

# **Digital Television (DTV)**

## **Review of a Year of Unprecedented Growth**

### **Updated at the Consumers Electronics Show (CES) 2004**



By Rodolfo La Maestra

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This report summarizes what is new in DTV related products, to help consumers regarding new purchases and upgrades of DTV technology, and with emphasis on HDTV.

It is also a follow up of the CES 2003 report; most models appearing on that report are still available to consumers. During the year, several announcements and events took place (such as CEDIA in September) to introduce some new models not shown at CES 2003.

Rather than providing the new information as a full jump of one year wrapping at CES 2004, all new products are highlighted with the date when they were introduced, in addition to the products announced at CES 2004, which are planned for release throughout 2004/5.

In other words, in order to have a broader picture of all DTV products available, discontinued, current, and future (as announced at CES 04), both reports should be consulted together. This makes this CES 2004 report more manageable to readers that just want to know the new products (or recently released). Most publications show tables with only current DTV products, and with limited information on the specs.

Hundreds of DTV related pieces of equipment are included on this report, with specifications and features that could facilitate comparisons with other models. The report also highlights manufacturing trends on adopting or abandoning certain technologies (such as the dramatic increase of flat panel displays relative to last year, and relative to CRT).

The report assumes that the reader has some basic knowledge of DTV; some of the technical information provided might seem overwhelming to readers that feel the need to understand the basics first. For that purpose, some links with basic information are included in

the CES 2003 report. Additionally, the reader might want to become familiarized with DTV by consulting tutorial articles on HD publications, such as the HDTVetc magazine.

All types of display monitors and integrated DTVs are covered on this report, such as RPTV (rear projection), FPTV (front projection), Plasmas (PDP), DLP, LCD, LCoS, D-ILA, etc).

It also includes a follow up of how digital video connectivity (DVI, HDMI and IEEE-1394 Firewire) is being implemented by manufacturers. It reviews the status and lists all DTV related equipment such as D-VHS VCR (and D-Theater), High Definition DVD for playback/recording, HD tuners for small-dish satellite, digital cable, and over-the-air (OTA) w/antenna reception, and HD PVRs (Personal Video Recorders also known as DVRs).

Not included in this report are DTV displays below the size of 40" diagonal and 4x3 aspect ratio (except for a few), computer related HD-tuner cards, computer Hard Disk Drives (HDD) for storage of HD video (similar to an HD Tivo PVR, but using a computer), C-Band (big dish) satellite equipment, and some after-market modifications to HD-Set Top Boxes (HD-STBs) for DBS small-dish satellite HD recording (such as 169time.com).

To the extent that was humanly possible, all the information about models, prices, and specifications has been confirmed with products demonstrations, lab tests, industry press releases, technical articles, and manufacturer interviews held at CES.

Although considerable effort was made to consolidate and verify the accuracy and completeness of the large amount of data included on this report, this writer cannot assume responsibility for omissions or errors. Any information you might want to contribute to correct or enhance the usefulness of this report would be certainly welcomed. The objective is to help the consumer, we all are.

Quoted prices are in MSRP US dollars as announced by the manufacturer at the time of product release/announcement. Some products are also quoted with a "street \$" when such price is known.

The term TTM is used to express product availability ("Time To Market"). Products introduced recently (a couple of months ago) could also be indicated as TTM "current", although most consumers will consider them as new products; new products prototyped at CES are quoted as announced by the manufacturer with either a projected TTM date or as TBA "To Be Announced".

The specifications of input/output connections focus primarily on DTV and HD video connectivity, such as broadband analog interfaces (component YPbPr, RGB/HV, VGA 15 pin D-sub), or digital interfaces, such as IEEE-1394 Firewire for compressed HD video, or DVI (Digital Visual Interface) and HDMI (High Definition Multimedia Interface), for uncompressed HD video.

For its second year, the DTV industry is aggressively incorporating DVI digital interfaces (some even including the newer HDMI) on DTV related equipment, and also including 1394 outputs on most OTA DTV tuners (and HD-STBs) to facilitate HD recording and networking (although unfortunately that is not the case, for another year, with DirecTV HD-STBs).

According to a recent statistic of the Consumers Electronics Association (CEA), there are now about 8.9 million HDTVs sold since 1998. A large percentage of them are legacy displays that do not have digital interfaces (they have only component analog interfaces). The implications of the lack of digital interfaces are covered of the CES 2003 report <http://mysite.verizon.net/rodolfo.lamaestra/index.htm>

## DTV Subject Areas

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## **Brief Highlights of CES 2004**

Panels, panels, all kinds of them, check the 70+ inches from LG on the plasma section and the 80 inches Samsung model. All the big ones come with 1920x1080 resolution already, and spectacular images.



50" plasmas coming down to the rock bottom price of \$5,000, like the new V, Inc. P50HD; or the low price units from Akay, Gateway and Daewoo on the same size.

Check also the new LCD TV panels on the first DTV section as well; they are now coming in large sizes (Sharp's 45, Samsung's 57 inches), and 1920x1080 resolution.

There were some announcements of company decisions, like Toshiba dropping LCoS due to chip unavailability to meet the delivery of sets of the current line, and Pioneer shift for the support to plasmas, possibly dropping CRT RPTVs. Pioneer said that the company would review the situation again in 2005, but it looks as the action from Pioneer has happened already, for their first time, there were no Elite RPTVs at the show. Most manufacturers announced new models of CRT RPTV for the coming year; this CRT tradition is not going away anytime soon.

DVI is growing fast, HDMI is coming but slow, DVI/HDMI switching in pre/pros and receivers is lacking support, DVI/HDMI multiple inputs in HD displays is mostly absent; Silicon Image developed a new pair of HDMI ICs for dual inputs, this helps, so we could hope to see new products with at least two HDMI inputs on their back panels in late 2004/early 2005.

Having many devices with DVI or HDMI and no switching (unless a separate switcher is installed on the audio/video system) is starting to become a problem, especially now with the new DVD players that upconvert to HD but on the DVI/HDMI output only. Check all the new models later on the report.

The CableCARD was shown at CES (left), still with unidirectional QAM tuner features only; it is appearing on many new integrated sets and some new cable STBs from Motorola and Scientific Atlanta for 2004. Digital cable is finally joining the HD crowd.



Some low cost EDTV projectors from Optoma and BenQ using DLP technology are becoming to appear, and appeal to low budget home theater enthusiasts; like the Optoma H30 (on the right) for \$1,400 (not HD, but a great image), and BenQ's PB6100 for \$1,000; check the new models on the DLP section, which includes a DLP feature article.

Texas Instruments' DLP 1080p for consumers is finally here, new models are planned for 2004 from Samsung, using the new xHD3 DMD chip; it is a single-chip with color wheel implementation for now, but 3-chip ultimate quality is expected to follow. Samsung estimated

that prices would be in the \$4,000 to \$6,000 range for 50 to 61 inches RPTVs, appearing in July 2004. The 1080p implementation in FPTV comes late in 2004.



DirectTV announced two new STBs but without 1394 for external D-VHS recording. One is the RCA DTC210 for \$600, TTM 1Q04 (on the left). DirectTV is going thru another year with no external HD recording capabilities. They announced that now they will control STB distribution themselves; so all STBs would look and behave alike, with that, gone will be the creativity benefit for consumers regarding STB features, connectivity, and user interfaces brought by competition of the past 5 years of STB manufacturing.

The other DirectTV STB is the Hughes HD-DVR250, coming April 2004, the long awaited PVR, for \$1,000, no 1394, but at least with PVR time-shifting Tivo capabilities.

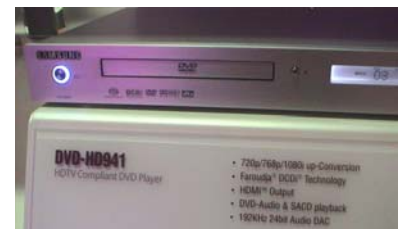
The Dish Network 921 (two year old prototype) is finally here as a finish product (right photo); as well as its JVC sibling; both with Fire Wire 1394 'jack' (to be made operational in the 'near future', but that is much better than no jack at all). The unit is a PVR with multiple satellite/ATSC tuners. Check the chapter about HD-STBs to see all the new models, including QAM cable STBs.



High definition DVD is finally here in 2004 as well; Samsung and LG announced new models to be available later this year in the Blu-ray format, check the dedicated chapter, with the many photos of the new products (a Blu-ray prototype from Sharp on the left).

On that chapter, checkout also the new Chinese EVD format and player (and price!), and know about the company behind the product. Do not miss the WMV HD format from Microsoft, and the first stand-alone HD player using the format, implemented by V, Inc. (the Bravo D3 HD player) to be available on the 2Q04, for \$350?

More DVD players are upconverting 480i NTSC DVD to HD. On the last CES there was only one (Samsung 931), then the Bravo D1 came to challenge, both at very low prices, now there are over a dozen models announced to appear later this year, all upconvert to HD, but there is a catch, they do the upconversion "only" over the DVI/HDMI outputs.



Therefore, if you are one of the five million-plus legacy HDTV owners out there, with only analog component inputs on your set, you are out of luck with any of these new products. The new models from Samsung will be available on the 3Q04 (the 941 that replaces the 931 is on the right). Check the dedicated section.

VOOM HD satellite service is here since October 2003; their presentation at CES had a demo of their future Motorola 580 PVR network with thin-clients around the house (using the home's coax wiring?). They are also moving to MPEG-4 compression later in 2004.

The company showed a good spirit to help current customers upgrade from their current 550 model to the newer box, perhaps by paying the difference; they disclosed no plans yet, just

spirit, but most others do not even have the spirit to offer anything for exchange-upgrades. Check the full coverage of VOOM's hardware and programming later on the report.

In summary, the DTV growth shown at CES 2004 was overwhelming, and very convincing that HDTV is strong and here to stay. This is good for everyone.

Now, spend your money wisely; and do not forget to check the articles about integrated tuners and QAM unidirectional CableCARD tuners later in the report; educate yourself to make the right choice of equipment for your tuning needs before you sign that check.

Enjoy the report.

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**CableCARD**



According to the agreement, by July 2004, digital cable operators are to provide a CableCARD to subscribers that request one. Motorola is already testing their CableCARD with most set manufacturers and have enough CARDS for the starting, and operators have few as well.

For operators to be able to work with CableCARDS they have to upgrade their equipment (video controllers, software, billing system, etc), and some industry analysts say that the cable-company would have to send a cable tech to the subscriber's place to install and activate the card, as well as confirming that the HDTV performs as expected. Perhaps the actual implementation could be easier when the time comes.

According to Cox, they have ordered CableCARDS from Motorola and Scientific Atlanta to start testing in two eastern markets (Pensacola, FL and Orange County, CA).

Comcast plans to introduce their CableCARD in St. Paul, Minnesota and Portland, Oregon; distribution is expected to take place via professional installations.

The expected cost to customers would be similar than an HD-STB rental, which could entail a small installation fee and a Card rental. Some small cable operators estimate that their cost for a CableCARD could oscillate between \$30 and \$90, volume would certainly affect such pricing, however, the actual cost of a CableCARD has not yet been disclosed.

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**Broadcast DTV Regulations Recently Approved**

In November 2003, the FCC approved the "broadcast flag" anti-piracy order, to limit the indiscriminate redistribution of digital broadcast content. A digital code embedded into a digital broadcasting stream would signal DTV reception equipment to activate the redistribution limit.

The FCC allowed broadcasters to decide whether or not to include the flag with specific types of programming, and declined to prohibit the use of the flag with regard to certain types of programming, such as news or public affairs, although two of the five commissioners disagreed with the section that dealt with restricting also news programs, and content with expired copyrights, which would affect the sharing of such video clips over the Internet.

This regulation excludes digital devices that are not built with internal digital tuners, such as digital VCRs, DVD players, personal computers, etc. According to the FCC .....

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## **HD-STB vs. Integrated Tuners**

### **Cost and Technical Considerations**

Several manufacturers started to offer HDTV integrated versions with OTA/cable tuners on their 2003/4 lines. The integrated TV versions cost between \$300-\$1300 more than their monitor-only versions (\$704 extra on average). The attached table and manufacturer specifications include a representative sample of lines and models.

The difference in price is justified by the cost of tuner/s and related components, such as an MPEG-2 decoder so the digital signal can be uncompressed for the TV to display, 1394 outputs so the tuned compressed digital signal can be sent out for HD-recording, etc.

HD-STB tuners are still costing between \$400 and \$900 MSRP. The retail value of tuners is expected to drop eventually.

Back in 1999, first generation rear projection HDTVs cost consumers between \$5,000 and \$10,000, most 42" plasmas started in the \$12,000 range; it was expensive for early adopters. HD-STB tuners were selling between \$400 and \$900 (although there were some extreme cases on the \$3000 range). At that time, the MSRP relationship between a RPTV and an HD-STB was approximately 10 to 1 on average.

Today, similar rear projection HDTVs cost consumers approximately \$1,000/\$3,000, and the 42" plasmas are now in the \$4,000 range, and they are better products (better line-doublers, lenses, digital inputs, video processors and scalers, etc.). The price of a new HD-STB today has not changed much, although one can still find some 1999 STB technologies at discounted prices. Today, the MSRP relationship between a RPTV and an HD-STB is approximately 3 to 1 on average.

In other words, the price of a HD-STB tuner today, relative to the reduced price of today's DTVs, should be much lower than it is. The same should apply to the price of tuners within integrated TVs, as it can be read on the attached table.

Over the last 5 years, tuners within HD-STBs did not have a record as clean as one could expect the product to become a component of HDTVs, but they are certainly improving.

A tuner needing replacement or service might become a nuisance if integrated within a 300 pounds RPTV that most probably require and in-home service call/extra cost. Having the tuner as a separate HD-STB the problem could be solved as easily as just replacing/servicing just the STB; and if it would be a leased box the cable company should take care of the problem, which could facilitate upgrades to newer/better models. Leasing could be a good proposition during the period a technology needs to mature/evolve, like this one.

### **HD Tuning Capabilities**

A cable-integrated HDTV owner that subscribes to premium cable services would be required to use a separate cable STB (unless the HDTV has an internal cable tuner with CableCARD, which are starting to come out on the last quarter of 2003). This subscriber would be paying for two tuners, one inside their new integrated HDTV for unscrambled services, and another into the external HD-STB for premium programming/interactive services (which also

performs unscrambled tuning). If you are required to use a STB for your particular cable services anyway, you might want to consider an HD monitor rather than an integrated set.

DBS satellite service subscribers of HD programming have already purchased a satellite HD-STB that should have an ATSC OTA HD tuner circuitry included; they should not need the OTA tuner integrated into a HDTV, nor they need a cable tuner.

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<b>Manufacturer</b>	<b>Models/Lines</b>	<b>Size</b>	<b>Original MSRP \$ Difference</b>	<b>Main Feature Difference</b>
<b>Hitachi</b>	2003 SWX Monitor vs. XWX Integrated lines	51"/57"/65"	\$1300	ATSC tuner w/1394
	2004 S500 Monitor vs. S700 Integrated lines	65" & 57"	\$400	ATSC/QAM unscrambled
	2004 S500 Monitor vs. T750 Integrated lines	65" & 57"	\$700	ATSC/QAM w/CableCARD
<b>JVC</b>	2003 84 Monitor vs. 94 Integrated lines	56"	\$400	ATSC tuner with 1394
		65"	\$300	ATSC tuner with 1394
<b>Mitsubishi</b>	2003 current models	48"	\$1100	ATSC/QAM unscrambled
		55" & 65"	\$900	ATSC/QAM unscrambled
	2004 models (4Q03, 1Q04)	48" & 65"	\$800	ATSC/QAM unscrambled
		55"	\$900	ATSC/QAM unscrambled
<b>Panasonic</b>	Integrated line for 4Q03 vs. WX 2003 Monitor line	47" & 56"	\$700	ATSC/QAM w/CableCARD, DVI (monitors) vs. HDMI (integrated)
		53"	\$800	Same
<b>Samsung</b>	.....			
<b>Sony</b>	.....			
<b>Thomson/RCA</b>	.....			
<b>Toshiba</b>	.....			
<b>Zenith/LG</b>	.....			

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### LCD FPTV

PLV-Z1 800:1 CR, 700 ANSI lumens

PLV-Z2 \$2,500, TTM Feb 04, 1280x720, 3 LCD 0.7 chips, 1300:1 CR, 800 ANSI lumens, DVI-I/HDCP, component, +/- 20% keystone correction, 24 dB fan noise, demo looked washed



### **Sharp**

AQUOS GD4U Series LCD panels integrated

45" LC-45GD4U \$TBA, TMM 2Q04, 1920x1080p, PC card slot, 1 bit digital audio amps, HDMI/HDCP, DVI/HDCP, ATSC/QAM unidirectional, 450 candelas, 800:1 CR, 60,000 hrs lamp life



### New Controller

TU-GD1U ATSC/QAM CableCARD tuners, TTM 2Q04, \$TBA, 2 component, HDMI and DVI

### **Sony**

(Announced Mar 03)

Fully integrated RPTVs

ATSC tuner, TTM Sep 03, DVI/HDCP, Enhanced memory stick slots, 3 i.Link 1394 connections

51" KDP-51WS550 \$2,500 (price drop from \$2,700 Sep 03)

57" KDP-57WS550 \$2,900 (price drop from \$3,000 Sep 03)

65" KDP-65WS550 \$3,300 (price drop from \$3,500 Sep 03)

### LCD based Grand WEGA RPTVs

TTM Sep 03, DVI/HDCP, enhanced Memory stick for JPEG playback, DDC (Direct Digital Circuitry) to reduce number of A/D and D/A conversions, DRC (Digital Reality Creation) scaler, and MIDX (Multi-Image Driver X) for side-by-side PIP with analog and digital sources, 720P>1080i

42" KF-42WE610 \$2,800

50" KF-50WE610 \$3,300

60" KF-60WE610 \$4,000

70" also will be produced

### New CRTs based Hi-Scan RPTVs Monitors

DVI/HDCP, TTM July 03, 720p>1080i

46"	KP-46WT510	\$1,700 (\$1,600 Sep 03), tabletop
51"	KP-51WS510	\$1,800 (price drop from 2,000 Sep 03)
57"	KP-57WS510	\$2,200, 480i > 960i using DRC, 480p and 1080i bypass DRC
65"	KP-65WS510	\$2,600

#### New Direct view CRTs

DVI/HDCP, memory stick, 720p>1080i

KV-34HS510	\$2,000 TTM Aug 03
KV-34XBR910	\$2,800 TTM July 03

#### New Sony Projection technologies

SXRD FDTV QUALIA 004 \$25,000 (Silicon Crystal Reflective technology)



Fixed pixel micro-device), image more film like, manufacturing more efficient and capable than LCoS, LCD and DLP, TTM end of 2003, for both RPTV and FDTV, 3 chip 1920x1080p, .78 " diagonal panel with pixel pitch of 9 micrometers each. Fill factor almost 92 percent. Pixel density increased almost 2.5 times over current micro display technology, 10-fold improvement in pixel spacing compared with typical LCD or single panel DLP products. Cell gap size less than 2 micrometers. 3000:1 CR, 1000 ANSI lumens, final products might be higher. The technology might be targeted as a step-up display to current LCD projection models, xenon lamp developed for this projector, Carl Zeiss glass optics, Cinema Black PRO

circuitry to adjust black levels via lamp wattage and iris control.

GLV (grating light value laser projection) technology showed by Sony in the past is probably still a few years from market, maybe for commercial movie theater projection systems.

According to Sony's statement in 2003, by 2005 the CRT based tech will continue to dominate the industry with unit sales still 85% of the total, non-CRT products will be 40% of all \$ sales.

#### Grand-WEGA XBR LCD Integrated RPTVs

ATSC tuner, iLink/DTCP, DVI/HDCP, QAM tuner without CableCARD

60"	KDF-60XBR950	\$5,500, TTM fall 03
70"	KDF-70XBR950	\$7,000, TTM Dec 03, 3x0.87"wide XGA LCD panels

#### New Cineza FPTVs LCD projectors

(Announced Sep 03)

TTM Oct 03, HDMI/HDCP, improved contrast and brightness over last year's models

VPL-HS3	\$1,500, 800:1 CR, 858x484
VPL-HS20	\$3,500, 1,300:1 CR, 1386x788

#### SuperLite LCD projectors

(Announced CEDIA Sep 03)

5 pounds

VPL-CS6	800x600, 1800 lumens
VPL-CX6	1024x768, 1500 lumens)
VPL-PX35	Network projector, 1024x768, 2600 lumens

VPL-FX51 upgrade to the VPL-FX50, 1024x768, 3500 lumens  
PJNet Network projector management software (about \$500)

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### **Analysis and Status of DLP**

Texas Instruments (TI) announced a new 1080p DMD chip (xHD3), and showed their new DMD chip HD2+ with Dark Chip 2 (Filler Mirror Via, or "dimple fix"), introduced in September 2003.

The HD2+ was released to improve contrast and black level, include Digital Video Enhancement (DVE) that adds a dark green segment on the color wheel to improve bit depth and shadow detail, reduced sparkly dither at low levels, and closer pixel fill which produces a smoother image with less screen door effect.

Some manufacturers are also using the newly designed 7-element color wheel, to improve the known DLP dithering artifact.

TI talked about a 1920x1080 chip informally at CES 2002/3, and again at CEDIA in Sep 03, but CES 2004 was the event that demonstrated a consumer HD RPTV built with the xHD3 1080p chip (Samsung RPTV set), which according to TI, offers the finest in picture quality with the new DynamicBlack™, DarkChip2™ and SmoothPicture™ technologies, and up to 5000:1 CR.

Featured at the TI's booth was also a DLP RPTV "flat panel" cabinet from Thomson/RCA, as thin as 6.85" in depth, which claimed to be higher resolution,

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### **Optoma**

#### **FPTVs**

New H30 \$1,400, TTM Sep 03; 2004 CES Innovations award winning projector



Widescreen-style home theater projector, VGA and component inputs, NO DVI, 800 lumens, 2000:1 CR, 4:3 DMD aspect ratio (16:9 compatible).

SVGA resolution 600x800, a 16x9 image actually uses 450 pixels of the 600 (but it still showing an excellent picture for the cost, the demo impressed as an HD image until you look at the SD specs)

2000 hrs lamp (3000 on eco mode), 32 dB noise level, image size 29 to 260 inches from projector distance of 4.1 to 32.8 feet, syncs to computer resolution of 1280x1024 (SXGA) and compresses, single 0.55 inch 12 degree DMD Double Data Rate chip, manual focus zoom, +- 16 degrees of keystone correction (vertical only), 4.6 pounds.

H56 \$4,000 (on CES 2003 report)  
H76 \$6,000 TTM 3Q03, 1280x720 HD2 Mustang DMD chip, 16x9 c.....  
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**Sim2 Multimedia**

(Announced Oct 03)

Domino Line

DCDi, motorized zoom and focus, digital keystone adjustments

Domino 20 \$6,000, "Matterhorn" 1024x576p DMD device, 2000:1 CR focus adj +/- 10%, digital keystone adjustments of +/-38% vertical, and +/- 14% horizontal

Domino 30 \$9,000, HD2, 1280x720, 2000:1 CR



Grand Cinema line

HD2+ chip, 2,800:1 CR, 28% black level improvement over original HT-300 model, DCDi, DVI, HT-300Link \$15,000, second generation DigiOptic Image Processor (DOIP) with HDMI, and can connect as far away as 1,600 feet



HT-300Xtra \$12,000

Grand Cinema RTX RPTV new line

HD2 Mustang chip, 1280x720, DCDi,.....  
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**Toshiba**

(Announced at CES)

Toshiba will introduce 10 DLP RPTV models later this year using the HD2+ chip, whit thin-cabinet designs.

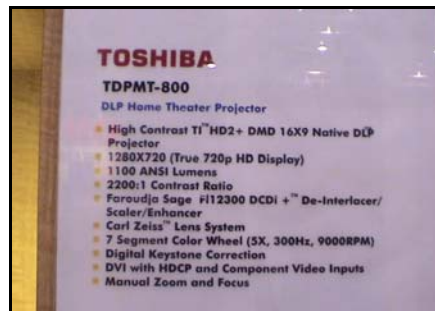
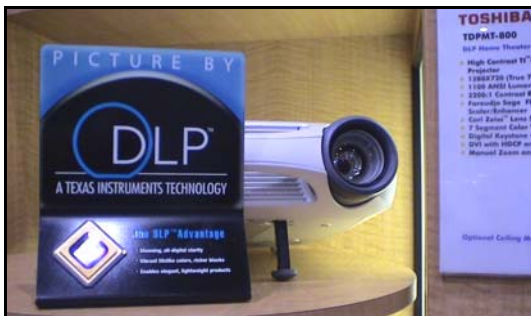
(Announced Jul 03)

TDPMT-500 \$3,500, 1024x576, 2000:1 CR, keystone correction, gamma control, preset and user definable color temperature controls, independent color control, memory settings by input, DVI/HDCP, 2 Colorstream component inputs, "Matterhorn" chipset



(Announced Aug 03)

TDPMT-800 \$10,000, TTM Mar04, HD2+, 2,200:1 CR, 1,100 ANSI, Carl Zeiss all glass optics, seven segment color wheel



(Announced Sep 03 CEDIA)

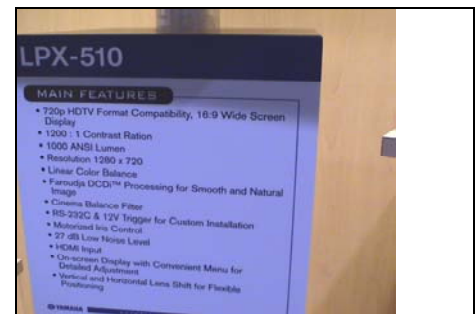
DLP projection cubes

38" P380DL 1024x768, 400 nits  
 60" P600DL 1024x768, 300 nits

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**Yamaha**

LPX-510 \$5,000, TTM May 04, 720x1280, 1000 ANSI, 1200:1 CR, DCDi, HDMI



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## Video Processors that Upscale to 1080i/720p

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### **DVDO**

iScan HD \$1,500, TTM Feb 04

Upconverts 480p/720p/1080i/p, Pan and Zoom, source-adaptive and motion-adaptive deinterlacing, individual picture control per input including brightness, hue, saturation, sharpness, and Y/C differential delay.

Frame-rate conversion and full frame Timebase correction, automatic Chroma Upsampling Error (bug) correction, automatic source activity detection and selection by priority pre-sets, precision AV LipSync to match audio soundtracks to video.

Two component ins, 1 DVI-D in, 4 digital audio ins (2 optical Toslink, 2 coaxial RCA), 2 S-Video ins, 2 Composite ins, 1 DVI-D out, 1 RGB D-sub 15 out, 2 digital audio outs (1 optical Toslink, 1 coaxial RCA), RS-232 port for software/firmware upgrades, infrared remote control with direct access codes, built-in test patterns for easy setup, future-proof design with upgradeable software.



### **Faroudja**

Digital Cinema Source Processors/Advanced Scalers TTM current

Digital Cinema Source DVP2000 \$15,000



DVI input/output (NO HDCP yet, as reported recently), updated Digital Cinema Source (DCS) with Faroudja's processing, includes a DVD transport (processing in digital domain skipping A-D conversion step of typical scalers), DCDi w/3:2 pull-down, 1 HD-PC D15 male input, 1 component/RGB input on BNC, 1 RBGHV output on 5 BNCs

and D15 female, "TrueLife" two dimensional non-linear luma/chroma video enhancer, HD transcoding YPbPr to RGBHV, HD RGB to DVI conversion, temporal and recursive 3D video noise correction, supports the following resolutions:

852x480, 800x600, 1280x1024, 1280x768, 1360x1024, 1024x768, 1280x720, 1366x768, 960p, 1920x540p, 1920x1080p, and Alis p.....

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## HD for Satellite, Cable, and Broadcast OTA

### HD-STBs/PVRs

#### Dish Network

DISH211 (included in 2003 report, but unit seems that will not be released as planned; it is not even listed now on the CES 04 product brochure)

DISH811



\$400, TTM Dec 03, ATSC OTA/satellite tuners (one each) DVI/HDCP, NO 1394, component out, NO RGB out, replaces Dish 6000, NO PVR, tuner module included inside the unit, same selectable outputs of model 921, converts formats to any output, 2 days of electronic program guide, optical digital audio out, also offered as part of a package that includes a 34" direct-view monitor or a 40" RPTV monitor for \$1000.

PVR 921



(Innovations CES 2003 best of show winner), \$1,000, original TTM was for 2Q03 (actual TTM was Dec 03), although the unit has been announced as ready to release for almost 2 years.

HD-PVR with a 250 GB HDD, up to 180 hrs SD, up to 25 hrs HD, one DVI-I/HDCP, two 1394/DTCP to be enabled via future software upgrade, dual satellite tuners, ATSC OTA tuner built in, one component out, 2 USB ports for future use (such as remote keyboard), records DD when available and over the air digital broadcasts, headphone and USB jacks in front panel, records up to two programs in the PVR simultaneously (HD or any) while capable to play another HD program stored in the PVR (or from the 3<sup>rd</sup> HD tuner).

Also offered as part of a package that includes a 34" direct-view monitor or a 40" RPTV monitor for \$1600, 9 days electronic program guide, optical digital audio out, 30-second skip for commercials, four fast-forward and fast-rewind speeds, picture-in-picture, multi-device remote control, selectable output from the menu for 480p/720p/1080i, stores signal in original resolution. Some users reported that the HDD is always turning. Beta testing reports are available on the Web.

#### Hughes

HTL-HD

\$500, TTM Nov 03 (unit apparently offered for \$99 temporarily by DirecTV)



ATSC and DirecTV tuners, similar to HD300 from Sony and 3200A from LG, but IR remote, DVI, component, optical digital audio (no coaxial), VGA D-sub 15 in, switch in back for DVI/VGA, DVI cable, 720p/1080i switch (front button on box)

New HD-DVR250

\$1,000, TTM Apr 04, w/HD Tivo, Best of Innovations CES 2004



2 ATSC + 2 DirecTV tuners (E\* 921 HD-STB has only 3 tuners in total), HDMI/HDCP, component, 2 sat RF inputs, digital audio Toslink, 2 USB ports (for future use), 1 RF antenna that splits internally to two ATSC tuners, 250 GB DVR for up 30 hrs of HD recording or up to 200 hrs of SD recording, built-in fan, S-video out.....

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**HD Recording**

**HD DVD Players/Recorders**

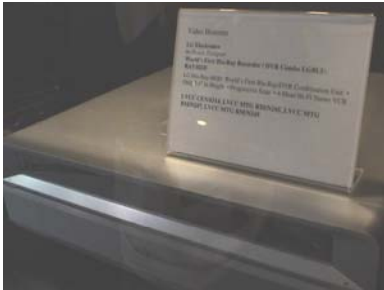
**EVD (Enhanced Versatile Disc)**

Chinese HD player DVD format (details on the General Review included below)

**LG**

Displayed a pair of Blu-ray HD optical disk recorders, available in September 2004

- A) One with built-in ATSC tuner
- B) Another unit (LGBBLU-RAYHDD)



With HDD VDR 160GB, \$ TBA (estimated to be at \$2000), VHS VCR combo, world's first Blu-ray recorder.

LG has put an emphasis on receiving and recording (also evident on their new 60-inch HDTV with built-in DVR), 1394, ATSC/NTSC tuners, Gemstar TV guide, does not record regular DVD, blue and red lasers, HDMI, component out.

**Panasonic**

Blu-ray Recorder



**Pioneer**

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