, DOCSIS and OCAP capabilities, External SATA for storage expansion, Multi-Room DVR feature enables viewers in three other rooms in the home to access content stored on the DVR hard drive.

Consult the 2005 HDTV Technology Report for specs on current models:  
Explorer 3250HD

Explorer 3250HD



Explorer 8000HD

Explorer 8000HD



And Explorer 8300

CES 2007

Scientific Atlanta showed a newer model 8300 with a Multistream-CARD (M-CARD), two-way capability, and two tuner DVR, TTM July 2007 to comply with the regulation.



OCAP can be deployed later following the CableCARD version by downloading the upgrade without the user knowing.

OCAP downloads are possible if the box has enough memory, not if the box is a 3250 for example, it will not be possible.

The cable operator is not expected to immediately replace existing non-CableCARD 8300 units in subscribers homes when the new one with CableCARD is out, unless they have inventory available.

The box would perform with the same features but physically would have a CableCARD inserted into the unit to perform the conditional access function outside the unit itself, a requirement of the FCC to all cable companies starting July 2007.



A model 4250HDC (pictured left) with CableCARD is expected to replace the 3250, with HDMI, bi-directional performance. To implement DCAS it is anticipated that a new STB will be released.

OTA tuners are not present on STBs because they are judged not add any value over the cable services, technically possible but the cable operator is not interested.

OTA tuners

Some features of the new STBs (HD200i DVR below) are



MPEG-4, home networking with IP for PC connection and coax for DVR access from other

STBs in the home, those features are expected to come after the CableCARD is implemented in STBs to comply with the mandate.

NAVIC was demo at CES 2007, is a 3<sup>rd</sup> party application development software that could be implemented into Scientific Atlanta STBs.





Scientific Atlanta said that the DCAS implementation will happen when the government approves DCAS as an alternative solution to CableCARD (and it actually happened on Jan 07, please check the section dedicated to Cable for more details); government is expected to determine what the system can or cannot do. Once DCAS is approved, it would be a year time for its implementation. Some chips are available and the architecture is ready to support the HW, it needs to add the SW.

### **Sharp**

HDD DVR recorders, check 2005 report for details  
DV-HRD200  
DV-HRD20

### **Sony**

ATSC/QAM cable tuner DVRs  
DHG-HDD250 \$800, TTM fall 04, 250GB HDD, 20 hours of HD recording  
DHG-HDD500 \$1000, TTM fall 04, 500GB HDD (two 250GB HDDs), 60 hours of HD  
Check specs and details at 2005 report

### **Sylvania**

6900DTE \$329 ATSC tuner

### **TEAC**

Nov 06

TEAC announced their plan to enter the HDTV tuner market with an external HDTV tuner for notebook computers early in 2007, and a first portable storage device was for Dec 1, 06.

"The HDTV tuner will be TEAC's first venture into this product category", said Aris Gharapetian, TEAC's marketing manager. The HD tuner connects via USB, \$TBD (but <\$200 was suggested).

The Multifunction Portable Storage Drive device is primarily intended for images or music but HD content was not mentioned, 2.5-inch 40GB HDD, LCD screen, other 80GB and 120GB versions were developed but not announced for availability.

### **Thomson**

In October 2005, the Association for Maximum Service Television (MSTV) and the National Association of Broadcasters (NAB) announced their selection of Thomson

and LG Electronics to each develop prototype OTA digital converter STBs to receive digital signals on conventional analog televisions, which would be used as future products of manufacturers for the implementation of the subsidy plan to help consumers unable to buy new digital sets.

This selection took several months in the making and was made after a comprehensive evaluation of more than a dozen of proposals submitted by other major manufacturers when responding to a Request for Quotation issued in June 2005 by the MSTV and NAB.

#### CES 2007

##### Cable STB DCI9000

Thomson unveiled the first OCAP MPEG-4 HD PVR at CES, an all-digital high definition set-top box with embedded DOCSIS 2.0 modem and OCAP (OpenCable™ Application Platform) middleware, decodes both HD and SD, MPEG-2 and MPEG-4, DSG (Digital Set-top Gateway), IP communication, facilitates services requiring two-way communication like switched broadcast, VoD, and bandwidth-intensive IP services, a new modem version supporting downstream channel bonding by TTM end 07 would enable download speeds of over 100 Mbps.

Cable operators can gradually introduce IPTV services on top of their existing broadcast and VoD services, available in two different versions, both supporting PVR functions, one with a 160 GB internal HDD, and one with an interface for an external disk, facilitates the deployment of Push Video on Demand, supports single stream and multistream CableCARDS.

Thomson is currently working to support Downloadable Conditional Access Systems (DCAS).

According to Thomson "Last year at CES, we introduced our first OCAP capable MPEG-2 Standard Definition set-top boxes. A couple of weeks ago, we signed an agreement with Polycipher, a joint venture between Comcast, Time Warner Cable and Cox Communications. Today, we are bringing our commitment to the North American cable industry to another level with the introduction of the DCI9000, the first MPEG-4 HD PVR supporting major open standards, like OCAP or DSG" said Frédéric Kurkjian, Vice President for Thomson's Cable Premises Systems.

##### Satellite STB

Thomson announced their new satellite High Definition DVR Receiver with MPEG-4 capabilities.

##### IP DBI200

Thomson launched a new range of HD MPEG-4 IP Set-top boxes, the DBI Series range, which feature a comprehensive portfolio of content protection technologies to secure video content delivered over IP networks, first products to integrate the NexGuard forensic watermarking technology developed by Thomson's Technology Division to prevent the copying and illegal distribution of copyrighted video content. Thomson's NexGuard solutions integrated into set-top boxes, alongside conditional access systems, will enable IPTV operators to assure content partners that their content is protected.

### Triple Play Services over Multiple Network Types

Thomson's pre-integrated service delivery platforms help service providers to introduce sophisticated voice and video features over broadband local loops and cable networks.

Thomson's triple play features combine innovative SmartVision TV services such as live TV with picture in picture, video on demand, network personal video recording and time shifting (the ability to pause and resume live broadcasts), with advanced Cirpack telephony management for services such as caller ID on TV for incoming calls, browsing call history with click to dial, activating call forwarding, configuring black lists or selecting musical ring back tones on the TV.

### **Tivo**

#### Series 3 HD

250GB DVR, dual HD recording (300 hrs SD, 30 hrs HD), dual CableCARD slots on back (Multi-stream 2.0 or Single-stream 1.0 variety) to support two signals, six tuners (dual cable tuners, dual NTSC tuners, dual ATSC tuners), can use any pair, supports digital and analog cable, external SATA drive, backlit remote, TTM 06, supports MRV and TTG, coax cable in, coax antenna in, no RCA or S-video inputs, outputs: HDMI, component, composite, optical audio, RCA stereo out, 2 USB ports, 10/100base T Ethernet jack connections, outputs 480i/p/720p/1080i/pass-thru, encodes analog content with MPEG-2, supports playback w/MPEG-4 AVC/H.264 and WM9.



### Sep 06 CEDIA

The TiVo's 'Series 3' High-Def DVR introduced above, "world's first and only THX-certified DVR", was demo at CEDIA, and announced availability mid-September 06, \$800, thru consumer chains such as Best Buy, Circuit City, Ultimate Electronics, and Fry's, in addition to [www.tivo.com](http://www.tivo.com).

The demo unit matched the features above, 35 hours of HD programming, 300 hours of standard definition, dual tuners, two program recording, two CableCARD slots, compatible with analog cable and OTA ATSC broadcast, Ethernet and USB ports to share digital photos, digital music, etc.

As announced, it was indicated that later in 2006 the box would also support the newly released TiVoCast service feature, for the access to content directly through a broadband connection for Internet and cable. Firmware upgrades are expected to enable advanced MPEG-4 based download features.

### **USDTV**

OTA STB, check 2005 report, closed business

### **UTStarcom**

RollinStream Media Console for IPTV  
IPTV STB with UWB wireless

UTStarcom (<http://www.utstar.com/> ) with IPTV and Tzero Technologies (<http://www.tzerotech.com/site/>) with UWB introduced their solution STBs for at ITU Telecom World 2006 show in Hong Kong.

Capable of over 500 MHz of bandwidth is suitable for simultaneously transmit several streams of uncompressed HD video.



Tzero's UWB is WiMedia Alliance based and is compliant with other WiMedia-compliant devices.

### **V,Inc**

Current model. As appeared in the CES 2004 report:

-----  
*Bravo HD1 \$350, TTM Feb 04, ATSC/NTSC tuners, scale to 480p/720p/1080i over component output, component, digital audio coax, titanium finish, NO DVI, NO 1394, NO VGA 15 D-sub outputs, aspect ratio control (4:3, 1:6 letterbox, 16:9 full), simultaneous SD and HD outputs*  
-----

### **Viewsonic**

(Both discontinued)

NextVision HD10 OTA HD-STB \$350

Nextvision HD12 OTA HD-STB

\$400, DVI/HDCP, 480i/p, 720p, 1080i output via remote, NO 1394, component, RGB, optical/coax audio.

### **Vizio**

Bravo HD1 \$350, ATSC tuner

### **Voom**

Discontinued models Motorola 550 and 580 due to closing of business, check 2004 and 2005 reports for details.

### **Winegard**

RC-1010 \$189, ATSC tuner, component, optical audio out, RS-232



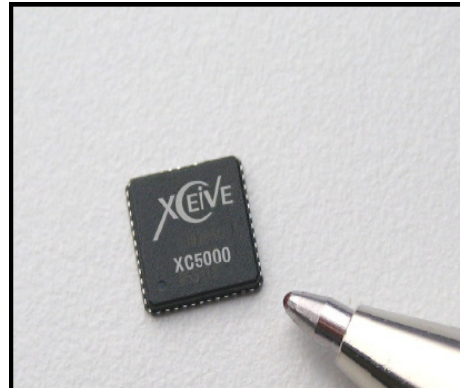
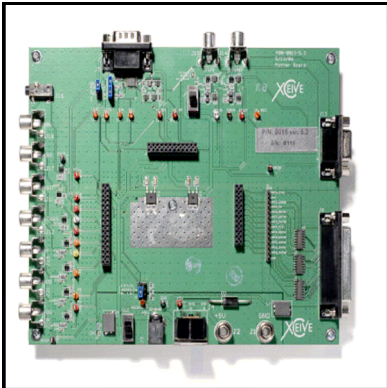
<http://www.winegard.com/mobile/pdf/RC-1010.pdf>

## Xceive



### CES 2007

Xceive introduced their XC5000 next generation silicon tuner, the world's most highly integrated silicon tuner, according to Xceive, and ultra-small footprint, for analog, digital terrestrial and QAM cable reception, positioned to replace the conventional CAN tuner architecture as the tuner of choice for the television market.



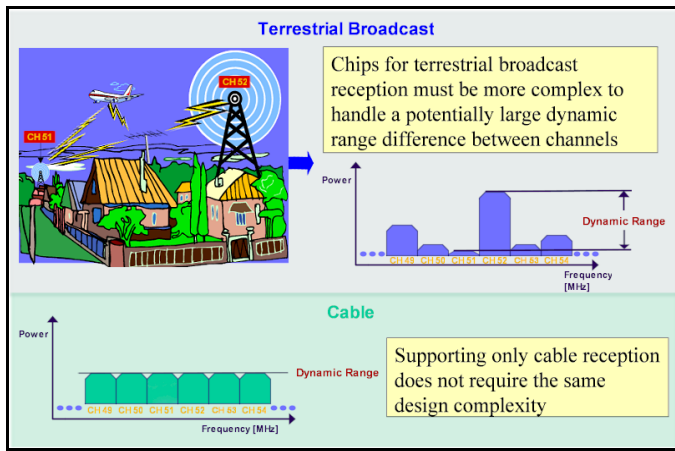
### SPECIFICATIONS

Outline Dimensions	7 x 7 x 0.85mm
Supply Voltage (DC)	1.8V, 3.3V
System setting time	5ms
Input Impedance	75ohms
VSWR (typical)	2.5
Noise Figure (typical)	5dB
Phase noise @10KHz (typical)	-95dBc
CTB	-63dBc
Image rejection	65dB
AGC range	90dB
Video SNR (unweighted)	54dB
Frequency range	42 -864MHz
Power Dissipation	1.0W

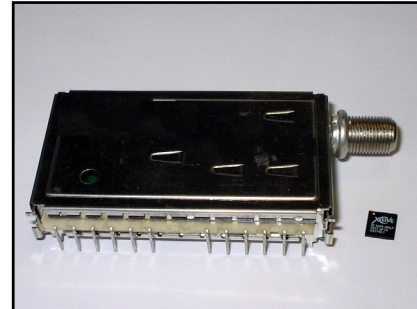
Optimized for large screen hybrid televisions, the world's best sensitivity, adjacent channel, phase noise, and dynamic range, unweighted signal-to-noise-ratio of 54dB and a noise figure better than 6dB for analog TVs, exceeding the parameters of a typical CAN tuner and exceeding DTV television standards (below) for both terrestrial and cable reception.

Xceive's QuickTune™ ultra fast per channel signal detection for complete 100 channel scan in less than two seconds, ChannelVista™ (PIP) provides up to 12 video channels simultaneously around the main channel, gain adjustment of the RF front-

end blocks in real time, integrated programmable DSP with on-board filters that can be configured to meet and exceed the requirements of ATSC, OpenCable, DVBT/C/H, DMB-TH and ISDB-T standards and can be used worldwide.



Can tuner next to miniature Xceive



#### Features:

World's smallest Hybrid TV tuner:

- Fully integrated RF-to-Baseband
- No metal shield required
- Alignment-free
- No external tunable parts

Built-in VIF/SIF circuit

Supports all analog TV standards:

- NTSC, PAL, SECAM
- CVBS, SIF or mono-sound output
- Works well for non-standard signals

Supports all digital TV standards:

- ATSC, OpenCable
- DVB-T, DVB-C
- ISDB-T, DMB-TH

Quick tuning supports ChannelVista™

Easily monitors signal performance

IIC bus controlled

Ultra small 48-pin QFN package, Lead-free

Onboard demodulation of NTSC, PAL and SECAM TV standards, housed in an ultra-small (7mm x 7mm) 48-pin QFN package, integrates all the SAW filters and video/audio demodulation in order to achieve a low BOM cost, on-board DSP controller minimizes tuner-to-tuner performance variations and achieves very tight tolerance specifications and yield. Production quantities will begin shipping in the second quarter of 2007, priced at less than six dollars in volume quantities.

#### XC3028/L

Ultra Small, Analog AND Digital Terrestrial and Cable Receiver

Featuring:

World's smallest Hybrid TV tuner:

- Fully integrated RF-to-Baseband

- No metal shield required

Digital picture carrier recovery:

- Alignment-free
- Quartz-stable and accurate
- No external tunable parts

Built-in VIF/SIF circuit

Supports all analog TV standards:

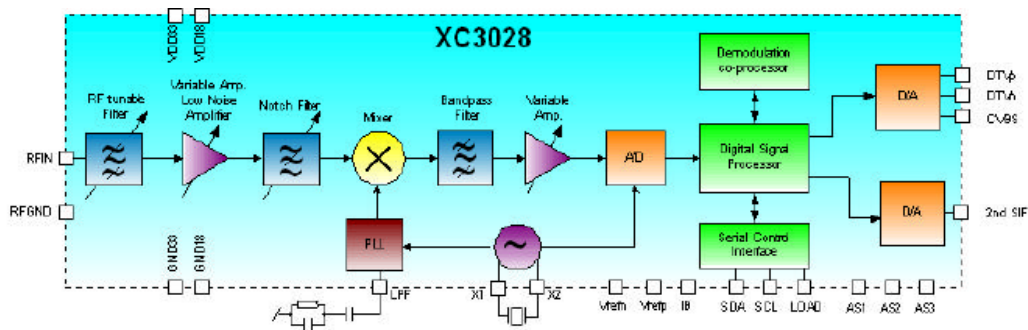
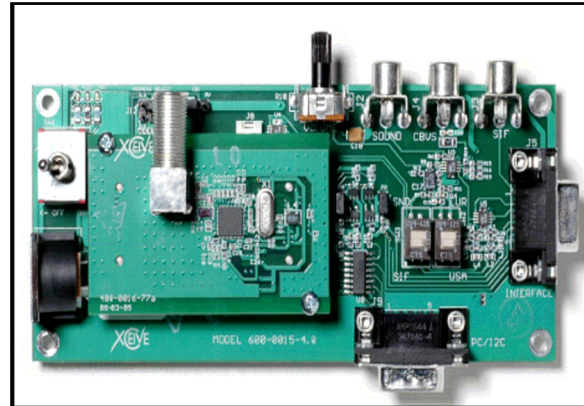
- NTSC, PAL, SECAM
- CVBS, SIF and audio output

Supports all digital TV standards:

- ATSC, DVB-T, ISDB-T, DMB-T, DVB-C

IIC bus controlled

Ultra small 48-pin QFN package, lead-free



#### SPECIFICATION

Outline Dimensions	7 x 7 x 0.85 mm
Supply Voltage (DC)	1.8V, 3.3V
System setting time	5ms
Input Impedance	75 ohms
VSWR (typical)	2.5
Noise Figure (typical)	6dB
Phase noise @10KHz (typical)	-85dBc/Hz
CTB	-63dBc
Image rejection	60dB
AGC range	80dB
Video S/N (unweighted)	48dB
Frequency range	42 - 864MHz
XC3028 Power Dissipation	< 1.2W < 1.0W

**Zenith**

HDV-420 \$260, ATSC OTA tuner, all-format HDTV reception, 1080i, 720p, 480p, 480i, and native output, 4th-generation VSB technology for improved terrestrial/cable reception and noise immunity, component, DVI, RGB 15 pin D-sub.

**Zoran**CES 2007

## SupraHD 760

The company announced a single-chip HDTV solution for ATSC tuners that integrates their HDTV processor technology with 8VSB demodulation technology at an exceptional price for the offered performance, so OEMs can manufacture cost-effective quality DTV products.

It supports full ATSC and NTSC functionality with a high quality video scalar, including LCD panels with 1440 x 900 resolution.

The chip features NTSC/PAL video decoder with advanced 3D comb filter, advanced 10-bit video processing for color fidelity of over 1 billion colors, adaptive edge enhancement, luminance and chrominance transience improvement, dynamic black level adjustment, integrated dual channel LVDS transmitter for direct connection to FPD, single-memory, 16-bit DDR memory interface, integrated HDMI/HDCP, market-proven ATSC software and TV application.

## **Chapter 12 - High Definition DVD**

### **HD DVD and Blu-ray Formats**

#### **Background**

Although this report covers the Hi-Def DVD subject comprehensively, please also consult the Hi-Def DVD section within the 2005 HDTV Technology Report for information before February 2005, and a complete background of formats, players, discs, audio/video codecs, etc.

I include below a summary of the basic background to facilitate the reading of this report, as follows:

The HD DVD disc is based in two 0.6 millimeter bonded discs (like regular DVD), with a capacity of 30GB dual layer (15GB single layer), which Toshiba says can hold up to 8 hours of HD. The Blu-ray disc has a capacity of 50GB dual-layer (25GB single layer) and is constructed with a 0.1 mm optical transmittance protection layer above the 1.1 mm substrate. Both competing formats use blue laser technology.

Both formats selected MPEG-2, MPEG-4 H.264, and WMV-9 VC1 as mandatory video codecs and all players must be able to decode them to be compliant. Discs would have to be encoded with at least one of them, at the choice of the content provider.

Triple and four layer discs for longer duration were also invented, as well as hybrid discs that would hold the HD and DVD version of a movie in the same disc, which would help consumers, replication, and distribution channels alike.

In October 2004, the DVD Forum and the Blu-ray Disc Association approved mandatory and optional audio formats for both Hi-Def DVD standards. Both groups approved Dolby Digital 5.1 and DTS 5.1 as mandatory HD player formats, which also ensure the audio playability of 5.1 multi-channel DVDs when played on HD players. At least one of the audio formats must be included on a pre-recorded disc, at the choice of the content provider.

In the 4th quarter of 2004, Dolby announced its Dolby Digital Plus lossy format, a higher-bit rate enhancement to Dolby's existing AC-3 lossy format (refer to the Glossary for details). DTS also announced their DTS ++ (later named DTS-HD), and later further extended to DTS Master Audio naming convention, capable of higher bit rates, and lossless.

At that time, both Hi-Def DVD format groups declared optional the player's ability of decoding the 6.1 channels of DTS. On September 23, 2004, Dolby announced that the DVD Forum decided to include as mandatory audio formats for HD DVD at Dolby Digital Plus and MLP Lossless based Dolby True HD. MLP is the core audio technology behind multichannel DVD-Audio.

During 2005/6 more multi-channel audio format decisions and announcements were made regarding their mandatory/optional application to both Hi-def DVD formats. Please consult the details on the Glossary or on the Multi-channel Audio section.

## **Formats Reconciliation**

The reconciliation efforts to unify the two competing formats gained strength at CES 2005, the efforts were lead by Toshiba (HD DVD) and Sony (Blu-ray). Unfortunately, the efforts failed shortly after, and the two formats were left heading to a market war. The history of CE has demonstrated many times that market wars are not good for establishing formats or standards, much less for consumers.

Phillips indicated that the war of formats is driven by the goal of collecting future royalties for the standard patents of the adopted format. Additionally, computer companies would produce PCs with drives that go along with the format they support, Blu-ray on Dell PCs for example.

Regarding plants for disc reproduction, when the formats where not even released, it was estimated at \$150,000 the cost for adapting an existing DVD plant to been able to produce HD DVDs, while it would cost about \$3 million for the adaptation of the same plant to produce Blu-ray discs. Sony responded by saying: "Blu-ray costs would quickly come down and the difference between costs of the two formats would be minimal."

According to Shina Abe, who runs the Panasonic replication task for Blu-ray, a test was made to measure the time it takes to produce a Blu-ray disc at a Panasonic plant in CA. It took about 4.5 seconds, and the expectation is to reduce that time to 3.5 seconds per disc.

Regarding combo lasers, a HD DVD single pickup with objective lens was reported to be able to hold 3 lasers (CD, DVD, and HD DVD), while Blu-ray objective lens are more complicated and more costly to implement in a similar feature, but it would still possible to make the combo pickup. Check the Universal Player chapter below.

In 2006, Toshiba declared they would "still like to develop a unified format for advanced optical DVD discs, but two competing -- and incompatible -- products are likely to hit the market at first".

"We have not given up on a unified format. We would like to seek ways for unifying the standards if opportunities arise," Toshiba President Atsutoshi Nishida told an annual shareholders' meeting.

## **Associations of the Formats**

### Sep 06

Sun Microsystems, the developer of the Java environment employed in Blu-ray, announced their association with the Blu-ray Disc Association (BDA) and became a member of the board of directors, joining more than 170 companies already belonging to the association, among which are Apple, Dell, HP, Hitachi, LG Electronics, Mitsubishi Electric, Panasonic (Matsushita Electric), Pioneer, Royal Philips, Samsung Electronics, Sharp, Sony, TDK, Thomson, Twentieth Century Fox, Walt Disney Pictures and Television and Warner Bros. Entertainment.

The company declared plans to include Blu-ray technology into its Java platform and offer its interactive capabilities to the format's movies, games, or other content.

## Formats - Companies Support

In Jan 06, iSuppli published the following summary table that shows the manufacturer and studio support to both formats, I updated that table on Feb 07, as follows:

### Blu-Ray and HD DVD Participants

Standard	Equipment and Components	Content and Software
<b>Blu-Ray</b>	Apple	Buena Vista Home Entertainment
	BenQ	Eagle Rock Entertainment
	Dell	Electronic Arts (Games)
	Hitachi	Fox Film Entertainment
	Mitsubishi	LIONSGATE
	Panasonic	MGM
	Philips	Miramax
	Pioneer	Sony BMG Music Entertainment
	Plextor	Sony Pictures Home Entertainment
	Samsung	Sony PlayStation
	Sharp	Twentieth Century Fox
	Sony	Universal Music Group
	TDK	Vivendi Universal (Games)
	Thomson	Walt Disney Home Entertainment
<b>Both</b>	HP	Paramount
	Sanyo (components)	Warner Bros
	LG (Multi-format)	
<b>HD DVD</b>	Acer	Bandai Visual (animation)
	Canon	Genius Product, Inc.
	Fujitsu	HBO Home Video
	Funai	Microsoft Xbox
	Intel	New Line Home Entertainment
	Kenwood	Studio Canal
	NEC	The Weinstein Company
	Niveus	Universal Studios Home Entertainment
	Toshiba	

Original Source: iSuppli Corp. January 2006 , with my corrections and additions dated Feb 07

## **Universal Player**

### **Samsung**

On September 2005, Samsung announced their work on a dual format player that would support both HD DVD and Blu-ray in the same unit. At that time, Choi Gee-Sung, Samsung's consumer electronics chief, indicated that the unit would be made available during 2006.

Likewise, Samsung representatives at CEDIA 2005 confirmed the effort, but did not specify how they were planning to deal with the two different discs, nor it was clear if there will be two different laser pickup hardware pieces.

Three months later, Samsung confirmed a change of direction. Samsung's North America senior vice president of marketing, Peter Weedfald, stated: "The rules that govern the organizations touting the different technologies currently bar manufacturers from combining the two standards into a single drive".

An analyst from iSupply, Steve Kovsky, reported that a Japanese CE manufacturer expressed: "Technically it is possible, but at this point, it doesn't look like it will happen, which is a shame, because it will hinder adoption."

Adding to the subject of how Samsung could address a dual format Mr. Weedfald commented:

"The conundrum is that you've got two different camps. You've got licensing issues, you've got trademarks, you've got copyrights" he said. "You can't just be on the Blu-ray side and say, '*We will put HD DVD in there*', and the reverse is true. Samsung may make a separate line of HD DVD players to complement the Blu-ray players it plans to release later this year. This would allow Samsung to support both formats, although not in a single product. The company, however, does not have current plans to do so", he said.

In June 2006, Samsung confirmed again that they had no plans to release a universal player for both formats in 2006 or early 2007, while Korean executives indicated, "Samsung has the ability to produce such a player, but does not have the intention to actually do so". Du-hyon Kim, an assistant manager in Samsung's home platform product planning group, added:

"We are considering a player that can play BD and HD-DVD, a universal player. We can't say when we might introduce such a player. If we launch a universal player, the decision would be made at the end of this year or early next year. Samsung has no intention to join the HD DVD player market, but if market trends are going to HD DVD or to a universal player, then we are going too. We are concentrating on Blu-ray. However, although Samsung has communications and alliances with Toshiba on standard DVD products, the two companies have no formal licensing agreements on HD DVD, but we want to make clear that Samsung is 'fully committed' to Blu-ray".

However, in April 2007, Samsung announced their plans to release a Duo player that would be able to play HD DVD and Blu-ray discs, the player will be available by the holiday season of 2007. The BD-UP5000 would also support the interactive technologies of both formats (HDi and BD-Java).

## **LG**

LG also confirmed several times during 2006 that they had no plans for a universal player "the future DVD hardware plans was not yet defined", the company said.

In March 2006, LG said that the players in both formats they planned for release later in 2006 will not be released, instead, the company is planning to develop a dual-format player and release it in late summer/early fall "in light of the uncertainty in this early stage of the market for pre-recorded high-definition optical discs", LG's VP Bob Perry said.

LG also announced in Mar 06 and later again in the year, their support for HD DVD, without dropping their support for Blu-ray. LG expected to announce the first HD DVD product in late 2006, its European president James Kim told Reuters on CeBit in Hanover, Germany. "We will do both," Kim said.

LG confused the market and the consumer expectations by issuing intermittent yes/no announcements of a universal player at several events over 2006, taking many by surprise by actually announcing at CES 2007 that a universal player will be available in 4 weeks.

However, the LG's universal player, announced to become available in Feb 07 for \$1200 (the BH100), was quoted as having licensing issues with the DVD Forum due to its inability to fully support HD DVD's interactivity standard iHD developed by Microsoft, which would disallow the use of the HD DVD logo on the player and on advertising, and, Microsoft said, if LG uses the HD DVD logo on the player, the DVD Forum would have to press charges against LG. LG did not respond to my inquiry.

### **The Universal Confusion**

LG's universal player must have been in production long before the company repetitively indicated "no plans" for a universal player, otherwise it could not have been on the street the first week of February 2007.

LG's contradictory announcements for over a year convey an image of lack of trust to company statements, and although I am not a journalist, I would rather not disseminate any analysis based on information provided by LG, because it could create more confusion and uncertainty than not saying anything at all.

Although the company stated that the creation of the universal player had the consumer in mind, after witnessing the several conflicting announcements, it is rather obvious that the company was actually looking for a profit out of the confusion of the format war.

Charging consumers \$1200 for their player does not actually help consumers, considering that the only thing consumers would have to do is wait until one format drops out of the war due to insufficient sales or pushed down by price competition.

At the end of the war, a top-of-the-line player from the winning format would have then a relative cost of probably even less than half of the price of the universal player. A consumer buying into the universal product for the sense of a safe choice would have actually wasted a large part of the investment, because the other format

did not survive, the studios supporting only the losing format would have reissued the discs on the winning format, and the enhanced playing ability of the expensive universal player becomes useless when there are no discs to play.

My recommendation is buy the product you need for your purpose when you need it, regardless of the format war, regardless of the profit LG appears to pursue with their universal player. However, if you can wait, let these companies learn a lesson and buy nothing until the war is over.

### **We Do it For the Consumer**

Ironically, the same path taken by LG above (Jan 07) is being followed by Samsung with their "yes we will, no we won't, maybe, definitely not - for sure". After the many contradictions, Samsung just announced (April 07) a Duo unit to become available for the 2007 holidays. Check the Blu-ray equipment further down.

The format war has given path to a land of profitable opportunities these companies adapt by switching directions very loosely to find angles of quick revenue within the consumer confusion, confusion they themselves created with a non-sense war of formats.

Then, when they release a product as "this is to benefit the consumer", rather than admitting the true intention of the introduction.

We know companies are there to make money, but exploiting the pockets of undecided consumers is not good business.

### **Player Interactivity**

A variety of interactivity features comes with both formats and on the demos it was very interesting to see how a viewer could perform new and many current functions in superimpose mode, functions than in DVD would require stopping the movie or going to the menu.

Some of those features are the ability to call up picture-in-picture overlaying with the viewed content to run commentaries, download extra content with the player itself, such as video trailers sourced directly from the studios, etc.

HD DVD uses iHD based interactivity layer developed by Microsoft and Disney, while Blu-ray uses a Java-based solution developed by Sun Microsystems. In December 2005, HP, an old member of the Blu-ray board of the Blu-ray Association, announced that it requested Blu-ray to comply with home networking interactivity features (Mandatory Managed Copy and iHD) to be more appealing to computer users and to be included within the near future MS Vista PC operating system, expecting lower development costs and to be similar to the implementation done by HD DVD.

However, the request was not approved because the BD Association did not want to delay further the implementation of the format to add this feature. HP then decided to end its exclusive support to Blu-ray, and support HD DVD as well; in other words, HP is now supporting both formats. The BD Association indicated that iHD

functionality could be added in the future, but it will launch the Blu-ray format with the Java based support.

Maureen Weber, general manager of HP's personal storage division confirmed the decision by stating "By joining the HD DVD Promotions Group and continuing work with the Blu-ray Disc Association, HP will be in a better position to assess true development costs and, ultimately, provide the best and most affordable solution for consumers."

### **Content Protection for Hi Def DVD**

Advanced Access Content System, AACS, is the Hi Def DVD digital rights management system used for both formats, even though they have two different format regulating organizations (DVD Forum for HD DVD, and BD Association for Blu-ray).

AACS was jointly developed by a group of companies including Intel, IBM, Disney, Microsoft, Warner Bros., Toshiba, Panasonic, and Sony. The AACS content protection system can revoke a number of levels of keys for content and players.

Additionally, the Blu-ray content protection system employs 2 extra components:

- A) BD+ to provide content protection renewability, and
- B) BD ROM Mark, to control against mass production piracy, mass duplication, and unauthorized copies of pre-recorded media.

The BD+ controls the playback on players that have been attacked by updating the security of the player that has been compromised. Players that have not been attacked but still vulnerable would not be affected by this control, in other words if one player of a model line has been attacked, the system will disable that player not the entire model line.

The BD ROM Mark is an identifier in Pre-recorded BD-ROM movies produced by licensed BD-ROM manufacturers to disallow playback on unlicensed players when read by a player before the disc will be allowed to play. The ROM Mark is unique per movie title, not per disc, and helps control illegal disc replication.

The BD Association (for Blu-ray) has agreed to adopt the Mandatory Managed Copy (MMC) feature as a requirement on the format. MMC is supported by Microsoft and Intel for the copying of video, however, the BD Association rejected the support to iHD for now, as mentioned above.

MMC technology would allow the content of the High Definition DVD to be copied on a home-server and stream it throughout the entire home network, although it would not permit unrestricted copying.

In February 2006, the HD DVD Promotion Group confirmed that "negotiations on the finished spec for the Advanced Access Content System (AACS) used to protect both HD DVD and rival Blu-ray Disc content are nearing completion and should be ready in time for the March rollout of Toshiba's HD DVD first generation players, and since AACS is primarily software it could be added to finished players in a flash-memory upload."

In July 2006, a German CT magazine declared it found a security hole in the copy protection built into HD-DVD and Blu-ray player software by just pressing the "print screen" button on the computer keyboard which made possible to copy every frame of an HD movie, a manual process that can be automated to repeat it for all the video frames of a movie.

Please check the HD Content Protection section for more coverage of AACS, and its situation of security breach with HD DVD and Blu-ray.

### **AACS Down-Res**

In January, 06, the AACS (Advanced Access Content System) consortium, the organization responsible for content protection on the new Hi-def DVD formats, reached an agreement to require manufacturers of the two High Definition DVD player formats (Blu-ray and HD DVD) to enable their players with the ability to reduce the resolution over component analog connections from 1920x1080 to 960x540, one fourth the quality of the image stored in the disc, when responding to a digital flag (Image Constraint Token) stored within the disc movie.

The player's digital outputs (HDMI or DVI) will still carry the full resolution of the disc because the outputs are protected by HDCP. Component analog connections cannot carry that protection, reason by which the resolution would be downgraded. The agreement would affect approximately 11 million HDTVs sold since 1998 suited only with component analog inputs, and many Home Theater PC (HTPC) systems not suited with HDCP compliant connections to the PC monitor.

According to the plan, the recording studio supplies the digital flag in the disc, if the studio sets the flag "on" the player would not feed a full resolution signal to the analog outputs.

To make a disc buyer aware, if a disc for a movie uses the flag, the disc package must disclose that the flag was used.

Manufacturers of players and software (movies) would have to comply with the AACS ruling in order to obtain their license, but it was left to the discretion of each individual movie studio to decide which movies to down-res HD content over component analog connections to 540p quality (DVD is 480p, HD is 1080p) by using the Token.

In March 2006, Sony announced their decision of not applying the "Image Constraint Token" on their Sony Pictures Blu-Ray titles, this decision was apparently temporary, Sony preferred to postpone the use of the Token until analog piracy proves to be a problem.

After this announcement, other Studios decided to follow the same approach, such as Disney, Fox, Paramount, MGM, and Universal. They all stated that they have no intention of using this feature, which certainly provides some hope to about 11 million HDTV owners that only have analog connections on their TVs and were looking forward to enjoy high definition pre-recorded movies on them.

Please consult the analysis of the potential of this agreement later in this section.

## PVP-OPM

Consult the 2006 HDTV Technology Report for details, this content protection method was to be implemented in the new Hi-def DVDs to prevent pirates from attaching recording devices directly to the PC graphics card's DVI or HDMI video outputs to gain access to a fully resolved unprotected image of the content. Please review the detail of this subject on the HD Content Protection Section.

## Gaming

Sony first demoed the PlayStation 3 console (below) at CES 2006, which was planned for release during 2006 (originally May in US, spring in Japan) but was finally introduced in Nov 06. According to the original specifications, the PS3 would playback Blu-ray discs at 1080/60p and 1080i over HDMI, and is suited with a High Quality Image Processing driven by RSX Graphic Processor with a 32bit floating point processing for color video and audio.

At the 2006 CES booth, it was revealed that Sony was subsidizing the PS3 and releasing the console at a loss (approximately \$400) to help establish the Blu-ray format. Many BD player (non-gamer) consumers could be benefited if buying the PS3 instead of Sony's \$1000 standalone player, because both players were said by Sony to have the same performance and features (although that was not actually the case upon release, the 1080p24fps output was only a feature offered on the stand-alone player).



In May 2006, CNET published the following comparison between the PS3 and Xbox 360:

Console	Price	Availability	Optical Media	Memory	Chip
Microsoft Xbox 360 without HDD	\$299	Available	DVD with possible add-on HD DVD	512MB	3 IBM PowerPC CPUs each at 3.2 GHz
Microsoft Xbox 360 with 20GB HDD	\$399	Available	DVD with possible add-on HD DVD	512MB	3 IBM PowerPC CPUs each at 3.2GHz
PlayStation 3 with 20GB HDD	\$499	Nov. 17, 2006	Blu-ray	256MB XDR RAM	Cell Processor 3.2GHz
PlayStation 3 with 60GB HDD	\$599	Nov. 17, 2006	Blu-ray	256MB XDR RAM	Cell Processor 3.2GHz

Later in the year the Xbox add-on HD DVD player was actually made available.

In March 2007, Sony disclosed their plans to release a new model of the PS3 console with 80GB capacity.

In April 2007, Sony decided to discontinue the US distribution of the 20GB version of the PS3. Over 90% of PS3's sales were generated by the 60GB model. The 20GB version would still be supported by Sony, and will still be offered for sale in Japan.

### **How Much does the PS3 Actually Cost?**

In November 2006, upon the introduction of the PS3, CNET provided an estimate of the actual cost of the console and its parts to help put in perspective the effort that Sony was doing to bring this console to market successfully for the gaming market and for the Blu-ray format.

CNET estimated the total cost of the console as follows "The game console might cost you \$499, but it's got \$806 worth of parts and manufacturing behind it, a research firm says".

CNET continued, "The cost of manufacturing and materials for the low-end, 20GB version of the console comes to \$805.85, iSuppli said in a report Thursday. That means that for every PS3 Sony sells for \$499, it will lose \$306.85 on components alone. Marketing and advertising costs would then boost the actual cost to Sony even higher.

The PS3 with the 60GB hard drive comes with a manufacturing and component bill of \$840.35. Since it sells that version of \$599, the component bill exceeds the retail price by \$241.35, iSuppli said. A Sony representative would not comment on the PS3's manufacturing costs."

Other analysts estimated the manufacturing and material costs for the PS3 between \$725 and \$905.

Merrill Lynch was quoted as saying "the PS3 manufacturing and materials cost could drop to \$320 in three years".

It is known that video game consoles manufacturers subsidize the hardware to recover the investment by selling expensive game software, but in this case the console has a feature that would facilitate the Blu-ray format establishment, an important matter for Sony.

In comparison to the other format, in Nov 06, the Xbox manufacturing and materials cost \$323.30, the box itself sold for \$399. CNET said, upon introduction "the manufacturing and materials costs for the box came with a component bill between \$501 and \$525".

CNET added "The higher costs for the PS3 are largely driven by the expenses associated with the Blu-ray Disc drives and the custom chips used inside the machine. The Blu-ray drive costs \$125, while the Cell microprocessor likely costs about \$89. The reality synthesizer, a graphics chip from Toshiba designed for the

PS3, comes to \$129, and an incredible motherboard and power supply that costs \$37.50, about double the price of the ones that go into PCs.”

In other words, the PS3 is an incredible deal for either gaming or Blu-ray playing, and much more if the consumer heart is looking for both activities.

### **Cables for PS3**

Monster Cable said it designed a GameLink line of high-performance audio/video cables to connect with HDTVs.

An HDMI cable that features 720p, 1,080i and 1,080p video, 5.1 and 7.1 channel surround-sound audio, silver-content solder connections for optimum transfer of low-level signals, a nitrogen gas-injected dielectric insulator that maximizes video signal strength, 24k gold contacts and heavy-duty shielding for maximum rejection of interference for graphics, Duraflex protective jacket, announced for \$100.

As alternative to the HDMI connectivity, Monster released another cable: the GameLink Component Video & Fiber Optic Digital Audio Cable Kit, which includes all the cables needed for 720p/1,080i high-definition video and digital surround sound, 24k gold contacts and PS3 Multi-AV Connectors, “Extra Low-Loss Optical Fiber” to reduce digital jitter, the kit was announced for \$70.

Another introduction was the GameLink Component Video & Stereo Audio Cable, for 720p/1,080i HD and enhanced stereo sound hook-up into a single cable, implementing Monster’s proprietary SingleHelix construction, with dual conductors twisted in a special helical configuration reject RF and EM interference, for \$60.

### **Console Comparative Speculations**

In December 2006, after the release of PS3, there were a number of comparative speculations made by some industry sources, such as “Sony’s PS3, priced at around \$600, faces two main competitors in Microsoft’s Xbox 360 at around \$400 and Nintendo’s Wii for about \$250”, adding that the PS3 seems to impose die-hard gamers to invest in a Blu-ray player they might not actually use.

PS3 at CES 2007 below



Microsoft introduced the optional HD DVD player with full-length film and TV downloads in HD via its Xbox Live online gaming service, and does not impose its

purchase to Xbox gamers that just want gaming.

Mark Knox, a spokesperson for the HD DVD consortium, indicated, "we know that every HD DVD drive being sold to Xbox users is being used to watch films. They're not being forced to buy it," he said.

"Every PS3 includes a Blu-ray drive, but that doesn't mean every gamer wants to watch a movie on PS3."

### **Xbox 360**

The console was launched by Microsoft in November 2005, sold 5 million units worldwide by June 2006, and planned to ship 10 million units by December 2006.

Originally, Microsoft announced at CES 2006 that they would release an external drive to allow the Xbox 360 game console to be able to play HD DVD discs and shortly after they commented that they could even do the same for a Blu-ray external drive, although that was graciously corrected later with "we have no plans for Blu-ray".... The external HD DVD drive was actually made available.

#### Oct 06

Microsoft announced the addition of 1080p outputs to the Xbox 360 game console HD DVD player accessory (when released), and over 85 enhancements to the game console itself, including the playback of WMV files from a connected PC, disc, or USB storage device, in addition to its current feature of receiving streaming video from a Windows Media Center PC. After the downloaded upgrade it would also receive from Windows Media Connect or Windows Media Player 11. No HDMI spec was provided at the announcement. Support for 50hz HDTV display modes was added.



Microsoft also reiterated their plans to launch the HD DVD add-on drive later in Nov 06 for \$199 with a free copy of Peter Jackson's "King Kong" from Universal on an HD DVD disc for a limited time.

According with Microsoft, the free update will be distributed thru the Xbox Live online gaming and entertainment network to all members (Xbox Live Silver and Xbox Live Gold) with no disc or hard drive required.

#### Nov 06

Microsoft announced their delivery of HD and SD movie and TV downloads via broadband connection to the Xbox 360 game console beginning Nov 22, 2007.

CBS and Viacom with programs like CSI, Jericho, and Numb3rs would be supplying content. Viewers could own downloaded TV programs, but movies could only be rented for a 24-hour period starting when is played, and stay in the HDD for 14 days.

Microsoft's VC1 Windows Media Video HD codec at 6.8Mbps and 5.1 Surround Sound will be used in all content, which would occupy about 4-5 GB for HD content, and can start playing when a "ready to play" message appears, even if the content is still downloading.

Over 200 hours of HD downloadable content was anticipated by Microsoft from CBS, Warner Bros, Viacom, Paramount, UFC and Turner, before the end of 2006.

The announcement was made one week before the Sony PS3 was expected to be released, and it would allow the Xbox to play HD movies without the consumer buying the HD DVD external player for \$199, a feature option that the PS3 would not have because the player is built into the console.

#### Mar 07

Microsoft introduced the Xbox 360™ Elite, an upgraded video game console with 120GB HDD, TTM Apr 29, 2007, \$480.

Features HDMI for 1080p, a high-definition cable, premium black finish, 30 feet wireless controller with 30 hr battery life with two AA batteries (\$50 if sold separately), and Xbox Live® headset, optional Play & Charge kit rechargeable battery and cable (\$20), optional rechargeable battery pack for 25hrs of play \$12).



The HDD can be sold separately for \$180 to mate the current model.

#### **Hi-Def DVD Formats Specifications**

Consult the 2006 HDTV Technology Report for background information.

#### Mar 07

The BDA has mandated that all Blu-ray players sold after Oct 31, 2007 must have PIP video capabilities using the BD Java interactive technology, and must hold a minimum of 256MB of persistent memory storage to support the PIP feature, and must conform to all BD the specifications of the standard. A BD player with Internet connection must also be provided with 1GB memory to store web-downloaded content.

## Computing – Hi-Def Laptops

### Toshiba

Microsoft announced at CES 2006 that they will support HD DVD on their Vista operating system. Microsoft, Intel, and NEC are backing the HD DVD format.

Toshiba also announced March's 2006 availability of the Qosmio notebook with new Centrino Duo processor with a HD DVD drive, CD/DVD multi-format read/write capabilities, \$3,000 price range, 1080p screen, and HDMI output.

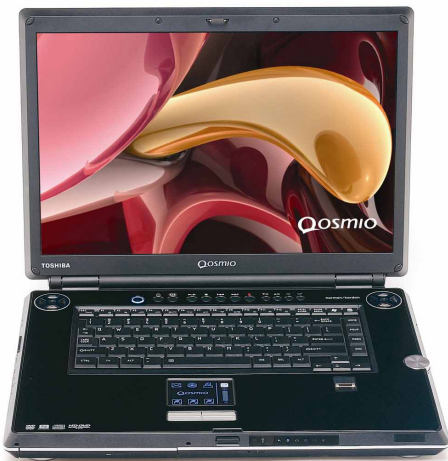


### May 06

Toshiba actually released the notebook above as the Qosmio G35-AV650, 17-inch display, resolution of 1,920 pixels by 1,200 pixels, plays back HD DVD, 2GHz Core Duo processor from Intel, two 100GB hard drives with RAID (redundant array of independent disks) support, 1GB of DDR2 memory, Nvidia's GeForce Go 7600 with 256MB of DDR3 memory, \$3,000, 10.1 pounds, Microsoft's Windows Media Center Edition 2005 operating system, no support for Intel's Viiv program on this system, maybe on future releases, according to Toshiba.

### CES 2007

Toshiba introduced the Qosmio G30/97A, an upgraded model of the existing Qosmio G30 laptop computer, \$3000 in Japan, TTM TBA but estimated 1Q07.



It features Intel 2GHz Core 2 Duo processor, 17-inch widescreen display 1920x1280, 4.8-kg, 320GB HDD, digital TV tuner, HDMI output.

The first notebook computer with HD DVD-R optical drive that can burn up to 30 GB of data, video, photo, music onto a single HD DVD recordable disc, as well as playing HD DVD movies, featuring Microsoft Windows Vista™ Ultimate operating system, HDTV tuner, digital video recorder.

This is a new Qosmio (left), which not only

plays HD, but also burns custom HD DVDs.

### Apr 07

Qosmio G40 (right), Intel Core 2 Duo T7300P CPU, 2GB of RAM, 512MB GeForce 8600M GT graphics, dual 200GB HDD, HD DVD drive, HDMI 1.3, 17" display 1920x1200, available in Europe in Jun 07 for about 3000 Euro.



## **Dell**

Dec 06

Dell introduced the XPSTM M1710 (price starts at \$3,700) consumer notebook computer with read/write capabilities across CD, DVD and Blu-ray Disc 50GB media.



48 Mbps, 1080p, 7.1 channels of uncompressed surround sound, options for up to 32 audio streams, NVIDIA® PureVideo™ technology, Intel Core 2 Duo T7600 and Intel Core 2 Duo T7600G (2.33GHz, 4MB L2 Cache, 667 MHz FSB) processors, Superior NVIDIA GeForce Go 7950 GTX graphics processing unit with 512MB, up to 4 GB 667 MHz DDR2 memory, Serial ATA HDD up to 160 GB.

## **Fujitsu**

Apr 06

Fujitsu announced they will be the first company to release desktop computers suited with Blu-ray drives and also other notebooks with HD DVD drives, TTM Jun 06.

The desktop PC from Fujitsu features a 37-inch LCD screen, \$5,000, in Japan. The notebook was expected to be around \$3,300.

## **HP**

Apr 06

The company announced similar plans of PCs implementing either format by fall 06. As mentioned before, HP has decided now to support both formats.

## CES 2007

Pavilion dv9000 notebook PC \$1624, TTM now  
17 inch, optional HD-DVD ROM with Super Multi DVD+-R/RW Double laser technology, Intel Core 2 Duo and Solo mobile processors or mobile AMD Turion 64x2 dual core and Mobile AMD Sempron processors.

## **Samsung**

Feb 07

Samsung introduced the M55 notebook PC with a Blu-ray drive.

Features an Intel Core 2 Duo T7200 2.0GHz processor, 2GB RAM, 120GB SATA hard disk drive, and GeForce Go 7600 graphics with 256MB RAM, 17-inch LCD screen with 1920x1200 resolution, WiFi 802.11 a/b/g, and Bluetooth.



## **Sony**



Sony's new line of Vaio RC desktops, Blu-ray support for recording 1080 HD content to 50GB Blue-ray (Dual Layer) discs, aimed at audio/video professionals, high performance configuration designed for video capturing, editing, burning and

other intensive multimedia tasks, TTM Summer 06, start at \$2,300.

#### May 06

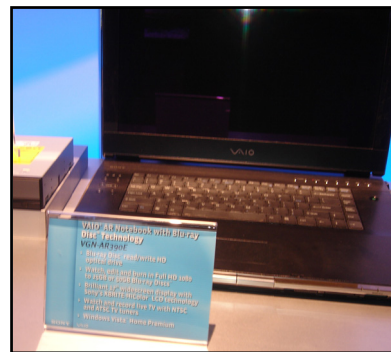
Sony Electronics introduced the Blu-ray enabled VAIIO AR190G, 17-inch screen, HDMI, BD writer, \$3,500, FireWire connection, you get a 2.0GHz Intel Core Duo processor, a midrange Nvidia GeForce Go 7600GT GPU with 256MB of VRAM, a 200GB 5400 RPM SATA hard drive, TV tuner.

#### CES 2007

VGN-AR390E VAIIO AR Notebook with Blu-ray Disc Technology, read/write HD Blu-ray discs, watch/edit/burn full 1080 to 25GB or 50 GB discs. 17" screen, watch and record ATSC and NTSC TV with dual tuners.

Sony also introduced a high-definition living room PC (VAIO XL3) with an integrated Blu-ray Disc™ drive, a Digital Living System™ to watch HD movies and record, store and playback personal content on high-capacity BD media.

Features built-in NTSC/ATSC tuners, unidirectional CableCARD™, wireless remote and keyboard, stylish, horizontal form factor for entertainment rack installation, connects to a television via an HDMI™ cable, camcorder video applications to capture, edit and burn to Blu-ray Disc HD media in full 1080 resolution.



Additionally, it features Intel® Core™ 2 Duo processor, NVIDIA® GeForce® 7600 GTL graphics, 2GB of RAM memory, 500GB hard drive, CPU with liquid cooling technology, Microsoft Windows Vista™ Home Premium operating system with Media Center, Sound Reality™ technology to boost audio performance, support for Direct Steam Digital, TTM March 07, \$3,300, crimson black.

### **Computer Drives**

(CES 2007 and late 2006 equipment introductions follow the group below).

#### **BenQ**

The company demonstrated in June 05 at Computex 2005 a Blu-ray DVD burner expected to become available in the 1-2Q06; the model BW1000 can write at 2x for Blu-ray single and dual layer, 12x for DVD+R/-R, 4x for DVD+R/-R dual layer, and 4x for DVD+RW/-RW. It reads at 2x for Blu-ray, 12x for DVD and 32x for CD.

#### Jul 06

Although not introduced as part of an US line the company unveiled a Blu-Ray recorder, the BW1000, \$1000, TTM Aug 06, burns CD, DVD, single and double layer Blu-ray BD-R/-RE media, 25GB or 50GB discs.

Writing speeds of 2x for BD-R/-RE single-layer and DL (single-sided double-layer) discs, 12x for DVD+R/-R, 4x for DVD+R/-R DL, 8x for DVD+RW/-RW, 32x for CD-R and 24x for CD-RW.

Reading speeds of 2x for Blu-ray, 12x for DVD and 32x for CD-R.

## Dell

Dell already supported Blu-ray, and Apple Computer has decided to join the Blu-ray group as well.

## NEC

NEC HD DVD-ROM Drive HD-1100A (below)



## Pioneer

Pioneer unveiled their first Blu-ray disc computer drive, the BDR-101A, with 25GB of storage, TTM 1Q06, \$1000, plays BD-ROM discs, and plays/records standard DVD, would offer HDTV recording capabilities with a PC HDTV tuner, as well as having 2x speed at Blu-ray, and 8x at DVD+-R, and 4x at rewritable DVD-+ formats. It can also support the reading of BD-ROM/R/RE, and all the other DVD -+ ROM/R/RW formats.



## May 06

Pioneer announced that was shipping the industry's first Blu-ray Disc (BD) computer drive, BDR-101A, single layer 25GB burn capability, bundled with Sonic Solutions'® Roxio® Blu-ray Disc software and blank media by TDK, targeted towards professional users and technology enthusiasts.



## Sony

Announced an external computer drive that will play and record BD discs, expected by year-end.



## Toshiba

Toshiba HD DVD slim drive (right)

## CES 2007 and Late 2006 Computer Equipment Introductions

### Hitachi

Super Multi Blue Drive, TTM Aug 06



HP

HP released its first Blu-ray disc player/writer, the HP bd135, records HDTV broadcasts, and stores data, digital photos, music and camcorder footage.

LaCie

LaCie introduced a Blu-ray external drive, the d2, compatible with Macs and PCs, and capable to read, write and rewrite 25GB or 50GB BD-R and BD-RE media, as well as being backward compatible with DVD and CD formats. TTM Jan 07, \$1,149.

LG

LG introduced the GGW-H10N Super Multi Blue 50GB dual format (Blu-ray and HD DVD) drive for computers, TTM May 07, compatible with DVD and CD



read/write, can record Blu-ray 4x-

speed 50GB discs, can only read HD DVD, \$1200.

GBW-H10N Blu-ray only 4x-speed BD-R/BD-RE PC drive that can record 25 GB Blu-ray (single-layer) blank media, compatible with CD-R/RW, DVD-R/RW/RAM +R/RW.



Niveus Media

Niveus Media introduced its Pro Series servers supporting HD DVD, the n7 and the n9 in rack mount, featuring Intel Viiv technology, Core 2 Duo Extreme processor, Nvidia's GeForce Series 7 Graphics, HDMI output, faster frame rates, "enough horsepower to distribute audio and video throughout a multi-zone home," according to the company.

Based on Windows Media Center Edition 2005 and Niveus' Summit Series platform, Niveus' proprietary Glacier Passive Cooling technology, active and passive cooling, and patent-pending Niveus Convergence Panel, RS-232, integrated SD and MMC flash card reader and RAID 5 Hard Drive Data Protection.

Additionally, Niveus announced its participation in the following programs: AMX's InConcert manufacturer partner program, Crestron's Integration Partner program and Exceptional Innovation's Life|ware Ready program. The company will also

continue to work with Netstreams, Universal Electronics and Vantage to ensure compatibility.

TTM Sep 30, 2006

n7                \$7,000  
n9                \$15,000

Two more HD DVD supporting Media Center servers, Niveus Media's 2007 Summit Series, were announced in the lower price range:

TTM Sep 30, 2006

Denali            \$3,500  
Rainier            \$7,000

As specified by the company "Denali features Niveus' Glacier Passive Cooling technology, as well as the patent-pending Niveus Convergence Panel. Providing faster frame rates, higher quality television, faster music encoding, rich graphics, and quicker response time.

Niveus' 2007 editions are amongst the first Windows Media Center systems to incorporate Intel's Viiv technology, Core Duo and Core 2 Duo processors, HD DVD and HDMI output; all in an audio/video component, based on Windows Media Center 2005 software.

The new Rainier includes: HDMI, integrated IR Receiver/Blaster, Serial (RS-232), Wireless 80211.b/g, integrated flash card reader (SD, MMC), Niveus' unique industrial design with an all new front panel and the signature extruded aluminum heat sinks, Imaging Science Foundation (ISF) Video Quality Certification.

The Windows Vista Capable 2007 Summit Series is eligible to receive the Windows Vista upgrade offered by Niveus.

#### Pioneer

Pioneer introduced their "Next Generation Combination Blu-ray Disc ROM and DVD/CD (Read/Write) Computer Drive - the BDC-202", TTM 2Q07, for computer OEMs and system builders, the drive features the following speeds:

<b>Format</b>	<b>Read</b>	<b>Write</b>
BD-ROM	5X	-
BD-R/-RE	5X	-
BD-R DL/-RE DL	2X	-
DVD-ROM	12X	-
DVD-RAM	5X	5X
DVD-R/+R	12X	12X
DVD-RW/+RW	8X	6X
DVD-RDL/+RDL	8X	4X
CD-ROM	32X	-
CD-R	32X	24X
CD-RW	24X	24X

Samsung  
Sep 06

Blu-ray supporter Samsung introduced HD-DVD player to their M55 notebook computers (source Engadget HD).

The new notebook claimed to be "world's thinnest and lightest 17-inch widescreen" notebook at 34.4mm thick, featuring a 256MB Nvidia GeForce 7600 Go graphics card, 120GB hard drive, 802.11 a/b/g wireless connectivity, Bluetooth 2.0, inputs and outputs galore, HDMI, Intel T2500 Core Duo processor.

The same source also claimed Acer and LG have also added HD-DVD to some devices.

Sony

Internal BWU-100A Blu-ray Disc drive, TTM mid-summer 06, supports recording of 25GB and 50GB BD-R (write once) or BD-RE (rewritable) discs, DVD R/RW and CD R/RW discs. 25GB Blu-ray disc will take approximately 30 minutes to burn, upon announcement there were plans to include software for capturing, editing, and burning discs of high-definition content from HDV camcorders.

Captures video as 1080i for viewing on a Blu-ray player in HD, or can downconvert to standard definition resolution for burning on a DVD disc.

Toshiba

Toshiba introduced the world's first desktop HD DVD Writer for content creation in Media Center PCs, the new SD-H903A, which provides read and write support also for legacy formats (CD and DVD).



The unit was designed for single-bay desktop PCs, to capture content, edit videos, and create digital content repositories for movies, music, and photos.

It features support for dual layer discs, for up to 8 hrs of HD, 7,500 MP3 songs, or 30,000 high-quality images, large data back ups, etc., Serial ATA (SATA)

interface, volume shipments scheduled for Feb 07, OEM sampling in January.

<b>Write</b>	HD DVD-R SL: 1x; HD DVD-R DL: 1x DVD-RAM: Max. 3x; DVD-R SL: Max. 8x DVD-R DL: Max. 2.4x; DVD-RW: Max. 4x DVD+R SL: Max. 8x; DVD+R DL: Max. 2.4x DVD+RW: Max. 4x; CD-R: Max. 16x CD-RW: 4x; High Speed CD-RW: Max. 10x Ultra Speed CD-RW: 10x
<b>Read</b>	HD DVD-R SL, DL: 1x; HD DVD-ROM: 2.4x DVD: Max. 8x; CD: Max. 24x
<b>Interface</b>	S-ATA
<b>Buffer capacity</b>	8MB
<b>Power source</b>	+5V, +12V
<b>Operating temperature</b>	5-50 degrees C (excluding media)
<b>External dimensions (W x H x D)</b>	146mm x 41.5mm x 184 mm
<b>Weight</b>	830g typical

### Mar 07

Toshiba announced the introduction of the PA3530U-1HD1 external HD DVD combo that reads HD DVD at 1X speed, and CD at 24x, writes DVD+RW, DVD-RW, and DVD-RAM, USB 2.0.

#### Write speeds

DVD+R	4X
DVD+RW	4X
DVD-R	4X
DVD-RW	4X
CD-R	16X
CD-RW	10X
DVD+R DL	2.4X
DVD-R DL	2X
DVD-RAM	3X

#### Read speeds

HD DVD	1X speed (maximum)
DVD	8X speed (maximum)
CD-ROM	24X



### **Parts and Chips**

#### Dec 06

Sharp Electronics announced their commercial production of blue laser diodes used by both competing formats to read and write data on high-definition optical discs; the current volume of 150,000 units a month is expected to be raised to 500,000 units by the end of 2007 with several billion yen of investment, using Sharp's plant in western Japan.

In Nov 06, according to EE Times, there are several manufacturers working with multi-format components, as follows:

"Leading chip vendors such as Broadcom, STMicroelectronics and NEC Electronics told EE Times they are developing ICs that allow high-definition optical drives and players to comply with the two competing specifications.

Broadcom Corp. has already shipped the industry's first dual HD/BD decoder chip, designed into the first-generation Toshiba HD-DVD player and into Samsung's Blu-ray Disc player. Broadcom will also make its next-generation platform--a much more highly integrated system-on-chip that is scheduled for announcement soon--comply with both formats, while adding support for BD's latest profile.

ST is integrating the latest Blu-ray software changes into its STi7200 chip, originally developed for the set-top market, along with support for the middleware required by HD-DVD and Blu-ray. The chip will be in volume in 2007, Nurser said.

While both Broadcom and ST—for now—offer only the back-end decoder IC for next-generation DVD players, NEC Electronics Corp. last month began sampling a front-end processor chip set that can handle read/write operations for both HD-DVD and Blu-ray Disc players.

A back-end decoder must be able to handle different operating systems and separate middleware--Java for Blu-ray and Microsoft's HDi for HD. Some HD-DVD players are based on Windows CE, others on Linux. ST's universal player platform, for example, is built on Linux so as to cater to both HD and Blu-ray.

"You need to pay close attention to each spec, anticipate changes in the future and architect a chip with the right partitioning of software and hardware so that there will be a built-in flexibility," said ST's Lagomichos.

Broadcom's Shulsinger said the specs must be compared carefully to ensure that each device supports the more stringent requirements of the two. The specs themselves can be a moving target. Blu-ray Profile 2, for example, requires the system to connect to the Internet and decode two video streams. The chip decodes the primary stream in high definition and the second either in standard or high def, though dual HD streams may soon be required. That would mean "adding more memory to a chip", Shulsinger said.

More difficult challenges include cases in which one format supports items that the other does not, Shulsinger said. For example, both formats support the Advanced Access Content System, but Blu-ray requires an additional layer of encryption, known as BD+. An even bigger hurdle is the different programming environment. "It's the underlying software infrastructure that requires the huge effort" to make the decoder chip's software robust enough to work properly in both environments, Shulsinger said.

Both ST and Broadcom plan to enter the front-end IC business as well. ST is working with a Japanese chip vendor that supplies ICs for optical drives. Broadcom is considering partnering with another vendor strong in the optical drive market. It's inevitable that a DSP and the analog chips used in the front end will be integrated into the back-end decoder IC, said Shulsinger.

The optical side looms as a daunting technical issue. "The bottleneck is optical units," said NEC's Niitsu.

Either a dual-format optical pickup unit or two separate optical pickup units would be necessary for any universal player, said iSuppli's Crotty, because each format stores information at a different depth on the disk.

Ricoh, for one, is developing an objective lens that can read and write disks of both formats. NEC has developed a front-end chip set consisting of two processors: the  $\mu$ PC3360, an analog signal processor that controls the optical pickup and reads out data from disks, and the  $\mu$ PD63410, a digital signal processor for data processing such as error correction.

NEC's chip set is designed to control read/write operations and process data from all the disks of 16 formats, including Blu-ray, HD-DVD, standard DVD and CDs (and I add, "according to other sources this chip would start shipping Apr 07").

ST's Nurser predicted that the cost delta for dual drives will become "very low" in 2007. Asked how much, he declined to comment, noting that he received the information under a nondisclosure agreement."

## PC applications for BD

Consult the 2006 HDTV Technology Report.

### Discs

Although both formats have done development efforts to provide multiple layer and hybrid solutions of 15GB, 30GB and 45GB from HD DVD, and 25/50/100 from Blu-ray, initially HD-DVD will become available in 15GB and 30GB versions and hybrid discs (HD and DVD versions of same movie), and Blu-ray in the 25GB and 50 GB versions, hybrid discs might arrive later.

Toshiba 38.5 GB hybrid disc is dual sided, 30 GB HD dual layer (15GB each layer) in one side for blue laser HD DVD, 8.5 GB on the other side for dual layer DVD version (4.7 GB each layer) readable with red laser.

The announced HD DVD 45 GB is a triple layer single sided blue laser-disc. The current 15 GB and 30 GB are also single sided, the 30 GB is a dual layer.

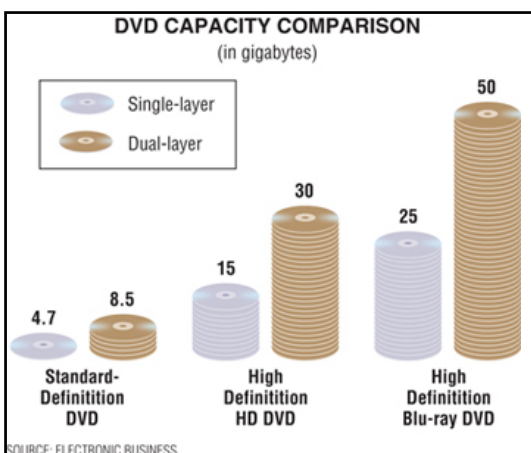


MEMORY-TECH HD DVD PRODUCTION LINE



MEMORY-TECH HD DVD MOLDING MACHINE

TDK announced that they have developed a 4-layer Blu-ray disc that is capable to store up to 100 GB, sufficient for holding four HD movies, and the company demo the prototype since CES 2006. The disc records at 72 Mbps, double the 36Mbps of Blu-ray, has special recording materials, and was able to perform at 6x speeds (216 Mbps) with prototype discs. TDK also developed DURABIS, a hard coating technology to protect the Blu-ray disc surface of scratches and fingerprints, to a level equivalent to 100 times better than an unprotected disc.



TDK discs will be available as 25GB BD-R (single-layer write-once), 25GB BD-RE (single layer, rewritable), 50GB BD-R (double layer, write-once), and 50GB BD-RE (double layer, rewritable).

Sony BD discs for recording featuring AccuCORE scratch-guard protection, were planned for release by summer starting with single layer R and RE, dual layer 50GB will follow. Regarding BD-ROM movies, Sony released 20 titles for the player's launch.

Sony announced in February 2006 their plans for their new films in Blu-ray to be priced at \$23.45 and catalog films at \$17.95. Sony's DADC (Digital Audio Disc Corporation) replication company was to begin producing Blu-laser 25 GB discs globally late February 2006 at a rate of 10 million per month with 30 replication lines. Sony planned that by the end of summer 2006 the plants would be ready for the 50 GB disc as well.

### **NME**

In August 2006, Britain-based New Medium Enterprises (NME) declared they had solved a technical production problem, which will now enable the manufacturing of a low-cost (about 9 cents, rather than 6 for regular DVD, according to Dutch company ODMS) multiple-layer DVD disc containing one film in different formats.

A multiple layer disc requires a player that is able to read it, and NME created new technology to read more layers than the current generation of DVD players, which can read up to two layers.

NME created DVD discs with 10 layers that are readable on the company's own player, and the company is willing to license the technology to other manufacturers.

### **Multi-layer Dual Optical Disc**

In September 2006, two employees of Warner Brothers filed for a patent for a hybrid HD DVD disc format that would store both HD DVD and Blu-ray content within two layers of one side.

Called a "multi-layer dual optical disc," would use the other side of the disc for other content, such a DVD version of the movie.

Blu-ray data is written at 0.1mm from the surface of a disc, while HD-DVD data is written at 0.6mm from the surface, the technique uses a semi-reflective film so either layer can be read selectively by the laser pickup, which means that either format would also be restricted to their individual single layer capacity (15GB for HD DVD, 25GB for Blu-ray).

### **Toshiba's Triple-layer Hybrid TWIN Disc Format**

Additionally, Toshiba announced yet another triple-layer hybrid DVD/HD DVD disc (a new TWIN format), to store both red-laser and blue-laser formats in a single side of the disc.

As mentioned above (and in the 2005 and 2006 reports), Toshiba also introduced their 38.5 GB dual side/dual layer disc (HD DVD dual layer 30GB in one side, DVD dual layer 8.5 GB in the other side), as well as their 45GB triple layer format for expanded capacity purposes, using 3 layers on one side.

In 2004, Toshiba and Memory-Tech proposed their first generation TWIN to the DVD Forum for approval, and the idea was to implement a practical, and cost beneficial to consumers, transition from DVD to HD DVD with a hybrid disc that would contain both formats, so consumers would not have to purchase the same movies again when they upgrade from DVD players to the HD DVD players.

The first generation TWIN is a single sided dual layer format in which the HD DVD layer holds 15GB of content while the DVD layer would hold 4.7 GB; certainly limited

in capacity, apparently unsuitable to long feature films, but according to Pony Canyon Inc. they have been releasing TWIN format titles very successfully since Apr 06.

The new TWIN disc was also developed together with Memory-Tech Corporation, and was submitted for approval of the DVD Forum. It is intended to store content as:

- A) Two HD DVD layers (30GB) and one DVD layer (4.7 GB)
- B) Two DVD layers (8.5 GB), and a third layer for HD DVD (15GB)

According to Toshiba, the same replication equipment with an additional process can be used to add the third layer in the manufacturing of discs.

From a consumer point of view, I personally find more practical to use different sides of the disc, one for the DVD version, and the other for the HD DVD version of the movie, and it would be practical if each side would still have the flexibility of dual layers.

A dual layer disc should be able to be read by any current player (DVD or Hi Def DVD). Dual layers per side would provide enough space for extended feature films, hi-bit audio codecs, and additional content, without having to sacrifice the quality of the video signal with excessive compression and low VBR (Variable Bit Rate).

Maybe by the time you read this, Toshiba would have submitted yet another disc format, however on the positive side, even with the reduced release of hybrid discs, the HD DVD format has done something positive for the transition from DVD. Blu-ray should be encouraged to do similarly, especially considering the high cost of single format Hi Def discs.

Consult the 2006 HDTV Technology Report and the 2005 HDTV Technology Report for information about other disc formats/inventions.

**Recording Media for HD DVD and Blu-ray**

Fujifilm  
Verbatim  
Advanced Media

Panasonic announced US introduction of BD discs for 2006 in 25GB and 50GB storage capacity, as follows:



Model Number	Specification	SRP*
LM-BE50DE	Rewritable, 50GB, Single-Sided, Dual Layer	\$59.99
LM-BE25DE	Rewritable, 25GB, Single-Sided, Single Layer	\$24.99
LM-BR50DE	Write once, 50GB, Single-Sided, Dual Layer	\$42.99
LM-BR25DE	Write once, 25GB, Single-Sided, Single Layer	\$17.99

*(data above courtesy of Panasonic)*

Jul 06

Verbatim announced availability of its new Blu-ray Recordable and Rewriteable media.

Initially discs will be only of 25GB, but Verbatim plans to release shortly a double-layer disc. Mass production of BD-R and BD-RE media can now be done.

Verbatim coats its discs with a ScratchGuard hard coat that protects the Blu-ray disc from scratches and fingerprints, and permits cartridge-less implementations.

BenQ and Toshiba were quoted to release Blu-ray recorders in the next few months, although not for the US market.

£20 for BD-R  
£24 for BD-RE

### **Sony** 1Q06

Sony announced the availability of the following BD discs:

25 GB write once discs (BD-R)	\$20, TTM Apr 06
25 GB Rewritable BD-RE	\$25, TTM Apr 06
50 GB dual layer BD-R	\$48, TTM delayed until Jun 06
50 GB dual layer BR-RE	\$60, TTM delayed until Jun 06

Sony BD supports a 2x recording speed, 72 Mbps data transfer rate.

### **TDK**

Apr 06

TDK confirmed that the company was shipping 25GB recordable and rewritable Blu-ray Disc media to retailers nationwide.

The single-sided discs are cartridge-less, single layer, with Durabis hard coating protecting technology that discharges static.

25GB BD-R (recordable)	\$20
25GB BD-RE (rewritable)	\$26



TDK also announced that, later in 2006, it was planning to release the 50GB versions of the above, with dual layer.

50GB BD-R (recordable dual layer)	\$48
50GB BD-RE (rewritable dual layer)	\$60

### **HD DVD ROM**

CES 2007

51 GB HD DVD-ROM

Toshiba announced their 51GB HD DVD-ROM Disc, with extended capacity able to store up to 7 hours of HD at a sampling rate of 17 mbps.

The disc is a triple-layer HD DVD-ROM (read only) format and still needs to secure the approval by the DVD Forum, which Toshiba hopes they will get within this year, each



layer storing 17GB of data.

The new disc is a step beyond the current discs that hold 15GB of data in each layer of a single-sided disc, through improvements in disc mastering technology for further minimization of the recording pit, still using the current two 0.6-mm thick discs bonded back-to-back standard, common to both DVD and HD DVD formats.

Toshiba also declared that the new disc can be manufactured in volume at little cost increment.

### **BD Discs**

TDK

Verbatim/MKM

Sony DADC

Panasonic disc manufacturing in Torrance, CA has modified (Dec 05) its existing pilot line for single-layer BD-ROM discs to be able to replicate dual-layer discs with 50 GB of storage capacity.

### **BD-ROM Pre-recorded Media**

#### **Studio Announcements**

Background of movie studios joining to both formats:

In July 2005, Fox announced that, due to the BD+ protection Blu-ray incorporated in their format, the company has decided to support Blu-ray for home video releases in HD.

In August 2005, Universal Music Group (UMG), one of world's largest music companies, joined the Blu-ray Disc Association (BDA) as a contributing member (more than 140 leading members). Content from Universal Music includes Elton John, Maria Carey, and U2.

In August 2005, Lions Gate Entertainment (LGHE), a division of Lions Gate Entertainment announced that it would release content on the Blu-ray Disc format. The studio is the fourth major studio to commit publishing movies in Blu-ray, and represents 4% of the home video market.

In October 2005, Warner announced that the studio would release titles also in the Blu-ray format in the US, Europe, and Japan; Warner also announced that it joined the BD Association.

In November 2005, MGM was reported to support the Blu-ray format and would start releasing titles from its library of 4000 films.

#### **Format Launching**

Both formats brought to CES 2006 (and later again in CES 2007) a collection of movies that would be released upon their individual launches, including some classics

and many blockbusters. Some studios are expected to release movies for both formats.

### HD DVD Launch

The format launch in March 2006 was accompanied by gradual release of titles from:



Warner Home Video,  
Paramount Pictures,  
Universal Studios,  
HBO Video,  
New Line Entertainment, and recently the following two  
Europe's Studio Canal and the Weinstein Company (Miramax previous owners), and Customflix.com (Amazon owned) for independent and small filmmakers.

According to Access Hollywood, these companies represent more than half of produced movies. Upon launch, only a few titles were released such as Twister, Lethal Weapon, U-571, and Apollo13, by June about 50 titles were planned to be available, to total 200 titles by December's Holidays. The titles became available in a

mixture of HD-DVD discs and hybrid discs that contain also the DVD version of the content, which were said to cost a few dollars more.

### Blu-ray Launch

The launch in April 2006 was accompanied by the gradual release of about 100 titles during 2006 from six studios as follows:

Paramount Pictures:

"Four Brothers," "Sahara," "Aeon Flux," "Sky Captain & the World of Tomorrow," "The Italian Job," "Tomb Raider," "U2: Rattle and Hum," "Sleepy Hollow," "We Were Soldiers," "Manchurian Candidate," "Mission Impossible," "Mission Impossible 2," "Mission Impossible 3";

Warner Home Video:

"Batman Begins," "Charlie & The Chocolate Factory," "Constantine," "The Dukes of Hazard," "The Last Samurai," "Lethal Weapon," "The Matrix," "Million Dollar Baby," "Oceans 12," "Swordfish," "Terminator 3: Rise of the Machines," "Training Day," "Troy," "Twister," and "Unforgiven"

Twentieth Century Fox Home Entertainment:

20 Titles, including: "Fantastic Four," "The League of Extraordinary Gentlemen," "Behind Enemy Lines," "Kiss of the Dragon" and "Ice Age";

Sony Pictures Home Entertainment/MGM/Columbia Pictures:

"The Fifth Element," "Bram Stoker's Dracula," "Desperado," "For a Few Dollars More," "The Guns of Navarone," "Hitch," "House of Flying Daggers," "A Knight's Tale," "Kung Fu Hustle," "The Last Waltz," "Legends of the Fall," "Resident Evil

Apocalypse," "Robocop," "Sense and Sensibility," "Stealth," "Species," "SWAT," "XXX," "Black Hawk Down" and "The Bridge on the River Kwai"  
 Sony will release four movies x month, increasing to 10 x month by the end of 2006.

Lion's Gate Home Entertainment:

"Lord of War," "The Punisher," "Devil's Rejects," "Saw," "T2: Judgment Day," "Reservoir Dogs," "Total Recall," "Dune," "Rambo: First Blood" and "See No Evil"

Buena Vista Home Entertainment/Disney:

"Kill Bill: Vol. 1," "Hero," "Dark Water," "Ladder 49," "The Brothers Grimm," "The Great Raid," "Armageddon," "Jay and Silent Bob Strike Back," "Dinosaur" & "Everest"

Eagle Rock Entertainment:

Planned to provide 20 music artists such as Miles Davies and George Benson.

Oct 06

Sony Pictures Home Entertainment announced first three 50GB Blu-Ray Disc titles:

Click (TTM Oct 10)

Black Hawk Down (TTM November 14)

Talladega Nights (TTM December 12)

**Industry and Content Support – CES 2007**

**Blu-ray Presentation**

- Seven of eight major Hollywood studios support BD
- Five are exclusive to Blu-ray
- You cannot watch films from these five studios on HD DVD
- More content means more consumers can be attracted to BD
- More important than any other factor for a format's success



Impact of 7 of 8 Studios

DVD sales illustrate current HD format alignment of releasing studio

The Top Selling 20 DVD Titles in 2006 (source: Daily Variety 1/5/2007)

	<u>Blu-ray</u>	<u>HD DVD</u>
1. Pirates of the Caribbean: Dead man's Chest	X	
2. The Chronicles of Narnia	X	
3. Cars	X	
4. Harry Potter & the Goblet of Fire	X	X
5. Wedding Crashers	X	X
6. Walk the Line	X	
7. King Kong		X
8. Over the Hedge		
9. The Da Vinci Code	X	
10. Ice Age: The Meltdown	X	
11. Chicken Little	X	

12. Click	X	
13. X-Men: The Last Stand	X	
14. Talladega Nights: The Ballad of Ricky Bobby	X	
15. Flightplan	X	
16. Superman Returns	X	X
17. The Devil Wears Prada	X	
18. High School Musical	X	
19. Bambi II	X	
20. Grey's Anatomy - Season 2	X	



Blu-ray hardware availability:

Jun 06 : Samsung BD-P1000  
 4Q06 : Pioneer Elite BDP-HD1  
 Panasonic DMP-BD10  
 Sony BDP-S1  
 Philips BDP9000  
 Sony PlayStation 3

**HD DVD Presentation**

Over 300 additional movie titles will be available in 2007, for an expected total of more than 600 titles worldwide.

As of January 5, 2007, there are estimated to be more than 175,000 HD DVD players sold in North America, with more than 2.5 million players estimated by the end of 2007.

Titles using player memory as well as the secondary video encoder for picture-in-picture were shipping throughout 2006, and titles using network connectivity are expected to be available in 2007.



**Warner's Total Hi Def Disc (Dual Blue Laser Formats) CES 2007**

Warner announced at the show their decision to release a 'Total Hi Def' or "THD" disc capable to store both blue laser formats.

Kevin Tsujiharo, Warner Home Entertainment Group president, called THD "a solution that will allow retailers to invest in more inventory for a broader selection of

titles and free up shelf space as title formats are combined onto one disc, we encourage a one-format platform. THD appears to be the best solution for retailers and consumers in the near term, to eliminate consumer confusion and fear of purchasing a player for using the eventual losing format. We view it as a solution, and so fundamentally this wasn't done to try and create a new revenue stream."

The disc will store Blu-ray content in one side and the HD DVD version of the "same content and features" in the other side, with both sides capable of carrying dual layers, a feature demonstrated at the show, it will be made by replicators of the two formats, and will be the only high-def version that Warner will be releasing.

Warner Home Video commented that the cost of manufacturing the product "isn't going to be materially more" while consumer motivation in buying a player (on either format) increased due to the peace of mind that their movie choice will play regardless of the playing hardware.

The price was not disclosed, but was indicated that will not be "prohibitively expensive".

Warner mentioned that Warner Brothers, New Line, and HBO will start doing THD discs in 2H07, instead of their HD DVD and Blu-ray disc releases, "Title names and pricing will be announced closer to the release dates" they said. THD is expected to motivate other studios.

Licensing fees would have to be paid for both organizations as if the discs were manufactured in the two different formats.

### **Format Market Penetration – CES 2007**

The HD DVD Promotions Group announced a projection of 1.8 million players sold within 2007, and that objective was considered "a minimum target".

Yoshihide Fujii, Toshiba Digital Media Network CEO and chairman of the International HD DVD Promotion Group, declared at CES:

"If our resolution for 2006 was to bring HD DVD to the early adopter, then our resolution for 2007 is to bring it to the early majority."

In supporting that forecast Mr. Fuji mentioned that HD DVD studios plan \$600 million in HD DVD revenue this year, and he anticipates almost 50 million HDTVs installed in consumers' homes in the same period, 1.8 million US players of that total is a reasonable forecast for the size of next-generation DVDs.



The Group also used the opportunity to announce the joining of four new manufactures. Onkyo and Meridian were mentioned as with plans to manufacture HD DVD products, and Chinese manufacturers Alco (Venturer) and Shinco were quoted with similar plans.

Alpine, a mobile audio equipment manufacturer, also demo at the show an HD DVD car player.

HD DVD studios also declared plans to manufacture at least 300 new HD DVD titles during 2007 (raising the total of above 600), of which hybrid HD DVD/standard DVD discs would become a larger share than today.

Hybrid discs are a feature of the HD DVD format that the HD DVD Promotion Group made special emphasis on their presentation.

The Group considered important to facilitate the transition from the current DVD format to the HD DVD format, a transition that also respects the consumer's investment purchasing media. The hybrid media would be playable on a current DVD player as well as on an HD DVD player when the consumer is ready for it.

### **Titles and Blu-ray Player Sales**

25 Blu-ray movies were released during 3 weeks in Jan 07, compared to 11 titles from HD DVD. Also, according to studio sources, from the volume perspective, two movies on Blu-ray disc were sold for every one sold on the HD DVD format during January, perhaps due to the higher number of Blue ray titles released on that period, perhaps also for the effect of having now PS3 available.

From another perspective, over the first 3 weeks of January Blu-ray outsold HD DVD on individual titles, Blue Ray's Crank with 7500 sold units, while HD DVD's top seller Batman Begins sold 4100 units, according to studio sources.

The title comparison above is not a clear-cut comparison because the titles appeared as first release at different times and are not of the same movie, although they were both considered top sellers on each format during the same period.

However, eProductWars.com, an Amazon related site, the movie The Departed released by Warner's (a dual format label) on February 13 has been the title that sold more units on both formats for the past month, Blu-ray ranks # 36 as top-selling product while the HD DVD version ranked # 45th as of February 8th.

Another sign of market movement is the recent offer made at some retail-store chains, such as Best Buy, of 2 Blu-ray movies for the price on one (of a selected group of 6 titles in the \$25 range). This type of incentive is needed to create sales momentum, I have not seen HD DVD doing similar promotions in the same period (first week of February 07).

Another factor to consider is studio and title variety, all studios except for Universal Studios Home Entertainment are releasing titles in a constant basis on the Blu-ray format.

Except for Paramount and Warner, which release movies on both formats, Sony, 20th Century Fox Home Entertainment, Buena Vista, Lionsgate, Warner Home Video and Paramount Home Entertainment are releasing films exclusively in Blu-ray, while only Universal is exclusively releasing movies on HD DVD.

In other words, the increased variety of studios participating on the constant introduction of new releases creates a wider choice of titles that could certainly attract more consumers than fewer studios.

Sony Pictures did not waste the opportunity to declare an early victory comment as follows:

"I think finally everything that we knew going into this format has started to happen," said Sony Pictures Home Entertainment worldwide president David Bishop.

"We have a critical mass of content, we have the biggest mass of consumer electronics companies in the world supporting this format. That has moved Blu-ray into the forefront. The message that we're going to put out to the consumer now is, now it is safe to make a choice, no more fence-sitting is needed."

Regarding hardware, more than 1 million US homes were reported to have Blu-ray players of some kind (standalone units or PS3 consoles). Consideration should be given to the fact that it was only during the previous few weeks that Blu-ray players (Pioneer, Sony, PS3) were on the market to make for that million, other than the Samsung player that received disappointing performance reviews when it was first introduced a few months earlier, which would certainly have discouraged consumers to purchase the Samsung player, and Blu-ray discs in general.

### **Film Grain Added to HD DVD**

In July 2006, Thomson's announced that their Film Grain technology will be used during playback of HD DVDs to recreate the film grain extracted before the video compression stage.

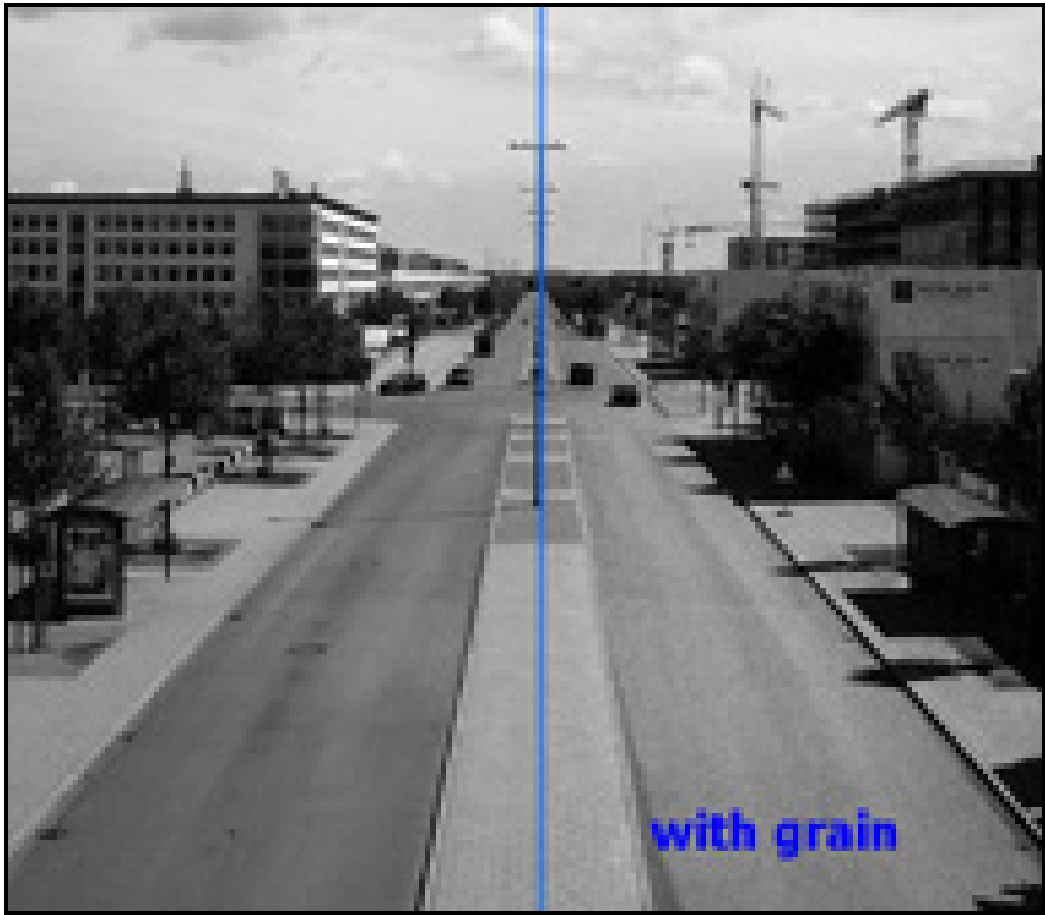
In cooperation with SMPTE, the DVD Forum selected Film Grain technology for mandatory inclusion in HD DVD products, RCA's HDV5000, Toshiba's HD-A1 and HD-XA1, and Microsoft's Xbox 360 HD DVD player.

Thomson's Film Grain technology can also be embedded in broadcast and home theater player devices to maximize bandwidth and storage space while viewers see movies that match the filmmaker's artistic intent.

The technology can also be implemented on H.264 compression and adapted to other compression algorithms.

Broadcom's BCM7411D and Horizon Semiconductor's Hz100 and Hz300 are the integrated circuits that will incorporate Film Grain technology.

Sigma Designs will soon offer an IC solution. Sonic Solutions is integrating Film Grain technology in its HD DVD production tools. NVIDIA is building hardware for its advanced line of Quadro Graphic Processing Units, and InterVideo, and CyberLink are integrating the technology into their personal computer HD DVD players.



## HD DVD Players/Recorders

### **Alco**

CES 2007

SHD7000 TTM 2007, \$TBA, Specs TBA

### **LG**

Announced and showed the HD-199 HD DVD player at CES 2006 (and a Blu-ray player as well), however, in March 2006 LG announced that the unit will not be released as planned. See further below for details on what they are working with.

### **Onkyo**

CES 2007

Onkyo Corporation announced their plan to launch its first HD DVD player for the US market in 2007, no pricing or exact date were announced.

Onkyo also announced plans to manufacture AV receivers to handle HD DVD with a HDMI cable for video, audio, and control signals. No specifics about the version of HDMI were given (hopefully it will be 1.3, 1080p capable, and with hi-bit audio codecs decoders installed in the AV receiver).

### **RCA**

At CES 2006 the company announced the 2Q06 availability of their HDV5000 \$500 HD DVD player, which was originally quoted as able to transfer HD video up to 1080p via HDMI output (right).



Updated specs upon release:

#### **HDV5000**

\$500, Ethernet port, decodes DD Plus, DTS-HD, and Dolby TrueHD (2 ch only), MPEG-2, MPEG-4 H.264 AVC, and VC1. However, even when the Dolby hi-bit audio decoders are mandated in HD DVD players they are not even mentioned on the product spec list in the RCA web site (as well as the DTS specs). The specs above were quoted as existing in the product; I suggest further research before assuming the product has those features.

#### Jun 2006

RCA has available software version 1.4 for the HDV5000.

This latest version offers the following improvements:

- Improves HDMI and DVI connectivity with some televisions, monitors and projectors.
- Reduces HD DVD playback block noise.
- Eliminates high frequency feedback with some televisions, monitors and projectors via the HDMI connection.

<http://www.rcaaudiovideo.com/en-US/HDV5000Firmware>

## **Sanyo**

At CES 2006 the company unveiled their HD DVD player model HD-S100, TTM March 06, outputs 1080i/720p/480i/p, 1080i on the first generation, \$500.

### CES 2007

Sanyo declared having no plans for manufacturing any player; the company said that it is rather supplying player components to the other manufacturers.

## **Shinco Electronics**

### CES 2007

The company will introduce their HD DVD player in the US during 2007. HD-A100 \$TBA, TTM TBA, Specs TBA.

## **Toshiba**

At CES 2006, the company announced two HD DVD players to be released by March, one low-end unit for \$500 (HD-A1, below), and another hi-end model for \$800 (HD-XA1, right). Blu-ray commented that the pricing of these Toshiba players was half of what was originally intended to attract the mass market.



Consult the 2006 HDTV Technology Report for specs.

## The Actual Value of the Player

### Jul 06

According to iSuppli Corp, after a "teardown" analysis, the Toshiba HD-A1 HD DVD player has a bill-of-materials (BOM) cost to Toshiba estimated at \$674, far exceeding the unit's \$499 U.S. retail price.

The estimate excludes costs for manufacturing, testing, cables, remote control and packaging, which could raise the total cost at least to \$700, iSuppli said.

In other words, Toshiba is subsidizing the HD-A1 to gain a market position based on value compared with Blu-ray.

The analysis also revealed lack of efficient design, "The Toshiba HD-A1 is basically a combination of a low-end PC and a high-end DVD player," said Andrew Rassweiler, teardown services manager and senior analyst for iSuppli, in a statement.

The HD-A1 is suited with a general-purpose microprocessor instead of more cost-effective application specific standard product (ASSP) semiconductors typically used in consumer-electronics products, iSuppli said.

It features an Intel Corp. Pentium 4 as the main microprocessor, as well as Broadcom Corp.'s BCM7411 for high-definition video decoding and four

ADSP-2126x SHARC programmable DSPs from Analog Devices Inc., according to iSuppli (estimated cost \$137).

\$125 worth of memory, 1-gigabyte dual inline memory module (DIMM) from Hynix Semiconductor Inc., three other types of DRAM, a 256-megabyte flash memory disk from M-Systems and 32 megabytes of MirrorBit flash memory from Spansion, iSuppli said.

Adding the memory chips bring the total cost of ICs used in the HD-A1 to roughly \$247 per unit, according to the firm.

Toshiba is not alone in doing this market approach, Sony is also doing the same with the Play Station 3, but no claims were issued regarding subsidizing Blu-ray stand-alone players.

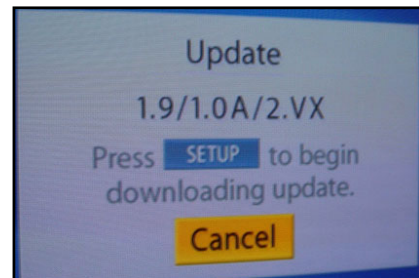
### Aug 06

An announcement was made regarding the availability of a firmware upgrade for the first generation Toshiba HD DVD player to upgrade the Dolby True-HD 2-channel decoder (limited by the format standard) to be enabled for 5.1 channels.

Such firmware was initially released as beta 1.9 and later released as version 2.0.

According to the same source the other firmware upgrades from Toshiba were:

- 1.2 fixed player glitching and Blacker than Black and Whiter than White via HDMI
- 1.3 fixed RCA players that had the Toshiba boot up screen
- 1.4 fixed certain HDMI/DVI problems (Toshiba never specified)



### CES 2007

Toshiba made clear that HD DVD as standard made mandatory for players to include secondary video decoders, to support networking and persistent storage to let consumers download and store new content on their HD DVD players.

The standard mandated lossy/lossless new Dolby Digital audio formats of Dolby Digital Plus and Dolby True HD. However, the spec mandates only two-channel True-HD decoders for HD DVD players. I wonder why anyone would be interested in playing back a hi-bit lossless multichannel movie soundtrack through a decoder that only handles 2 channels.



An example of that implementation was the first release of the Toshiba HD DVD player with a True-HD Dolby decoder for only 2 channels.

Toshiba announced its second generation of HD DVD players, and increased shipment volume to meet market demand.

The HD-A2, HD-A20, and HD-XA2 are all backward compatible with DVD and CD, and upconvert DVDs. The HD-A20 and the high end HD-XA2 are designed to output 1920 x 1080p via HDMI (but not at 24fps for film content), please refer to the analysis of this subject below.

Current Toshiba Players:

HD-A2 \$500, TTM now, HDMI for 720p or 1080i (no 1080p), originally planned for TTM Oct 06 but in Nov 06 Toshiba announced that shipment was delayed to Dec 06 due to a performance issue with one of the components manufactured by an external supplier, Dolby TrueHD 5.1, Dolby Digital Plus, DTS HD (core only), HDMI, component, Digital Optical out, Ethernet port.



HD-XA2 \$1,000, TTM Dec 06, supports Deep Color output through HDMI 1.3, and 297MHz / 12 bit Video DAC, 4x over-sampling, picture setting function, adjustable settings for color, contrast, brightness, edge enhancement and block noise, lossy and lossless formats decoding from Dolby Labs and DTS® including the Dolby® Digital Plus and Dolby TrueHD, DTS HD (core only), black high gloss finish and slim chassis design, component, Ethernet port, Digital Optical out, 5.1 analog connections.

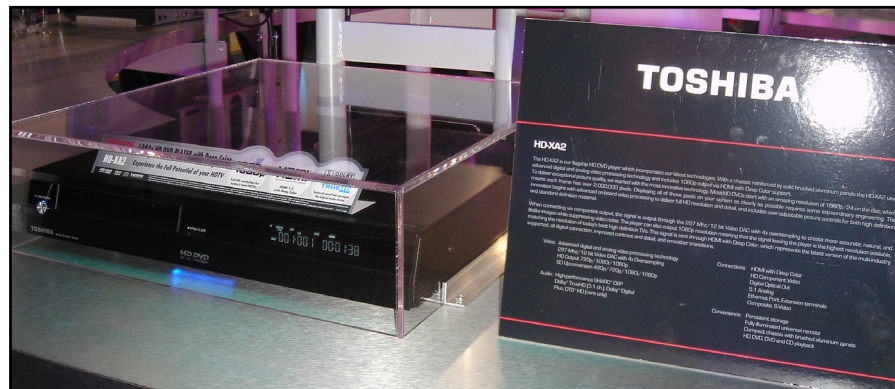


It also features Reon-VX HQV video processor from Silicon Optix, HDMI 1.3 for 720p,

1080i or 1080p, however, be aware that currently this player will output 1080p as 60fps only "- it deinterlaces the 1080p 24fps HD DVD content", according to Toshiba.

1080p Video Processing in Toshiba Players

A) The signal is first converted to 30 fps (interlaced as 60i) by performing 2:3 pull-down of the 48 half frames (from the 24 full frames of the film) and adding another (artificial) 12 fields



to complete the 60i fields format required for the 1080i interlaced output of the player.

B) For the 1080p output the player then de-interlaces the 60i interlaced signal above by doubling up the frames to obtain a 60 fps progressive version of it. The resulting signal is then outputted as 1080p 60fps (if the player has that feature) when that output format is selected in the player.

Such 1080p 60fps output format matches with the inputs of some 1080p TV sets suited with the capability of accepting 1080p as 60fps. The format is more suitable for content that originated from 60i interlaced video, but is less suitable for 24fps film sources.

#### 1080p 24fps Output in Toshiba Players

When playing back 24fps film content, recorded and stored on the disc as 24fps, applying the video processing above subjects the signal to unnecessary processing. That processing could have been avoided if the player would have been suited with a 24fps option on the 1080p output, in addition to the 60fps option. In other words, a pass-thru feature for 24fps film content to be output as is.

Such a feature would be appealing to some TVs and front projectors that accept 24fps, and can display it at a higher frame rate without going to the 3-2 pulldown interlacing-deinterlacing processing mentioned above. Those capable TVs/projectors, to avoid the image judder that 24fps would produce if displayed at that slow speed, display the 24fps at multiples of 24, such as 48fps of Optoma front projectors, 96fps of Sony Pearl, to name two.

Local theater film projectors avoid the judder by opening the shutter twice per each frame of the 24 celluloid frames, projecting at 48fps.

Having the 24fps pass-thru feature is particularly important when the Hi Def image is projected in large screens, where excessive video processing is easier to detect, and should be avoided as much as possible.

The video processing described above could be done all in the player (3:2 pull-down to get to 60i and later the 60p deinterlacing), or could be done as just the 60i part in the player, output the signal as 60i and the TV accepting it that way, and do the deinterlacing 60i-to-60p part within the 1080p TV.

As in the past, when doing multiple tasks of video processing in the video chain, it is good to have the choice to assign the best performer on a particular video processing task (the player, the TV, or in an external scaler, or a combination of them distributing the steps). However, in this case, there is no choice for 24fps film, it has to be output as 60i or 60p, as it would be a video source content frame rate.

This is not only about assigning a better performer to a task, is also about avoiding unnecessary video processing when 24fps film content is to be displayed in a 1080p 24fps capable device.

#### Toshiba Plans for 1080p 24fps

According to Toshiba and the HD DVD Promotion Group, there are no upgrade plans to make this player 24fps capable. That official statement includes the near future player A20 (below), which was specified also as 1080p outputs without any frame rate indication, but is meant to be only 60fps.

To be more specific, Toshiba's response about the A20 was "the specs on that player are not yet complete (as of CES Jan 07 time frame) and we cannot comment about such a feature at this time, nor it can be anticipated 'if and how' that feature would be upgradeable".

Some unofficial sources in forums have commented that such features "would" be added to the HD-AX2, but I discourage recommending purchasing decisions of expensive equipment on promises that are not officially backed by the manufacturer.

Considering the current situation of the format war, and considering that this level of media quality is appealing to large screen home theaters with projectors with 24fps capabilities, not having such feature is a disadvantage for the format (while Blu-ray has had it since day one).

It would have been in the best interest of the HD DVD format that the second generation players of Toshiba would have been positioned more strategically with competitive quality features like this, especially after Toshiba obviously recognized the competitive edge of having 1080p outputs, which the first generation of players lacked.

### New Toshiba Players

HD-A20 \$600, TTM Spring 07, HDMI for 720p, 1080i, 1080p. 1080p only as 60fps, refer to analysis above, Dolby TrueHD 5.1, Dolby Digital Plus, DTS HD core only, HDMI, component, Optical audio, Ethernet port, CD playback,



### Mar 07

Toshiba introduced the HD-EP10 HD DVD player for the market in Europe.



Features 1080p, DTS-HD, Dolby True-HD, Dolby Digital, Dolby Digital Plus, HDMI output, can read HD DVD, DVD, DVD-R/RW, and CDs.

### Mar 07

Toshiba announced a reduction of price on their HD DVD players effective April 1, 2007, the prices will go down by \$100 for the HD-A2 (to \$399), \$100 for the HD-A20 (to \$499), and by \$200 for the top-of-the-line HD-XA2 (to \$799).

Datavision, a retailer, further reduced the prices by another \$50 with an instant rebate, not backed by Toshiba. The retailer also offers purchasers of their HD DVD players the inclusion of 5 free HD DVD titles within the purchase.

## Blu-ray Players / Recorders

Several announcements and player/recorder introductions from various companies, such as Panasonic, Sony, and Hitachi, were made in the Sep/Oct 06 timeframe at CEATEC in Japan. It was made clear that those products are not planned for the US market (not even with modified components, such as the Japanese digital TV tuners to ATSC tuners), so I am not including these products in this section.



Blu-ray recorders in particular were said not to be appearing in the US market due to market and company decisions.

### Hitachi

Consult the 2006 HDTV Technology Report for Hitachi models such as the HDD and Blu-ray combo recorder in the right:

CES 2007 Hitachi BD Video Recorder (below)



### JVC



At CES 2006, JVC showed their BD player prototype (left), JVC gave no plans to support the other HD DVD format, no date commitment for their BD player.

The company announced the development of the world's first Blu-ray/DVD Hybrid ROM disc using three layers to store both

HD and SD content on a single side, a technique authorized as part of the Blu-ray disc format by the Blu-ray Association. Consult the 2006 HDTV Technology Report and earlier as well to get the details of that disc format.

Pre-recorded three layer hybrid discs were said to be available upon BD introduction. No JVC player was released during 2006.

At CES 2007, the company showed again their Blu-ray player (right).

### LiteOn



### LG

At CES 2006, the company introduced their Blu-ray player model BD199 (left), and announced a TTM 2Q06 release date even though final ROM specs were not yet completed.

The unit plays back 1080p from a 1080p content in disc, and 1080i50/60, DTS++.

However, in March 2006 LG announced that the player will not be released, and instead the company was planning to develop and release a dual-format player in late summer/early fall "in light of the uncertainty at this early stage of the market for pre-recorded high-definition optical discs", LG's VP Bob



Perry said.

CES 2007

LG launched the industry's first dual-format Hi Def player, the "Super Multi Blue" BH100, which plays Blu-ray and HD-DVD discs, as well as DVD. No CD playback but the computer drive does playback CDs.

BH100 \$1,200, TTM Feb 07

Additionally, as mentioned in the PC section above, LG introduced the GGW-H10N Super Multi Blue 50GB drive for computers, TTM 1Q07, compatible with both Blu-ray Disc and HD DVD formats, and compatible with DVD and CD read/write.

LG declared, "This is a great first step towards resolving consumer confusion and uncertainty due to the two high-definition formats. The Super Multi Blue Player will allow studios to better meet consumers' growing demand for high-definition content in both the Blu-ray Disc and HD DVD formats; by providing a high-definition player that supports both Blu-ray Disc and HD DVD discs, LG is delivering a product that puts the customer first,"



The player features up-conversion of standard DVDs to 1080i resolution, 1080p outputs, interactive functions based on BD-Java, which allows advanced menus and functions to be displayed over the video of Blu-ray discs, although the same level of advanced menu interactivity is not available while playing HD DVD discs (see the universal player section above). The player takes 25 seconds to play Blu-ray, 30 seconds to play HD DVD.



The player also features support for MPEG-2, VC-1, H.264 video, MPEG1/2 audio, Dolby Digital, Dolby Digital Plus, DTS and DTS-HD audio, HDMI out, component/composite video outputs, optical,

coaxial, and discrete 5.1 channel audio outputs, ergonomic remote control.

No Dolby True-HD audio decoder specified, although is a mandated audio format for HD DVD players (perhaps this is only a missing spec). Player review: <http://www.soundandvisionmag.com/hd-dvd-bluray/2154/lg-bh100-blu-ray-disc-and-hd-dvd-player.html>



Summary of key points to consider:

- HDMI 1.2, not 1.3
- 1080p over HDMI is outputted only as 24 or 30 fps, not 60fps.
- Initial HDMI problems with Denon and Pioneer A/V receivers, reportedly fixed on newer units, firmware update for existing units was said to be available.
- HDi interactivity features not implemented (for PIP onscreen video commentaries and downloading Internet content), a standard HD DVD feature that theoretically disqualifies the player to carry the HD DVD logo.
- No menu screens from HD DVDs (yes for Blu-ray discs)
- Dolby TrueHD implemented as 2-ch only (as Toshiba's first player)
- Downmixes six-channel uncompressed PCM to stereo over HDMI 1.2.
- No CD playback (similar to the Sony and Pioneer Blu-ray players).
- Decodes only the "core" 5.1-channel from DTS-HD Master Audio recordings.
- High price when considering the lack of the features above.



### **Mitsubishi** CES 2006

The company showed their 1080p Blu-ray prototype model, TTM N/A, \$ N/A.

The company did not release any model during 2006, and nor yet in 1Q07.

### **Panasonic** CES 2006

The company announced the launch of their 1080p Blu-ray player DMR-E700BD planned for release by the summer 2006 (right).

The player was released, but under another model number, see below.



### Jun 06

Panasonic launched its first Blu-ray Disc player, as part of an "entertainment package" which includes the DMP-BD10 Blu-ray player (\$1,300 MSRP), a 1080p ready SA-XR700 HDMI A/V receiver (\$1,000) and a 5.1-channel surround sound SB-TP1000 speaker package (\$3,000), all TTM Sep 06.



The components sell separately, but Reid Sullivan, Panasonic entertainment group VP, said Panasonic was considering a package price for the whole system.

DMP-BD10 \$1,300, TTM Sep 06

The player features 1080p output over HDMI, plays back standard DVDs, music CDs and DVD-Audio discs, in addition to high-definition Blu-ray Discs, Pixel Precision for High Definition (P4HD) pixel-by-pixel processing system and a 296MHz/14-bit digital-to-analog video converter (DAC), offering 4.4 trillion colors and 16,384 levels of gradation, 192kHz/24-bit DAC audio, virtual battery system to isolate noise before the signal is amplified, DTS, DTS-ES, Dolby Digital, and Dolby Digital EX, said to be upgradeable to include Dolby Digital Plus and Dolby Digital True-HD.

### CES 2007

Panasonic Blu-ray player as released:



### **Philips**

At CES 2006, the company planned to release first in the US in the 2H06 a Blu-ray player and a PC triple-writer for Blu-ray write-once, BD rewritable, DVDs, and CDs.

As with past years at CES, Philips just demonstrate a prototype and pricing was not confirmed. The unit supports DTS-HD and Dolby TrueHD via HDMI 1.3, supports 1080p (although it was not confirmed upon the announcement), multi-channel analog outputs not confirmed to be able to carry the newer hi-bit DTS and Dolby codecs.

As with the Pioneer BD player (further below), the unit was said not to have Internet audio streaming support on its first generation for Director's commentary while the disc is playing.

Philips CEO, Rudy Provost, made a remark of importance to about 10 million early adopters of HDTV with only analog inputs on their sets: "The company said it's confident the AACS content-protection group would approve copy-protection rules that would allow component analog outputs to carry HD video to early-generation HDTV monitors and TVs that lack HDMI inputs." Unfortunately, after the remark was made, the AACS organization did not approve the feature that way, however, most movie studios are not implementing the Token feature that would downgrade the HD image over component analog connections. Please check the Content Protection section for details.



Philips planned to introduce a Blu-ray player/recorder in 1H07, which also would play/record CDs and DVDs.

Philips player (not recorder) as released:

Original MSRP \$1000 MSRP, Feb 07 MSRP \$800 at Amazon, listed also as \$550.

Plays Blu-ray movie discs, DVD movie, and CD audio discs, upconverts DVDs to near HD quality through the HDMI output, HDMI at 720p/1080i/p, 1080i through the component video output for Blu-ray discs (standard DVD's are output 480p through component video), hi-def animated menu, advanced subtitle functions, video scene search and pop-ups, unique 10-in-2 multi-format memory card slot displays 3-megapixel and larger images, compatible with Secure Digital (SD), MultiMedia (MMC), CompactFlash, MicroDrive, XD Picture Card, Memory Stick, Memory Stick Duo, Memory Stick Duo Pro, Memory Stick Pro, RS MMC, and Mini SD.



CES 2007 (right)

Confirmed technical features include:

- Up to 1080p (1920 x 1080p) output through HDMI digital output
- Selectable 1080p/1080i/720p video upconversion of DVD's through HDMI
- BD-RE, BD-ROM, DVD ROM, DVD RAM, DVD-R/RW, DVD+R/RW, CD-ROM, CD-R/RW playback compatible
- MPEG2, VC-1, H.264, HD JPEG decoding
- 12-bit/192Mhz video D/A converter; 24-bit/192KHz audio D/A converter
- Decodes Dolby Digital, Dolby Digital Plus, Dolby DTS, and MP3.
- 1xHDMI
- 1xComponent Video

### **Pioneer**

As per CES 2006, Pioneer's Blu-ray BDP-HD1 player was announced to be due in Apr/May 2006 with MSRP of \$1,800 under the Elite brand, Pioneer commented there might be another non-Elite player later. The \$1,800 price was said to be consistent to other Elite products of which higher quality is expected (right).

The player's HDMI output that was then quoted to be version 1.3 spec, but it was not released that way at launch. It was reported to also include



IEEE-1394 (iLink) with DTCP. Outputs 1080p24fps.

Having a 24fps 1080p output is a perfect match with the 1080p plasma that Pioneer also introduced at CES, the Elite PRO-FHD1 for \$10,000 MSRP, TTM June 06, with HDMI, DVI, and component inputs.

Consult the 2006 HDTV Technology Report for the specs of that early announcement.

#### Jun 06

Pioneer announced a delay in the introduction of the player above, postponed for September 2006 at a reduced price, from \$1800 to \$1500.

#### Dec 06

The player arrived to market.

Some "negative" points to consider (in addition to its high price):

- Although it has an Ethernet port to stream audio, video, and digital pictures using a home network from a PC running DLNA-certified server software, the player does not support BD Live, which Pioneer says is due to the specs were not yet completed; players with that feature would probably be available starting 4Q07.
- HDMI interface is not 1.3.
- No CD playback.
- No Dolby True HD or DTS-HD Master Audio decoders.

#### CES 2007



#### Feb 06

A first review of this player was performed in Feb 06 as follows: Review of Pioneer Elite BD Player: <http://www.soundandvisionmag.com/hd-dvd-bluray/2142/pioneer-elite-bdp-hd1-blu-ray-disc-player.html>

#### **Samsung**

At CES 2006, Samsung showed a Blu-ray recorder (BD-HR1000 on the right) that also performed as a network center with Ethernet IEEE802.11b/g wired/wireless transmission of audio/video (DVD quality) with PC, the unit records also in its

internal 400GB HDD DVR (47hrs HD), 2.5 hrs HD recording on Blu-ray disc, available in Korea for \$5,000 (right), HDMI out (720p/1080i) EPG.

At the same 2006 show, the company announced their BD-P1000 player planned for release on April 06, \$1000 MSRP (but also quoted as \$1200), consult the 2006 HDTV Technology Report for the original specifications on the announcement; the updated specs are further below.



Although it was earlier commented that Samsung would also produce a player that would support the HD-DVD format, it was negated at CES 2006 time.

#### Updated specs of the BD-P1000 player (Jun 06)

Supports DVD playback, CD Audio, MP3, JPEG photo display, can read BD-ROM, DVD-Video/RAM/-RW/-R/+RW/+R, CD-RW/-R. Reading of BD-RE/-R discs required the original unit to receive a firmware upgrade.



The player can also read CF, MicroDrive, MS PRO/Duo, SD, Mini SD and RS MMC cards from its built-in card reader. The first firmware upgrade was supposed to fix compatibility with 50GB Blu-ray discs.

Video formats supported: MPEG-2, VC-1, H.264, and JPEG.

Outputs Blu-ray disc, DVD selectable upconverted as 1080p, 1080i, or 720p (HDMI), and unscaled DVD disc as 576p or 480p. 1080p resolution over HDMI only.

It is suited with HDMI, Component Y/Pr/Pb, Optical/Coaxial S/PDIF, and built-in Memory Card Reader, BD Java interactive capability.

A late addition to the player was an 11-in-two multi-memory card interface, instead of the originally announced nine-in-two reader.

Samsung's proprietary single pickup with two-lens technology for DVDs and CDs in addition to Blu-ray discs, pop-up and always-on menu options, full color high-definition animated button, improved bitmap and text subtitles, audio formats include multichannel uncompressed 192kHz/24 bit audio LPCM, Dolby Digital, DTS and MP3, 216MHz/12-bit video D/A converter.

Without getting into performance details that most probably the reader already knows by now, this Samsung player had several performance problems upon introduction that rendered an unacceptable soft image. Samsung acknowledged the

problems and informed consumers that sold units would be fixed with a firmware upgrade, and new units would not contain the problem.

This Samsung BD-P1000, being the first Blu-ray player that appeared in the market after the HD DVD launch, proved a disappointing introduction which shattered the format expectations among Blu-ray supporters.

In addition to the issue of image softness caused by the player, there was uncertainty of how much of the image problem was created by the format or the use of MPEG-2, or both.

Concerns were raised about the combination of using less efficient MPEG-2 (than VC1 and AVC-264) with a limited 25GB single layer disc.

#### Oct 06

Samsung announced a firmware fix for the BD-P1000 player, which was expected to fix the noise-reduction circuit in the Genesis scaler chip (that was left enabled) causing the picture to be softer, and to add Java title compatibility to coincide with the launch of BD Java titles being released during fall 06. Unofficial reports indicated that although the fix was supposed to take care of the softening of the image it actually did not as expected, but the upgrade did fix the image stuttering caused by the use of the DTS tracks (I could not confirm these claims with an actual player).

#### Dec 06

According to a recent review of the Samsung BD-P1000 player the player does not actually output 1080p from the disc 1080p source, it uses the same HD Broadcom BCM7411 decoder chip as the Toshiba HD-A1 HD DVD player, which outputs the 1080p 24fps disc content as 1080i (from the decoder) and then uses a Genesis Faroudja FLI8638-LF video processor/scaler to de-interlace the video and output it as 1080p from the player. I could not verify this claim with an actual player myself.

For the implications in applying this technique, please refer to the analysis of the new Toshiba players regarding the issue of not having 1080p 24fps outputs.

#### CES 2007



BD-P1200 \$800, TTM Mar 07

Samsung announced their next generation Blu-ray Player BD-P1200 replacing their first model BD-P1000 released to the U.S. market in June 2006.

Some new features include the Hollywood Quality Video (HQV) processor for true 1080i to 1080p HD de-interlacing even for DVD, HDMI 1.3 for 7.1-

channel Dolby Digital Plus, Anynet+ (HDMI-CEC) technology for systems operability with a single remote.

Samsung already offers a Blu-ray recorder that features the company's proprietary dual-lens pickup (one pickup with two lenses that allows backward capability, to play standard DVDs and CDs in addition to Blu-ray discs).

The player also features 720p, 1080i and 1080p resolutions, 192KHz LPCM, Dolby Digital, Dolby Digital Plus, MPEG 2, DTS and MP3 formats, 'Easy Top Menu' for font and color changes of subtitles, menu titles, background color, and menu graphics.

	<u>DVD Player</u>	<u>BD Player</u>
	SD	HD
Disc capacity Single-layer:	4.7GB	25GB
Disc capacity Dual-layer:	8.5GB	50GB
Compression:	MPEG 2	MPEG 2/VC-1/H.264
Data transfer rate up to:	10.08 Mbps	50 Mbps
Recording time max:	2 hr. (4.7GB)	2 hr. (25GB)
Maximum resolution:	720 x 480	1920 x 1080
Output:	480i/p	480i/p,720p,1080i/p

1080p native output, up-conversion of DVDs to 720p, 1080i/p, CD backwards compatibility, HDMI 1.3 (1080i/720p/1080p).

In April 2007, Samsung announced their plan to release for the 2007 holidays their first Universal player, the Duo BD-UP5000 capable to play HD DVD and Blu-ray discs with the full interactive capabilities of both technologies HDi and BD Java. I could not confirm pricing, nor if the supplied photo is actually of the future unit.



### Sharp

At CES 2006, the company demo their DV-BP1U Blu-ray player (below with specs), 1080i/720p HDMI outputs, Dolby TrueHD, DTS HD, but the player was never introduced during 2006, neither on 1Q07.



### Feb 07

Sharp announced that is has developed a new technology to reduce the cost of BD recorders to about \$1260 in Japan (these units are not yet in the US), by using the AQUOS TV tuner.

The new Sharp's BD-HP1 Blu-ray standalone recorder, planned for Japan's market on March 20, 2007, connects to the iLink port of Aquos LCD TVs to obtain the tuned content from the TV to record externally and to draw just enough power from the TV to record video without the TV to be on. It was not specified if the recorder/feature would be compatible to other non-AQUOS iLink suited TVs.

Comment for the US market: if the recorder does not actually have a tuner it could pose a problem with the FCC regulations that mandate the inclusion of an ATSC tuner on a device that previously tuned NTSC, although Blu-ray recorders did not exist before in the US they may be included in the mandate because of their generic TV content recording purpose, such as VCR/DVD/D-VHS recorders, which have NTSC tuners.

#### CES 2007

Sharp showed a Blu-ray player that will be available 2Q07, featuring HDMI, \$1200, above.



#### **Sony**

At CES 2006, Sony demonstrated and announced the availability for spring 06 of a series of Blu-ray products from a stand-alone player (BDP-S1), VAIO desktop computers with BD drives, and separate drives for BD playing and recording (BD-R write-once and BD-RE rewritable).

Consult the 2006 HDTV Technology Report for original specs upon announcement.

In the second semester of 2006, Sony delayed the release of the BDP-S1 player several times due to software glitches and parts shortages. First delayed for July, then postponed until August, then to October 25, and finally arrived in Dec 06 to retailers (when I got mine).



In December 2006, Sony announced that the BDP-S1 Blu-ray player was already shipping to retailers, for \$1,000, outputs 1,920 by 1,080p at 24fps and 60fps over HDMI 1.1/HDCP, and up to 1080i over component analog, supports MPEG-2, MPEG-4, AVC and VC1, 1,080p up-scaling of regular DVD through HDMI.

Additionally, the player features uncompressed multi-channel linear PCM digital audio output via HDMI, optical digital audio out and 5.1-channel decoding capability for backward compatibility with existing receivers, BD-ROM, AVC-HD and DVD playback

from DVD/DVD+R/+RW encoded discs, MP3 audio files, JPEG images stored on DVD+R/+RW discs.

The Blu-ray diode used in the BDP-S1 was said to be the same used in Sony's PlayStation 3 game console.

Sony declared they would issue firmware updates in 2007 to enable the BDP-S1 model to play back BD-R/RE recorded media and enhanced BD-Java functionality, which they did.

On my unit, the playback of 1080p24fps was missing frames at intervals, and such fault was not listed on the features the firmware upgrade would fix, but after contacting Sony I was told that the upgrade would actually fix that fault as well. I just received the upgrade DVD (April 07) but I did not install it yet. When I do, I would be able to provide an assurance that the upgrade actually fixes that error.



#### CES 2007

Sony Sapphire 1 Next Generation Blu-ray player – Prototype design (shown above).

#### Feb 07

Sony introduced for dealers a \$600 Blu-ray Disc player, the BDP-S300.

Featuring 1080p24fps output over HDMI 1.3, upconversion to 1,080p, HD component output, supports AVC-HD discs encoded with xvYCC technology that expands the available color gamut 1.8 times, BRAVIA Theater Sync system via HDMI with a single remote, multichannel linear PCM digital audio output via HDMI, decodes Dolby Digital Plus, supports BD-ROM, BD-Java, AVC-HD, DVD video, CD audio, MP3 audio files, JPEG photo on DVD, supports DVD+R/+RW and DVD-R/-RW formats.

### **Formats Implementation Issues**

As with any new format, system, or new technology it is to be expected to experience some operational or performance issues, and these two formats are no exception. This by no means is to be considered a log list of all those, but just a highlight of the fact that, even though the general appearance of the image of both formats is nothing short of what was expected, the players and discs are not perfect, especially on this first generation of software and hardware.

#### Blu-ray

##### 'The Descent'

The movie produced some playback compatibility problems with some standalone Blu-ray players, when playing back its extensive extras authored in the BD-Java environment, such as Blu-ray format's first picture-in-picture video commentary

feature, extensive featurettes presented in full 1080p HD video, which in some cases just showed a blank screen.

Reportedly, the problem apparently is caused by a player's lack of playback support for BD-Java-enhanced titles. Sony for example, promised a firmware upgrade early in 2007, which was issued. Pioneer was not reported as promising the same, yet.

Sony's PlayStation 3 and other firmware-updated standalone Blu-ray players were reported to perform correctly, although I personally had some problems with playing back 1080p24fps where the image seemed to be jumpy at times, missing frames; Sony firmware upgrade was supposed to correct that problem as well but I did not install the upgrade yet.

The Samsung player had several issues of concern at launch, mainly regarding picture quality, firmware updates were delivered to correct some of the problems.

#### HD DVD

The HD DVD format was also reported to have its own technical glitches with some titles (some mentioned were 'The Matador,' 'Derailed,' and 'Wolf Creek'), and some player/remote/HDMI issues, True-HD limited to 2-channel, etc.

Toshiba and RCA players received firmware upgrades as well to correct some of the problems.

## **Analysis for the Hi-Def DVD Adopter**

### **Balancing Features**

There are several factors that might affect the adoption and success of any format at product introduction, in the case of Hi Def DVD is more complicated but the factors have to combine well to strike the correct balance of cost, protection of content, protection of the consumer rights, backward compatibility with existing HDTVs delivering the full quality of the format and be future proof for 1080p HDTVs accepting 1080p, etc.

In addition to the above, the choice decision for a consumer gets more complicated when two formats collide against each other for market domination showing similar features of quality, strong studio support, and, other than the subsidizing factor, there is no apparent reason of why one format is releasing players at almost half price of the other.

### **1080p Outputs**

A consumer that does not have a 1080p HDTV (or one that has it but does not accept 1080p) might not be interested in paying more for a Blu-ray player (or any player) that claims 1080p output capability as a superior feature (Sony, Pioneer, LG, possibly Philips, even Sony's PS3).

It is obvious that Blue-ray has chosen to emphasize the fact they have that feature, while HD DVD ignored it on the first generation.

In other words, if you were just looking for 1080i quality, spending twice as much on a Blu-ray player to get "similar" HD 1080i quality than HD DVD would not seem to be a good investment, other than the exclusive movie titles selection.

However, one has to determine what other features make up for the higher price of some 1080p capable players, such as quality design and construction, which may justify the higher price; 1080p would be a bonus then.

### **1080p24fps for Film Content Playback**

HD DVD still ignores the 1080p24fps feature on the second generation players, an important feature for film content reproduction with capable displays.

Not having a display that can properly handle 1080p24fps might already provide the answer for the decision: ignore this requirement on the player.

However, do you know if you are planning to get a 24fps capable TV/projector in the near future? Are you willing to replace the player if you do? Why not get a player now that is capable of 1080p24fps and save you from a player upgrade in the near future?

Those consumers that have interest in TVs/projectors with 1080p inputs at 24fps for film content might find that paying less for a non-1080p HD DVD Toshiba first

generation player might look like good savings now, but may become a loss down the road if/when upgrading to a 1080p display with such 1080p inputs.

The purchased player without 1080p could turn out to be another piece to upgrade down the line once realizing how good 1080p 24fps film content looks on a 1080p display that can handle 1080p correctly without performing unnecessary interlacing video processing.

### **The Format Choice - Survey Question**

A recent survey was made on the HDTV Magazine about selecting HD DVD or Blu-ray, and the following question was asked:

"What factors are weighing in your decision?"

I provided the following candid response and analysis:

#### Response

Blu-ray. 24fps on 1080p. Manufacturer recognition and tendency to better quality.

#### Analysis

Although HD DVD is reading from the disc film content as 24fps, it is not outputting it that way, not even on their second-generation players.

Toshiba's decision of not including such feature on the 2nd players was taken after Blu-ray came out with specs and players with such feature (Sony, Elite), bragging about it because of its importance for film content (with suitable displays).

Even then, HD DVD ignored the feature on 2nd generation players (one player is out, one is coming out in spring 2007, neither one has it).

Ignoring the 24fps quality feature while concentrating in price reduction suggest that there might be other possible shortcuts implemented across the player to make it enter the market fast at a lower price point (this is an assumption, but with valid logic based on verifiable facts). I would suspect that they would eventually incorporate the 24fps feature.

Blu-ray is also releasing their players with features that are just partially implemented, my message goes for them as well.

Since most TVs accept 1080i, or 1080p only as 60fps, this feature would not be as important as it is for front projectors and some new displays that can accept and process 24fps into frame-multiples to display a clean, artifact-free image, instead of converting it to 60i and later to 60p, the interlaced world of video that film should not be bothered with.

Even Toshiba is promoting the 120Hz panels now (5 times 24fps), so it is not even consistent with their panel plans. Many other display manufacturers are also introducing displays that handle 120Hz. However, that does not necessarily mean that they will accept 1080p24fps and display it cleanly at 5 times the frame rate, anything could happen on any display, proper research is the key to an intelligent purchase.

I have tested the 3 Blu-ray output versions of 1080p24fps film content (as 1080i, 1080p60fps, and direct 1080p24fps) and there is a clear difference between them, easier to recognize in large screens, and it is detectable in casual viewing not just in lab type conditions.

Because most of the TV consumer market does not have a way to handle 24fps without video processing conversions, the HD DVD market might be putting its bets on the logic that consumers will "keep on upgrading to the next model".

High quality HT enthusiasts have waited very long for pre-recorded Hi-Def media, and would appreciate the 24fps feature. They most probably are the early adopters paying the first players at high prices (\$1000+) so a format can be established and the R&D bills can be paid for newer and better models.

However, Toshiba has apparently stop implementing heavy subsidizing on their stand-alone players to kill the price and establish their format based on volume, because it has introduced a player with the \$1000 price point similar to Blu-ray. Toshiba is showing the real price of this technology in 2006/7.

Unfortunately, even at the high price, Toshiba still ignores the quality 1080p24fps feature on their hi-end player. The true war begins now. A war of quality and merits without free lunches.

I am not including the video game consoles on these comments because both formats have killed the prices to compete in that world. This is about stand-alone players.

If you have a front projector, a large screen, and a quality HT that handles 1080p 24fps properly, you owe it to yourself to get a 24fps capable player.

If you do not, or you do not have a scaler dealing with 24fps at higher quality processing than the player, you probably would never notice a difference and might ignore my comments in making your selection based on that feature.

### **Audio Claims**

Players on both formats claimed different capabilities regarding optional multi-channel audio internal decoders, some do DTS-HD but no Dolby TrueHD, and some do Dolby TrueHD but only as two-channel, the minimum HD DVD standard requirement.

Some are suited with HDMI 1.3 for streaming out the new hi-bit DTS/Dolby multi-channel soundtrack for external decoding using a suited A/V receiver (when they are introduced in the near future).

Some are suited with just HDMI 1.1 or 1.2, which would only be able to stream out DTS HD, but not DTS Master Audio, Dolby Digital Plus, or Dolby True-HD. Those can only be transported over HDMI 1.3 version that can handle the higher bit/protocol requirements.

Check the section dedicated to "Multi-channel Audio for HD" for details about the connectivity issues when playing the new audio codecs on Hi-def DVD players.

However, just playing Dolby True-HD soundtracks down-mixed as 640 Kbps Dolby Digital 5.1 over the coax/optical digital legacy connection, is a considerable improvement compared to the typical DVD Dolby Digital 5.1 soundtracks reproduced at just 384 Kbps (and sometimes even less).

In other words, if the player or your system does not have hi-bit audio decoding capabilities you can still get the improved Dolby Digital legacy multi-channel mentioned above, which might be a sufficient benefit during this early adoption period of either format, until A/V receivers and Hi-Def players with the hi-bit decoders of your preference become more available.

### **Image Constraint Token (ICT) - Early Adopter Impact**

One would think that the large mass of HDTV early adopters (about 11 million since 1998) would be the most appropriate group of consumers to start up another high quality format like Hi Def DVD.

However, they were out of luck with the recent AACCS decision of not allowing Hi-Def DVD played back at HD resolution over the player's analog connection if the content protection Image Constraint Token is used on the disc. The reason: is the only connection their TVs have for HD, analog.

Many movie studios already announced that they will not be using the Image Constraint Token on the discs they encode, but the decision was temporary, it should be permanent, it has not been proven that using analog outputs for 1080i promotes piracy.

Content providers control the decision not the consumer, and they might eventually implement the Token as planned and down-res HD viewing of pre-recorded movies over the component analog connections.

If the token is turned on, those 11 million DTVs would be affected. Ironically, those DTVs were the ones that cost considerably more compared to current DTV prices. Imagine paying about \$10,000 back then for one of those legacy HDTVs and not been able to view Hi-Def DVDs in HD.

This also affects a large number of movie viewers that use their PC as home-theaters with a new Hi-def DVD player drive, where the PC/monitor system is not enabled with an HDCP compliant content protection connection, which is very common not having for most computer purposes.

This matter will certainly be a turn-off to all those millions of legacy HDTV and PC owners in adopting either format, and that might be the reason that movie studios decided not to use it temporarily.

### **ICT Token - An Issue Anytime any Place**

A 4-8 year component analog DTVs should not be considered as ready for replacement and suitable for a landfill. Even when those early adopter owners might buy newer replacement DTVs, the older DTVs would naturally be put to use on secondary rooms as most people do.

This is the scenario of the 2.6 average ratio of TVs per household that CEA statistics estimates people have. According to the estimate, non-primary TVs (such as the legacy DTVs above) are destined for secondary use on secondary rooms, for video games and pre-recorded media. That is DVD and Hi-Def DVD. Even as a secondary DTV, there is a need for those DTVs to continue performing the HD 1080i role, which would not be possible if the Token is implemented later on.

### **ICT Token - Industry Impact**

However, when a movie studio uses the ICT token the regulation says that the disc package must indicate so. Many millions of buyers could choose not to buy Token protected discs.

If many movies of a format are found token protected, it could also affect the sales of players of that format (or both formats) by not attracting 11 million possible clients. That has the potential to produce consumer apathy in making a purchase. Apathy produces a slow market. A slow market could cause a dead format. A dead format could cause heavy economic losses on movie studio revenues which could affect the availability of movie selection to consumers. No one wins.

It would be illogical that movie studios producing discs on both formats would issue a movie with token in one format but not in the other. Both formats could be affected equally with the token issue, but anything could happen in the heat of a format war.

If the launching of new players would have been for just one format, a slower momentum to reach market acceptance might not hurt as much as when two formats are competing against each other.

Both formats are under the pressure of demonstrating success as quickly as possible to the shareholders that want to see ROI after so much "I" of many years in development. Time is very valuable in those circumstances, cutting out the very people that could almost guarantee the sale of 11 million players in short order might be very damaging, to everyone.

A token could become the worst enemy of the needed success because it makes the adoption slower. Prolonging the withdrawal decision of a losing format could produce economic losses much larger than dropping the ball in time and move on to another CE business.

### **Hybrid Discs**

HD DVD brags about their introduction of some movie titles on hybrid discs, which consumers could view on a DVD player as well as an HD DVD player by flipping sides of the disc. This feature helps everyone in the transition from DVD to the higher quality, incompatible format. Please check the discs and the analysis about this feature on the 2006 HDTV Technology Report.

Blu-ray hybrid discs have not yet arrived to the market at the time of this report but they will hopefully be introduced soon as a dual side format, with the Blu-ray version in one side, and the DVD version on the other side.

Although scarce in quantity and variety, the hybrid disc feature is viewed by some as a competitive edge of HD DVD.

The new Total disc introduced by Warner, implements a similar dual side hybrid feature, but to store the two competing blue-laser formats, one on each side of the disc.

My opinion about this is similar to the introduction of universal players. Discs and players would have to cost more to the consumer to offer duality, because the industry could not make up their mind and went to a war of incompatible formats. Why should the consumer have to pay extra for universal features on any product for other reasons than backward compatibility?

### **Partial Implementation of Features**

Both formats were initially introduced without all of the features each format can offer, which could certainly make them fully competitive if implemented.

Some of those missing features are the lack of 1080p outputs, the lack of HDMI 1.3 for outputting hi-bit audio codec streams for external decoding (especially if the player lacks the decoder for that format), True HD in two channel mode only, none or limited Internet connectivity/functionality, no full implementation of interactive menu features, an included 1080p output but not at 24fps, a 1080p signal output obtained with work-around methods, such as not extracting and outputting directly the 24fps content stored in the disc, etc.

A full format comparison should be made when both formats have implemented all the features of hardware and software.

In the mean time, it seems both formats are expecting that the first batch of early adopters invest in players and discs with partially implemented features, quite an investment in the case of Blu-ray players above the \$1000 threshold.

Perhaps manufacturers expect that those consumers would reinvest again six months later another \$1000 to get some missing features on the next generation of players, some not upgradeable via firmware.

On a positive note, the players are finally here, and we should be grateful that Hi-Def ROM pre-recorded movies are now available, and that they make good use of the 1080p/24fps format of film sources.

## A Different View of Hi-Def DVD Booths at CES

It is 6:00 PM!

Quickly, lock away these Hi-Def DVD players from the pirates, I meant consumers; they might even copy our fake carton mockups to install them in their Home Theaters!



## Asia's Hi-Def DVD Challengers

### China's EVD, HVD, and HDV

Over the past couple of years, I have written in these reports (as well as in the pages of DVDetc and HDTVetc Magazines) about the four Hi-def DVD formats in the China/Taiwan market, three from China (EVD, HVD, and HDV), and one from Taiwan (FVD). Please consult 2005 and 2006 reports to find details about those formats.

### Taiwan's Forward Versatile Disc (FVD)

I met with Mr. Job Liu, Managing Director of POSO (Power Source Group Limited), who was representing the FVD format at CES 2006. Mr. Liu introduced also Margaret Fan, General Manager of Idar Electronics Co., a company involved with the FVD players and format.



They showed the player, the movies, the FVD format efforts, and we discussed about specifications and technical capabilities of the format, discs, and players. At the end of our long meeting, I was offered if I wanted to take the player with me after the show, which took me by surprise, I declined politely, but I certainly accepted an FVD disc demo as my after show teaser.

FVD discs and players were already available for sale back then. The player MSRP was \$250, and FVD movies were quoted as about \$6 per disc, although I have not seen an official price list as I did with Chinese EVD companies the year before.

FVD is a red laser solution that supports FVD-video and WMV-9 HD video codecs, and WMA, LPCM and ITRI-Audio codecs. The disc can store 135 minutes of HD full-length movies in 720p/24/30 (SL), or in 1080i60/p24 (DL, or 3 hrs TL), in addition to 720x480 and 320x240 regular video resolution at 60i. Peak rate of 15 Mbps at 1920x1080x24fps.

The FVD player is suited with DVI or HDMI and component analog connections, optical and coax for 5.1 or 2-channel audio, digital sampling 96kHz/24bit. According to the company at CES the player is able to output 1080i over component analog because the format uses its own content protection system (ITRI-AES, Innovative Technologies Research Institute - Advanced Encryption Standard).

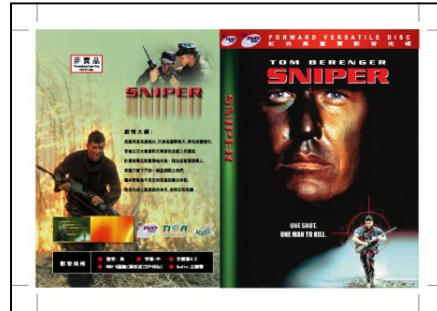


There was a PC playback software version (Super FVD, in beta then) that allows the use of existing DVD-ROM drives for HD FVD playback of movies without any additional hardware. There is no need for Microsoft's

Media Center in the PC because as mentioned above the format uses its own content protection system, no DRM.

There are 29 companies and ITRI in the AOSRA (Taiwan Advanced Optical Storage Research Alliance), an organization founded in January 2002.

There are several FVD disc producers like RiTek Corporation, Prodisc Technology Inc., U-Tech Media Corporation, Leaddata, Infodisc, Giga Storage, Optodisc, Nan-Ya, and CMC Magnetics Co. (their discs are pictured above on the left). Players are being manufactured by TATUNG, BenQ, LITE-ON, Actima, Mustek, PROTOP, Arima, MSI, QSINC, Ultima, and A-DATA. Chip-set manufacturers include VOS, ALI, MTK, SUNPLUS, and CHEERTEK. Video software content includes Newsoft, Deltamac, and Cine-Asia Entertainment.



In addition to the existing titles, and WM9, fourteen FVD films were planned to be released soon: Air Panic, Avalanche, City of Fear, Death Train, Edges of the Lord, The Order, Us Seals, The Confession, Earthquake, Fire, Volcano, A Wobot Christmas, The Opponent, Diary of a City Priest, Buried Lies, Combustion, Malie.

FVD was introduced on April 5, 2004 in Taipei Taiwan. The first FVD players were made available in May 2005 for \$175 with 10 free movies in Taiwan.

With a sales promotion in Europe and the US, the global volume was estimated to reach 100,000 players in 2005, 3 million in 2006, and 5 million in 2007. Later, Taiwan's Kolin offered in November 2005 an initial sales promotion period for their first KVD-1080 player with an HDMI cable included, and three 1080i FVD movie discs, all for \$240.

Content is available mainly from independent studios but the alliance is doing efforts to expand to 100 the initial offering of titles by including other major studios.

Idar Electronics Co. below



Comparison of Formats				
	DVD	FVD	HD DVD	BD
<b>Leading Organization</b>	DVD Forum	Taiwan's AOSRA	DVD Forum	Blu-ray Association
<b>Physical Capacity (single side)</b>	(SL) 4.7GB (DL) 8.5GB	(SL) 5.4/6GB (DL) 9.8/11GB (TL) 15GB	(SL) 15GB (DL) 30GB (TL) 45GB	(SL) 25GB (DL) 50GB (4L) 100GB(TDK)
<b>Laser</b>	Red Laser (650nm)	Red Laser (650nm)	Blue Laser (405nm)	Blue Laser (405nm)
<b>Resolution</b>	720x480i60	1280x720p24 1920x1080i60 1920x1080p24	1280x720p 1920x1080i/p	1280x720p 1920x1080i60 1920x1080p24

Chart sourced from FDV with my additions/corrections

### FVD at CES 2007



## **Versatile Multi-layer Disc - VMD Format**

Mar 06

Another high definition DVD format was introduced named "VMD" Versatile Multi-layer Disc by New Medium Enterprises (NME), but the company stated that is not trying to compete with HD DVD or Blu-ray.

According to the company, a VMD player would cost just \$150, and a VMD burner could be introduced as well.

The disc would hold up to 40GB and could be read using low-cost red lasers of standard DVD drives. The format is capable of multi-layers with 20GB, 30GB, and 40GB discs. Even 100GB VMD recording had been achieved in the lab.

NME is based in London, and was doing a merger with E-World, which owns a standard called EVS, a Chinese standard that is backed by the Chinese government.

The technology can be adapted to blue laser when more affordable.

The VMD format claims to have 2,600 Bollywood titles, distributed by Eros, and about 300 Chinese film titles through E-World, the two largest markets in the world, according with Bolger-Hagerty from NME.

Other markets, such as the large Indian communities in London and New York might be also included in the distribution, and Hollywood content might be possible if/when content protection issues are addressed.

Mar 07

New Medium Enterprises has signed a retailer agreement with PC Rush, and online electronics superstore, to distribute VMD players in the US for a period of 3 years, TTM 2Q07.

Two players will be offered:

HD VMD Media Player Duo	\$200
HD VMD Media Player Quattro	\$250

The players feature DVD upconversion to hi def, in addition to playback VMD discs.

## Chapter 13 - HD Video Processors

A good number of HD video processors were included on earlier State of HDTV Review reports. Many of those units are still available as current models from companies like Lumagen, Center Stage, Cinemateq, Faroudja, Key Digital, etc.

Please consult the 2006 HDTV Technology Report and the 2005 HDTV Technology Report for details on some of those previously released products.

I am listing first the companies that have created video processing solutions/engines/etc, such as ABT, creator of the DVDO product, the Realta HQV by Silicon Optix, and the VXP by Gennum. Following that group, I review products/companies that have implemented those video processing solutions (or their own) on their products.

### Engines for Video Processors

#### ABT

Anchor Bay Technologies is the original creator of the award winning line of DVDO® iScan, the company demonstrated at CES a 1080i (to p) de-interlacing product among other technologies. ABT's HD de-interlacing technology includes detection of interlaced video, which originated from any progressive source, motion, and edge-adaptive de-interlacing for video sources as well as low latency options for video gaming. ABT's Precision Video Scaling technology was first deployed in ABT's DVDO iScan HD. It has been incorporated into many hi-quality products such as the early Marantz's DV9600 and the DVD-5910 Denon's flagship, DVD players.

The scaling engine is completely flexible, accepting standard definition (480p, 576p) and high definition (720p and 1080i) inputs and outputting any resolution from VGA (640x480) to 1080p (1920x1080) with multiple standard and custom aspect ratios, and supporting other image manipulation features, including zoom, pan and border controls. ABT's high performance frame rate conversion also supports converting film sources from 24 frames per second to 48, 60 or 72 frames per second.



Some of the ABT technologies are:

VRS Precision Video Scaling II™, Precision Deinterlacing™, Progressive Re-Processing™ (PReP™), RightRate™, AutoCUE-C™, and Precision AV LipSync™.

Progressive Re-Processing (PReP™)

Improves video signals and removes artifacts caused by poor deinterlacing in source equipment, restoring a video signal to its interlaced beginnings and is properly deinterlaced using reference-quality Precision Deinterlacing™, applying motion, edge

and source adaptive algorithms to eliminate jaggies, combing, and other degrading effects. PReP can enhance 480p, 576p, 1080p/50 and 1080p/60 signals.

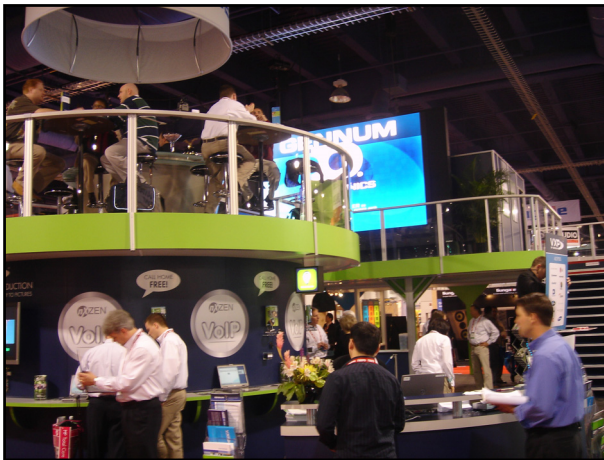
ABT2010 ASIC for OEMs:

Second-generation video processing ASIC for up-conversion (up to 1080p) applications in DVD, HD-DVD, Blu-Ray player/recorders, and AV receivers. Featuring Video Reference Series™ (VRS™), 10-bit Precision Deinterlacing™ with five-field motion adaptive and edge adaptive processing, 10-bit Precision Video Scaling II™ that can independently scale horizontally and vertically, VRS Progressive Re-Processing (PReP™) technology, to revert progressive video to its original interlaced format, and then converts the interlaced signal to progressive format using Precision Deinterlacing.

## **Gennum Corporation**

Gennum Corporation is a leading producer of hybrid and silicon integrated circuits (ICs), electrical components and sub-systems for the video and audio markets, and a new provider to the data communications market.

### CES 2007



The following was declared by Gennum's about their new video processors GF9350 and GF9351, both suited with VXP Visual Excellence Processing technology, originally designed for broadcast quality use.

These products are being implemented by companies like Christie, Leitch, Anthem, LG, Samsung, Optoma, Marantz, and Pixel Magic.

A couple of examples are: high quality video processors, like Pixel Works' Crystalio II, and Optoma's front

projector model 81, true single-chip 1920x1080p DLP projector released 4Q06 (of which a witness their excellent demos of the model 81 since CES 2006, reason by which I own one myself since November 2006).

"The VXP technology incorporates fourth generation broadcast quality image processing algorithms, which deliver superior SD and HD video image quality. The key features of VXP technology include:

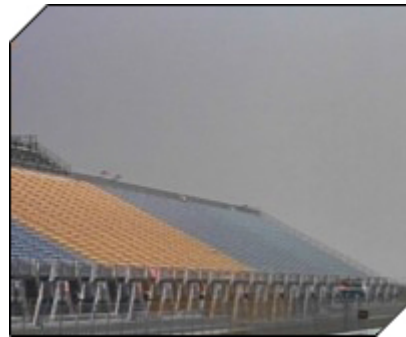
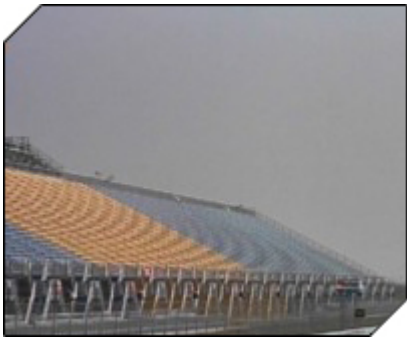
- 1080p adaptive de-interlacing for optimal image sharpness TruMotionHD™ 1080i and resolution.
- FineEdge™ dynamic directional interpolation to eliminate jaggy artifacts found in traditional de-interlacing algorithms.
- FidelityEngine™ image enhancements for removal of unwanted noise and improved detail and uncompromised image quality.
- RealityExpansion™ 10-bit image processing for eye-catching natural imagery."



VXP supports picture-in-picture (PIP), picture-on-picture (POP), and picture-by-picture (PBP) applications, and supports all VESA and SMPTE formats up to 2048 lines by 2048 samples, universal frame rate conversion and full programmability for dynamic effects.



Fidelity Engine Processing



TruMotionHD Processing



FineEdge Processing

## Silicon Optix



This company was covered since the CES 2005 report when they introduced their Realta HQV video-processing engine. Please refer to that document 2005 HDTV Technology Report (and even the 2006 HDTV Technology Report) for details.

Other companies implementing their video processing-engine have quoted impressive performance statements about the Realta product; some of those are as follows:

"The Realta HQV processor powered by Teranex with true 10-bit video processing, full four-field motion adaptive video de-interlacing for both standard definition and high definition signals, temporal-recursive noise reduction, automatic multi-cadence detection, and pixel-based detail enhancement. It also utilizes the same video processing power—1 trillion operations per second—as the famous \$60k Teranex Xantus box."

"Instead of discarding half the resolution, and just doubling the lines (a shortcut that many video processors take today). HQV processes all 2 million+ pixels in both odd and even fields of a 1080i signal preserving all the rich details in an HD scene. Also, HQV per-pixel, motion adaptive noise reduction cleans the random noise that can plague HD broadcasts."

"Currently, given the scarcity of HD content, most of the HD broadcast programs are SD material up-converted to HD, often with Teranex equipment. Also, for years to come, much of the TV programming will continue to be delivered as standard-definition (SD) 480-line interlaced video. Going from 480i video to 1080p involves resizing an image up to six times."

"Realta HQV employs for 480i to 1080p conversion the same algorithms used in Teranex up-conversion equipment. The processing relies on a combination of powerful features, such as multiple fields pixel-by-pixel analysis, 1024-tap scaler, HQV detail enhancement, HQV random, block and mosquito noise reduction, to deliver standard-definition broadcast TV and DVDs that approach HD quality."

"Unlike any other video processor, Realta HQV is also fully software programmable and upgradeable. The Realta HQV processor executes its video algorithms entirely in software. As new video processing software is developed, consumers can simply download the upgrades."

"The Realta HQV video engine has received numerous awards and accolades, including the "Best of Innovations" award for the Embedded Technologies category at the 2005 Consumer Electronics Show, "Most Promising New Technology" and "Most Exciting New Company" from The Perfect Vision, "Best Buzz of CEDIA" from Insight Media, AVGuide Monthly's "Best Product Overall," Red Herring's "Top 100 Innovators" award, Fred Kahn's "Silver Best of CES" award, and most recently "Best Picture of the Show" at the Home Entertainment 2005 Show in New York City, from Tom Norton of UltimateAVmag.com."

Additionally, the company has introduced a test program for video products, the "HQV Benchmark Test DVD" for consumers to objectively evaluate picture quality. The test program includes patterns that have been designed to evaluate video performance such as decoding, video deinterlacing, film-cadence detection, video-over film, motion correction, noise reduction, and detail enhancement, in addition to ten tests with color bars, jaggies patterns, waving flag, detailed static image, etc. MSRP \$30, TTM now.



#### Jun 06

Silicon Optix announced the Reon-VX chip, targeted for high-volume applications, including plasma TV, LCD TV, RPTV, home theater and business projectors, A/V receivers, personal video recorders, set-top boxes, Mediacenter PCs, and DVD players, including Blu-ray and HD DVD.

"With the fully programmable, one-trillion-operations-per-second Realta chip, we've delivered a future-proof, no-compromise flagship video-processing engine using technologies proven on the front lines of Hollywood," said Paul Russo, Chairman and CEO of Silicon Optix.

"Reon-VX delivers many of the same Hollywood-proven HQV algorithms for mainstream markets. By focusing on typical home theater content and dynamically deciding which algorithms to apply on a per-pixel basis, Reon-VX offers mainstream markets the opportunity to experience HQV video processing," continued Russo.

The following specifications were provided by Silicon Optix about Reon-VX's Hollywood Quality Processing:

**HQV FOUR-FIELD PER-PIXEL SD/HD DEINTERLACING:** Reon-VX offers true HQV four-field, motion-adaptive, per-pixel, high-definition (HD) deinterlacing, delivering the sharpest and most detailed HD images possible. With 1080i material you'll be able to see things such as strands of hair, guitar strings, and even threads in suits and ties. By looking at each individual pixel, HQV processing ensures that there is no unnecessary loss of resolution, as is the case with region-based or frame-based solutions.

**HQV SD/HD FILM CADENCE PROCESSING:** The wait for 1080p content is over. With HQV's content-based HD cadence detection, the Reon-VX delivers true 1080p reconstruction of HD film sources, including Hollywood films and television shows produced on film.

**HQV SD/HD MULTI-DIRECTION DIAGONAL FILTER (MDDF):** A true 10-bit diagonal interpolator that removes any "jaggies" and/or stair-step artifacts from deinterlaced video sources without blurring the image.

**HQV SD/HD DETAIL ENHANCEMENT:** Detail enhancement brings out the fine detail in scenes and is important for SD and HD material. For example, it is possible to see blades of grass, small details on jackets, and wrinkles on faces. When combined with noise reduction and advanced scaling, Reon-VX detail enhancement can make regular DVDs approach the quality of high-definition DVDs.

**HQV SD RANDOM NOISE REDUCTION:** Random noise or film grain is an issue with DVDs and cable broadcasts. While many competitors take the simple approach of looking at a single frame and cutting off the high-frequency information, Reon-VX uses a much more advanced temporal approach of looking at many frames over time, which preserves image quality while reducing noise.

**HQV SD MOSQUITO AND BLOCK (CODEC) NOISE REDUCTION:** Satellite and cable providers, as well as PVRs, compress the signal to get the maximum content into the smallest space. Reon-VX delivers high-quality codec (mosquito+block) noise reduction to remove the noise and artifacts caused by this compression.

**HQV COLOR SPECTRUM CONTROL:** Selective color region enhancement allows certain regions (e.g., skin tones) to be accentuated. Reon-VX also contains advanced color edge enhancement that corrects artifacts caused by restricted chroma and luma bandwidth. It also provides full detection and correction of chroma upsampling errors.

**TRUE 10-BIT PROCESSING:** Reon-VX offers complete input-to-output 4:4:4 color processing and a full 10-bit internal data path, thus enabling the rendering of more than one billion colors.

**DUAL-CHANNEL PROCESSING:** Reon-VX's powerful image-processing engines can process two full HD or SD resolution channels, thus enabling equal image quality for each video window in split-screen (PAP) mode.

**eWARP VX GEOMETRY PROCESSING:** For applications requiring image warping, the Reon-VX's proprietary eWARP VX engine allows for AnyPlace flexible projector placement while maintaining the highest-quality graphics, fine text, and crisp HD video."

Products that include the Reon-VX video processor will display the "HQV" logo.

Products that include the fully programmable Realta processor will display the "HQV Powered by Teranex" logo.

As of September 2006, several products have incorporated the Reon-VX and HQV technology as follows:

Algolith

DragonFly external Realta HQV video processor: \$3000, TTM now.

BenQ

The company announced their selection of the Reon-VX HQV® processing engine to power its new WXGA (1280x768) DLP projector, TTM 4Q06.

"Reon-VX HQV processing encompasses true 10-bit video processing, full four-field per-pixel SD/HD motion-adaptive video deinterlacing, SD per-pixel temporal-recursive noise reduction, SD codec (mosquito and block) noise reduction, and SD/HD per-pixel detail enhancement.

The BenQ projector will also take advantage of Reon-VX's exclusive advanced real-time warping and scaling engine to scale resolutions for correcting extreme keystone

angles in both horizontal and vertical dimensions, or for projecting on curved or warped surfaces while maintaining full image integrity” BenQ said.

#### Calibre

Vantage HD external Realta HQV video processor: \$2900, TTM now.

#### Cinetron

HD-900 1080p projector with built-in Realta HQV processing: \$6000, TTM Oct 06.

#### Denon

DVD players: 5910CI, 3930CI and 2930CI, with built-in Realta and Reon-VX HQV processing: 3930CI \$1500 MSRP; 2930CI \$850, TTM now.

#### Digital Projection

VIP 1000 external Realta HQV video processor: \$6000, TTM now.

#### Epson

Epson also announced their decision to implement Realta HQV processing in their PowerLite Pro Cinema 800 720p projector, featuring 3LCD technology and an external HQV TX3 video-processing box for \$7,000, TTM Jun 06.

“We selected HQV processing because it delivers the best image quality in the industry. When viewing high-definition (HD) material with the PowerLite Pro Cinema 800 and HQV processing, one can see every detail and nuance in scenes, from strands of hairs to threads in suits and ties. These kinds of details are lost with other video processors,” said Lowell Wolf, Product Manager, Home Entertainment Division, Epson America. “For regular DVDs and standard-definition (SD) material, HQV processing performs admirably, making SD material approach HD quality,” continued Wolf.

#### JVC

DLA-HD10K projector and external Realta HQV HR1080Pro video processor, TTM now.

#### Mitsubishi

HC5000BL 1080p projector, built-in Reon-VX HQV processing, \$4500, TTM Oct 06.

#### NEC

TheaterSync external Realta HQV video processor: \$3600, TTM now.

#### Proview

1080p LCD, Reon-VX HQV processing, TTM 1Q07.

#### Syntax

Olevia 7 Series, 1080p 42" and 47" LCD displays, built-in Realta HQV processing: 42" 742i \$4000, 47" 747i \$5000, TTM 4Q06.

#### Toshiba

TDP-ET20U all-in-one projector, with built-in Realta HQV processing,



\$1,400. TDP-ET20U can project a 100" inch image from just 3.9 feet away, TTM now.

Toshiba's new top-of-the-line HD DVD player, the HD-XA2, offering 1080i-to-1080p HD deinterlacing, per-pixel motion-adaptive algorithms, multidirectional diagonal filter for jaggie-free video, per-pixel motion-adaptive noise reduction, detail enhancement, and advanced scaling for upconverted SD.



#### Yamaha

DPX-1300 720p projector with built-in Realta HQV processing, TTM now.

#### Oct 06

Silicon Optix's increase in revenues of 513 percent from 2001 to 2005 resulted in a 17 ranking in the Software & Information Technology category of Deloitte's Technology Fast 50 Program for Silicon Valley, a ranking of the fastest growing technology, media, telecommunications and life sciences companies in the area by Deloitte & Touche USA LLP, one of the nation's leading professional services organizations.

#### GEO chip

#### CES 2007

Silicon Optix announced the volume availability of the new Geo chip by 1Q07.

Geo enables RPTVs to compete with LCD and plasma displays and ensures pixel-by-pixel brightness and color uniformity for both projection and LCD panels

Silicon Optix announced Geo, a video/graphics-geometry processing chip that would enable RPTVs to be thin and be hung in the wall to compete with current flat panels.

The technology eliminates hot spots and color non-uniformity, allows for pixel-by-pixel brightness control for uniformity, eliminates "green glob" (pastel-discolored regions), commonly seen in three-panel projection systems, offers three independent geometry-processing channels capable of high-precision, pixel-by-pixel processing capable of digitally achieving lateral chromatic aberration correction.



Features electronic correction of optical problems such as lateral chromatic aberrations, optical distortion, and three-panel misconvergence, instead of typical optical and mechanical solutions.

Geo offers inexpensive TV manufacturing, small cabinet depth, less weight, and less power consumption.

"Picture a 55-inch rear-projection TV with a depth of just 5 inches, weighing half of what an LCD or plasma weighs and consuming a fraction of the power. That's what's possible with Geo," said Paul Russo, Chairman and CEO of Silicon Optix. "Geo is going to revitalize the RPTV segment and solve common image-quality problems that have plagued projectors forever. Geo also solves the brightness-uniformity issues associated with LED-driven LCD displays, and the color-uniformity issues associated with three-panel projection systems."

## Video Processors

### Algoith

DragonFly video processor, \$3,000, consult details and original specs on the 2005 HDTV Technology Report. According to the conversations I had back at CES 2006, the company had some financial problems that made it unable to release the product as originally planned by mid-2005, and was postponing release for 1Q06 but it was further postponed for later. The unit implements Silicon Optix Realta HQV chip, 1 component in (max 1080i/60), 2 HDMI in (max 1080i/60), 1 component out (max 1080i/60), RGBHV (max WXGA), 1 HDMI out (max 1080i/p/60), no pass-thru of 1080p apparently because it does not even accept 1080p, full four field deinterlacing



window for HD deinterlacing and cadence detection (1080i to 1080p), upgradeable algorithms via USB port. 1080p output could be 24/30/60fps.

### CES 2007

DragonFly \$3,000, TTM now. The unit has been finally released. Featuring the above specs, 10-bit

diagonal interpolator which removes so-called jaggies and stair-stepping artifacts from de-interlaced video sources without blurring the image; Noise Reduction capability, available as an option, reduces analog and MPEG noise artifacts and the fully automatic adaptive software algorithm adds a fourth dimension of pixel-by-pixel noise and motion measurement.

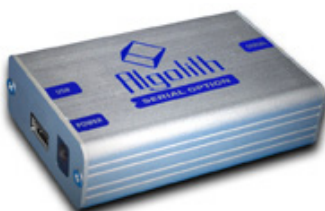
Onboard USB interface allows Dragonfly software to be fully upgraded and re-programmed via the Web, Automatic Per Pixel Video/Film Detection lets the Dragonfly make pixel-level decisions when processing film pixels as film and video pixels as video — rather than frame-level decisions, which can lead to visible artifacts, eWARP-2 engine allows AnyPlace™ flexible projector placement.



The optional Noise Reduction and SDI Input are available for an additional \$495 each.

Mosquito (video enhancer) \$3,000, TTM now, noise reduction for digital and HD video signals, filters and reduces video imperfections without losing detail, HDMI, new edition, Version 2.0, of Algoith's software core.

Flea (video enhancer) \$1,000, TTM now, HDMI input, new edition, Version 2.0, of Algoith's software core, reduces noise and artifacts introduced by compressed digital video signals from such sources as DVDs, satellites, digital cable, PVRs, and Home Theater PCs.



Serial Option \$500, TTM now, small accessory module for the Mosquito and Flea to be controlled by Home Automation systems, such as Crestron, AMX and other manufacturers, RS-232, USB port, power input, bi-directional communication.

## Calibre

In September 2005, the company launched their Vantage-HD Home Theater video scaler and switcher suited with Silicon Optix Realta HQV chip with true 10-bit processing, automatic multi cadence detection, and four-field per pixel deinterlacing, \$2,900, TTM 4Q05.



Upon the introduction of the Vantage product the company released the following statements:

"The video processing built into most home theater displays and progressive-scan DVD players has limited processing ability and runs basic algorithms none of which can match the awesome power of Vantage-HD's 1T-flop DSP with 30-bit 4:4:4 scaler datapath, 12-bit component video A/Ds and studio quality 10-bit video decoder with super-adaptive comb filter and 4 x ITU656 over sampling."

"Vantage-HD includes per pixel multi-angle aperture-adjusted motion-compensated de-interlacing of both SD and HD images, with full de-interlace performance on 1080i formats as well as 480i and 576i, out performing all competitor algorithms providing a level of de-interlacing quality previously only found in high end studio facilities."

"Vantage-HD expertly processes film based material with full automatic detection of all pull-down cadences including broken cadences and non-standard cadences typically found in animation sequences, as well as the common 3:2 and 2:2 formats, all with automatic scene change detection to ensure clean cuts between scenes and the ability to process mixed scenes where film and video are overlaid."

"Lip-Sync errors significantly degrade the home theater viewing experience Vantage-HD automatically adjusts the audio time-line to suit its internal video processing delay. Audio time-line correction operates on all audio channels—digital coaxial, digital fiber-optic, analog and HDMI audio channels. It's easy to see that Vantage-HD is far more than just another scaler."

"For DVD and digital cable/satellite users Vantage-HD provides real-time MPEG artifact reduction while leaving picture detail intact. Even conventional external scalers don't fix all picture defects, even those considered benchmarks in home theater cannot reduce MPEG noise and cannot run their full de-interlace algorithms on HD signals due to a lack of real-time processing power."

In 2006, Calibre continued committed to HQV and actually introduced the product above for \$2,900, as follows:

Calibre released its Vantage-HD Home Theater video scaler and switcher powered by the Silicon Optix Realta HQV™ video processing engine.

"We selected the Realta HQV for the Vantage-HD because it delivers spectacular image quality. Not only does it convert NTSC or PAL standard definition (SD) material to superb high definition (HD) images, but it is the only processor to correctly process HD video for maximum image quality," said Tim Brooksbank, CEO of Calibre.

Unlike any other video processor, Realta HQV is also fully software programmable and upgradeable. The Realta HQV processor executes its video algorithms entirely in software. As new firmware is developed, Vantage-HD consumers can simply download the upgrades from the Calibre web site.

Vantage-HD is a scaler and a switcher with flexible range of inputs and outputs, integrated with on screen menu controlled by remote or by an RS232 serial link for use with third party control systems, the base input configuration is 2x HDMI with support for up to 8 channel digital audio, HDCP capability and backwards capability with DVI, 2xcomposite video and 2xcomponent analog video for YPbPr or RGBS SD, ED or HD signals compatible with 480i (NTSC), 576i (PAL/SECAM), 480p, 576p, 720p and 1080i as well as 1080psf. Additional options include 2xHDMI expansion board and an HD-SDI expansion board with single or dual port inputs available during 2006.

On discussing some technical features with Calibre, I obtained the following information:

1. There are several aspect ratio conversions available; the aspect ratio can be customized for non-standard applications. Vertical stretch of a 2.35:1 image for use with 1080p projectors fitted with an anamorphic lens is pre-programmed into the selectable aspect ratio conversions. The chosen aspect ratio is automatically saved and recalled on a per-input, per signal aspect-ratio basis. It is also possible to select the required aspect ratio from the OSD menu, or via the OSD select button on the remote control, or via discrete IR command, or via RS232 serial command.
2. 1080p will physically pass through the on-board circuitry but signal processing can be disabled by turning off the various filters and enhancement settings via the OSD menu. By 1080p passes through the scaler so that it can be scaled to different screen sizes or aspect ratio conversion can be performed.
3. 1080i de-interlace uses a true per-pixel motion detection algorithm with MDDF (multi-directional diagonal filter). The algorithm temporal aperture is four fields.
4. At present 1080p 24fps is output as 60Hz or 50Hz, there is presently no 48Hz/72Hz option. That functionality may be added later, it has been discussed, but there is presently no timescale for this as market demand has been virtually non-existent. The cadence detection and pull-down mode is automatically adaptive to the input cadence, so is not just fixed at 3:2 for 60Hz or 2:2 for 50Hz, it adapts to non-standard and broken cadences.
5. There is an HDMI expansion card due soon, to add a further 2 HDMI inputs, giving a total of 4. You can fit either the HDMI expansion card, or the HDSDI expansion card.

### **Digital Projection**

In September 2005, the company released their VIP 1000 video processor developed in partnership with Silicon Optix for use with Digital Projection displays. The VIP 1000 is suited with the Silicon Optix Realta HQV state-of-the-art processor. Details

about the Realta processor were mentioned on the product above (from Calibre), which also uses the same chip. MSRP \$6,000, TTM 4Q05.

## DVDO

VP30, Third Generation 1080p capable video processor, ABT's Precision Video Scaling II technology with 10-bit scaling, enhanced sharpness controls and non-linear scaling, analog transcoding, 11 video inputs (4 HDMI, 2 component, RGBHV, optional SD-SDI input), each input has separate picture controls, \$2,000, TTM now.



Other DVDO models are listed on the 2005 HDTV Technology Report and the 2006 HDTV Technology Report.

DVDO® iScan™ VP50      \$3,000, TTM now

HD video processor/AV hub, converts SD, HD (including 1080p), and PC signals from DVD players, HD-DVD players, Blu-ray players, HD DVRs, game consoles, and PCs to any output resolution between VGA and 1080p.

Features Anchor Bay's Video Reference Series (VRS) technologies, 10-bit Precision Video Scaling II™ to independently scale horizontally and vertically, 10-bit HD Precision Deinterlacing™ adaptive processing (motion, edge and source) for artifact-free images, PReP processing.

## Faroudja CES 2007



## Gefen CES 2007

HD Mate Scaler      \$350, TTM Jan 07  
Scaler/switcher combo, 2xcomponent inputs with TOSlink and analog audio inputs, 1xDVI output with its own TOSlink and analog audio, 1080p, mirrored audio in both digital formats.

Home Theater Scaler      \$450, TTM Jan 07  
Scaler/switcher combo with HDMI, 2xHDMI inputs each with its own audio in S/PDIF and TOSlink format, 2xcomponent inputs each with



its own analog audio, IR remote control for switching, each source is output in HDMI format, with mirrored audio delivered in both S/PDIF and Toslink, 1080p.

Home Theater Scaler Plus \$350, TTM Feb 07

Scaler/switcher combo, supports composite and S-video sources with analog audio, 1xcomponent, 2xHDMI inputs, each with their own audio, scales all HDTV resolutions up to 1080p, audio delay compensation to match lip-sync of video and audio automatically.

## Lumagen

Most Lumagen products and specifications can be found in 2005 HDTV Technology Report and the 2006 HDTV Technology Report.

In September 2005 the company declared that they "now use" Silicon Optix's Realta HQV engine on the new processor they were developing, RadianceXD (further below).

Vision HDQ \$2000, TTM Mar 06



1080p 60  
upconversion, 4  
DVI/HDCP, 2  
comp, 1 SDI,  
transcoding

between component and RGB analog HD, zoom feature up to 33%, programmable input types, output resolution 480p to 1080p, plus 1080i, VisionDVI processing, 3D comb filter for composite and S-video inputs, vertical refresh from 48-120 Hz, per-pixel motion adaptive HD and SD deinterlacing, fully programmable scaling and aspect ratio, Panamorph mode 1 and 2 compatibility, onscreen setup and control with included remote, RS232, rack mountable, optional brackets.

## CES 2007

RadianceXD \$4,000, TTM 2Q07

High definition audio/video switcher/processor with 1080p/60Hz support, 18 video/audio inputs including 6xHDMI/HDCP 1080p/60, 4xSD/HDcomponent, 4xS-Video, 4xcomposite, PIP/POP, 2xHDMI outs, 2xcoax audio, 10-bit video processing, per-pixel SD and HD video de-interlacing, MPEG mosquito and block artifact reduction, second HDMI output can carry a copy of the first HDMI or used for audio out only for receivers.

User-adjustable image enhancement with four configuration memories per input, programmable output resolution from 480p to 1080p, plus 1080i, ability to zoom in on any source by up to 33 percent, selectable aspect ratios of 4:3, 4:3 NLS, 16:9, 1.85, and 2.35.

The 4:3 NLS aspect ratio uses Lumagen's Preciseview™ user programmable non-linear-stretch mode for 4:3 sources to fill a 16:9 display. For film sources 2:2, 3:2 and 3:3 pull-down detection and output at 24, 48, 60 and 72 Hertz for 24 fps film sources, plus 50 and 75 Hertz for 25 fps film source.

## **NEC**

In June 2005, the company announced that was partnering with Silicon Image to implement the Realta HQV engine on their plasma panels and projectors via the new NEC Theater Sync™ external video processing unit that will seamlessly connect to its displays.

The Theater Sync unit handles all SD, HD, and PC signals over standard analog, DVI, and HDMI inputs, and will incorporate the newest HQV algorithm, CNR™ (CODEC Noise Reduction), to reduce the artifacts caused by MPEG and other CODEC compression methodologies. MSRP \$3,600, TTM Oct 05.

## **Pixel Magic (Crystalio II)**

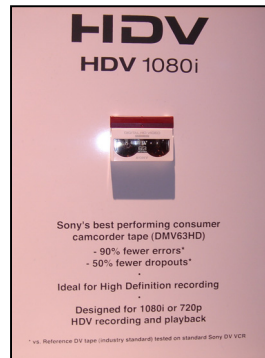
In September 2005, the company announced their new Crystalio II HD consumer video processor implementing Gennum Corporation's VXP (Virtual Excellence Processing) engine with upconversion to 1080p60fps.

" The Crystalio™ II, the second generation in the Crystalio™ product family, is an advanced video processor with true 1080p HD motion adaptive de-interlacing and true 10-bit 4:4:4 broadcast quality processing. The Crystalio™ II also includes a wide range of advanced capabilities including 4 HDMI inputs, 2 HD-SDI/SD-SDI inputs, Ultra Fine Audio Delay™, an internal HD media player, and support for 48 Hz and 72 Hz outputs."

## Chapter 14 - HD Video Cameras

### HDV Format

HDV was announced in the summer of 2003 and was established as an official format in the fall of 2003. Canon, JVC, Sharp, and Sony are the primary manufacturers supporting this HD format that uses mini-DV videotape, MPEG-2 and at resolutions of 1080i and 720p. The companies indicated that camcorders could be made that can record on the same mini-DV both regular and HD formats.



### AVCHD Format

Panasonic co-developed this standard with Sony. The format is capable of recording 1080i or 720p video to standard DVDs. In July 2006, both companies announced that the format was to be expanded to record in flash memory cards and hard disc drives.

AVCHD based camcorders were first launched by Sony. Hitachi will launch their AVCHD model in 2007.

Panasonic was quoted as declaring "Our development teams are studying the feasibility of a Blu-ray disc camcorder, since the AVCHD format is compatible with Blu-ray, the former would not be made obsolete with the advent of Blu-ray disc camcorders".

AVCHD records onto standard 3-inch DVD discs, which can be played back on Panasonic and Sony Blu-ray disc players, and Sony's Playstation 3.

Canon, Sharp, Cyberlink, Intervideo, Nero AG, Sonic Solutions, Ulead Systems, Samsung, and Pioneer support the AVCHD format.

### Ambarella

Dec 05

A1 digital camera SoC (System on Chip) platform, TTM now  
The platform combines an HD H.264/AVC codec video processor, still image processor, audio compression, and system functions on one chip with an operating power of less than 1W and priced for consumer applications. 2.5x compression gain over MPEG-2/4 would allow storage of HD video content in flash-based memory. For more information, visit <http://www.ambarella.com/>

The company is producing chips that would allow manufacturers of HD cameras to release products in the \$800 range.

### Canon

Professional Products

Sep 05

XL H1 HD camcorder, \$9,000, TTM Nov 05  
Records images at 1,080i resolution to DV  
tape using three 1/3 inch interlaced CCDs,  
selectable frame rates of 60i, 30 frames per  
second (fps) and 24 fps.

HD-SDI output for image transferring, 20x  
optical zoom lens with built-in optical image  
stabilization technology, Canon's DIGIC DV  
II processor, captures 2-megapixel still  
images to an SD card.

Still picture technology in development by  
Canon: "Automatic face detection  
technology" Cameras using this technology  
can automatically locate a person's face and  
apply two other developing technologies,  
"smile detection" and "blink detection," that will tell the camera to wait until the  
subject is smiling and has his/her eyes open before snapping the picture.



Detailed features and specifications:

<http://www.usa.canon.com/consumer/controller?act=ModelFeaturesAct&fcategoriid=175&modelid=14061&pageno=1>

Aug 06

Canon introduced two new camcorders to its high-end 3-CCD HDV line.

XH A1            \$4,000, TTM Oct 06  
XH G1            \$7,000, TTM Nov 06 (shown)



The Image Quality of High Definition  
(1080i 60i, 30f, 24f)  
Genuine Canon HD Zoom Lens, 20x  
3 CCD Performance  
Super-Range Optical Image Stabilizer  
Instant AF  
DIGIC DV II HD Image Processor  
Complete Customization  
60i / 50i Video Mode Option  
Professional Backpack

XH G1 detailed features and specifications:

<http://www.usa.canon.com/consumer/controller?act=ModelFeaturesAct&fcategoriid=175&modelid=14057>

XH A1 detailed features and specifications:

<http://www.usa.canon.com/consumer/controller?act=ModelDetailAct&fcateoryid=175&modelid=14061>

Both camcorders record 1,080i HD video, 20x optical zoom lens with image stabilization, 2.8-inch widescreen flip-out LCD screen under the handle, 60i, 24F, 30F frame rates, Canon's Digic DV II processor, new noise reduction system, lens with fluorite and UD (Ultra-Low Dispersion) glass elements and multi-coatings to reduce flare and ghosting, manual focus and zoom rings, manual iris ring, high-speed zoom mode, new instant AF focusing system, which Canon says improves the speed and accuracy during autofocus, external sensor, in combination with Canon's autofocus system, to decrease the time it takes to find focus, including in low-light conditions.

The camcorders offer control over 23 image settings, including color gain, RGB independent gain, and six-axis matrix, and can customize the camcorder's display. Users can store up to nine image presets to internal memory or to an SD card for exporting to other XH A1 or XH G1 camcorders. SD cards can also be used for storing 2-megapixel digital still photos.

The XH G1 model features HD-SDI output with embedded audio and timecode, Genlock synchronization and timecode In/Out.

#### Consumer Camcorders

Canon also announced the new model:

HV10 \$1,300, TTM Sep 06

Records at 1,080i resolution to DV tape, the smallest and lightest HDV camcorder on the market at 0.9 pounds and sizing in at 2 inches wide by 4 inches tall, HD optics with super range optical image stabilization, Canon's DIGIC DV II image processor, the company's 1,920 by 1,080 video CMOS sensor, recently introduced Instant AF auto-focus technology, 10x optical zoom HD video lens with a 200x digital zoom and smooth zoom control, 2.7-inch widescreen LCD.



Level shot control to assist in framing, built-in video light, letterboxing for viewing 16:9 footage on standard-definition TVs, snaps 3-megapixel images to MiniSD cards or 2-megapixel images to tape while simultaneously recording video, 11 shooting modes, including continuous shooting to capture five full-resolution still images per second, built-in flash, histogram display and PictBridge compatibility.

#### Jan 2007

Canon announced their addition of a second HD Camcorder, the HV20, TTM Apr 07, \$1,100, to join the current model HV10.

The HV20 has several enhancements, new horizontal design, accessory shoe for adding video lights and microphones, 24P mode for recording feature film style video, HDMI output, microphone and headphone jacks with a manual level control for

audio recording, records 1,080i video to DV tape, 2.7-inch widescreen LCD, 10x optical zoom lens, Canon's Super Range Optical Image Stabilization for video and still capture modes, smooth zoom control to regulate the speed of lens extension.

The camcorder also features DIGIC II processor, 2.96-megapixel CMOS image sensor with on-chip noise-reduction technology, RGB primary color filter, "Instant AF" focusing system (which uses an external sensor to augment the internal autofocus system for a quicker and more accurate focus, according to Canon).

CINE tonal and color adjustment settings existent on their higher-end video cameras, CINE mode can be used with 24P recording or independently, records 3.1 megapixel still images to a miniSD card or 2-megapixel images while simultaneously shooting video that can be saved to the card or DV tape, 11 still image shooting modes, built-in flash, PictBridge enabled.



Feb 07

PowerShot TX1 HD Camcorder

TTM Mar 07, \$500, US distribution unconfirmed



Canon announced the new camcorder featuring a 7.1 Megapixel CCD image sensor, 10X optical zoom, 4x digital zoom, DIGIC III image processor, can record movies in 1280x720 HD resolution (16:9) at 30fps, supports up to ISO 1600 (800 in low-light), 1.8-inch TFT LCD screen, uses SD or SDHC as

storage media, measures 88.8x29x59.9mm, weights 220g, component video output, records 44 KHz audio, captures VGA/30 fps or QVGA video at 60 fps, "MovieSnap" (still images while recording video), optical



stabilization, zoom functional on movie recording or shooting stills, 14 shooting modes, compatible with SDHC memory cards and MS Vista.

## **Hitachi**

Oct 06

Hitachi announced their plans to release Blu Ray and AVCHD Camcorders in 2007 with 1080i capabilities at around \$1500 for the Blu-ray model and a bit larger than the DVD camcorder size.

The company plans to also release a dual DVD/HDD model.

"Hitachi will try to come out with a video camera with a built-in Blu-ray burner in one to two years", said Hiroto Yamauchi, general manager of storage products marketing at Hitachi. "I hope it is one year," said Kazuto Shimagami, senior manager in the company's storage products division.

However, the planned camcorder would not use a 12 cm disk conventional drive, but rather a not yet existing Blu-ray burner for 8 cm disks, according to both managers above, for which specifications are being defined by the Blu-ray companies.

The new disks would hold about one third of the data (1.4 GB) of a standard DVD disks (4.7 GB), and much less than the 25GB to 50GB (dual layer) of Blu-ray disks, but Hitachi thinks the capacity is sufficient for personal video footage.

The camera is expected to be small when using that size of disks.

Hitachi already has a camcorder with that disk size in Japan, and includes a HDD as well, which is hoped to come to Europe and the US in 2007. Hitachi showed at CEATEC in Japan one camcorder based on Blu-ray but it will delay introduction until it could be sold for 100,000 yen (<\$1,000, currently estimated as \$2,500), according to Yamauchi.

Apr 07

Hitachi introduced at NAB the HD POV camera model HD30, 3x1/3-inch format, 1.3 megapixel CMOS sensors, 1080i and 720p, operating parameters and video adjustments can also be made on a remote panel or PC.

## **JVC**

Sep 05

HDD attachment for tape less HD recording  
DR-HD100, \$N/A, TTM N/A, 40GB (3hrs) and 80 GB HDD  
(7 hrs), attaches directly on the JVC GY-HD100E  
camcorder, FireWire to communicate audio, video, time  
code, and control information. Records and backs-up both  
DV and HDVTM video, newly developed MPEG-2 encoding  
chip enables high quality pictures to be recorded readily to  
both hard disk and compact DV cassettes simultaneously  
or consecutively, records standard definition DV25 files to  
disk as Raw DV, AVI Type 1, AVI Type 2, AVI Type 2 24p,  
Matrox AVI, Canopus AVI, QuickTime or QuickTime 24p



and includes MXF, Pinnacle AVI and Avid DV-OMF format support. It records high definition 720p 24/25/30 M2T for HD non-linear editing systems.

Consumer Products – CES 2007

JVC announced their first consumer full HD recording 3-CCD Camcorder System featuring 16:9 Progressive Scan CCDs, broadcast HD camera Fujinon Lens, 1920 x 1080i:

Everio GZ-HD7 HDD recorder      \$1,800, TTM Apr 07  
 Everio SHARE STATION CU-VD40    \$400, TTM Apr 07



Super high-end processor, new HD Gigabrid high-resolution signal processing engine, Hard Drive 60GB Camcorder, 30 Mbps max, three 1/5-inch 16:9 progressive scan CCDs, diagonally offset pixel configuration, large pixels measuring 3.28 microns x 3.28 microns, 3 spherical lens elements, minimal F. No. is F1.8 wide open and F1.9 for telephoto, lens surface coated with a new Electronic Beam Coating (EBC) used for broadcast HD lenses reducing detrimental flaring and ghosting, optional HD Everio SHARE STATION CU-VD40 for transferring footage to disc, HDMI (digital viewing), USB (file sharing). ILink (HD streaming in 1440CBR), analog component.

Options: 46mm telephoto and a 46mm wide conversion lens, battery charger and three additional batteries including standard, high power and extended power. stereo microphone.

Specs and figures courtesy of JVC.

Record Mode	Record Resolution	CODEC Video/Audio	System Bit Rate	Recording Time
FHD (Full HD High Quality Mode)	1920x1080i	MPEG2-TS / MP2 (MPEG1 Layer 2)	Variable Bit Rate (VBR): Max 30Mbps Ave. 26.6Mbps	approx. 5hr
SP (Long Time 7 Hour Mode)	1440x1080i	MPEG2-TS / MP2 (MPEG1 Layer 2)	VBR: Max 22Mbps Ave. 19Mbps	approx. 7hr
1440CBR (Constant Bit Rate Mode)	1440x1080i	MPEG2-TS / MP2 (MPEG1 Layer 2)	Constant Bit Rate (CBR): 27Mbps	approx. 5hr

For editing/archiving, it includes the Cyberlink BD Solution software suite for Windows, PowerDirector for HD video editing, and PowerProducer for authoring high

definition Blu-ray discs and DVD-Video discs, and PowerCinema for HD file management and playback.

As the Everio GZ-MG505 3-CCD hard disk camcorder, JVC adjusts the GZ-HD7's three CCDs precisely in the 3-CCD prism on each axis of a 6-axis color matrix before mounting them firmly in place with the high precision appropriate for an HD camera, # of pixels per CCD: 1016 x 558, approximately 570,000 pixels, # of effective pixels per CCD: 976 x 548, approximately 530,000 pixels, JVC Uses Pixel Shift Technique (figure 1) by which the Red and Blue imaging CCDs are shifted a half-pixel both horizontally and vertically relative to the Green imaging CCD. Because the pixel-shift system uses progressive scan CCDs, signals are processed first as 1920 x 1080p progressive signals, then converted to 1920 x 1080i interlace signals for recording.

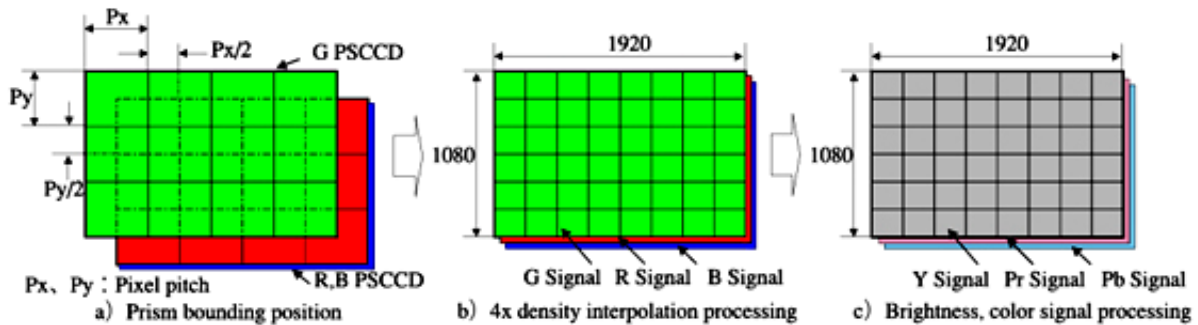


Figure 1: Pixel Shift Scheme Concept

As a result, the system records a higher resolution HD image than the interline (IL) CCD system shown in figure 2.

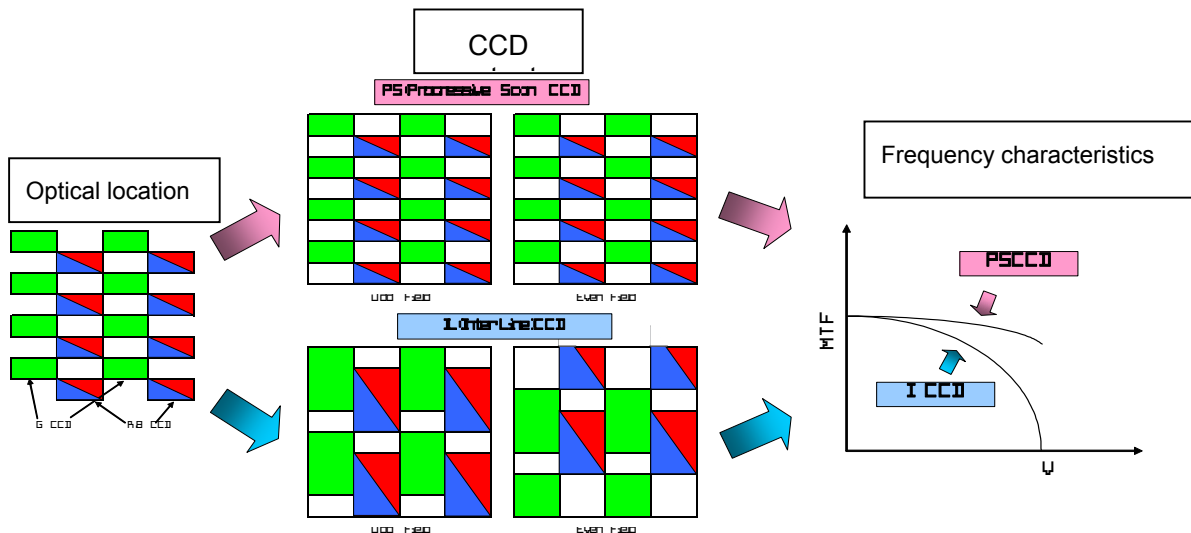


Figure 2: Frequency Characteristics

HD 1920x1080i MPEG2 Transport Stream video with MPEG 1 Layer 2 audio, seven hour SP mode with a resolution of 1440x1080i, and a 1440CBR mode with a resolution of 1440x1080i and a five-hour capacity, HD Everio recordings can be

archived onto Blu-ray discs using provided software and a high definition Blu-ray recorder.

Pixel summary of recorded images

Total pixels: 2032 x 1116 (equivalent to 2.27 million pixels)  
Number of effective pixels: 1952 x 1096 (equivalent to 2.14 million pixels)

The analog front end (AFD) uses 14-bit signal processing to produce HD high-quality resolution.

Professional Products



GY-HD110U ProHD Camcorder \$6,550, TTM Jul 06

Latest version of the HD100 series of ProHD camcorders; same design as the GY-HD100U with additional features requested by producers and cinematographers.



ProHD HD100 Series Attributes:

- True 24 frame Progressive recording
- Time Code
- HDV and DV compatible
- Standard ¼-inch tripod mount
- Full HD resolution 1280 x 720 image capture
- Interchangeable lenses with bayonet mount
- Professional design and compact form factor
- Three 1/3-inch native high definition CCDs
- Output in multiple HD formats including 1080i

New GY-HD110U Features:

- Black and white viewfinder display mode
- Simultaneous use of both eyepiece viewfinder and tri-mode LCD display when powered by Anton Bauer or IDX battery system
- Selectable mirror mode on vertically flipped LCD display
- Adjustable setting of FOCUS ASSIST function
- Choice of three image formats on composite out (letterbox, squeeze, side cut)
- User selectable DNR ON/OFF menu setting
- 13 segment audio level indicator
- Manual audio control within FAS (Full Auto Shooting) mode
- Audio limiter available in manual mode
- Parallel power off management of DR-HD100 hard disk recorder

The GY-HD110U can use all accessories including lenses and battery system adapters designed for the HD100 series of camcorders with no modifications necessary.

<http://pro.jvc.com/>

GY-HD200U            \$9,000, TTM now  
3-CCD ProHD camcorder w/16:1 FUJINON Lens



According to JVC:  
Designed for newsgathering, field production, and cinematography, the GY-HD200 offers multiple frame rate recording including full-frame 720p/60 imaging and real 24p. New image processing puts this camera at a performance level that can be considered for mainstream HD production.

Multiple frame rate recording: 720/24p, 25p, 30p, 50p, and 60p  
Compact Shoulder Professional form factor  
Wide choice of lenses and accessories  
Optional HZ-CA13U Prime Lens adapter  
Built-in image flip recording when using prime lenses  
Built-in 14.4V type Battery Mount  
Dual-media (tape +HDD)recording with DTE  
Next generation super-efficient MPEG-2 encoding  
Enhanced Cinema Gamma  
Advanced 14-bit A/D converter  
Lower noise in low light  
Better highlight handling  
BNC connectors

GY-HD250U    \$11,000 with Fujinon lens  
(\$10,000 without)

60p recording, and upgrade from previous models that only recorded at 720p/24 frames per second, for a film look, records on either MiniDV cassettes or hard disk with the optional DR-HD100U recorder, 16x Fujinon lens.



Capable to output 1080i for broadcast plants, KA-HD250 studio adapter, new codec for efficient compression without visible motion artifacts, DA converter improved from 12 bit to 14, genlock capability for multiple camera shoots, HD-SDI output, enhanced cinema gamma, external time code synchronization, BNC connectors, built-in mount for an Anton Bauer Gold Mount 14.4V professional battery, patented focus assist feature.

## **Panasonic**

Oct 05

AG-DVX100B camcorder

Camera-to-camera time-code synchronization (facilitating simultaneous, multi-camera shoots). User-settable file transfer over IEEE 1394, 24p/30p/60i MiniDV, a successor to its AG-DVX100A and AG-DVX100 models, RoHS-compliant (virtually free of lead, arsenic and other hazardous substances, directive becomes mandatory July 2006 in Europe), 4lb, 16:9 letter-box display mode on the electronic viewfinder (EVF), 3.5in color LCD monitor for distortion-free Squeeze Mode or Anamorphic Display, remote control of focus and iris (wired) when mounted on a jib or tripod, single button character off for LCD and EVF displays, improved video S/N for better low light recording; and higher resolution LCD (210,000 pixels) and EVF (235,000 pixels) monitors.



### Panasonic Broadcast

AG-HVX200 handheld HD solid-state storage camcorder, \$6,000, TTM Dec 05, captures video in 21 video formats, recording in both 1080i and 720p at 100Mb/s DVCPRO HD, intra-frame compression, full 4:2:2 color sampling, video is recorded onto P2 cards as IT-friendly MXF files in 1080/60i, 30p and 24p; in 720/60p, 30p and 24p; in 50Mb/s DVCPRO50 and in 25Mb/s DVCPRO or DV, provides 64 minutes of record time in DVCPRO or DV using two of Panasonic's new 8GB P2 cards, 40 minutes in 720p, 32 minutes in DVCPRO50; and 16 minutes in 1080/60i and 720/60p.



P2 card video can be downloaded to a nonlinear editing system or server, or instantly edited from the P2 card through an IEEE 1394 or USB 2.0 interface. The AG-HVX200 is also equipped with a MiniDV tape drive for shooting 4:3 and 16:9 images onto DV tape in 60i, 30p and 24p. With two P2 card slots, a shooter has hot-swap capability and a loop-recording feature. To prevent missing the start of a press conference or event, the camera can be preset to pre-record (up to seven seconds in DVCPRO and three seconds in DVCPRO HD).

Captures images at any of 11 rates between 12fps and 60fps. Camera play back of the recording at normal rate allows the shooter to preview the off-speed effect without a frame rate converter. Down-converts off-speed recordings in 720p from a P2 card and copy it to a MiniDV tape to allow creation of special off-speed effects during DV production (technique previously possible only with a complete VariCam system).

Eight gamma modes including Cine-Like gamma, and for newsgathering, a news gamma curve to assist a news photographer by allowing him to suppress over-saturated highlight areas during sudden contrast changes.

Native progressive 16:9 1/3in, 3-CCD optical block, and a wide-angle, 13X Leica Dicomar HD lens with optical image stabilization. The lens covers a wide range from 4.2mm to 55mm.

In the wide-screen mode, the 3.5in LCD monitor can display images in letterbox, which places vital camera operating information in areas above and below the active image area. The LCD permits the shooter to view and select thumbnail clips to speed editing, and allows random access to the thumbnail-displayed scenes (from the P2 card) for instant playback and the creation of an in-camera storyboard.

Audio is supported with four-channel non-compressed 48KHz/16-bit digital processing in DVCPRO HD and DVCPRO50 and two channels in DVCPRO and DV. Interfaces include IEEE 1394 and USB 2.0, 2 XLR audio (with +48 volt phantom power) inputs, a component (D4) output, composite I/O, S-video I/O, audio (RCA) I/O, and headphone. Panasonic also announced that Apple's Final Cut Pro, Avid's Newscutter XP, Newscutter Adrenaline FX and Xpress HD, and Canopus Edius HD are supporting the camera with complete P2 editing solutions.

For more information on the AG-HVX200, visit <http://www.panasonic.com/hvx200>

#### Apr 07

Panasonic introduced at NAB the AG-HPX500, a shoulder mounted camcorder P2, 3x2/3-inch sensors, \$13,000.

#### Consumer Products

##### Dec 06

Panasonic introduced two new 3CCD HD AVCHD camcorders for SDHC or DVD recording.

HDC-SD1	\$1,500, TTM Mar 07
HDC-DX1	\$1,400, TTM Mar 07

On Mar 07 the MSRP was reduced to \$1,300 on both models.

The HDC-SD1 records onto high capacity, solid-state SDHC Memory Cards, lightest 3CCD High Definition video camcorder, no moving recording parts make the unit resistant to impact.

Supports three recording modes at 6, 9 and 13Mbps, a 4GB card could record 40 minutes of 1,080i video at 13Mbps, or 85 minutes at 6Mbps mode.

The HDC-DX1 records onto DVD discs, video and sound data are recorded directly onto the disc, 40 minutes of High Definition recording on a dual-layer DVD-R disc.

Both models implement the AVCHD format, 3CCD camera system, Optical Image Stabilization, light received through the lens is split into its three primary color components (red, green and blue), and the signal from each is processed by one of the three CCDs (charge-coupled devices or chips), 5.1-channel surround sound system with 5 microphones.



Zoom Mic function links the microphone's action to the camera's action, when zooming in on a subject in the distance, for example, the microphones also zoom in and record the sounds specific to that subject, Leica Dicomar lens with 13 lens elements in 10 groups, with 21 multi-coated surfaces, using low-dispersion optical glass to reduce chromatic aberration, minimizing harmful reflections, 1080i recording (the AVCHD standard supports 720p and 1,080i recording).

HDC-SD1 below:



HDC-DX1 below:



Feb 07

Panasonic introduced the AG-HSC1U High End AVCHD Camcorder for the professional market, TTM mar 07, \$2,100, 3-CCD, records 1080i high definition video to SD memory cards, can store up to 88 minutes on high speed 4GB SDHC card or 41 minutes in the highest quality mode, 4GB SDHC card included, accessory 40GB hard drive with a built-in SD card reader for transferring images, image stabilized Leica Dicomar lens.

3-inch wide screen rotating LCD, five microphone system for recording 5.1 channel surround sound, "zoom mic" function to isolate sound in the front channel as the camcorder zooms in on a subject, 2-megapixel still images can be taken during video recording, HDMI output, HD Writer 1.0 software for editing, Panasonic declared that "more sophisticated" editing software from third party non linear editing companies will be available in the spring, HD Writer can also burn HD video onto DVD-R discs for playback on Sony and Panasonic Blu-ray disc players and PlayStation 3.

Panasonic unveiled a new camera using new solid-state memory card for its P2 line of camcorders.

The card holds 16 gigabytes (GB) of data, about 16 minutes 1080i, doubling the capacity of the current 8 GB P2 cards, TTM May 07, enabling P2 cameras with 5 memory card slots to record up to 80 minutes of HD.

Remarks were issued about a 32 GB card ready in November 2007, for P2 cameras to record up to 160 HD minutes, \$TBA (but estimated as \$1,200, the price of the current 8 GB cards).

Regarding the new camera, TTM May 07, Panasonic introduced a new shoulder-mounted P2 HD camcorder, the AG-HPX500 \$14,000, an enhanced AG-HVX200, with three 2/3" imaging chips (CCDs), 4:2:2 sampling and independent frame encoding, records 32 HD and SD formats, swappable compatible lenses, four P2 card slots for

64 minutes in DVCPRO HD, 128 minutes in DVCPRO 50, and 256 minutes in DVCPRO on four 16GB P2 cards, "Native Mode" recording in 720p.

P2 cameras were said by Panasonic to outsell tape-based HD cameras 10 to 1.



Apr 07

Panasonic introduced two new models that support MPEG-4 AVC/H.264, 1080i, with 3x0.52 megapixel CCD sensor, 10x optical zoom, 30x digital zoom, 3-inch LCD display: HDC-SD3, records SD-2GB, SDHC-4GB memory cards HDC-DX3, records to 8-cm DVD

## Sanyo

Jan 06

Xacti HD1 video camera, \$800, TTM Mar 06, with ultra-res and ultra-clear 2.2in OLED display with 210,000 total pixels display that flips out from the camera and rotates up to 285 degrees on axis for taking video or still images in otherwise difficult locations, pocket-sized, tape-less combo camera, weighs 8.3oz, can simultaneously record 720p HD video (MPEG-4 at 30fps) and 5.1 megapixel still images to SD flash memory card, 16:9 widescreen format (HD-SHQ / HD-HQ modes).



High-precision large-scale integration for image processing executing a vast number of calculations in a short period of time, image processing functions for HD 720p processing, real-time MPEG-4 compression and noise reduction. 10x digital zoom, 10x optical zoom lens with a maximum aperture of f/3.5 in both wide and telephoto angles, allowing for clear images in lower light situations, 21 minutes of 720p HD on 1GB SD card, 42 minutes on a 2GB card, 2hrs in SD mode (640 x 480 pixels at 30fps progressive) on a 2GB SD card.

Upon its introduction this camera was reviewed with disappointing results (quoted as "everything except for HD, the disappointment"). I have not tested the camera myself though. In doubt, I suggest potential buyers to perform proper research to confirm that quality, performance, and features match your requirements and expectations.

● Sanyo Xacti DMX-HD1 720p HDTV  
[http://viphttp.yacast.net/yacast/akihabara/AKIBA\\_HD1\\_HDTV\\_720p.wmv](http://viphttp.yacast.net/yacast/akihabara/AKIBA_HD1_HDTV_720p.wmv)  
(Progressive Download HTTP "right click and save as", or "left click and view while buffering")

● Sanyo Xacti DMX-HD1 720p HDTV  
[mms://vipmms9.yacast.net/akihabara/AKIBA\\_HD1\\_HDTV\\_720p.wmv](mms://vipmms9.yacast.net/akihabara/AKIBA_HD1_HDTV_720p.wmv)  
(Streaming Windows Media, Requires at least 6MBits/s, copy link to your browser and execute it there)

### CES 2007

Sanyo announced the world's smallest and lightest HD digital video camera,

Xacti HD2      \$700, TTM Mar 07

Featuring a new 7.38-Megapixel Sensor, up to 76% Greater Low-Light Sensitivity, HDMI into the HD2's multifunction docking station, 720p HD digital camcorder, 7.1-megapixel digital still camera, pocket-sized, pistol-grip and thumb-operable design, records up to 21 minutes of high-definition video (or up to one hour of standard-definition video) per gigabyte of available memory on any standard SD or high-capacity SDHC card (memory cards sold separately), 8-gigabyte SDHC card for three hours of high-definition video, or up to eight hours of standard-definition video or thousands of 7.1-megapixel digital still images.



Additionally, the camera features increased low-light sensitivity to respond to light as low as 12.5 lux in auto mode representing up to 75% increase in low-light sensitivity when compared to the 50 lux auto mode capability of the previous models, the HD1 and HD1a. The HD2 responds to light as low as 6 lux, in lamp mode, representing an up to 76% increase in low-light sensitivity when compared to the 25 lux capability of the HD1 and HD1a.

A special "High Sensitivity" button, super-fast start up and shooting, no tape to queue up, ready to record in as little as 1.7 seconds, digital image stabilization that works across the full shooting range from wide-angle to telephoto, distinguishes between "trembling hands" and "camera work" such as panning and tilting.

1280 x 720 progressive HD video scanning, MPEG-4 technology for 30 frames per second, high-precision LSI (large-scale integration) circuitry for advanced, high-definition image processing, super-fast 9Mbps frame rate, 10x optical zoom built from 12 elements designed in 9 groups and with a built-in neutral density filter, with a maximum aperture of f/3.5 in both wide and telephoto angles, combined with a 10x digital zoom capability.

The HD2 is capable of a total 100x zoom, 2.2-inch LCD display with 210,000 total pixels that flips out from the camera and rotates up to 285 degrees, video recording optimized for personal media players, "Web-SHQ" recording mode to capture video destined for video iPod and other popular MPEG-4 personal media players for which

the video is captured at a resolution of 320 x 240 pixels and a smooth and natural 30 frames per second.

16:9 still shooting to capture stills in the same widescreen format as their high-definition videos, in-camera video editing enabling quick A>B deletions and easy combining of video clips, only 8.3 ounces (including battery and a standard SD memory card), measures 3.1" W x 4.7" H x 1.4" D, stylish blue graphite body.

Other features include sequential still shooting, High-quality 48 kHz, 16-bit, stereo AAC-LC sound (MPEG-4 Audio), pop-up flash, HD/Norm switch, Super Macro shooting down to 1 cm (W) / 1 m (T), self timer (2 seconds / 10 seconds), voice recorder function, red-eye reduction mode, Component, rechargeable Lithium-ion battery, remote control, Exif Print and Print Image Matching III, PictBridge-capable for PC-Free printing with PictBridge-compatible printers

SANYO Xacti HD2 optional accessories include:

- NEW Belt-clip Holster Case (VCP-HCX1) \$19.99
- 0.6x Wide-angle Lens Adapter (VCP-L06WU) \$99.99
- 1.4x Telephoto Lens Adapter (VCP-L14TU) \$99.99
- 49mm Lens Filter Adapter (VCP-AL49) \$17.99
- L40 Battery Charging Cradle (VAR-L40U) \$39.99
- Original SANYO L40 Battery (DB-L40AU) \$49.99

## **Samsung**

### CES 2007

Samsung launched its first HD camcorder, 1080i and 720p resolution.

SC-HMX10 \$850, Sep 07, compact and lightweight design, 10x optical zoom, 4GB built-in flash memory, 2-in-1 memory card slot compatible with the leading memory card formats: MMC and SD cards, 2.7-inch-wide touch screen LCD, 1.5 megapixel CCD for still photos.

After the show Samsung decided to withdraw this model from the plans, no particular reason was provided.

## **Sony**

### March 2005

HDR-HC1, TTM July 2005, \$2,000 (street pricing of \$1,000 on Feb 06), HDV 1080i, video and still images, Sony's CMOS imaging sensor technology (one complementary metal oxide semiconductor image sensor instead of the system of three charge-coupled devices (CCDs) employed by the HDR-FX1, one main reason for the price and size reduction from the previous model HDR-FX1), weights 1-1/2 pounds, more compact Carl Zeiss Vario-Sonnar lens.



InfoLithium battery, which delivers about 90 minutes of continuous recording (depending on recording mode), 2.7-inch wide hybrid, touch-panel LCD screen to access menu options, can switch between 16:9 and 4:3 aspect ratios (in DV mode).

Fully automatic controls, a built-in microphone for audio quality, an intelligent pop-up flash, and Super SteadyShot image stabilization. Captures 2.8-megapixel digital still images, which can be stored directly on Memory Stick PRO Duo" media for transfer to PCs and other devices.

The only HD camcorder that allows to record high-definition video and take a 1-megapixel digital still image at the same time. 10X optical and 120X digital zoom, zoom ring, zebra pattern, and spot focus. White balance, shutter speed, and focus can all be adjusted manually. Cinematic mode to record video with a film-like appearance, Shot Transition" feature to create cinematic effects, records HD in total darkness with Sony's Super NightShot Plus Infrared System.

i.Link Digital Video Interface (IEEE 1394) to enable high speed, bi-directional digital video/audio communication between two devices equipped with a compatible i.Link DV interface, including camcorders, professional digital video recorders, and PCs, PictBridge" Compatibility with PictBridge-enabled printers, such as Sony's new PictureStation" DPP-FP50.

Sony reduced the number of circuit boards from 5 to 2 and the amount of parts from 3000 to 2000 with a better design compared with the previous model. Optional accessories will include custom cases, lights, lenses, microphones, Stamina batteries, chargers, and cables.

Jan 06 (pre-announcement)

HDR-HC3      \$1,100



This camcorder was expected to be announced in the next few months by Sony (after Jan 06). Sony did not confirm the existence of the unit in January, it was unknown at that time if the HC3 was aligned to be a replacement of the HC1, or it is a lower level version of it (removed the mice jack and zoom ring).

Records 1080i HD, 1/3" CMOS sensor, 2,103,000 gross pixel count, Carl Zeiss-Sonnar T\* lens, 30mm filter diameter with 10x optical and 80x digital zoom, a focal length of 5.1 – 51mm, with a 35mm equivalent of 41.3mm – 485mm in 16:9 aspect ratio, and 50.5 – 594mm in 4:3 aspect ratio. Gross pixel count of 2,103,000; a 1,076,000 effective pixel count in 4:3

mode; a 1,434,000 effective pixel count in 16:9 mode; a 1,991,000 effective pixel count in 4:3 still mode; and a 1,493,000 effective pixel count in 16:9 still mode.

HDMI out. HDR-HC3 video Review: [http://cnet.nytimes.com/digital-camcorders/sony-handycam-hdr-hc3/4505-6500\\_7-31749257.html](http://cnet.nytimes.com/digital-camcorders/sony-handycam-hdr-hc3/4505-6500_7-31749257.html)

Sony High Performance Broadcast

April 2005

HDC-1000 studio (\$100,000), HDC-1500 portable (\$90,000) cameras, TTM Aug 05.

Both capable of 1080i or 720P HD operations. High-performance 2-megapixel 1920x1080 progressive scan CCDs provide enhanced image quality and stability, native 1080/60P image acquisition with a newly developed video image processor, utilizing the latest 0.11um semiconductor technology.

The 1080/60P performance of the new CCD combined with the camera's image processing algorithm permits an over-sampled 720P signal, resulting in unmatched spatial frequency characteristics and the highest level of 720P performance.

The new cameras operate across the entire spectrum of HD standards including:  
Interlace 1080i mode @1080/59.94i, 50i  
Progressive 1080P mode @1080/23.98p, 29.97p, 24p, 25p  
Progressive 720P mode @720/59.94p, 50P

Integrated down-conversion (SDI or VBS, with or without pull-down), dual HD SDI outputs, and output to VF signals with 60Hz scanning to minimize VF flicker even in 24P mode. Two-channel external control lines can be secured within the fiber system with RS-232C or RS-422 connections for virtual studios. SD monitors can also be used as sub monitors with these cameras.

Sony has made available the HDC-1550 triax interface portable camera for triax-based applications (\$96,000, TTM December 05), and an HDLA-1500 large-lens adapter for the HDC-1500 and HDC-1550 cameras.

HD XDCAM cameras with 1080i resolution (right) PDW-F330 (\$16,800) and PDW-F350 (\$25,800), 3 half inch CCDs of 1.5 megapixel each, use Sony's Professional Disc optical discs for data storage.



#### Apr 07

An XDCAM EX camera was introduced at NAB as a technology demonstration only, MPEG-2, solid-state recording, two slots for 16GB cards for 1hr of HD video, 3xhalf-inch sensors, can record at multiple frame rates (50i, 30p,25p,and 24p, and 720/50p for international), 1080/60i and 720/60p.

#### Consumer Products

##### Sep 06

Sony introduced a new High-End HD Camcorder:

HDR-FX7      \$3,500, TTM Oct 06



Records in 1,080i HDV, three-chip ClearVID CMOS sensor, smaller and lighter than the first high-end HDV model, 20x optical Carl Zeiss Vario-Sonnar T\* lens with image stabilization equivalent to 37.4 - 748mm (35mm equivalent) in 16:9 widescreen mode, new digital extender function to magnify 1.5 times for the effect of a 30x optical zoom without significant video quality degradation (according to Sony).

Smooth slow recording in a six-second burst of video played back in 24 seconds as slow motion video, 1.2-megapixel stills while shooting video, manual controls for zoom, focus, shutter speed, white balance, iris, and gain, can record 8hrs with optional largest Sony's L-series InfoLithium battery.

Records and playback both 1080i HDV and standard definition DV video on standard miniDV tapes, HDMI, ClearVID CMOS sensor allows high-speed data transfer rates and lower power consumption, Enhanced Imaging Processor, greater light sensitivity with minimal picture noise, more accurate color reproduction than previous Sony models.

High-resolution viewfinder to accurately check composition, focus and image color, 3.5-inch SwivelScreen™ LCD screen with Clear Photo Plus LCD™ technology for superb contrast and accurate color reproduction, viewfinder and LCD screen can be turned on independently or simultaneously, extra-low dispersion lens glass in order to reduce color distortion, Super SteadyShot® optical image stabilization helps to reduce shaky footage, even when shooting handheld at high zoom settings.

Selectable exposure dial with iris, exposure and auto-exposure shift functions, to adjust both gain and shutter speeds.

Options include lights, lenses, microphones, InfoLithium® batteries, chargers and cables.

**HDR-HC5**     \$1,100, TTM now, MiniDV cassette

HD camcorder for HD and SD video using MiniDV cassettes, 10x optical/80x digital zoom and Carl® Zeiss Vario-Sonnar® T\* Lens, 4.0 megapixel still image, snaps 2.3 megapixel photos while filming in dual record mode, slows down the audio, x.v.Color. Detailed features and specifications:

[http://www.sonymstyle.com/is-bin/INTERSHOP.enfinity/eCS/Store/en/-/USD/SY\\_DisplayProductInformation-Start?ProductSKU=HDRHC5&Dept=camer as&CategoryName=dcc\\_DICamcorders\\_HighDefinitionVideo](http://www.sonymstyle.com/is-bin/INTERSHOP.enfinity/eCS/Store/en/-/USD/SY_DisplayProductInformation-Start?ProductSKU=HDRHC5&Dept=camer as&CategoryName=dcc_DICamcorders_HighDefinitionVideo)



**HDR-HC7**     \$1,400, TTM now, MiniDV cassette



Professional grade Carl Zeiss® Vario-Sonnar® T\* Lens with 10x optical/20x digital zoom and a 1/2.9" ClearVid™ CMOS Sensor, 4.6 megapixel still images while recording video with the dual record mode feature, manually control focus, exposure, shutter speed, auto exposure shift and white balance shift, 2.7"2 Wide Clear Photo™ LCD Plus featuring Touch Panel SwivelScreen™ technology, Super

SteadyShot® technology, Super NightShot®, x.v.Color™. Detailed features and specifications: [http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY\\_DisplayProductInformation-Start?ProductSKU=HDRHC7&Dept=cameras&CategoryName=dcc\\_DICamcorders\\_HighDefinitionVideo](http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY_DisplayProductInformation-Start?ProductSKU=HDRHC7&Dept=cameras&CategoryName=dcc_DICamcorders_HighDefinitionVideo) .

**HDR-UX5** \$1,000, TTM Mar 07, AVCHD DVD camcorder, 5.1 channel audio.  
2.1 Megapixel (Gross) ClearVid™ CMOS Sensor  
Switchable HD/SD Format Recording  
x.v.Color  
DVD Format Video Recording  
DVD-R/-RW/+RW and +R Dual Layer Compatible  
10X Optical/80X Digital Zoom  
Professional Quality Carl Zeiss® Vario-Sonnar® T\* Lens  
2.7" Wide (16:9) Hybrid Touch Panel Clear Photo™ LCD Plus Display (211K Pixels)  
Smooth Slow Record  
Memory Stick Duo™ Media Slot  
Capture still images up to 2304x1728 resolution, directly onto Memory Stick Duo™ Media  
Dual Record  
Super SteadyShot® Picture Stabilization System  
Tele Macro Function  
Active Interface Shoe  
Built-in Intelligent Flash  
Super NightShot® Infrared System  
Scene Selection Modes  
Fader Effects  
Picture Effects  
InfoLithium® Battery with AccuPower™ Meter System  
One Touch Wide Angle Shooting  
Easy Handycam  
On Screen Zoom and Record Buttons  
Manual Focus  
Multi-Language Menu  
Detailed features and specifications: [http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY\\_DisplayProductInformation-Start?ProductSKU=HDRUX5&Dept=cameras&CategoryName=dcc\\_DICamcorders\\_HighDefinitionVideo](http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY_DisplayProductInformation-Start?ProductSKU=HDRUX5&Dept=cameras&CategoryName=dcc_DICamcorders_HighDefinitionVideo)



**HDR-UX7** \$1,300, TTM Feb 07, AVCHD DVD camcorder, 5.1 channel audio  
According to Sony, the DVD recording format, in both MPEG2 (SD) and AVCHD delivers digital picture and sound quality comparable to that of MiniDV and high definition, but on DVD. Playback of these DVDs, after finalizing the disc in the camcorder, can be done in most DVD Players (SD), computers, Blu-Ray Disc™ players and even PlayStation®3 video game consoles.



Detailed features and specifications:

[http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY\\_DisplayProductInformation-Start?ProductSKU=HDRUX7&Dept=cameras&CategoryName=dcc\\_DICamcorders\\_HighDefinitionVideo](http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY_DisplayProductInformation-Start?ProductSKU=HDRUX7&Dept=cameras&CategoryName=dcc_DICamcorders_HighDefinitionVideo)

**HDR-FX1** \$3,700, TTM now, HDV  
Detailed features and specifications (right):

[http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY\\_DisplayProductInformation-Start?ProductSKU=HDRFX1&Dept=cameras&CategoryName=dcc\\_DICamcorders\\_HighDefinitionVideo](http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY_DisplayProductInformation-Start?ProductSKU=HDRFX1&Dept=cameras&CategoryName=dcc_DICamcorders_HighDefinitionVideo)



**HDR-SR1** \$1,500, TTM Oct 06, AVC HD  
30GB HDD, 10 hrs HD in LP, or 4hrs of  
higher quality, HDMI, left. Detailed features



and specifications:

[http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY\\_DisplayProductInformation-Start?ProductSKU=HDRSR1&Dept=cameras&CategoryName=dcc\\_DICamcorders\\_HighDefinitionVideo](http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY_DisplayProductInformation-Start?ProductSKU=HDRSR1&Dept=cameras&CategoryName=dcc_DICamcorders_HighDefinitionVideo)

AVCHD 3-inch DVD video recording, HDMI.

**HDR-UX1** \$1,400, TTM Sep 06,  
Right:

Detailed features and specifications:

[http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY\\_DisplayProductInformation-Start?ProductSKU=HDRUX1&Dept=cameras&CategoryName=dcc\\_DICamcorders\\_HighDefinitionVideo](http://www.sonystyle.com/is-bin/%3Cwbr%20target=blank%3EINTERSHOP.enfinity/eCS/Store/en/-/USD/SY_DisplayProductInformation-Start?ProductSKU=HDRUX1&Dept=cameras&CategoryName=dcc_DICamcorders_HighDefinitionVideo)



CES 2007



Apr 07

Sony introduced three AVCHD camcorders, using MPEG-4, and Dolby Digital 5.1 audio:



HDR-CX7 \$1,200, records 3 hrs of 1080i on a 8GB Memory stick PRO Duo card, 15 ounces.

HDR-SR7 \$1,400, can record 22hrs of 1080i on a built-in 60GB HDD.

HDR-SR5 \$1,100, can record 15 hrs on a 40GB HDD.

## Chapter 15 - Screens and HT Equipment

### Digital Innovations

Power Mount TTM 1Q07

The first affordably priced wall mount for flat panels that is motorized and remote-controlled, \$300 (40" panel size, up to 80 lbs) and \$450 (50" panel size, up to 130 lbs), pivoting mechanism for left/right screen adjustments of 60 degrees or more per side, electronically performed with a two-button remote from up to 30 feet of distance, extends up to 20" or 26" from the wall depending on the model, fold flat when not in use, built-in safety clutch to stop rotation upon an obstacle, high-performance ball bearings for smooth long-lasting operation, solid metal construction, integrated cord organizers, smaller model also operable with 4 "C" batteries, <http://www.digitalinnovations.com/> .

### Dnp

Sep 06

Retractable Supernova Flex Optical Front Screen with brushless DC motor for fast, smooth and quiet positioning, lightweight anodized aluminum enclosure, looks like a picture frame suspended by a pair of unobtrusive 1/48-inch cables, removable/replaceable cover comes in a variety of finishes, stainable surface can be painted to match the wall for invisible installation, highly resistant to ambient light, 20:1 CR, peak gain of 2.0, sizes up to 150-inches in 1.33:1 (4.3), 1.78:1 (16:9) and 2.35:1 Cinemascope, recommended for projectors with a minimum throw of 1.8:1.

### D-Box

CES 2007

Universal Motion Platform (UMP) featuring a two-point actuator system, plug-and-play product installable on most single seats, can be retrofitted to an existing home theater set-up, offered at a third of the price of current D-BOX motion simulation systems, works in conjunction with a wide variety of DVDs that are D-BOX motion compatible, \$3,600.



Quest and Custom Motion Platform (CMP), two



motion simulation products  
designed for home theater, media



and gaming rooms. Quest is a recliner chair available in a single-seat or love seat configuration that features pre-installed D-BOX motion actuators. CMP (formerly known as Odyssee), is a custom-built motion platform designed for installation in pre-built or dedicated home theater set-ups.

Products require a motion controller system that may require the use of a PC running Windows 2000 or XP with a USB port. D-BOX offers over 650 encoded movies, adding 10-15 new titles per month, <http://www.d-box.com/>



### **Hillcrest Labs**

Spontaneous Navigation and Freespace remote system with 3 dimensional pointing "The Loop" to navigate screen menus remotely in 3 dimensions using everyday gestures.

### **Jasco GE**

Quantum Digital Antenna with exclusive three-panel design made to receive digital television signals from multiple angles and avoid constantly repositioning the antenna, 20db gain, 3 HD3 circuit boards, one in each panel, filters out erroneous signals from cell phones, microwaves, and lights, built-in amplifiers to increase reception quality, hinged panels, \$50, 2007 Best of CES Innovations winner.

### **Lightscope**

CES 2007



Displays art while protecting the flat panel TV when is off, TTM Mar 07.

Come in three distinct designs, fine art silkscreen prints on quality vinyl, sample light and color from the TV to create dynamic, changing patterns, placed over the existing TV screen with a suction tape, available in small, medium and large sizes, \$210 to \$360, <http://www.tv2art.com/>

## Optoma

Panoview screen, 1.8 gain, 4 configurations, pull-down, motorized, fixed-frame and portable tilt.

## Panamorph

Anamorphic lens and sled system for 2.35:1 CinemaScope constant height applications.



According to the company, "The Panamorph UH380 [\$2,500] is a high performance, patented, anamorphic add-on lens installed in front of digital projectors to convert them to a higher (wider) aspect ratio. The UH380 currently represents the industry standard for home cinema conversion to 2.35:1 screens and is sold and endorsed by more home cinema projector manufacturers than any other lens. This lens can be used for constant height 2.35:1 imaging as either a moveable lens (electronic vertical image stretch required for 2.35:1 content) or a fixed lens (both electronic vertical stretch and horizontal squeeze [for

non-2.35:1 content] required)."

The M380 (\$2,500) mount supports the UH380 with an IR remote-controlled motor transport system to change projector aspect ratios in less than 3 seconds at the push of a button.

<http://www.panamorph.com/index.html>

Please consult the sections dedicated to front projectors (specially DLP), many projector manufacturers are packaging CinemaScope lens/sled systems with their projectors or a separate systems.



## Planar Systems



### CES 2007

Planar Xscreen \$4,100, FP use on any room regardless of lighting conditions using ambient light rejection technology, eliminating the need for dark room theaters.



## **Sima**

### **XL Theater**

Portable inflatable screen, 16x9, durable frame and screen material, includes 2 amplified speakers, inflator/deflator pump included, inflates in under 5 minutes, compatible with most projectors, 0.15mm PVC screen material, .6mm PVC with 1000D Substrate Mesh frame material

XL-8 \$1900, 8 feet, 8 inch speakers, 80w amp

XL-12 \$2300, 12 feet, 10 inch speakers, 100w amp



<http://www.simaproducts.com/>

## **Stewart**

Silent retractable projection screens implementing Lutron's Sivoia QED (Quiet Electronic Drive) technology to eliminate the noise of typical motorized window treatments.

### **StarGlass**

The first glass rear-projection screen, laminated between two pieces of glass for durability in even outdoors, childproof, resists wetness and direct sunlight.

### **ElectraScope**

New 2.35:1 electric screen with 1.78:1 masking capabilities, ceiling retractable.

### **Microperf X2**

THX Ultra certified acoustically transparent screen.

### **Firehawk G3 1080p**

New screen that has also been paired with Sony's VPL-VW50 SXRD front projector, which Sony calls "Sony/Stewart Theater" or "SST".

Check the Cinecurve and other screens on the 2006 HDTV Technology Report.

## **VUTEC**

Art Screen SoundScape 360 flat screen masking system for plasma and LCD televisions from 32 inches and up, for front projection screens is available up to 110 inches in size, \$4,750 and up. <http://www.vutec.com/artscreen/>



### SilverStar screen

The performance of SilverStar (6.0 gain) enhances all measurements of picture brightness and quality.



### Vutec Vision XFT native 2.35:1 screen

Flat-fixed, vertical masking screen for anamorphic lens projectors, maintains constant vertical height for 2.35:1 CinemaScope, 16:9 HDTV, and 4:3 NTSC TV aspect ratios, no curved screen shadow effect, no space between the masking

panels and projection screen, built-in intelligent motor control system, Decora-style keypad control, IR6 infrared interface adaptor for learnable IR remote, interfaces with AMX, Crestron, Lexicon and other manufacturers, ships fully assembled for immediate installation.



Offers selection of varied screen fabrics including the Silver Star 6.0 gain and 180 degree off axis viewing, BriteWhite Opaque with 1.3 gain, PearlBrite with 3.1 gain, GreyDove with 0.95 gain, Soundscreen with 0.95 gain, and Rear-Vu with 2.5 gain.

<http://www.vutec.com/>  
1(800)770-4700

## Glossary of H/DTV Terms

The following are some descriptions for terms of video and audio concepts as they relate to DTV. I wrote this Glossary for the Reference Guide Issue of the HDTVetc Magazine a few years ago and have been updating it over the years, now updated as of May 2007.

**480i:** SDTV format of 480 interlaced visible lines of 704 total pixels each (in 16:9 or 4:3 aspect ratio), or of 640 total pixels each (in 4:3 aspect ratio). 480i is per frame (240 lines x two fields) at 30 fps (frames per second). 480i/30fps is similar to interlaced DVD quality. Comparatively, NTSC color television is also 480i visible lines but is analog in a 4:3 aspect ratio with 450 pixels edge to edge (also measured as 340 TVL lines of horizontal resolution per picture height).

**480p:** EDTV format of 480 progressive visible lines of 704 total pixels each (in 16:9 or 4:3 aspect ratio), or of 640 total pixels each (in 4:3 aspect ratio). 480p is per frame at 24, 30, or 60fps. The 480p/60fps format is similar but in theory it should be better than progressive DVD quality, because the DVD progressive is the result of re-interleaving/line-doubling 480i/30fps stored DVD images, not 480p/60fps as EDTV, which should have better temporal resolution suitable for fast action content (like 720p is). This format was originally a SD format, in late 2000, the CEA promoted it to an EDTV level created for 480p.

**5c:** Copy-protection protocol used by the IEEE1394 digital connection. Also known as DTCP. The name originates from the group of five companies that developed the standard.

**720P:** HDTV format of 720 progressive visible lines of 1280 total pixels each in 16:9 aspect ratio. 720p is per frame at 24, 30, or 60 fps. ABC and ESPN are broadcasting in 720p/60fps. 720p is considered a better format for fast action images like sports due to higher temporal resolution than the other commonly used HDTV format (interlaced 1080i).

The higher temporal resolution of 720p allows the format to complete an image frame in 1/60 of a second while 1080i is only drawing 540 lines with half of the information of the frame of the format. On the next 1/60 of a second the 720p could record complete detail of a different fast moving image, while the 1080i would be registering picture information of only the second set of 540 lines containing only half of an image that could also have moved fast enough to produce interlace artifacts when putting the two fields together.

**810i:** In late 2000, when the CEA created the additional EDTV level with the DTV formats, there were a number of 4:3 TV sets that manufacturers labeled HDTVs but only showed 810i lines of a 16:9 1080i image (25% less in the vertical resolution), using a letterbox approach to convey the rectangular widescreen geometry of the HD image within the 4:3 frame of the TV.

The remaining 270i lines (1080i minus 810i) of the TV set were wasted on scanning black information for the top/bottom bars, instead of using the lines for the benefit of the image. The concept is similar to what a DVD player does when a regular 4:3 TV displays a 16:9 image as letterbox (throwing away 1 line for every 3 that kept to maintain geometry).

The new EDTV category was placed by the CEA between the original SDTV and HDTV standards, but instead of putting those 4:3 810i sets on that EDTV category the CEA did the following:

a) The 480p sets were promoted from SDTV to the EDTV level, and

b) The 810i (non-HDTV) 4:3 DTV sets were promoted to the group of fully capable HDTV sets (720p or 1080i). With time, manufacturers of 4:3 DTV sets gradually designed those to adjust their scanning raster so they could show all the 1080i lines of incoming signal closer together, all within the displayed 16:9 image; in those TVs the black bars are dead space, the TV is not using vertical resolution lines for the black bars (as opposed to the 810i style). It is recommended that consumers verify how a 4:3 DTV handles 16:9 images before making a purchase.

**1080i:** HDTV format of 1080 interlaced visible lines of 1920 total pixels each in 16:9 aspect ratio. 1080i is per frame (540 lines x two fields) at 30 fps, and the HD format is commonly used since 1998. See DTV.

**1080p:** HDTV format of 1080 progressive visible lines of 1920 total pixels each in 16:9 aspect ratio. 1080p is per frame at either 24fps or 30 fps. 1080p/60fps is not one of the 18 ATSC formats but new displays introduced since 2005 are able to display in that format. 1080p/24fps should be ideal for the transfer and broadcast of 24 fps film-based material, but it is not used at the present broadcasting. However, should it be used, objectionable flicker would require the 1080p/24fps to be converted to either progressive 1080p/60 fps or interlaced 1080i/30fps (60 fields per second).

If the signal were to be converted to the higher 1080p/60fps, it would also require a CRT based video projector with a fast raster (67.5kHz, double the 33.75kHz of 1080i/30fps) to be able to synchronize to the signal and display it as 60pfs. The same (fast raster) requirement would apply if the 1080p/60fps were obtained from line doubling a 1080i/30fps broadcast program using a scaler/line doubler processor. Some fixed pixel displays released on the first generation/s of 1080p HDTVs capable of displaying 1080x1920 are not actually able to 'accept' a 1080p/60fps signal from an external source. In 2006, such source was introduced, Blu-ray Hi-Def DVD.

**2-3 Pulldown (also mentioned as 3-2 pulldown):** Technique used to display/transfer film based content to video. Film is shot at a rate of 24 frames per second, when projecting it on a motion picture cinema theater screen any visible flicker is minimized by opening the film shooter of the film projector twice for each frame, so viewers actually see 48 frames per second.

Interlaced video systems display at 30 frames per second (in 60 interlaced fields for 480i NTSC or 1080i HDTV). Simply transferring each of the 24 film frames onto one video frame would result in a video version of the film running about 25 % faster than intended, this is solved by repeating some of the images to restore the proper speed of the film when viewed as video. Telecine machines are used to transfer film to video to produce masters.

Although DVD is a NTSC interlaced video media (480i 60 fields x second), frame content that originates from film is actually stored as 48 fields rather than 60 fields to save space. The original 24 frames of the film source can easily be reconstructed

from the 48 fields by assembling a frame from each pair of fields that came from the same original film frame, without any motion between them (motion the interlaced video has between fields). In order to help on the identification of film source material for its frame reconstruction, a flag is usually inserted (but not always) within the MPEG-2 data stream to indicate that the content is sourced from film and has that frame structure cadence.

If the flag is used, or if the playback device (DVD player, HDTV) detects the 24 fps film frame cadence automatically, it instructs the internal circuitry (when suited with that) to perform a 2-3 pull-down processing to repeat some of the 48 fields to construct a 60 fields video sequence 'in real time', so a video display device can synchronize and display it properly at 60i.

Content originating from 60i video cameras is stored as is on the DVD and does not require this playback technique because all the 60 fields are already within the signal. Additionally, a deinterlacing technique is used to convert the 60 interlaced fields x second video to 60 frames x second for the progressive outputs of the player (and the display device to show it as a progressive image).

The above also applies to 1080i HD resolution images sourced from 24 fps film, by applying the same technique, the film sourced HD image can be converted to 60 fields x second for 1080i sets, or 60 frames x second for progressive displays.

**A/D (Analog-To-Digital Converter):** Electronic device that converts analog signals to digital. A D/A is also a similar device that performs the reverse function.

**AC Line Conditioner/Surge Protector:** Equipment that performs filtering of power-line noise/interferences on AC (alternate current), and protects the connected audio/video components from voltage surges and spikes. Some line conditioners are designed with separate sections to connect digital or analog equipment in two groups; the design claims that such separation blocks the feedback of digital equipment from interfering with analog equipment.

**Active Lines:** Visible lines of the horizontal scanning (on NTSC is 480i of 525i, on HDTV is 1080i of 1125i). Blanking and vertical sync signals are within the non-visible lines.

**Active Subwoofer:** Loudspeaker constructed to reproduce only low frequencies, with a power amplifier that is usually built within the speaker cabinet. Some subwoofers are 'passive', which means that the subwoofer requires a separate amplifier to drive the loudspeaker.

**AES/EBU Interface:** Connectivity standard for professional use established by the "Audio Engineering Society" and the "European Broadcasting Union" for digital audio transmission between equipment components. AES/EBU is carried on a balanced line terminated with three-pin XLR connectors. Sony/Philips' S/P DIF is the consumer adaptation of this standard.

**Aliasing:** (also called as flicker) Effect of a CRT electron gun drawing the scanning lines too slow, which gives time for the phosphors to fade.

**Alternate Scanning:** (also known as Interlace: i) Technique that displays a full frame of a picture by showing two different fields containing only half of the video information (such as 480i, 1080i).

**Analog:** (same as analogue) Continuous movement that takes time to change from one position to another. Standard analog audio and video signals have an infinite number of levels between their highest and lowest value, as opposed to digital that represent changes as only two steps ('on' or 'off', or binary's 'one' or 'zero'). Analog signals are stored magnetically, optical (films), and frequency modulated (Laserdiscs and VHS-HiFi).

**Anamorphic:** (also specified as Widescreen video 'enhanced for 16:9 televisions') Technique that improves the vertical resolution of widescreen video (number of horizontal lines in the vertical direction). The technique horizontally squeezes a wider 1.78:1 aspect ratio (16:9) image to a 1.33:1 (4:3) image, making objects look thin and tall, so when the image is unsqueezed by the display, the original widescreen geometry of the image is restored without reducing the vertical resolution lines.

This results in a gaining of 33% of vertical resolution compared to letterboxing with black bars (letterboxing takes away actual image content lines to show as black). In other words, a 16:9 image of 480i scanning lines would be shown with all its 480 lines, not as 360 of the letterboxed version (which discards 120 lines of image content to create top/bottom black bars so a regular 4:3 TV can show the image as widescreen).

**ANSI Lumens:** Method of measuring brightness by which the display device is divided into nine rectangles and light is measured from the center of each rectangle, then averaged among the nine and expressed as lux (lumen/square meter), which is then multiplied by the number of square meters of the image at the plane of meter reading. The result is the light output specification expressed in lumens.

**Aspect Ratio:** The ratio between the width and height of the video image. Standard NTSC television has a 4:3 (1.33:1) aspect ratio, which is similar to the Academy standard for films before the 1950's, almost a square box shape. Widescreen screens are rectangular with a 16:9 aspect ratio (1.78:1); some widescreen display panels are only 15:9.

Widescreen sets are offered to the consumer in several flavors: front projection, rear projection, direct-view TVs, LCD TVs, and Plasma TVs. Some film aspect ratios are 1.85:1, anamorphic scope 2.35:1 or 2.40:1, and 65mm (70mm) from 2.05:1 to 2.21:1. Images from those wider aspect ratios are fitted within the 16:9 (1.78:1) HDTV image as a wider rectangle with top/bottom black bars (that use some vertical resolution lines of the 1080i or 480p DVD).

**ATSC:** Advanced Television Systems Committee, the federal committee that selected the new DTV standard, which the US adopted on December 24, 1996 except for the full application of the 18 video formats described on the ATSC table III.

**Automatic Convergence:** Automatic alignment of red, blue and green color images.

**A-VSB - Advanced-Vestigial Side-Band:** A-VSB is a DTV broadcast system for mobile purposes proposed to the ATSC in December 2005. During 2006 Sinclair Broadcast Group, Samsung Electronics, and transmitter manufacturer Rohde & Schwarz, joined efforts to successfully test DTV mobile reception at highway speeds.

At CES 2007, A-VSB was demoed, and expected to be included in the Advanced Television Systems Committee (ATSC) digital-TV standard by 1H07, and is backward compatible with 8-VSB the current DTV terrestrial system.

A-VSB, was previously simulated at NAB in April 2006, using forward-error-correction (FEC) "turbo-coding" for difficult signal environments, which used about one fifth of the transmitted bits for the actual video, the rest was to provide robustness so the signal is tuned well by the receiving device.

1.5 megabits per second (Mbps) of transmitted signal would have only 375 kbps of actual video. That number of bits is considered sufficient for small devices such as cellphones and PDAs.

The use of Single Frequency Network (SFN) within A-VSB can improve broadcast quality with higher uniform signal strength throughout a service area, even in locations that normally would have their signals interfered with by obstacles such as hills or buildings.

A broadcaster adds a specified Supplementary Reference Sequence (SRS) to the transmitted signal and A-VSB receivers can use the SRS in order to remain "locked in" to the transmission. This helps maintain reception of the main signal and extra 'turbo' signal(s) even when interference would normally disrupt a signal, like when the signal is reflected from moving objects near the receiver. A-VSB also enables the receiver to stay 'locked on' to the signal when the receiver itself is moving, such as when someone is walking with their portable TV.

Please consult the "DTV Standards" section of the HDTV Technology Review Report for 2007 for more information.

**Bandwidth:** Range of frequencies that equipment for radio, TV, audio, and video operate and let pass-thru. The wider the bandwidth, the better the audio, or video quality. The higher the bandwidth, the better the performance of the equipment. In a digital circuit, bandwidth is measured as bits per second.

**Baseband:** Prime signal that is not modulated onto a carrier signal, but rather has its own path (composite, component, etc).

**Bi-directional:** Devices and ports that can let signals pass in both directions (such as RS-232, IEEE1394).

**Black Level:** (also known as brightness) Level of light produced on a video screen when it emits no light at all (screen black), the color NTSC system places the absolute black level at +7.5 IRE (unit of video defined by the Institute of Radio Engineers), a level that is higher than when the television was black and white, which set the absolute black level as 0 volts DC. The level was raised because B&W transmitters at that time could not handle a color signal with black level at zero volts.

**Blooming:** Effect that occurs on CRT images when the light hitting the screen is too high, because of excessive brightness or contrast, overdriving the phosphors (in CRTs) in a way that edges of images appear to exceed their boundaries dispersing the light to adjacent areas.

**BNC:** Professional type of connector with a cylindrical shape with pins that lock into place.

**Brightness:** (also known as black level) Intensity of light produced on a video screen, regardless of color.

**Burn-in:** Term given to the permanent damage on a video display caused when a fixed image has been shown for too long. CRT and PDP plasma panels are prone to burn-in; LCD and DLP chip-based displays are not. To reduce the risk of burn-in, some display devices shift the entire image just a few pixels at intervals, in a way that is not noticed by the viewer.

Usually manufacturers deliver displays with the contrast setting to its highest to increase the appeal of TV sets that stand out on fluorescent lighted showrooms. However, when you own the set it is always recommended keeping the contrast levels as low as possible until the display is properly calibrated, and to use stretching modes in 16:9 displays when viewing 4:3 images (to avoid long viewing with dark pillar bars).

**Ceiling Surround channel/speaker:** Audio format that uses a ceiling (height) surround channel/speaker decoded from the center front and center back channels, using an algorithm similar to what Dolby Pro Logic uses when extracting and steering to the center front the signal decoded from L and R fronts. One war movie already explored that format.

In the late seventies a similar technology was developed by ADS, Model 10 Acoustic Dimension Synthesizer, a comprehensive digital time-delay processor (and expensive at that time, almost \$1000), the unit decoded a ceiling and center back surround channels/speakers in addition to the side/rear surrounds. After almost 25 years, the ceiling and back surround approach 'reinvents' itself.

**CRT (Cathode Ray Tube):** Vacuum tube containing an electron gun that drives an electron beam that rapidly hit a phosphor-coated screen and produce video images.

**Center Channel:** Channel that primarily carries the dialogue from a movie soundtrack, but also contains a substantial portion of other non-dialogue sounds. The center channel also helps maintain the front sound imaging for off-center viewers. Center channel speakers are magnetically shielded.

The use of TV's small speakers (and small TV amps) as alternative for a missing center channel is not recommended as a permanent home-theater setup. The dialog and much of the sound of a movie comes from the center channel, some have estimated it in the order of 60% of the movie soundtrack.

When using the TV's small amp/speakers in a home theater, the speaker's loudness capacity would be exceeded much earlier than the external L/R speakers/amp (assuming that it is larger than the TV audio, as typically is the case). The effect could be worsened if the system does not have a subwoofer to redirect low

frequencies from a small center and surrounds. The distortion on the center channel would affect the clarity of the dialog over loud passages.

Additionally, sounds that are panning side-to-side would have different timbre while switching among speakers (from left to center to right) accompanying the video movement in that direction. Voices of people walking side-to-side will change their tone as they enter the TV's center speaker and as they depart from it, reason by which it is recommended for the center speaker to be of similar type and timbre than the L/R, and be driven by similar amplification as well.

**Center Channel Input:** Having this input in the DTV allows for the use of the internal speakers to reproduce the sound of the center channel in the home theater set-up. If the TV center channel input is line-level (RCA type), it can receive the center channel signal already decoded by an external surround processor, and use the TV set's internal amplifier to drive the internal speakers of the TV.

If the center-channel input of the TV is speaker-level, it can receive a speaker cable carrying an amplified center channel signal from an A/V Receiver or separate amplifier, bypassing the TV's internal amp. This may be useful if your audio/video system has insufficient space to place a center channel speaker, or you might want to start your surround system at a reduced cost. However, as mentioned in the Center Channel description, this approach should not be permanent.

**Chroma:** Sometimes called 'Hue', is the term used to characterize color information, such as hue and saturation (not black, gray and white). Interference of chroma can be seen as rainbow images and color transition dots, caused by the interaction between the chrominance and luminance components of a composite video signal.

**Circle Surround:** Multi-channel surround effect produced from two channel sources by using ambient information stored in a stereo recording, a stereo recording encoded for surround, and recordings specifically encoded in Circle Surround. The surround sound information sent to the surround speakers is stereo, as opposed to the monaural approach of Dolby Pro Logic. Circle Surround creates a believable front soundstage, apportioning the stereo signal more comfortably across the three front channels; this makes the system appealing for music listening.

**Color Fringing:** Artificial outlines surrounding the edges of colored objects on the video image.

**Color Temperature:** The correct color temperature of a video display should be 6500 degrees Kelvin, and expresses the color quality of a light source, which is bluer when the Kelvin measurement is high, and reddish when is low.

**Comb Filter:** This filter separates the luminance and chrominance from the composite video signal, improving, resolution, picture quality, and reducing objectionable color patterns. Low-to-mid-line sets utilize a glass comb filter. Higher-end sets utilize a CCD or digital comb filter, which greatly enhances resolution. The highest quality comb filters are 3D-Y/C digital comb filters, and may be motion-adaptive.

**Component Video:** Analog component video connections used typically for DVD players/recorders, HD-STB/PVRs, audio/video receivers, video switchers, D-VHS VCRs, and HDTVs are:

a) 3-wire 75 ohm coax analog YPbPr (YCbCr is actually 'digital' component video, and the nomenclature has been incorrectly used abroad for analog connections in consumer equipment), and

b) 5-wire RGB BNC or VGA 15 pin D-sub, with the horizontal and vertical sync signals separated from the other 3 signals. Component video connections do not carry audio, for which separate audio connectors are required, such as digital coaxial and optical (Toslink). Component video offers higher quality performance than composite and even S-video, it bypasses the composite en/decoding process, and color carrier frequency.

**Composite Video:** NTSC standard video connection (typically a yellow jack/plug) for the passage of an interlaced video signal that has luminance (black and white information), chrominance (color), sync (horizontal and vertical), blanking, and color burst signals, all in one wire. The standard has been used also in VHS and laserdisc equipment. Regardless of the type of connection (component, composite, S-video) the use of gold plated jacks/plugs is known to offer better connectivity between them.

**Contrast:** Range between the maximum and minimum values of brightness; contrast ratio (CR) is a measurement obtained from the division of both. The specification came from the same panel of experts that established the ANSI lumens as the measurement of brightness in 1992 (under the American National Standards Association). A 'perceived' CR measured from an image as viewed would differ from the CR measured at the lens of the projection device (FPTV), and would differ from the CR measured at the screen point.

**Convergence:** Alignment of the red, green, and blue CRT guns on a projected display device (RPTV or FPTV). Using the convergence controls of the TV, the three colors should overlap and display a white line on the crosshatch test pattern over the entire surface of the image. Display devices using fixed pixel arrays (such as DLP DMD chips) do not require convergence adjustments.

**D/A:** Digital to analog converter (the inverse conversion is also mentioned as A/D).

**D-Sub:** Name associated with the VGA connection with 15 pins for RGBHV signals.

**DBS (Direct Broadcast Satellite):** Satellite system that distributes signals from the satellite to the individual receivers, such as DirecTV, Dish Network, and Voom.

**DCDi Processing:** Created by Faroudja, the DCDi technique is an additional improvement/upgrade to the 2-3 pull-down technique. It stands for Directional Correlational Deinterlacing, which according to Faroudja, provides for error-free deinterlacing of video originated sources such as sporting events. Reportedly, DCDi produces smooth, natural images by eliminating the jagged edges than can be seen on moving angled lines in video.

**Decibel (dB):** (One-tenth of a Bell, named after Alexander Graham Bell) Logarithmic ratio used to measure power, sound pressure level, or voltage. A 3dB

loss/increase is considered an attenuation/augmentation of half/double of its original value; zero dB is the threshold of hearing; 120dB is the threshold of pain.

**Decorrelation:** Technique used in THX processors for rear speakers to create an ambient DSP sound field similar in spaciousness and depth as a commercial theater.

**Definition:** Fidelity of the reproduction of a video picture, affected by resolution.

**Deinterlacing:** (or re-interleaving) Technique that involves assembling pairs of interlaced fields into one progressive frame (1/60 of a second long), and showing it twice, over the same amount of time as two fields. The need for 60 flashes on the screen each second stems from a biological property called the Flicker Fusion Frequency, whereby the human brain needs to see a minimum number of single image flashes in a second to see motion without seeing flicker. See progressive scan below.

**Digital Audio Inputs/Outputs:** Audio jacks that can be either coaxial (RCA jack) or optical (Toslink) and allow for the passage of multi-channel digital audio signals over a single connection. There are other digital audio connections for multi-channel audio such as IEEE1394 (FireWire) used in some proprietary links between DVD players/Receivers/Processors, or the audio portion of HDMI. Digital connections are prone to less noise and interference than analog audio connections by keeping the signal in the digital domain.

**DLP:** DLP stands for Digital Light Processing. DLP projectors and rear projection televisions provide premium quality images with excellent black levels without the use of a CRT (Cathode Ray Tube). These projectors use a Digital Micro-mirror Device (DMD) to create images that are enlarged to fill the screen. The DMD chip has upwards of 1.3 million tiny mirrors to resolve 720x1280 HD resolution images.

In January 2004, the xHD3 DMD chip was introduced by Texas Instruments (TI, the manufacturer of DLP DMDs) that claimed having resolution enough to resolve 1080x1920 HD images, although using a 1080x960 DMD chip (half of the mirrors) and using a technique named wobulation. In 2005, TI announced the release on a true 1080x1920 DMD chip for front projectors, and new projectors using the technology introduced at CES 2006. Since DLP is a reflective technology, DLP will typically have higher ANSI lumens and Contrast Ratios than LCD. A color wheel is employed to help create a full palette of colors on one-chip projection implementations, which can produce a "rainbow" viewing effect for some people; three-chip implementation does not need a color wheel to show all the range of colors.

**DNIe:** Samsung's proprietary name for their video enhancement technology "Digital Natural Image" enhancement.

**Dolby Digital 5.1 Surround:** Multi-channel perceptual encoding scheme. Initially, Dolby's new surround system was called AC-3 (for audio coder 3). It was introduced in movie theaters in June 1992 as Dolby Stereo Digital (or Dolby SR). Dolby Surround is a single-band-limited surround channel with a range of 100 Hz to 7,000 Hz. Dolby Digital, on the other hand, offers a full dynamic range on five discrete main channels L, C, R, Ls, and Rs (20 Hz - 20,000 Hz), plus a separate .1 channel for Low Frequency Effects (LFE) intended to be reproduced by a subwoofer. The surround channels are in stereo (as opposed to mono with Dolby Pro Logic).

This format has been adopted as the audio standard for DTV signals. Perceptual encoding seeks to eliminate the data humans cannot hear, while maintaining all the information humans can hear, and was designed to encode multi-channel digital audio. It divides the audio spectrum of each channel into narrow frequency bands that correlate closely to the frequency selectivity of human hearing allowing coding noise to be very sharply filtered taking advantage of the psycho-acoustic phenomenon known as auditory masking. Coding noise stays close in frequency to the audio signal being coded. This effectively masks the noise.

AC-3 uses a "shared bit-pool" arrangement plus human auditory masking to make use of transmitted data as efficiently as possible, and allows multi-channel surround sound to be encoded at a lower bit rate than required by just one channel on a CD. Dolby Digital can process a 20-bit dynamic range digital audio signal over a frequency range of 20 Hz to 20,000 Hz +/- 0.5dB (LFE bass channel: 20 - 120 Hz +/- 0.5dB) with sampling rates of 32, 44.1 and 48 kHz with a typical data rate of 384 kbps (versus 1,411 kbps for DTS) with a compression rate of 12:1.

The AC-3 algorithm was designed by Dolby to faithfully reproduce film and music based programs with interference-free discrete channels, not folded or matrixed like Pro Logic; whatever the director wanted to be heard from a specific area was the only thing that would be heard from that area. Dolby Digital is ported out of a DVD player or HD-STB via its digital coaxial or optical output and fed directly into the digital coax or optical jack of a Dolby Digital decoder/processor or receiver (with built-in DD decoder).

A decoder/processor has six separate analog audio outputs, one for each discrete channel of the 5.1 Dolby Digital, five to be amplified by a separate power amp, .1 LFE to be amplified by an active subwoofer. Dolby has enhanced the basic 5.1 format with EX (adding a matrixed back surround channel extracted from Ls/Rs as Pro Logic extracts the Center channel, and Dolby Digital Plus, a new format to facilitate broadcasters with a more efficient compression method for the DD audio in DTV transmission (more on both formats below).

**Dolby Digital Plus:** A powerful, flexible codec based upon Core Dolby Digital technologies. For broadcasters, it provides higher efficiency coding at lower bit rates. For the new blue laser Hi-Def DVD formats, it provides more channels, extended bit rates and higher quality.

The Dolby Digital Plus format was announced in April 2004 at NAB. Dolby Digital Plus enables broadcasters to transmit 5.1 at 50% (192 kbps) data rate of regular Dolby Digital (384 kbps). Compatibility with all existing Dolby Digital consumer decoders is ensured, as the Dolby Digital Plus signal will be upconverted to a standard 640 kbps Dolby Digital Plus output in the set top box (a set top box that performs the upconversion would be needed).

The format supports multiple languages in a single bit-stream, and was selected by the Advanced Television Systems Committee (ATSC) as the standard for future robust broadcast applications, and as an option for multichannel audio delivered by the Digital Video Broadcasting (DVB) Project for satellite and cable TV.

Dolby Digital Plus was also announced as being capable of a higher-bit rate enhancement compared to Dolby's existing AC-3 (Dolby Digital) lossy audio

compression format. Dolby Digital Plus format supports new levels of quality data rates as high as 6 Mbps on 7.1 channels, with a bit-rate performance of at least 3 Mbps on HD DVD and up to 4.7 Mbps on Blu-ray disc.

According to Silicon Image, although the HDMI transport is able to handle 18Mbps, Dolby Digital Plus has no ability to carry uncompressed audio nor can it be operated in a lossless way. Check the Multi-channel Audio for HD section of the H/DTV Technology Review report for applicability and connectivity details.

Dolby worked closely with Silicon Image to ensure transmission of Dolby Digital Plus signals on HDMI v. 1.3, earlier versions of HDMI are not capable to transmit this format. Those protocols and specifications were finalized by mid-2006.

Dolby Digital Plus is a mandatory audio format in HD DVD players and an optional feature in Blu-Ray players.

**Dolby Digital Surround EX:** Format of 6.1 multi-channel playback that provides a third surround channel (back) on Dolby Digital movie soundtracks encoded onto the left and right surround channels of 5.1 soundtracks. The format can be decoded by suited A/V receivers and Dolby decoders for playback over surround speakers located behind the seating area, while the left and right surround channels are reproduced by surround speakers to the sides.

To maintain compatibility, no information is lost when the film is played in conventional 5.1. The benefits of Dolby Digital Surround EX include more realistic flyover and fly-around effects, a more stable image for atmospheres and music, and a more consistent surround effect. No additional effect tracks are needed; the mixer directs the available sounds to the appropriate channels for greater directional precision.

Because the extra surround information is carried on the left and right surround channels, Dolby Digital Surround EX encoded soundtracks are still regarded as 5.1 soundtracks, although with respect to home playback, the terms 5.1, 6.1, and 7.1 mean that there are five, six, or seven main speakers, plus a subwoofer that still reproduces the LFE channel recorded on 5.1 soundtracks, plus any bass the main speakers cannot handle.

A 5.1-channel soundtrack can also be played on a 6.1- or a 7.1-speaker system, the two surround signals on the 5.1 soundtrack are spread across the three or four surround speakers by a Dolby Digital EX decoder, a THX Surround EX decoder, or other proprietary methods provided in home theater equipment by various manufacturers.

**Dolby Pro Logic:** Matrixed surround system with four channels of information (Left, Center, Right, and Surround) that are folded into two channels and encoded onto the L/R channels. The Pro Logic processor, in turn, extracts those four channels from the two encoded channels, and steers or directs them to the appropriate speakers, e.g. dialogue to the center channel and mono effects to the rear.

Under this scheme, the rear surround channel mono signal is divided over two speakers, which gives it more coverage. The rear channel information is derived by the simple formula of L-R with added reverb to give it a more natural like sound.

The Pro Logic format concept helped originate the newer Dolby Pro Logic II, and IIX as follows.

**Dolby Pro Logic II:** Format that creates a 5.1 surround sound field from a two-channel stereo program material, whether or not it has been specifically Dolby Surround encoded. Encoded material, such as movie soundtracks, sounds more like Dolby Digital 5.1, while unencoded stereo material such as music CDs, sounds like a wider effect and more involving sound field. Pro Logic II provides two full-range surround channels, as opposed to Pro Logic's single, limited-bandwidth surround channel.

**Dolby Pro Logic IIX:** Format that works with 5.1 audio as well as two-channel material, producing up to 7.1 channels, by decoding center back and side surround channels from the left/right surround channels of Pro Logic II and 5.1 audio. Pro Logic IIX includes center channel width control and panorama mode, as well as music, movie and games modes. Dolby is positioning this format as an expansion of 5.1 audio with the option to extend it to 7.1 surround.

**Dolby TrueHD:** Introduced in September 2005, Dolby TrueHD can support up to 14 discrete of lossless 24-bit/96 kHz audio channels at bit rates as high as 18Mbps. HD DVD and Blu-ray disc standards currently limit their maximum number of audio channels to eight. Check the Multi-channel Audio for HD section of the H/DTV Technology Review report for applicability and connectivity details.

Dolby TrueHD™ builds upon the proven foundation of MLP Lossless™ by incorporating higher bit rates, additional channels, enhanced stereo mix support, and extensive metadata functionality, including dynamic range control and dialogue normalization.

Dolby TrueHD is 100% lossless audio, delivering audio playback performances in the home that are bit-for-bit identical to studio masters, designed for next generation HD DVD and Blu-ray formats, and selected as mandatory (only 2 channel required) for HD DVD players and optional for Blu-ray players.

**Dolby Volume:** At CES 2007, Dolby announced a new feature called Dolby Volume, developed to level out sound differences in TV programming without the typical "pumping" and artifacts introduced by other technologies.

As said by Dolby, " some programmers use compression techniques that allow them to boost the volume of their material without exceeding the peak limits set by Government. Some operators of TV channels also make different decisions about volume levels or fail to operate equipment properly".

Dolby modeled how the human ear works, responding to the energy of sound waves, the pitch, and the tone quality of sounds, and applied formulas to reduce the volume differences between programs and commercials without losing the needed sounds.

**DTCP (Digital Transmission Content Protection):** Scheme created for the purpose of copy protection of digital video transmitted over the 1394 connection. DTCP is also known as 5c for the five companies that participated on the standard (Sony, Toshiba, Intel, Hitachi, and Matsushita). The format allows for copy freely, once, and never, as options of protection.

**DTS (Digital Theater Sound):** DTS originated as a digital 5.1 surround scheme developed for the movies by MCA/Universal and Steven Spielberg. DTS was first employed in Spielberg's *Jurassic Park* in the summer of 1993. While it has not been around as long as Dolby, hundreds of films have been released with DTS encoded surround soundtracks. DTS Coherent Acoustics Coding (CAC) maps discrete 6-channel, 20-bit encoded data onto the 16-bit PCM digital audio stream, which is found on either a laserdisc or compact disc.

DTS' CAC signal is passed via the digital output (either coaxial or optical) present on many laserdisc, CD, and DVD players. While Dolby Digital uses perceptual coding to reduce the bit rate, DTS uses compression technology and the CAC algorithm with a higher bit rate than DD. The compression ratio is 3.75:1 of a 20-bit PCM digital audio stream with eight times over-sampling rate. It has a typical data rate of 1,411 kb/s (as opposed to 384 kbps of Dolby Digital). It performs transparently by coding 20-bit data at a bit-rate lower than 16-bit linear PCM.

The Coherent Acoustic Coding algorithm is a scaleable digital coding methodology, which operates on a multirate filterbank. It has been designed to filter the audio signal into frequency bands, which match the critical perceptual bands of the human ear. Within each frequency band, the signals are re-quantified at a variable resolution. This is determined by the available bit-rate and an analysis of the long/short periodicity of the audio signal in each frequency band.

According to DTS, this allows an efficient sharing of the limited number of quantization bits without any transient pre-echo distortion. Furthermore, by coding the spectral analysis to extend and include all channels, the re-quantization routines are fed from a common bit-pool. DTS feels that this optimizes the coding performance and audio quality of each individual channel in a multi-channel format delivering a full-bandwidth for each.

Essentially, this allows six channels of transparent quality 24-bit recorded material at 48 kHz with less digital compression. While Dolby Digital uses a different approach of providing multi-channel sound with low bit-rates, the results might seem similar to the untrained ear.

Although the DTV standard does not include DTS as an audio alternative (only Dolby Digital), DTS was selected as a mandatory format for HD-DVD and Blu-ray players (in addition to Dolby Digital).

**DTS Formats Extensions:**

- XLL Extension for Lossless Audio coding, a bit-for-bit recreation of the original master recording using variable bit rate encoding as high as 24.5 Mbps for Blu-ray Disc and 18.0 Mbps for HD DVD formats.
- XXCH Extension for additional channels, beyond 6.1.
- XBR Extension for higher constant data rates, up to 6.0 Mbps for Blu-ray Disc and 3.0 Mbps for HD DVD formats.
- XSA Extension for Secondary Audio/Sub Audio Content, also known as DTS-HD LBR (low bit rate).

**DTS-HD Master Audio™:**

(Disclaimer: DTS graph shown under permission)

The format is bit-for-bit identical to the studio master using high variable bit rates to provide up to 7.1 audio channels at 96k sampling frequency / 24-bit word resolution, as well as containing the DTS 1.5 Mbps core soundtrack within the bit stream to be backward compatible with legacy DTS-enabled audio devices, and deliver up to 6.1 channels of sound. The format can also handle 192 kHz / 24-bit word resolution.

DTS-HD is a 100% lossless format using a set of extensions to the coherent acoustics audio coding system, comprised of DTS Digital Surround, DTS-ES, and DTS 96/24, which allows the format to down-mix to 5.1 and two-channel, or deliver audio quality at bit rates extending from DTS Digital Surround to 7.1 DTS-HD channels, using a single stream up to 24.5 Mbps (18 Mbps for HD DVD).

When the format was created, DTS announced that the original DTS++ would be capable of higher bit rates. In October 2004, the DTS++ name was changed to DTS-HD. In December 2005, DTS announced their demonstration of a 24.5 Mbps extension of the format, DTS-HD Master Audio, 100% lossless and bit-for-bit identical to the studio master. Later, the HD audio format below the Master Audio level was called DTS-HD High Resolution Audio, capable of up to 6 Mbps resolution.

The format was approved as an option for HD DVD and Blu-ray. HD DVD can handle up to a maximum of 18 Mbps, and by Blu-ray up to a maximum of 24.5 Mbps.

**DTS-HD High Resolution Audio™:** The format delivers up to 7.1 channels of sound said to be “virtually indistinguishable from the original soundtrack” using high constant bit rates and 96k sampling frequency / 24-bit depth resolution. The format offers an alternative for high quality audio when disc space for Master Audio is not sufficient for that higher format.

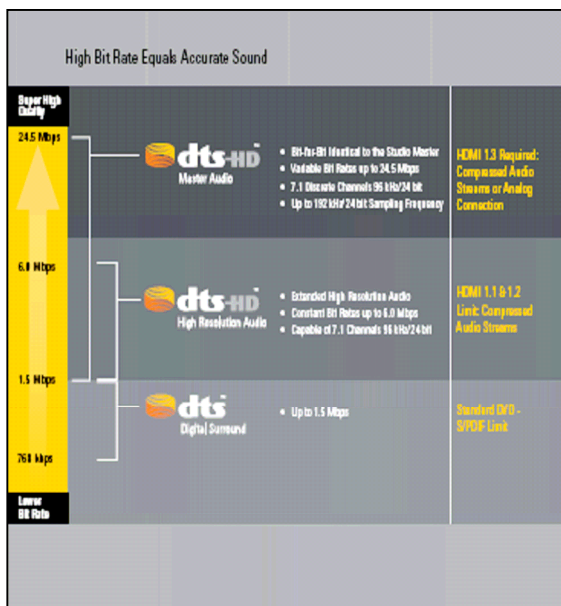
As with Master Audio, the audio format also contains the DTS 1.5 Mbps core for backward compatibility with legacy DTS-enabled audio devices and deliver of up to 6.1 channels of sound.

The format was approved as an option for HD DVD and Blu-ray. HD DVD can handle up to a maximum of 3 Mbps, and by Blu-ray up to a maximum of 6 Mbps.

#### **DTS-HD LBR (Low Bit Rate Audio):**

##### A) Blu-ray Secondary Audio

Multi-channel sound “Secondary Audio” is a scalable format using low-bit rate audio, an optional feature on Blu-ray Disc, designed for network streaming, broadcast and Internet applications. Data rates range from 24 kbps per



channel, at sampling rates of 48 kHz for Blu-ray Disc, and 44.1 kHz and 48 kHz for HD DVD, with a resolution up to 24-bits.

#### B) HD DVD DTS Sub Audio

An optional format for HD DVD discs, considered of high quality using low bit rate audio; designed for network streaming, broadcast and Internet applications. Is a two-channel (2.0) scalable format, using from 64 to 192 kbps data rates, and sampling rates from 8 kHz to 96 kHz with 24-bits resolution.

**DTV (Digital Television):** The DTV standard is composed of 18 digital formats grouped into two levels of quality, as approved by the ATSC (American Television Systems Committee) in 1995:

1) SD: Standard definition, 480i/p visible vertical resolution lines, with up to 704 total pixels of horizontal resolution, aspect ratio in 4x3 or widescreen 16x9, and

2) HD: High definition, 720p and 1080i/p visible vertical resolution lines, with respectively 1280 and 1920 total pixels of horizontal resolution, in widescreen 16x9 aspect ratio.

The FCC actually let manufacturers implement compatible DTV tuners with the ability to receive/decode the formats without imposing TVs to display the formats at their original resolutions; the tuners would generally convert the signals to 480p, 720p, and 1080i, to match the native format of most monitors. Later in 2000, the Consumer Electronics Association (CEA) created another level in between SD and HD: ED (enhanced), which promoted the 480p format from SD to ED, among other changes (see 810i).

The current NTSC over-the-air (OTA) TV system is 480i analog (actually 525i with 480i visible lines) and is interlaced. Digital satellite and digital cable are equivalent to digital SD but they are also transmitting some channels in HD. To facilitate the transition broadcasters were given one extra channel slot from the FCC for the simultaneous broadcasting of the analog and digital versions of their programming.

It is a large investment for stations to build a DTV facility with new cameras, equipment, etc. When DTV is fully implemented, broadcasters have to return one of the two channels, analog over-the-air broadcasting will stop, and current TVs, VCRs, Tivos, and any other equipment with analog tuners would stop tuning as well.

The DTV system implementation is mandatory; HDTV is optional. The implementation of DTV was originally planned by 2007, but the deadline has been conditioned to when 85% of the US population can receive DTV signals, discussions were held in 2004 to determine if cable and satellite subscribers should be considered as part of the 85%, cable itself covers about 70% of the US population.

In February 1, 2006, an extension to the deadline was approved, the new date for the discontinuation of analog transmissions is February 17, 2009, and the deadline is not conditioned to a percent of DTV reception by households per market as originally, it is a hard date.

**DTV Tuners:** The ATSC (Advanced Television Systems Committee) selected 8VSB as the digital television standard for terrestrial (over-the-air) broadcast of HD signals

in the U.S. All integrated DTVs have an 8VSB tuner, DTV monitors do not have one, and they need a separate HD-STB as a tuning device.

In 2002, under a five-year phased-in guidelines mandated by the FCC, over-the-air DTV tuners were required to be added to 50 percent of sets measuring 36 inches and larger by July 1, 2004, and 100 percent by July 1, 2005. After that, 50 percent of sets measuring 25 inches to 35 inches are to add DTV tuners by July 1, 2005, and 100 percent by July 1, 2006. The rest are to conform by July 1, 2007.

On November 2005, the FCC voted for setting the new date as March 1, 2007 for all sizes including those smaller than 13 inches, which received the support from the NAB taking into consideration how important they are in times of emergency, and that they are commonly used without STBs.

The revised mandate has been approved as follows:

Upon approval  $\geq 36$  inches

Mar 1, 06 for  $\geq 25$  inches (was July 1, 06)

Mar 1, 07 for  $\geq 13$  inches (was July 1, 07, although the FCC proposed Dec 31, 06)

Mar 1, 07 for  $< 13$  inches (was not required before)

The mandate does not apply to other small screen video capable devices that do not receive OTA broadcasting, even when they might be used to watch TV shows, such as PDAs, mobile phones, iPods, etc.

The NCTA (National Cable and Telecommunications Association) chose QAM as the HD system for Digital Cable. Many 8VSB-integrated sets also include a cable QAM tuner to receive "in-the-clear" (unscrambled) cable signals, or a QAM tuner with Cable CARD for premium services.

QAM integrated HDTV sets introduced during 2004 have CableCARD tuners but as only unidirectional; in order to receive VOD, impulse PPV, and cable customized electronic program guide, CableCARD tuners have to be bi-directional, which means that owners of 2004 QAM integrated HDTVs w/CableCARDS might still need a second cable tuner (HD-STB) for the bi-directional features.

**Dual Antenna Inputs:** The existence of these inputs in the TV means that the set can accommodate two antenna sources, e.g. master antenna and cable-box or master antenna/cable-box and satellite receiver. By having dual inputs, antenna sources could be easily switched, rather than using external switching devices.

**DVi:** Also known as iLink 1394 digital connection for digital video cameras.

**DVI (Digital Visual Interface):** The DVI 1.0 specification was introduced in April 1999 by the Digital Display Working Group integrated by Silicon Image, Intel, Compaq, Fujitsu, Hewlett-Packard, IBM, and NEC to create a digital connection interface between a PC and a display device. It is a connection with enough bandwidth for uncompressed HD signals.

The 1.0 DVI specification is a point-to-point solution that supports video content but not audio. DVI standard cables have typically a five-meter distance limitation, although with better quality wiring, such as fiber-optic, higher distances are possible.

There are three types of DVI connectors:

DVI-I (integrated), carries a single or dual-link digital signal, with an additional analog signal for legacy devices.

DVI-D (digital) carries digital-only video data to a display.

DVI-A (analog) is available for legacy analog applications to carry analog signals to a CRT monitor or an analog HDTV (claims to be better than VGA).

DVI is being used as a secure connector for the passage of uncompressed digital video signals from HDTV receivers and other digital source devices such as DVD players, keeping all signals in the digital domain.

DVI (or HDMI, its upgraded sibling) is found on most 2004 and after HD equipment and HDTVs. To protect content transmitted over DVI, the High-bandwidth Digital Content Protection (HDCP) scheme was created that provides a secure digital link between source and display, and does not allow for any recording of the digital signal. See HDCP. Additionally, HDMI has been aligned as the successor of DVI (see more below).

**DVD Changer:** Player capable of playing multiple CDs or DVDs. Changers fall into two categories. Simple changers rotary in type with up to five or six discs fitting into the rotary platter, or Mega-Changers that can hold a library of up to 400-discs within the confines of a single machine. Some brands allow several mega-changers to be tethered together allowing for vast libraries of movies and music videos.

**DVD Recordable:** There are presently three "re-writable" schemes for recordable DVD: DVD-RAM, DVD-RW, and DVD+RW. Depending on the format, DVD recorders will also record DVD-R or DVD+R ("write-once" recordable DVD) formats, which are reportedly playable on all standard DVD players. Several DVD recorders have been introduced since 2002 that are capable of playing/recording a combination of rewritable formats in one unit.

**DVD/VCR Combo:** Specialized machine that combines a DVD player with an integrated HiFi VCR into one cabinet. Designed for those users that want to "bridge the gap" from one video generation to another. There is also a TV/VCR or TV/DVD or TV/VCR/DVD Combo, which includes a television.

**DVD-Audio:** A typical CD is PCM encoded into 16-bit words at a sampling rate of 44,100 per second. DVD-Audio can use a variety of PCM resolutions, from multi-channel 24-bit/96kHz all the way up to 2-channel 24/192. Also included are sampling rates of 48kHz, 88.2 kHz, and 176.4kHz, as well as DTS and Dolby Digital data streams.

For better space utilization, some channels can be encoded with high resolution while others, like the surround, in lower resolution. A single-layer, single-sided DVD holds 4.7GB, enough for 40 minutes of six channels at 24/96. Six-channels of uncompressed 24/96 audio data require 13.8Mbps data speed while the DVD standard allows for up to 9.6 Mbps only, reason for which a lossless form of data compression was needed (Meridian Lossless Packing). MLP reduces storage and transfer-rate requirements by a factor of two without sacrificing quality (unlike "lossy" used on Dolby Digital and DTS).

**Dynamic Range:** Audio range expressed in dB measured between low-level noise and overload distortion; also defined as the range between the softer and loudest sound passages.

**EDTV (Enhanced Definition TV):** Additional level of DTV created in late 2000 by the Consumer Electronics Association (CEA) fitted in between the SD and HD levels. ED (Enhanced) is the naming convention to be used for display devices capable of 480p, previously part of the lower SD level.

**Enhanced AC-3 Audio Standard:** In July 2005, it was announced that the Advanced Television Systems Committee (ATSC) added an enhancement (A52B) to the AC-3 standard currently used for DTV (Nov 94), this was a result of a RFI issued by the ATSC in December 2002, to which Dolby Laboratories responded (E-AC3).

E-AC3 is said to provide improvements regarding the flexibility and performance not only for broadcast but also for cable, satellite, DVD, among others, using new coding, wider range of bit-rates, and number of channels. E-AC-3 is said to be able to be converted to AC-3 to be backward compatible with current decoders.

**Enhanced-VSB (E-VSB) Transmission Mode:** In October 2005, the ATSC announced the publication of four new candidate standards related to E-VSB, namely the video system characteristics of VC-1 and AVC and how closed captions are to be carried with both, the transport of AVC, and an alternate transport approach for MPEG-2. The candidate standards: CS/TSG-658, CS/TSG-659, CS/TSG-660 and CS/TSG-661 are available at:

[http://www.atsc.org/standards/candidate\\_standards.html](http://www.atsc.org/standards/candidate_standards.html)

**External Speaker Jacks:** Connections that allow the attachment of separate speakers directly to a TV for improved sound quality, or the attachment of rear speakers to experience surround. However, the low wattage of the internal television amplifier could become a loudness/performance limitation.

**Front Projector:** Video display device that is able to project an image on a reflective screen.

**Gamma:** Exponential function that expresses the non-linearity of the light output of a CRT (relative to voltage). The 'Gamma Correction' control in video monitors compensate for such non-linearity.

**Gray-scale:** Test pattern with shades of gray from white to black used to measure a monitor's ability to reproduce all the shades in an uniform manner and at the correct color of white (6500 degrees Kelvin). Gray is defined as equal amounts of red, green, and blue; white is the peak level of gray; sunlight is in the area of 5400 degrees Kelvin.

**Harmonic Distortion:** Distortion caused when audio equipment adds unwanted overtones to an original signal.

**HDCP (High-bandwidth Digital Content Protection):** Content protection system developed for DVI. The HDCP 1.0 specification was developed by Intel with contributions from Silicon Image in February 2000 to protect DVI outputs from being copied by providing a secure digital link between a video source and a display device. HDCP offers authentication, encryption, and renewability.

The Motion Pictures Association of America (MPAA) endorsed HDCP as the standard for the secure transmission of HD signals over DVI. Since the DVI signal is uncompressed (overwhelming for the digital storage devices of today) and protected by HDCP, HD recording over the DVI connection is not feasible.

**HDMI:** On December 9, 2002, the seven founders of HDMI (High-Definition Multimedia Interface) announced the 1.0 specification of this connectivity standard, the enhanced, more robust form of DVI. The seven founders are Hitachi, Matsushita, Philips, Silicon Image, Sony, Thomson, and Toshiba.

The standard supports HD uncompressed video, 8-channel digital audio (reportedly up to 192 KHz), and some control signals on a single cable (15 mm, 19 pin), while using less than half the available bandwidth. HDMI has the same video capacity as DVI, or up to five Gbps of bandwidth (single link), double what a HD signal would require, and is backward compatible with DVI by using an adapter, although only for the video signal. The HDMI connector is smaller than DVI. Silicon Image has also announced an HDMI version with a smaller connector suitable for portable equipment, such as video cameras.

The HDMI specification supports 1080p, however there are HDMI transmitter and receiver chips that were developed without using that capability of the specification, either because they were very early releases or they were created that way for equipment that does not need 1080p capabilities, like a 1080i TV. Equipment manufacturers using those chips on otherwise capable 1080p sets could handicap the equipment. The version 1.3 specification planned for release on 1H06 is capable for Dolby TrueHD and DTS HD multichannel audio codecs for new Hi Def DVD players.

**HDTV (High Definition TV):** Level of DTV quality capable of 720p or 1080i vertical resolution, with a 16:9 aspect ratio and Dolby Digital audio. See DTV.

**Horizontal Resolution:** Not to be confused with horizontal scanning ('vertical resolution', which is the number of scanning lines of the television systems NTSC 480i and HDTV interlaced 1080i). Horizontal resolution is measured left to right, and has been traditionally specified as the number of transitions (TVL, TV vertical lines, carried forward from the CRT analog age) in the horizontal direction measured up to the point equal to the picture height (75% or  $\frac{3}{4}$  of the width of a 4:3 TV, 56% or  $\frac{9}{16}$  of the width of a 16:9 TV).

The horizontal resolution of a standard broadcast NTSC television is 340 TVL lines per picture height (450 edge to edge), DVD is 540 TVL (720 edge to edge), laserdisc is 425 TVL (567 edge to edge), and VHS is 240 TVL (333 edge to edge). Regarding HDTV the 'total pixel count edge to edge' for 1080i/p is 1920 horizontal pixels, and for 720p is 1280 horizontal pixels.

In the more modern age of fixed pixel displays such as PDP plasmas, LCD, DLP, LCoS, and DILA, horizontal resolution is generally expressed as the number of pixels measured in the 'complete' horizontal line, edge to edge (not TVL).

**IEEE1394:** 1394 is the short for IEEE1394. Digital interface conceived by Apple Computer in 1986, and it was called "Fire Wire" for its fast speed of operation. In 1995, the Institute of Electrical and Electronic Engineers (IEEE) adopted the serial

bus as its standard 1394. Sony trademarked their name iLink for their implementation of the 1394 bus as a 4-pin connector.

HD signals are broadcast in compressed MPEG-2 format at approximately 19.4 Mbps. D-VHS VCRs and stand-alone HD-PVRs record MPEG-2 compressed HD signals, but only from a 1394 connection, which receives the digital data stream. HDTV monitors require a separate MPEG-2 decoder to decompress the signal for display, as oppose to DVI that is uncompressed.

To address security issues, a scheme called Digital Transmission Content Protection (DTCP) was developed for 1394 that works with MPEG2 compressed video. Mitsubishi implemented a 1394 network/control called HAVi for the passage of digital compressed signals between DTV equipment.

There are three types of cables used for 1394. A) A 6-conductor type that has two separately shielded twisted pairs for data and two power wires in an overall shielded cable with 6-pin connectors on either side. B) A 4-wire cable that uses two separately shielded data cables without power wires in an overall shielded cable with 4-pin connectors on either end. C) A conductor using either type of cable above, but with a 6-pin connector on one side, and a 4-pin connector on the other side of the cable.

The 4-pin connector is more common on digital video camcorders and other small external devices because of it's small size, while the 6-pin connector is more common on PC's, external hard drives due to it's durability and support for external power for 1394 peripherals.

**Interlaced:** Technique applied in television by which video images are sent/displayed in two separate fields of lines that are merged together to complete one picture (frame). In the 480i NTSC and DTV formats, the 240 odd lines of one field are merged in an alternating mode with the other 240 even lines of the consecutive field, each field displayed at 1/60 of a second, and completing a frame of two fields in 1/30 of a second, fast enough for the persistence of vision to see them as they are all part of one single frame.

When NTSC was created in the 1940s, this technique was implemented to been able to efficiently fit and send images within the bandwidth transmission constraints. The NTSC system has 525i scanning interlaced lines of which 480i are visible; the same concept was applied to DTV digital 480i and 1080i formats, the 1080i format has actually 1125i lines, 45 of which are not visible.

**Interpolation:** Technique used in line-doublers to adjust for time differences in interlacing fields, to minimize 'jaggies', and improve overall picture sharpness. Some line doublers also interpolate calculated pixels between pixels on the horizontal line.

**Invar:** The invar shadow mask, found on direct-view CRT TVs, allows the picture to have more contrast level without risking long-term damage of the shadow mask itself. When the set's contrast is driven too high, a side effect called "blooming" occurs, to counteract this bleeding of colors, some manufacturers include the invar shadow mask, although still running the risk of burning the phosphors in the tube. A properly calibrated set would have the contrast level low enough not to need the invar (and the additional cost associated with it).

**ISF (Imaging Science Foundation):** Organization dedicated to promote the importance of properly calibrated display devices so they can perform to their full potential (NTSC or DTV). Training, calibration DVDs, and calibration professionals are offered by the organization to help consumers perform the necessary adjustments for their monitors to reach their best performance.

**Keystone Effect:** Effect that produces a picture that has one edge with a different dimension than the opposite edge, most usually produced by positioning the projector at a pronounced angle relative to the screen. To compensate for the distortion, some projectors have digital keystone corrections (horizontally and vertically), however, the correction could create other image problems. It is recommended to avoid the keystone effect by physically realigning the projector with the screen, so keystone correction adjustments are used as little as possible.

**Lambert:** Unit that measures the light intensity reflected off an object.

**LCD (Liquid Crystal Display):** LCD front and rear projectors use LCD panels to create images, which are then enlarged to fill a screen. The LCD panel uses two transparent sheets of polarizing material with a liquid containing rod-shaped crystals between. When a current is applied to pixel areas, those crystals align to create dark images. Panels do not produce color nor emit light; they are often side lit or backlit, and act as shuttles to selectively block off light and create images.

Three black and white panels are used, and the white light from the lamp is separated (via dichroic mirrors) into red, green, and blue beams. These beams are fed through the panels and then recombined to create the full color images. An LCD projector can provide rich colors and a good-quality picture, but some LCD projectors show a "screen door" effect.

**LCoS (Liquid Crystal on Silicon):** Type of projection HDTV that uses liquid crystals coated onto a silicon chip, which uses a reflective (aluminized) layer. As compared to standard LCD chips, this reflective design increases contrast, and eliminates any dotted "screen door" effect. Since it is a digital display device, LCoS technology also eliminates any chance of image "burn-in".

**Lenticular Screen:** Screen used in RPTVs with a surface designed to reflect maximum light over horizontal and narrow vertical angles.

**Letterbox:** Name used to describe the effect of viewing widescreen films or video wider than 1.33:1. To that end, black bars above and below the movie image are added to fill the 4:3 aspect ratio, to maintain the geometry of the original film (the aspect ratio chosen by the movie director). The 'anamorphic' method squeezes the image laterally when storing it, and the DTV monitor unsqueezes it when displaying it, which maximizes vertical resolution.

The letterbox technique wastes vertical resolution (horizontal lines) for the black content of the bars. When the film image is even wider than the 1.78:1 aspect ratio of a 16:9 TV (such as 2.35:1, 1.85:1, etc.) two letterboxing black bars are embedded within the 16:9 image itself, in such case a combination of anamorphic and letterboxing methods are used to minimize the waste of vertical resolution for black bars.

**LFE (Low Frequency Effects):** '.1' channel in Dolby Digital or DTS 5.1/6.1/7.1. The LFE channel contains low frequency effects in the range of 20-100 Hz intended to be reproduced by a subwoofer.

**Line Doubling:** Technique that stores in digital memory the horizontal scanning lines of each field of an interlaced video image, and then displays them both together at once, producing a picture that has twice of the original lines, and providing an appearance of improved resolution. HDTV sets typically perform line doubling of 480i NTSC images to display them as 480p.

**Line Quadrupling:** In addition to applying the line doubling technique, line quadrupling interpolates additional lines in between to fill the image with calculated pixels of information, providing an even better appearance and brightness. Line quadrupling requires a display device with a scanning rate of four times the normally required. Some display devices obtain the quadrupling effect by interpolating additional calculated pixels in the horizontal line (in addition to the doubling of lines). In such case, the display would just need a scanning rate for line doubling speed.

**Lossless:** Check DVD-Audio.

**Lumen:** Unit of measure used to express the amount of light emitted by a source (see ANSI Lumens).

**Luminance:** Signal that represents brightness in a video picture.

**Lux:** Unit to measure the amount of light per square meter taken at an illuminated surface.

**MPEG-2:** MPEG stands for the Motion Picture Experts Group. MPEG-2 is a video compression encoding/decoding method used in DVD, DBS satellite, and DTV to reduce the amount of data in the storage/transmission of digital video, by, for example, condensing redundant or repetitive image signals, or eliminating some picture elements.

**Multiscan:** Feature of some monitors that are able to automatically synchronize their scanning rate to a variety of signal scan-rates. Generally, HDTV monitors are able to synchronize to 480p and 1080i, and sometimes to even 720p.

**Multi-Channel Analog Outputs:** Set of six analog audio outputs designed to pass DVD-Audio and/or SACD aural information from the player to an A/V Receiver or A/V Processor.

**Notch Filter:** Filter that helps remove a small part of the signal that contains excess color information. By doing so, it helps eliminate some objectionable color effects from less than desirable signals. However, by utilizing the circuit, there is a slight loss in resolution of picture.

**NTSC:** National Television Standards Committee. Committee for the US analog color television video standard.

**Overscanning:** Effect that occurs when parts of an image cannot be viewed because they have been placed beyond the edges of the TV frame. The effect is

caused when the TV scanning lines are adjusted to exceed the boundaries of the screen to hide the ruff edges of the image.

**OTA (Over-The-Air DTV tuners):** Also known as ATSC tuners. See DTV tuners.

**Pan-And-Scan:** Technique used to transfer a widescreen movie into a 4:3 format with no black bars; the transfer operator actively searches and selects the 4:3 part of every widescreen image that contains important content in the movie. A 'Full-frame' 4:3 transfer may not always have been made with a Pan-And-Scan technique.

**Pixel:** The smallest element on a picture. Unit used to convey image/device resolution.

**PIP (Picture-in-Picture):** PIP allows you to view the active images of two sources simultaneously. For a monitor to perform this feature it requires receiving the images from dual tuners, or external sources that provide the images, or a combination of both.

**POD:** (Point Of Deployment interface) of the Host Interface License Agreement (PHILA) for cable tuners. Now called CableCARD.

**Power Conditioning:** Not all power is created equal. For audio/video components to perform to their best the power should be well-balanced and clean of noise and interference, if the utility company does not provide clean power or your audio/video system is sharing electrical circuits with appliances or other devices that can degrade the power quality, it is recommended to install a separate electrical circuit for the audio/video system, and/or the use of an AC line conditioner/surge protector device (refer to the term further above in the Glossary).

**Progressive Scan:** Video format/technique that presents all of the scanning lines in the screen in one single pass from top to bottom, producing an image that has more resolution and brightness than its interlaced version. The 480p format, for example, requires the double of the transmission bandwidth and twice the monitor scanning raster speed of the 480i version.

Video that originates as 480p/60 fps is able to better follow fast action content producing much better results than 480i/30fps, and it even displays better than 480i line-doubled to 480p/60fps, because the image originates as 480p/60 fps at the camera point. 720p is also considered more suitable to fast action content, such as sports, than the other 1080i HD format.

**PVR:** Personal Video Recorder (recording on internal hard drive, HDD), also known as DVR. Tivo type of time-shifting device for HD content.

**QAM (digital cable tuners):** Quadrature Amplitude Modulation. Digital modulation technique that calls for 64 and 256 QAM; using 64 QAM a cable channel that today carries one analog video channel could carry 27 Mbps of information, or enough for multiple video programs; using the 256 QAM, the standard 6 MHz cable channel would carry 40 Mbps. See DTV tuners.

**Raster:** Rows of dots scanned when producing a video image.

**RCA-type Jacks:** Standard connection used for analog and digital purposes. Composite video jacks are labeled yellow, and standard audio cables for left (white) and right (red) channels. RCA type jacks are also used for YPbPr component analog, Dolby Digital/DTS digital coaxial audio, Super-Audio/ DVD-Audio analog multi-channel, etc.

**Resolution:** Capability of a video device to reproduce (or an image to resolve) detail. The term is generally used to express horizontal resolution, as the number of lines/pixels that can be displayed in the horizontal direction (see horizontal resolution).

**Response Time:** A specification typically associated with LCD panels used to indicate how fast pixels react to changes of light and avoid a blurring effect that typically shows as trails and pixel movement that is not in the original content while displaying fast moving objects on the image.

The measurement is expressed in milliseconds and, depending on the manufacturer, indicates the time it takes a white pixel to show black and back to white again, others express that as gray-to-gray, or just indicate the time it takes to become black from white but not to white again (half of the white-black-white task) which certainly appears as a faster spec to unsuspecting consumers (such as SXRD's Sony RPTVs did when introduced with 2.5 ms spec).

Many LCD panels that were 20ms in 2004-5 have gradually been improved to 16, 12, 8, 6, and even 4 ms. The smaller the number the faster the pixel reaction time is and the better the LCD should be in avoiding the blurring effect on fast moving images.

**Retrace:** Action of moving the electron beam from the end of one scanning line to the beginning of the next one. Usually associated with CRT type of display devices.

**RGB:** Red, Green, and Blue color signals (chrominance), primary components for color television; the primary colors of light. RGB video can be transmitted as: RGsB (the Green contains the sync signal), RGBHV (sync separate from colors, horizontal and vertical separate), RsGsBs (sync on each of the colors), and RGBS (sync separate from colors). See component video.

**RMS (Root Mean Square):** Measurement of continuous power output produced by an amp. The higher the RMS number, the cleaner, and louder (without distorting) the sound will be; one of the primary specs to base an amplifier purchase. Peak power ratings show the maximum wattage delivered by an amp during a brief burst during a musical peak.

**Saturation:** Term that expresses the purity and intensity of a color signal, and the extent by which it is free from white (less white results in more color saturation, less saturation results when adding more white to the color).

**Scanning:** Action of moving an electron beam horizontally and vertically across the raster in CRT video.

**Scan Velocity Modulation (SVM):** SVM adjusts the rate of horizontal movement of the beam as it "draws" the scan lines. Dark areas look larger over lighted background; lighted areas appear smaller over dark background. It is generally

recommended to disable SVM on a properly calibrated monitor; one of the first things an ISF calibration job do is to find a way to disable SVM; look for a menu setting that is able to turn off SVM.

**SDTV (Standard Definition TV):** Lowest level of DTV that originally grouped the 480i and 480p formats together within that category (ATSC table III), see DTV. In late 2000, the CEA promoted the 480p to EDTV, leaving the SD level for just 480i digital.

**Shadow Mask:** Metal plate on a CRT device that helps the electron beam hit each individual phosphor by using perforated holes. See Invar.

**Sharpness:** Term to describe apparent focus and edge definition on video. Sharpness should be kept below the point at which extra edges are added to objects in the image.

**Spatial Interpolation:** Technique that calculates additions/removals of pixels in a digital image using weighted averages of information from adjacent pixels, producing a more transparent result with fewer artifacts. The technique facilitates the re-positioning or re-sizing of digital images.

**Spatial Resolution:** Number of pixels appearing on the entire video image (matrix of horizontal and vertical resolutions combined).

**S/PDIF:** Sony/Philips Digital Interface standard for digital audio connections (coaxial or optical TosLink). A consumer version of the AES/EBU digital transmission standard.

**Special Picture Tube:** Better grade of picture tube, such as either dark tint or dark glass picture tubes, which, by darkening the faceplate, provides greater contrast between black and white, although requiring an increase of brightness levels so that the picture does not appear too dark.

Other advancements include flat square tubes (FST) sometimes called "SuperFlat" or "FSTPerfect", which offers less distortion on the outer edges of the picture. Some manufacturers use special coatings to help cut down on glare and dust build-up giving the appearance of a richer picture, others use a combination of techniques to tweak out the highest performance from their picture tubes.

**STB (Set-Top-Box):** Also mentioned as HD-STB, Digital set to box to tune DTV via OTA, cable or satellite signals.

**Subwoofer:** Loudspeaker designed and dedicated to reproduce very low frequencies (bass) from the .1 LFE Dolby Digital or DTS channel, and/or from the bass received from the other channels if their lower frequencies are crossed-over to the sub with a low-pass control. A subwoofer normally looks like a big black box. Since bass is non-directional, it can be placed anywhere in the room. Woofers range in size from about 5-inches to 18-inches in diameter with the majority falling in the 12-inch category.

Some of these enclosures are ported with a hole on the side or the bottom, which helps add a thump to the bass response.

Virtually any mid-line A/V Receiver or above has a subwoofer output jack on the back panel. This will attach directly to the Left input of the sub. If the receiver does not have a separate subwoofer output jack, the left and right speaker outputs of the receiver can be connected into the appropriate left and right jack inputs of the sub, then, the left and right speaker outputs of the sub should be connected to the individual left and right speakers. In such case, the receiver crossover should be set as full range, and the sub's crossover hi-pass control should be set to send only the non-bass frequencies to the L/R speakers.

Verify the menu options of the receiver regarding not using the .1 LFE sub output, and to make sure it has a way to redirect the LFE effects to the main speakers (where the sub is connected). In either set-up, the lowest sounds are directed only to the subwoofer. Subwoofers are either active or passive. 'Active' subwoofers have internal amplifiers, 'Passive' subwoofers are less costly but require power from either the receiver or a separate external amplifier.

**Super-Audio CD (SACD):** Sony introduced Super-Audio (SACD) in the fall of 1999. Warner Music launched DVD-Audio in early 2000 with a coalition of hardware manufacturers such as Toshiba, Panasonic, Pioneer, and Meridian. Record labels wanted to prevent digital copying so the players would have only analog outputs; this means six cables for multi-channel playback, which also requires a receiver/pre-pro with six pass-through inputs.

When Sony acquired Columbia records it decided that CD quality was not enough for archiving the musical heritage, and invented a digital storage medium of high density (1 bit resolution sampled at 2.83MHz) called Direct Stream Digital (DSD), later used as an archival format and recording medium for the next generation of SACDs. The format was made able to record frequencies above 20KHz (the CD limit), which are inaudible but affect the audible range since they still modulate lower frequencies.

Dual-layer "hybrid" SACDs would contain the new format as well as the CD standard 16-bit/44.1 KHz "Red Book" (as published by Sony/Phillips) layer, which makes them backward compatible with CD & DVD players as well as on SACD players. The stereo tracks are a separate mix, not fold down from SACD multi-channels.

**Surround:** See specific details in Dolby Digital, Pro Logic, DTS, Circle Surround, etc.

**Surround Speakers:** Surround speakers are normally placed to the sides/corners above the listening area. Additionally another speaker may be positioned behind the listener as 'center back' for some formats, and even one on the ceiling. They carry directional effects (Dolby Digital/DTS) and/or just sound field enhancements (DD, DTS, Pro Logic, Circle Surround).

Speakers for discrete full-bandwidth surround formats such as DD/DTS should be able to handle full frequency response of 20Hz-20KHz and be sufficiently larger to handle loud passages (compared to the ambience purpose of Pro Logic for example). Rear speakers are either bipole or dipole design; dipoles produce sound from the rear and front, out-of-phase from each other (for which some people recommend for surround); in the bipolar design the front and rear are in phase and sound equally.

There are different views regarding which type to use for music or movies, or for discrete and non-discrete surround formats, for directivity or dispersion, and for the

type of room in which they are installed. Consult your specialty audio store for your particular application.

**S-Video (Inputs/Outputs):** S-Video separates the luminance (Y) and chrominance (C) signals offering better picture quality and resolution than using standard composite/RF video connections. Use with S-VHS VCRs, and with other equipment as a second alternative to component video, if not present.

**THX:** License that identifies and certifies compliance with color and sound high performance parameters for home theater systems.

**Timbre:** Tonal characteristic of a sound determined by its harmonic structure.

**Toslink:** Fiber optic connection for digital audio developed by Toshiba.

**Twitter:** Type of flicker effect that occurs when white lines alternate within refreshing fields.

**UHF (Ultra High Frequency):** Subset of the television broadcast frequency that ranges between 470 MHz and 890 MHz. Most of the DTV broadcasting stations are currently using this band.

**Underscanning:** Effect caused by decreasing the horizontal and vertical raster size, allowing the four edges of an image to be seen into the screen, including skew and tracking (which should not be seen). See overscanning for a description of the opposite effect.

**VC-1:** In April 2006, the SMPTE (Society of Motion Picture and Television Engineers) released the VC1 standard for compressed video bit-streams, together with a Recommended Practices document to provide guidelines for interoperable solutions.

The SMPTE's Compression Technology Committee put together a working group to maintain the test materials and documents, and to administer the bit-stream exchange program. Reportedly, Microsoft, who contributed the decoder source code, a prototype encoder, and other resources towards development of the process, proposed the formal standardization.

The VC-1 documents are available at <http://www.smpte.org/> :

SMPTE 421M-2006, VC-1 Compressed Video Bitstream Format and Decoding Process

Recommended Practices:

SMPTE RP227-2006 VC-1 Bitstream Transport Encodings

SMPTE RP228-2006 VC-1 Decoder and Bitstream Conformance

**Vertical Blanking:** Automatic action of turning off the scanning electron beam in a CRT while returning from the bottom to the top of the image to draw the next set of lines.

**Vertical Resolution:** Measurement in the vertical direction of the number of horizontal lines scanned from top to bottom to complete a picture frame. The NTSC system has 525i lines (with 480i visible), which includes TV broadcast/satellite/cable,

laserdisc, VHS, and DVD. The ATSC DTV system includes three levels: 480i digital for SDTV, 480p digital EDTV, and 720p/1080i digital for HDTV, all visible lines.

Although not a broadcast format, HD also includes the 810i format of visible lines displayed within a 16:9 image when shown in some 4:3 TVs, as per CEA definition for HD updated in 2000. Vertical resolution should not be confused with horizontal resolution, which is the number of lines/pixels measured left to right in the horizontal direction.

**VHF (Very High Frequency):** Subset of the television broadcast frequency that ranges between 30 MHz and 300 MHz. Some of the DTV broadcasting stations are currently using this band.

**Video Compression:** General name given to the methods used to reduce the digital data in a DTV signal (and DVD), such as MPEG-2, so the signal can be transmitted/stored within the allotted limited bandwidth/space. See MPEG-2.

**White Level:** Level of the maximum picture brightness in TV, defining the range between the darkest and the lightest areas of the picture.

**x.v.YCC:** x.v.YCC is a technology established as an industry standard by the International Electronics Commission in January of 2006 that expands the current color data range of video by approximately 1.8 times. It is based on the "Munsell Color Cascade" a universal color chart defining the colors of natural objects and is used to evaluate color expression capability of displays, which provides the ability to display more natural and vivid colors similar to what the human eye can actually see.

Sony, Mitsubishi, Silicon Image, HDMI Licensing, LLC., and others are implementing and facilitating x.v.YCC, a technical standard that expands the range of colors of the current standard, BT.709-5, used for HDTV; it adds shades of cyan, bright green, etc. making the colors more natural and richer. Sony is implementing the technology under the name x.v.Color.

**Y:** Abbreviation for luminance.

**Y/C:** Y=Luminance, C=Chrominance (color). Nomenclature used for S-Video connections that separate both signals using 4-pin DIN connectors.

**YPbPr:** Analog component video connection with 3 cables. Also mentioned simply as "component" on the report. Some component connections are only for 480p (DVD or EDTV). HD enabled component connections should be specified as 720p/1080i or HDTV, otherwise, there might be a bandwidth limitation for HD signals, even when the connectors fit well.

## About the Author

Rodolfo La Maestra is the Senior Technical Director of the HDTV Magazine. Rodolfo participated in the HDTV vision since the late 1980's when HDTV was first proposed as an analog system. In the late 1990's, he began tracking and reviewing HDTV related technologies and hundreds of consumer products, which prompted him in 2002 to pioneer the authoring of the annual HDTV Technology Review report, which encompasses all HDTVs and related equipment including Hi-Def DVD, content providers, distribution systems (broadcast, cable, satellite), government, standards, connectivity, content protection, H/DTV tuners and DVRs, etc.



Rodolfo considers himself an educator, not a journalist, transferring knowledge, research, and experience. In addition to this annual publication, he has authored a variety of tutorials and educative articles for HDTV Magazine, DVDetc, and HDTVetc Magazines, and served as technical consultant and editor for the "Reference Guide" and the "HDTV Glossary of Terms" for HDTVetc Magazine, included in this report and now available for HDTV Magazine readers.

In 2004, to help the public understand the H/DTV complexity, he began recording a TV technology periodical for Cable television that airs weekly. By 2006, the show reached the rating of second most viewed by the public among all the technology episodes. The opening episode at HDTV Magazine Resources:

[http://www.hdtvmagazine.com/reference/tvshow\\_how-it-works.php](http://www.hdtvmagazine.com/reference/tvshow_how-it-works.php)

Rodolfo's background encompasses Electronic Engineering, Computer Science, and Audio and Video Electronics, over 4,000 hours of professional training, a BS in Computer and Information Systems, and over thirty professional and post-graduate diplomas, some from American, George Washington, and MIT Universities.

After 38 years of computer systems career Rodolfo retired in 2003 as Chief of Systems Development from the Inter-American Development Bank. He directed 65 computer professionals in the areas of information/transactional/web online systems, database administration, etc. supporting about 30 member countries 24/7.

In parallel, from 1998 he concentrated his personal efforts in helping the public with his other career of audio/video electronics. Rodolfo started with hi-end audio in the early 60's and merged with Home Theater video and multichannel audio technologies over the past 40 years, such as the niche widescreen laser disc, anamorphic DVD, 16x9 NTSC displays, HDTV, Hi-def DVD, and 2.35:1 CinemaScope HD Home Theater.

When HDTV started airing in November 1998, he was an early adopter of the HDTV dream he followed since 80's but realized that the technology as implemented would overwhelm regular consumers due to its complexity, and it certainly does even today. Rodolfo then launched his HDTV mission of educating and helping consumers understand the complexity, the challenge, and the beauty of the technology, so the public learns to appreciate HDTV not just as another television.

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