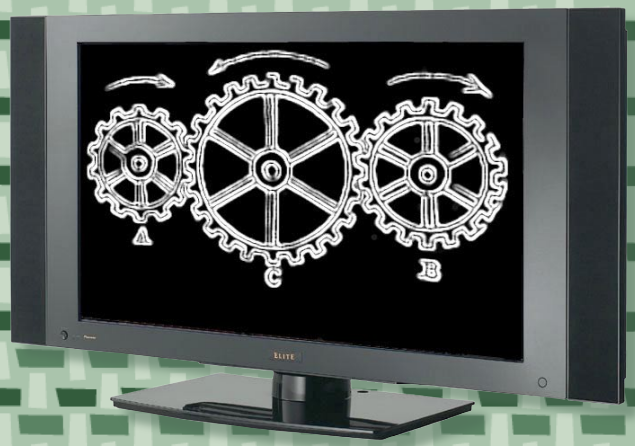
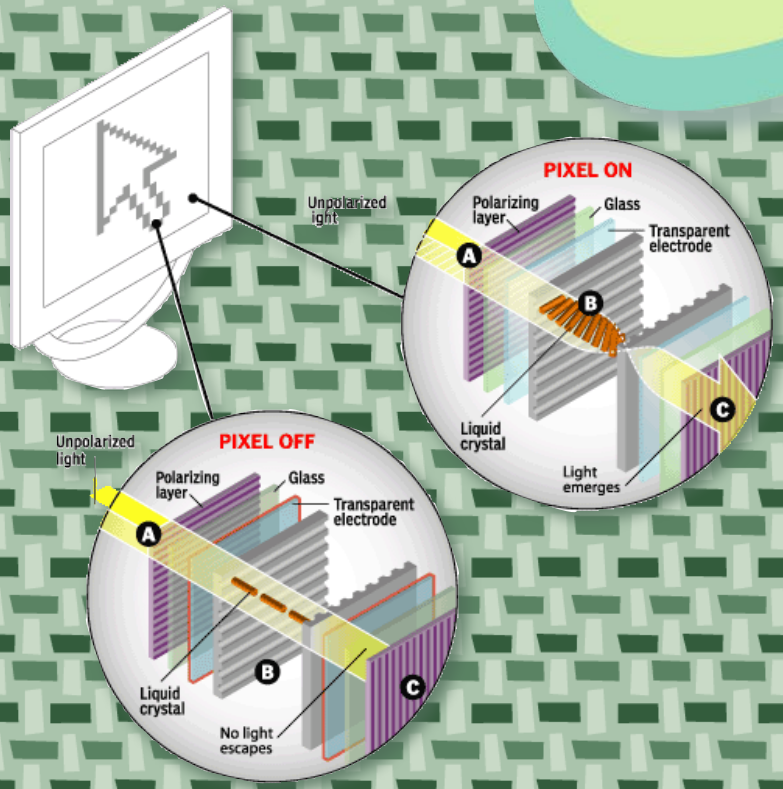


PC MAGAZINE PRESENTS

the Brave New HDTV World



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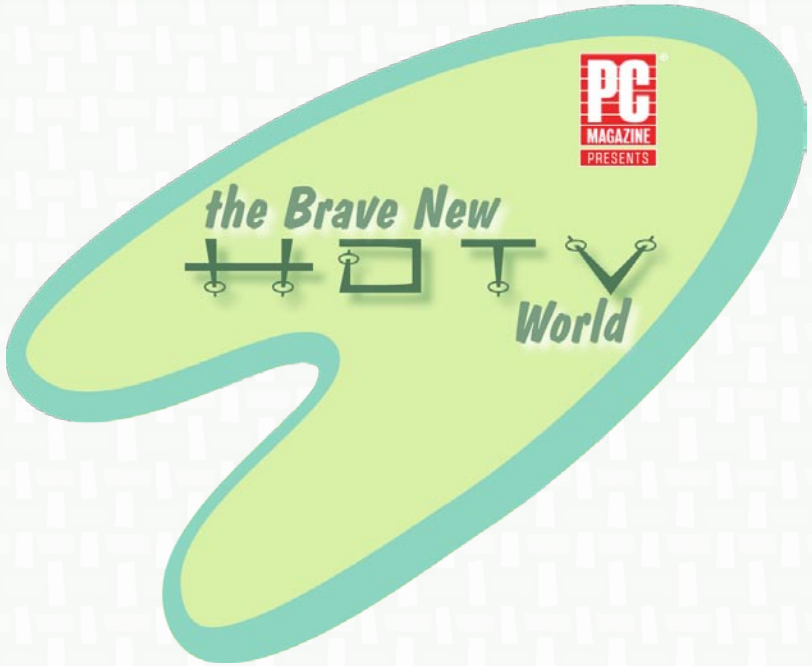


It was time to buy a new TV. My trusty old Sony Trinitron finally chewed dust, and we needed something new. Being me, I wanted the latest and greatest. And that meant I had to look at the new high-definition television signals, which promised better-than-DVD-quality video and sound.

I decided to make the plunge into ***HDTV*** (HD is high definition), buying a 30-inch Toshiba. I was amazed. The Sopranos' New Jersey never looked so fresh. I could peer inside the helmets (and practically into the souls) of players on "Monday Night Football." My DVD collection got an immediate upgrade-watching a movie was a lot more like actually going to the movies.

That's the good news. The bad news is that, like many new technologies, it's not fully baked yet. There are a bewildering array of different television types, along with a plethora of sizes, types and features. Finding good stuff to watch can be frustrating, especially since normal TV shows often look worse on these newfangled, much more expensive HDTV sets.

Still, six months later, I'm the proud owner of three HDTV sets. I also know a whole lot more about what works and what doesn't. I'll mostly focus on the hardware here– sets and add-ons. For those who want to know why HDTV is better, read up on the technology in our "How It Works" section. For the rest of you, just trust me that it really is better, and I'll show you how you can enter this amazing, wonderful new world of high-definition entertainment.

Must-See HD

There are two reasons to move to HDTV today: movies and sports. If you'd like to replicate the cinema experience at home-or you love football, baseball, hockey, basketball or soccer– HDTV is a superstar.

A word of caution: While HDTV sets look great when displaying high-definition video and DVD images, they don't do as good a job on regular TV. It's often a big shock to many first-time buyers. That's part of the paradox of HDTV. You get far superior viewing when the image has

been designed for HDTV– but regular TV suffers. Why? Because the sets have to convert and sometimes stretch those lower-quality images to display on the higher-quality TV.

So for the best-quality regular TV, you're still better off with a good, old-fashioned regular TV– for now. The world is going HDTV, though. If you keep your TV for 10 years or more, then consider an HDTV anyway. Some of these are better at displaying regular TV than others, and I'll point those out as I describe the options below.

First, if you want HDTV, you want a set that's wider than normal (look for a ***16:9*** display ratio, rather than the standard ***4:3***). Beyond that, HDTV sets today come in six basic flavors: ***plasma***, ***direct view***, ***DLP*** and three types of ***LCD***. Each has its own strengths and weaknesses. However, there are certain things to look for in all sets, before we move into specifics. And that concerns the number and type of inputs.

Every HDTV should have at least one set of inputs for standard TV (yellow ***composite*** and ***S-Video***), and one ***component input*** (red, green, blue). The component input is for HDTV and ***progressive-scan*** DVD, while the standard TV input is used for VCR, TiVo and cable set top boxes. If you want to watch standard over-the-air TV, also look for a TV tuner and cable jack. Many HDTVs include multiple standard and high-definition inputs, but

these are only necessary if you're hooking up more than one of each type and lack a home theater receiver or other type of switch.

Although not strictly necessary, I'd also recommend a digital input port– called either ***DVI*** or ***DVI/HDCP***. These digital input signals are used to deliver high-quality HD signals, and in the future they may be required to view copyright-protected content. If you want to hook a PC to your HDTV to play games or surf the Internet, also look for a PC-style, 15-pin video connector. However, an emerging standard known as ***HDMI*** (High Definition Multimedia Interface) is replacing DVI and will carry both the video and audio signals.

There's one more wrinkle before you buy. If you head into a store today, you'll see three different types of sets, all called HDTV.

The first, and most common, is actually a monitor, not a television. That's because it has no tuner. You'll have to buy separate standard and HDTV tuners to watch television. These can cost $400 or more– or you can rent them from your cable operator.

Next come HDTV sets with standard, over-the-air tuners. LCD TVs from Gateway, Dell and others include standard TV tuners (called ***NTSC*** tuners) but lack an HDTV tuner. Finally, we have true HDTV sets. These come with what's called an "***ATSC***" tuner built in and let you tune in HDTV broadcast signals without buying a separate

box. Panasonic's nifty new Viera line offers an example of HDTVs with built-in tuners. Finally, later this year, many sets will ship with a tuner that's also capable of receiving HDTV via cable. Yes, there's another acronym for that: ***QAM***.

OK, now that you're armed with all the acronyms, it's time to go shopping. Even if you buy over the Internet, make sure you stop by a few stores first to get an idea of what you like and what you don't like. Bring your own DVDs, though– most stores simply show animated movies such as "Toy Story" and "Ice Age." These look great in a darkened room but really don't stress the sets much.

Direct View: This is just a fancy way to refer to the a variant of your old, reliable, tube-based TV– what you've got now, just with a wider screen capable of displaying high-definition signals. Tube-based HDTV sets offer a number of benefits. First, they mostly excel at displaying standard video images along with HDTV images. They also do a better job displaying continuous video images. There's just a bit of blur, which can make standard TV and poorly compressed high-definition signals look better than on some other types of sets.

Direct-view sets are also pretty inexpensive. You can get a 16:9, 30-inch HDTV for well under $1,000. My first set, the 30" Toshiba HF83, cost me about $1,100. It's beautiful and fits right into my home entertainment center (another big consideration).

However, tube-based TVs are heavy. The biggest, which top out at about 40" across, can weigh more than 300 pounds. They're also pretty deep-more than 2 feet deep in some cases. If you want bigger than 40", you'll need a different technology. Still, if you're making the HDTV transition, don't want to spend a lot, and standard video quality is key, look at tube-based HDTV sets first.

Plasma: If you're looking for the best high-definition video quality, arguably Plasma is it. Plasma displays consist of thousands of tiny cells containing gases that emit light when charged with electricity. There is nothing like watching high-quality video on superior plasma in a dark room. The blacks are deep and rich, motion is superb and colors can be almost flawless. Also at just a few inches deep and up to 63" wide (with wider sets on the way), plasma is the choice of many home theater aficionados. It looks good from almost any viewing angle, too.

However, plasma has its drawbacks. First, it's expensive and not likely to drop in price anytime soon. My Panasonic 42" plasma set me back $4,300– and it was a great deal!

Also, plasma can suffer from burn-in. If you leave an image on the screen for a few days or weeks, it can permanently etch itself into the display surface. That makes plasma less attractive to X-Box, PlayStation and GameCube addicts, as video-game status bars and menus may leave a

ghosted image behind long after the last alien is fragged.

Plasma has also been accused of fading rapidly, but that's not nearly as true now as it was a few years ago. A set bought in 1998 might last only 20,000 hours before losing half of its brightness. Today, the best sets will last 60,000 hours or more before dimming noticeably. That's almost seven years of constant display. For most normal TV viewers, today's plasmas should last for 15 years or more before noticeably deteriorating. And by then, you'll have stuck 'em in the basement or kids' room..

Also note that there are two types of plasma TVs: ***ED*** and ***HD***. Only the HD plasmas are true HDTVs that support 720 or more lines of TV. (Want to know what that means? See our "How It Works" section.) The ED versions display only 480 lines. That's great for DVDs but merely OK for real HDTV. ED sets cost about 75 percent of HD, though, so if you're on a budget but absolutely must have plasma, ED will suffice. Otherwise, I'd recommend spending the extra money and getting a real HDTV-capable plasma. (As I'm writing, I note that Dell's offering HD plasmas for just $200 more than ED.)

One last plasma problem– it's a power hog. If you're worried about power bills, look elsewhere.

LCD Rear Projection: LCD technology, the same used to power computer monitors, has been applied to HDTV in three ways. The first, and worst, is rear projection. Rear-projection LCD shoots beams of light through an LCD panel and displays them on a screen from behind (thus the term "rear projection"). It looks good head-on, but view the set from the side, above or below and the picture washes out.

Don't be fooled by the low price of rear-projection LCD TVs. The quality is almost always terrible. Most sets suffer from the "screen door" effect, where you can see the spaces between each video picture element (called a ***pixel***), so it looks like you're watching through a screen door. Get a direct-view tube set before an LCD projection TV.

There is one reason to buy a rear-projection TV: Size matters. If you want the absolute biggest screen, currently 70", there are only two choices. One is a projector, which I'll get to in a minute, and the other is Sony's 70" Grand WEGA rear projector. It looks OK on an angle, better than most, and costs less than many plasma sets. Still, it's not the best picture you can get.

Flat-Panel LCD: If you like flat screens but are put off by plasma's limitations, or you want a screen smaller than about 35", look at LCD TVs. These look like computer monitors on steroids.

The advantages to LCD TVs are that they consume much less power and are brighter than plasma. There's no burn-

in problem, so you can play games all you want. Computer games look great on them.

You can also get a great value on an LCD TV, especially if you buy online from either Dell or Gateway. Smaller LCD TVs double as both computer monitors and HDTVs. Both Dell and Gateway sell 16:9 17" models that do double duty- perfect for small apartments and dorm rooms.

But on the downside, video just doesn't look as good on LCD as it does on plasma or direct-view TVs. It's crisper and brighter but loses some depth because the blacks aren't as strong and the colors less intense. Standard TV looks pretty bad, particularly compressed digital images from TiVo and other digital video recorders. And sets are relatively slow to respond as scenes change, which can cause ghosting.

The ED versus HD issue also exists with LCD TVs. Make sure you get a true HD-capable LCD TV– it must support 720 or more lines of resolution.

If you're looking for a really flat TV that does a good job on DVD, HDTV and a computer, then an LCD TV is most likely the way to go. At 30", I'm partial to Gateway's $2,500 LCD TV. It's not cheap, but HDTV and DVDs look pretty good on it, and PC games rock! I also like Dell's 23" LCD TV. It makes a great monitor for a roll-your-own or store-bought media-center TV, or for a bedroom or dorm room.

DLP Rear Projection: This is fascinating, silicon-based technology that combines the best of rear projection– big screens and light weight– with picture quality rivaling plasma. Instead of projecting light through an LCD panel, digital light projectors project light through a silicon-based optical switch that directs color to the appropriate part of the screen, using more than 750,000 tiny mirrors.

DLP-based HDTVs are bright and look great from any angle. They're also reasonably lightweight (less than 100 pounds) and deliver stunning pictures. They don't suffer from burn-in and deliver pretty good standard TV images as well.

DLPs are still somewhat expensive; a 40" version costs about $3,000. But prices are dropping rapidly, as the DLP chips become less expensive. The other analysts at **ExtremeTech** who have taken the HDTV plunge have opted for DLP because it also does a good job displaying computer input and does not suffer from burn-in.

DLP sets are still about a foot or more deep and cannot be hung on the wall like a picture. But that'll change later this summer, as Thomson releases DLP sets that are less than 7" thick.

One small problem with DLP today: About 10 percent of us see a rainbow effect when watching them– which can be quite annoying. It's genetic, so make sure you actually check out a DLP in action before buying.

What's best here? My co-workers at **ExtremeTech** are partial to Samsung's line of DLPs. They're fashionable and deliver a great picture.

Rear Projectors: So, maybe you're building a real home

theater, where you can control the lighting and want a really, really big picture. You can buy real HDTV projectors and mount them on the ceiling. Both DLP and LCD projectors exist, and they deliver a pretty nice and big image. But now you're getting into real home theater territory and away from just replacing the home TV.

If you're that serious, hire a specialist to help you out. For everyone else, make sure you try before you buy, and enjoy the brave new world of TV!

Once you have an HDTV, there are a growing range of add-ons that will improve the experience. These range from new recorders that work TiVo-like to pause and record HDTV video, to media adapters and players. Here's a quick look at the best in each category.

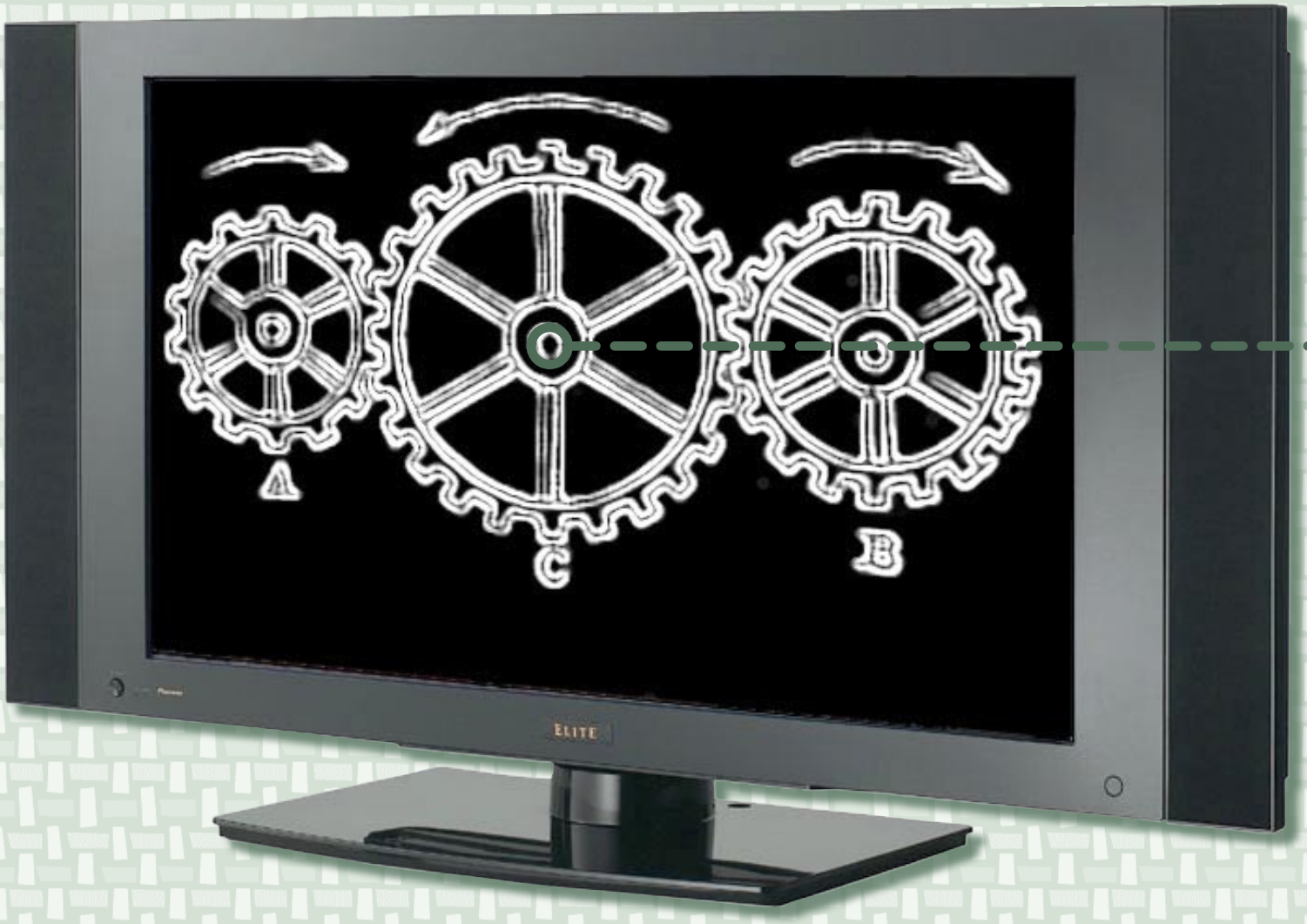
Recorders: This is a wide open field. TiVo just started shipping its HDTV recorder, for DirecTV only. A similar device for Dish Network, the DishPlayer 921, has been out for a few months but it's very hard to find. You'll have to have deep pockets too, as these recorders start at around $1,000. Cable customers catch a break here. Some can rent an HDTV recorder from their provider for less than $20 a month. Motorola's Moxi box takes the lead here, although it's available on Charter and Adelphia only today (Comcast will start a trial later this year). Over the air customers have a potential alternative from ATI: the **All-In-Wonder HD**. With this card, you can turn your PC into a TiVo-like HDTV recorder.

Media Hubs: These let you stream photos, video and music from your PC to your HDTV. The choices are limited today. We liked the **Roku HD1000**, but more for its potential than today's performance. Pinnacle's ShowCenter also performed well in my tests. Both cost around $300.

D-VHS: As the name implies, D-VHS uses tape to deliver content (mostly movies) in high-definition format. It may seem like an anachronistic delivery format in the age of DVD, but it has been well-received by high end home theater buffs. It is, however, a stopgap measure at best, as new technologies emerge.

HD-DVD: Finally, we'll see high-definition optical discs arrive on the scene late this year, but a standards battle is brewing between the supporters of Blu-Ray (backed by Sony, Philips and many others) and High-definition DVD, backed mainly by Toshiba and NEC. Until this format war shakes out, it's unlikely we'll see lots of prerecorded discs arrive on your store shelves. Interestingly, players that support Microsoft's WM9HD will arrive on the scene later this year, but content support may be shaky.

HOW IT WORKS



Digital vs. HDTV

Both digital TV (also called **DTV**) and HDTV are bandied about as if they were synonymous. They aren't. HDTV is just one type of DTV, but not the only type. Let me explain.

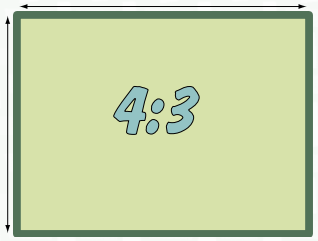
Standard cable and over-the-air TV is transmitted via a series of radio waves that oscillate like waves in the ocean. Your TV picks up on those waves and turns wave height, strength and frequency into video you can watch. With digital TV, the signal is converted (or encoded) from those waves into a series of ones and zeroes, or bits, representing on, or off. At home your TV or set top box decodes the ones and zeroes back into video and audio, for your enjoyment.

You may already be watching digital TV. DirecTV, Dish Network and digital cable all transmit standard video in digital format. The satellite or cable box converts those bits into a video signal your traditional TV can understand.

Many broadcast TV stations also convert their existing video to digital, and transmit it. Digital TV will probably look better than over-the-air TV, simply because there's no opportunity for interference. With a digital signal, you either get it, or you don't. There's no ghosting, snow or other noise. But ultimately, the video quality is the same. To get better, clearer and sharper video, you need a more detailed signal, with more video information. And that's where HDTV comes in. It's simply a form of digital TV, but with more information packed in.

TV Signal Primer

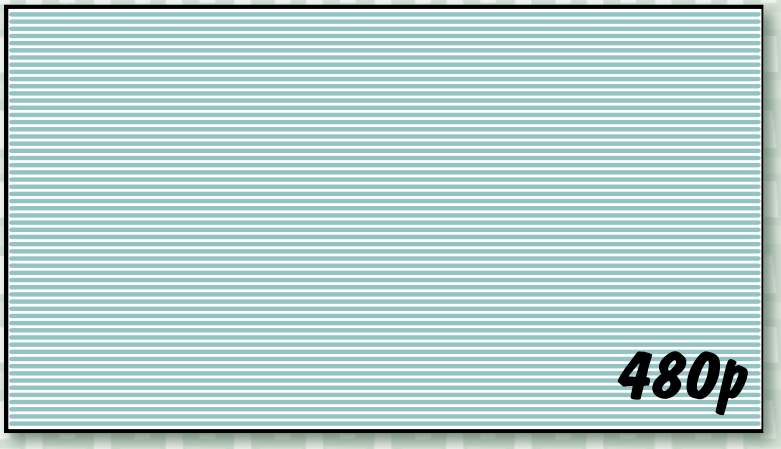
To understand why HDTV is better, you have to understand how TV actually works. Think of a TV as a window covered with Venetian blinds. A standard TV picture comes in an almost square format, with a ratio of **4:3**. Or in other words, if your TV is 40" wide, it'll be 30" tall. Each video image is painted on the screen in a series of horizontal lines, similar to the rails on a Venetian blind. Each TV image is broken up into 480 of those lines.



Regular TV delivers 30 still images a second, which are rapidly drawn on your TV to fool your eye into perceiving smooth motion. But each line only gets drawn 15 times a second. The television alternates between drawing the even lines (2,4,6…) and the odd lines (3,5,7…), by "interlacing" the signals. It's as if every other Venetian blind rail were opened 15 times a second. That can make TV flicker. In video-geek terms, regular TV is called **480i**, for 480 horizontal lines, interlaced so only 240 of them are drawn at a time.

HDTV, on the other hand, improves the width of the video picture, the number of video lines, and the frequency in which they are painted or drawn onto the screen. Going back to our window blind example, an HDTV expands the size of the window to a **16:9** format. In our previous example, a 30" high HDTV would be 53" wide, not 40"—more like a wide-screen movie than today's TV.

But if it were just a bit wider,



HDTV wouldn't be nearly as special. The video quality is improved as well, by either increasing the number of horizontal lines or throwing that whole "interlacing" concept out the window, as it were. The technical term for that is "progressive" scan.

However, and here's where it gets tricky. There are really three different types of HDTV signals that you need to know about.

480p: The first, and lowest quality, is called 480p. This is what a "progressive scan" DVD player delivers. It's still only 480 lines of video, but all of them get drawn 30 times a second. Buh-bye flicker!

720p: For some broadcasters, notably ESPN, this is the best resolution. Here the screen is broken up into 720 lines, 50% more than a standard TV image. Each line is also drawn 30 times a second, or once for every video image.

1080i: Finally, at least in the US, there's 1080i. Each video image is sliced into 1080 separate horizontal lines, but only 540 of them are drawn for each 1/30 second video frame. No need to worry about flicker, however, because there are more than twice as many lines as a standard TV signal.

So which is best? 1080i and 720p are considered true HDTV. To purists, 480p is not real HDTV because it contains only 480 horizontal lines of video resolution.

I can't tell the difference. And it's not that big of a deal- HDTV sets support both resolutions. Want to know more about how DLP, LCD, plasma and more actually work? Don't miss our **detailed story, with pictures**, about these and future technologies– including ***LCoS***, ***Bistable*** and ***OLEDs***.

Where to find it

Every new HDTV owner goes through the four stages of HDTV adoption:

1. **Euphoria:** Oh-my-gawd! Even the test pattern looks great!
2. **Satisfaction:** OK, I've never actually watched Nova, but I can't change the channel. And I'm actually learning something, too.
3. **Despair:** You mean that's not available in HDTV? And that isn't either? Why not?! Waaaaaah!
4. **Acceptance:** At least my DVDs look better.

It's not really that bad, but unfortunately there's a lot more regular TV than HDTV available today. Change is happening, albeit slowly.

Today, HDTV is being rolled out by over-the-air broadcasters, cable TV providers and satellite TV. All HDTV broadcasts are not created equal - some HDTV streams are compressed more heavily than others to save on bandwidth. However, all true HDTV broadcasts do share common features: They support either 720p or 1080i and are purely digital in nature. Let's look at each of these three sources in turn.

Over-the-Air Broadcasts: This is similar to broadcast television, except the signals are broadcast in digital and at either 720p or 1080i. Quality of broadcast HDTV varies from one city to another. Over-the-air HDTV quality varies tremendously. Fox's quality is pretty poor, while CBS and ABC look good. ABC's "Monday Night Football," in particular, looks great, and that's probably all any true football fan needs to know to justify the investment. Like regular TV, over-the-air HDTV is free. Unlike regular TV, if you can get it, the picture is perfect.

If you mostly watch over-the-air broadcasts, you'll need a good antenna. One good place to start your search for an antenna is the **CES Antenna site**. It won't give you brand names but will list the best type of antenna for your particular location, based on building type and presence of nearby high structures.

Cable TV: Cable has been late to the party, but that's rapidly changing now that the industry has decided on a single transmission standard. If your cable company offers HDTV, you'll have to rent a separate box for about $10 a month.

Satellite HDTV: **DirecTV** and **Dish Network** both offer HDTV channels. You'll need to buy a brand-new satellite receiver-my **Samsung SIR-TS160** cost about $500- but deals are available. Dish Network even offers bundled direct-view or rear-projection HDTV displays, but I've heard bad things about the set's quality. Both satellite services heavily compress HDTV signals, which can adversely affect signal quality. And in both cases, only a few channels are offered.

An alternative is **VoomTV**, a brand-new HDTV-centric satellite TV service. Voom claims to offer less compression than DirecTV and Dish, plus many more native HDTV channels. Unfortunately, it lacks some of the biggies, including ESPN and ESPN HD. But it's ramping up rapidly, and at the least it'll shake up the entrenched players.

Best Channels

As you evaluate HDTV programming options, there are a few must-have channels. Make sure you can get access to at least a few of these, or you'll be stuck in the despair phase forever.

ESPN HD: If you're a sports fan, you absolutely must have this channel. ESPN has put more thought into how to broadcast sports in high definition than almost anyone else (except maybe Mark Cuban, but more on that in a bit). They are already doing a wonderful job on major league baseball, basketball, football and hockey. Next month, ESPN HD will launch its 120,000 square-foot, all-digital studio. "Sports Center" will begin broadcasting in HD right away, and the network's NFL studio shows will follow this fall. Alas, for baseball fans, "Baseball Tonight" isn't scheduled for high definition until 2005. But the network has the right attitude. According to ESPN HD chief Bryan Burns, "Quality is more important than quantity." That means big events done right, not lots of little events barely distinguishable from regular TV.

HDNet: Dallas Mavericks owner and former dot-com billionaire Mark Cuban launched HDNet and HDNet Movies in 2001- both devoted to 100 percent high-definition content. The flagship HD Net delivers sports, news and entertainment. This is the place for high-definition NCAA football and basketball, along with NASCAR, major league soccer and more. HD Net is available on many cable systems, along with DirecTV and Dish.

Showtime and **HBO**: These are the flagship entertainment brands. HBO delivers "The Sopranos," along with many major movies, in high definition (truly, Jersey never looked so good). Showtime does the same and also offers live boxing in HD.

Discovery HD Theater: Your favorite Discovery shows, including "Trading Spaces," "Great Books" and "Wild Nights" are broadcast in stunning HD.

NFL Network: The NFL Network is on DirecTV and VOOM only, but "Game of the Week" -which started last fall-delivers a great recap of the best football games of the year.

CBS: CBS delivers all of its prime-time, episodic programming in HDTV, including "CSI," "Judging Amy," "Everybody Loves Raymond" and more. It also delivers "The Young and the Restless" in HD during the day, along with special and sporting events. Letterman is coming, although the start date hasn't been announced.

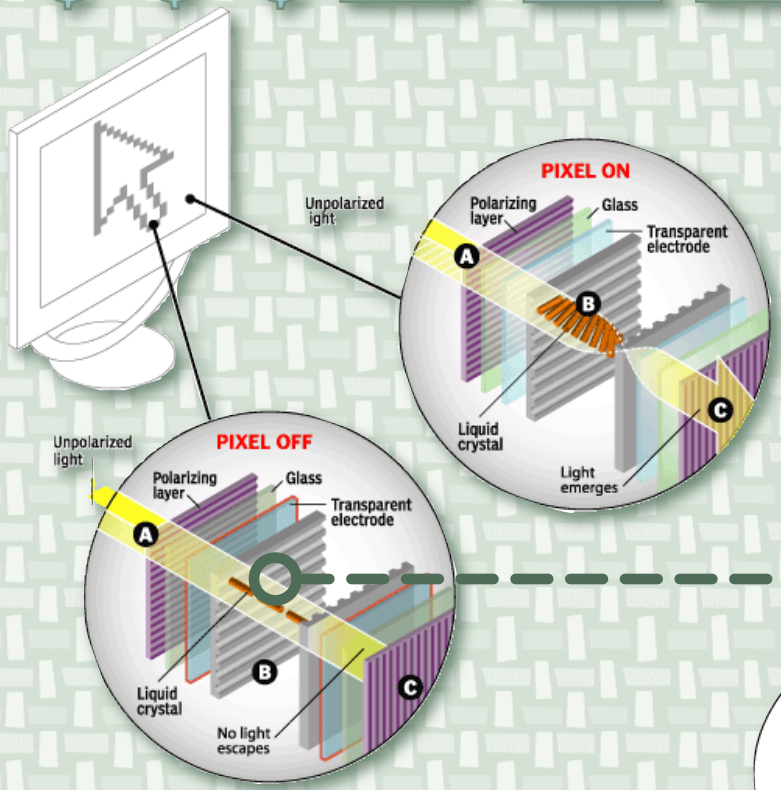
PBS: Your tax dollars at work. PBS provides some of the best high definition content out there, including Nova, American Family and Nature.

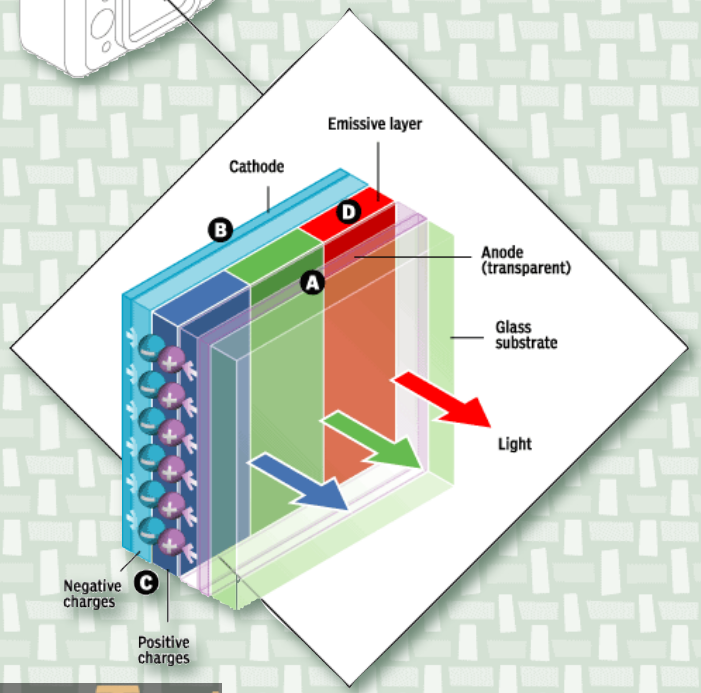
ABC: Similar to CBS, ABC offers almost all of prime time in HD- except for reality TV and news.

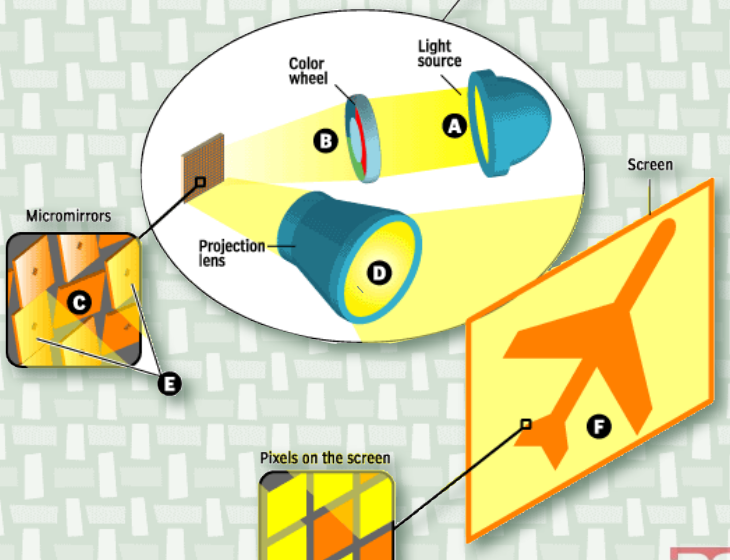
NBC: Catching up, but NBC's not up to ABC and CBS's level yet.

Fox: The network will do real HDTV this fall, Fox promises, but their sports channel, Fox SportsNet, offers several HD programs already.

New display technology







ExtremeTech®

PC Magazine

Micromirrors. Electrophoretic spheres. Organic diodes. Stephen Hawking's shopping list? Props from a science fiction movie? Wrong! You'll find these technologies inside the latest computer and projector displays.

This year marks the end of the CRT's dominance on the desktop: LCDs have now taken the lead in unit sales. In this story, we'll introduce you to display technologies that make the CRT seem prehistoric. These developments go far beyond conventional LCDs and CRTs. Giant plasma screens have reached sizes measuring up to 76 inches diagonally. Projectors use a range of technologies, from LCDs to Digital Light Processing. And the same technologies are finding their way into rear-projection displays.

Driving many of the innovations is the quest for sharper images on tiny mobile devices and giant TV screens alike—both places where CRTs don't play. A CRT's volume typically increases by a factor of eight when the horizontal screen size doubles. As a result, CRTs become unwieldy as the screens get larger. By contrast, the small footprint and thin dimensions of an LCD or plasma panel save space and look cool.

Displays often consume the lion's share of a mobile device's power, but improved technologies have helped reduce the amount of electricity they require. This gives engineers the choice of using a smaller battery, and thereby reducing the device's size and weight, or using the same battery but offering longer life with each charge. Bistable displays, which consume just tiny sips of power, are especially promising in this endeavor.

Dozens of novel display technologies just over the horizon hold out the prospect of higher-quality and lower-cost displays. For example, research is well under way toward "printing" displays with ink jets or with thermal transfer techniques. And exotic materials such as carbon nanotubes may be used to create wafer-thin CRTs.

But you don't need to wait for "maybe someday" to take advantage of hot new technologies. Currently available displays and projectors keep improving, offering better images at constantly falling prices. On the following pages, we explain the most exciting developments in five technologies that are already starting to show up in products you can buy now.

LCD: A Faster Flat-Panel

Flat-panel LCD TVs are all the rage, owing to their sleek, handsome designs, but it turns out they're not ideal for watching moving images. That's because the liquid crystal molecules in LCD panels move relatively slowly from one orientation to another. As a result, video or games played on an LCD can look smeared. You're actually better off with a CRT for those things, because the response of the phosphors to the electron beam in a CRT is nearly instantaneous. But continual improvements to the responsiveness of liquid crystal are helping speed up the on-screen action.

Liquid crystals have the special ability to twist light waves. A typical LCD uses a polarizing layer between the liquid crystal layer and the backlight to screen out all light waves except those oriented in a single plane. Another

polarizing layer in front of the panel transmits only the light waves oriented in a different plane. In between, the liquid crystals either let the light pass through untwisted or twist the light so that the plane of the waves matches that of the second filter. This allows the light to be transmitted or blocked on demand.

An LCD panel may take an average of 16 to 25 milliseconds to change from white to black and back to white again. And these are the best-case measurements; changing from one shade of gray to another can take three to four times as long as that. This isn't a serious issue for images that don't move, such as word processing documents or spreadsheets, but a slow response time can be a problem when the LCD is used as a television.

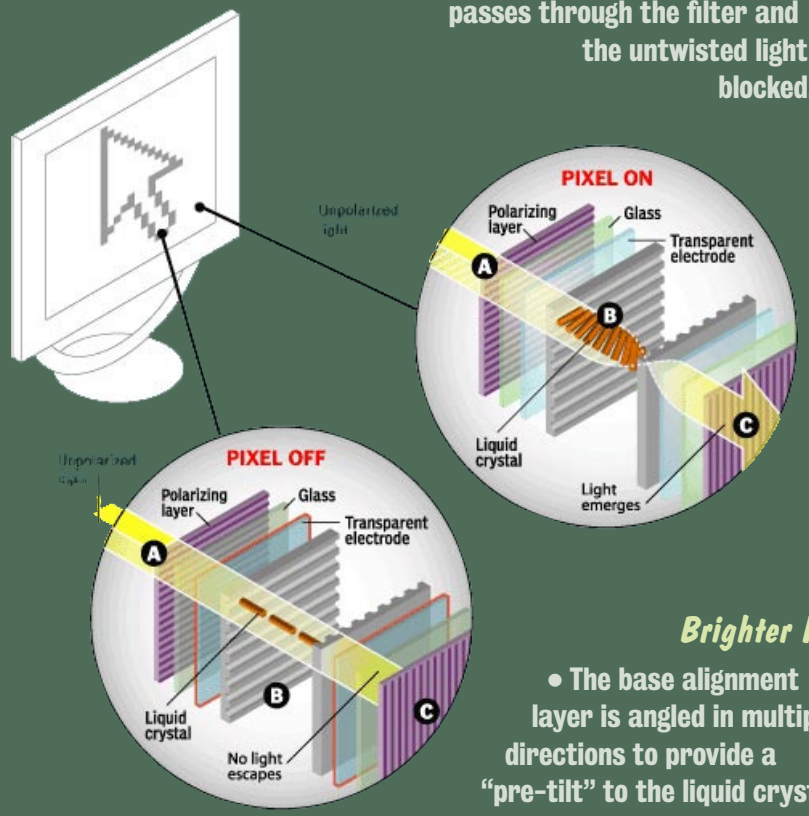
One promising solution tricks a cell into changing more rapidly by giving it an initial charge greater than what it needs to achieve the correct shade of gray. This technology is often called overdrive or feed-forward. Taiwan-based AU Optronics has developed another solution, known as Intrinsic Property technology, that enables liquid crystals to move faster.

Another problem with LCDs is that image brightness and colors can change as your viewing angle changes. CRTs have a distinct advantage here, because they emit light from the surface of the screen, sending out light in all directions. Liquid crystal molecules are rod-shaped, however, so when they are aligned with each other, the image may look distorted if not viewed straight on. (Think of being able to see through window blinds only when you're at the correct angle.)

One solution, referred to as multidomain, is to divide

How LCDs Work

An LCD works by selectively blocking light. A polarizing layer (A) filters the backlight so that light in only one plane reaches the liquid crystal layer (B). The liquid crystal material can twist or stay straight, depending on whether a charge is applied to the given cell (the smallest area of the display that can be individually controlled). This in turn determines whether the light will pass through a second polarizing filter (C). In this example, the twisted light passes through the filter and the untwisted light is blocked.



Brighter Ideas

- The base alignment layer is angled in multiple directions to provide a "pre-tilt" to the liquid crystal molecules, increasing the range of viewing angles.
- Liquid crystal cells have become faster in response, either from improved liquid crystal materials or from improved driving circuitry that increases the electrical charge used to switch the cells.

each liquid crystal cell into multiple regions and build microscopic structures that cause the molecules to tilt in different directions. Although the individual areas still look different if you change the viewing angle, the average light from each cell has the correct brightness and hue from a wider range of viewing angles.

LCOS: Now Showing on TV

One way to coax liquid crystals into responding fast enough for moving images is to make them on silicon wafers. But this would be prohibitively expensive for a notebook-size screen, and a tiny display measuring just an inch diagonally would be too small to view directly. When magnified, though, the tiny display can create a much larger image. And here is where liquid crystal on silicon (or LCOS, pronounced "el-koss") comes in.

Manufacturing thin liquid crystals requires the individual cells to be extremely small, but this presents new problems. In order to get fast and accurate response from the cells in a high-resolution device, an LCD must have an active-matrix backplane. This means there must be at least one transistor behind every subpixel. For a display with 1,024 by 768 pixels, with red, green, and blue subpixels, this amounts to at least 2,359,296 transistors.

Most direct-view LCD panels– those in notebooks and desktop monitors– use inefficient but inexpensive amorphous silicon backplanes that are well suited for large displays. Unfortunately, amorphous silicon is limited in how close together transistors can be placed. LCOS displays are created on more efficient pure silicon crystal wafers, allowing transistors to be much smaller and closer together.

The larger transistors on amorphous silicon block some light from being emitted, which limits the density of pixel placement; this in turn limits resolution. The portion of each pixel that can transmit light, expressed in terms of the aperture ratio, determines how bright the display can be. If you make an LCD using a silicon crystal wafer, transistors become much smaller. This makes for thinner liquid crystal cells, which react more rapidly to changes in electric current.

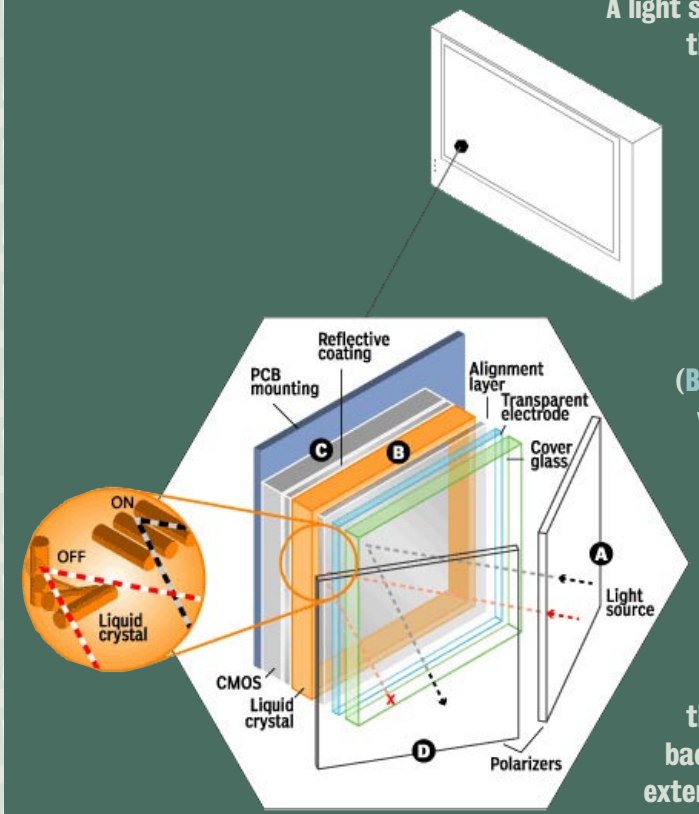
That's exactly what's happening in rear-projection televisions (***RPTVs***), a market in which LCOS is starting to compete effectively with DLP. Unlike most LCD panels, LCOS panels are reflective rather than transmissive. The active matrix of transistors is fabricated on the silicon crystal substrate, then covered by a thin reflective layer before the liquid crystal material is placed on top. This means that all the light striking the cell can be reflected without obstruction.

The biggest obstacle LCOS faces now is a lack of volume production. When the volume picks up, prices should go down. A few years ago, the panels cost about $600 apiece. Prices have fallen to about $200, but they will have to drop below $100 to make the prices of finished displays competitive with those of units based on other technologies.

Intel made a big splash at the Consumer Electronics Show in Las Vegas this January when it announced its commitment to manufacturing LCOS products. This step not only validates the technology but also could be a harbinger of higher-volume production in the near future.

How LCOS Displays Work

An LCOS chip puts the switching logic behind a reflective layer. The chip's tiny size makes the liquid crystal response time much faster than with a direct-view LCD panel, so it's well suited for projecting moving images.



A light source shines through an external polarizing layer (A) that blocks all light except waves oriented in one plane. The liquid crystal layer (B) twists some waves and lets others proceed unchanged to the reflective layer (C), depending on each pixel's charge; from there they bounce back to another external polarizing layer (D). Here the untwisted light passes through, and the twisted light is blocked.

Brighter Ideas

- Manufacturers have been able to improve production efficiency and increase volume, which has helped lower prices for the imaging chips.

OLED: The Thinnest of All

Think thin display and you probably think of an LCD panel. But an up-and-coming display technology that uses organic light-emitting diodes is actually much thinner than an LCD– even thin enough to be placed on a plastic film. Since each subpixel in an OLED is controlled individually, you get an image that's sharper than on a CRT and potentially of better quality than on an LCD. OLEDs are as responsive as CRTs, with no smearing from slow pixel response times.

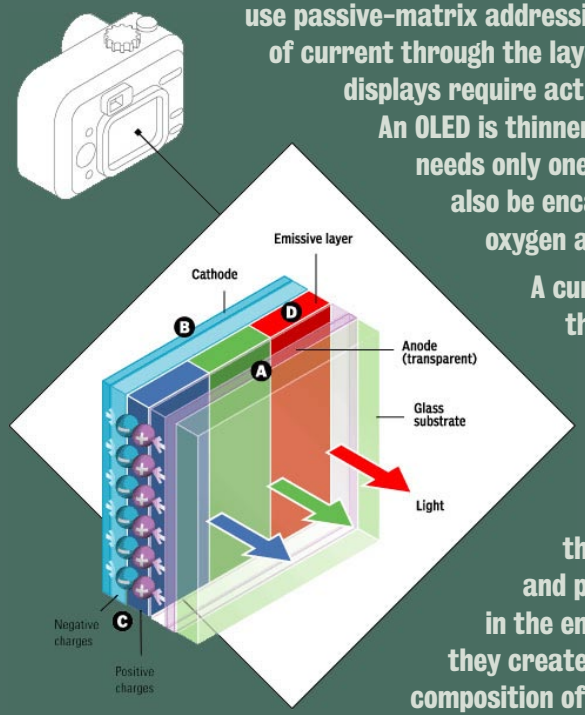
The inorganic cousin of the OLED is commonplace: LEDs are the glowing lights on most digital clocks. They emit a great deal of light using relatively little power, last much longer than incandescent bulbs, and are more rugged. An LED emits light from a seam between two layers of different materials, which is fine for small points of light but not for large displays. OLEDs emit light through the layers, so many can be fabricated next to each other for large displays.

High-resolution displays have been slow to emerge, but the Kodak EasyShare LS633 camera has a 2.2-inch OLED panel. This full-color, active-matrix OLED display is clearly superior to an LCD in terms of viewing angle and image quality under low-lighting conditions.

One of the problems with active-matrix OLEDs is that they require two transistors per subpixel. Until recently, only expensive polysilicon backplanes were used for OLED production, because of their greater electron mobility. But researchers have started creating OLED structures on cheaper amorphous silicon substrates. In fact, IDTech– a joint venture between Chi Mei Optoelectronics and IBM–

How OLEDs Work

OLEDs are thin devices that emit light when a current is passed through a sandwich of materials. Simple displays can use passive-matrix addressing to control the flow of current through the layers, but high-resolution displays require active-matrix substrates. An OLED is thinner than an LCD, because it needs only one substrate, but it must also be encapsulated to keep all oxygen and water vapor out.



A current is applied across the anode (A) and the cathode (B), causing negative charges to move from the cathode and positive charges to move from the anode (C). The negative and positive charges combine in the emissive layer, where they create light. The chemical composition of the emissive material determines the color of the emitted light.

Brighter Ideas

- Developers have improved the lifetime and color emission of the OLED materials. They have also succeeded in using amorphous silicon substrates with OLEDs, despite their lower electron mobility compared with more expensive polysilicon substrates.

has demonstrated a 20-inch full-color OLED panel on an amorphous silicon substrate.

Another problem is the lifetime of the OLED materials. In the display industry, lifetime is measured as the length of time it takes for the display to drop to one-half its initial brightness. Last year, red and green OLED materials had lifetimes of only 10,000 to 15,000 hours, but the big problem was that blue materials had lifetimes of less than 1,000 hours. This meant that the color of the panel would shift rapidly toward yellow as the blue materials dimmed.

Both corporate and academic research efforts have gone a long way toward improving the lifetimes of OLED materials. Red and green materials now last for 20,000 or more hours, though blue materials continue to lag behind. Many companies are making considerable investments in OLED research, and we can expect steady progress on these and other problems that must be resolved before large-scale OLED display production begins.

DLP: Wide-Screen Action

Texas Instruments has established a strong foothold in projection displays with its innovative technology Digital Light Processing (DLP). This technology, which uses tiny mirror chips, already dominates lightweight data projectors and is making inroads in the home entertainment market for both front- and rear-projection systems.

A DLP chip is built like a memory chip, using semiconductor components fabricated on a silicon substrate. On top of each bit storage device, however, is a microscopic square mirror, called a Digital Micro mirror

Device (DMD). The mirror is attached to a hinge, which lets it rock back and forth depending on whether a 0 or a 1 is stored at the transistor below it. Measuring about 1 inch diagonally or smaller, this kind of chip can have high resolutions: One model has 1,280 by 720 pixel resolution, suitable for wide-screen entertainment displays.

The mirrors can switch on and off as fast as several thousand times per second. Engineers have taken advantage of this rapid response time to develop full-color displays by combining a single imaging chip with a color wheel divided into red, green, and blue sections. The three different-colored images alternate so rapidly that the human brain combines them into a single full-color image.

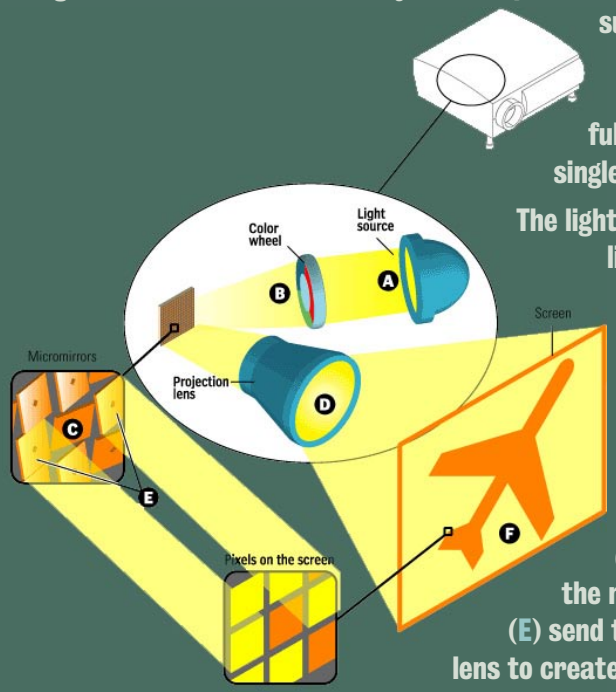
Filtering the source light so that only red, green, or blue light is transmitted means that at least two-thirds of the available light is blocked. This is a problem in projectors, where brightness is crucial. Engineers realized that by adding a clear segment to the wheel, they could shine white light on the imager to make white and light shades of color brighter.

Texas Instruments also developed the Sequential Color Recapture system, which uses a color wheel with spiral-shaped segments. Instead of being absorbed by the filter material, the unwanted light is reflected back into a rod-shaped integrator that reflects the light back toward the wheel. There, a portion of it strikes the segments of another color, and the recaptured light is passed through to the DLP imager.

In terms of reliability, this technology looks promising: The chips have been tested for more than 1 trillion cycles with no signs of hinge failure in the mirrors.

How DLP Works

DLP uses microscopic mirrors to deflect light toward or away from the projection optics. This micromechanical design can fit more than 1.3 million Digital Micro mirror Devices on a chip with just a 0.9-inch diagonal. The mirrors' extremely fast response time makes DLP well suited for entertainment displays. Many projectors produce full-color images using single DLP panels.



The light source (A) directs light through a rapidly rotating color wheel (B) toward the chip. In this example, the middle mirror (C) reflects the light away from the lens (D), creating a dark pixel on the screen, while the mirrors on either side (E) send the light through the lens to create bright pixels on the screen (F). The mirrors move so rapidly that the panel can display the red image, then the green, then the blue, in sync with the colored light coming from the color wheel. These images are created in sequence so quickly that the observer's brain recombines them into a single full-color image.

Brighter Ideas

- DLP chips are being made with increasingly high resolutions and with wide aspect ratios for home entertainment displays.
- The color wheel in single-chip displays has been improved with a color recovery system that increases brightness and a color drum design that results in a smaller and quieter projector.

Bistable: Ideal for Mobility

The most exotic of all display technologies is the bistable display, which has the uncanny ability to retain on-screen images even after the power has been turned off. As the term bistable implies, the picture elements are stable in two (or more) states. The display needs power only when the content changes. Unlike the other display technologies we've covered, bistable displays can use more than one technique to achieve this goal.

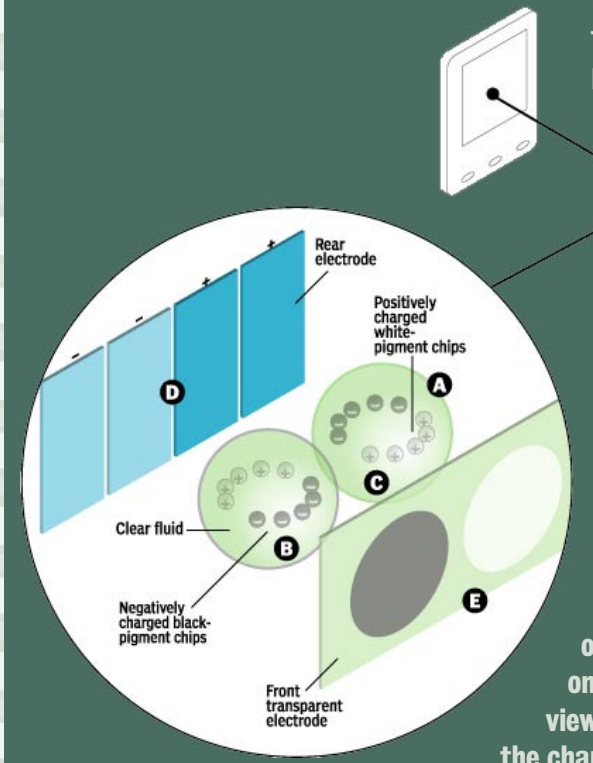
The power efficiency that a bistable display can bring to a PDA is significant, since you often need to display the same information you saw the last time you looked at your PDA's screen. Research by Motorola has shown that a battery can last over 600 times as long on a device with a bistable display as on one with a regular LCD.

For now, bistable displays are mostly limited to use as retail store signage, but that's an excellent start. Store management can change the prices on different products automatically, without requiring staff to go around and change all the shelf-price signs by hand. As costs decrease, we expect to see similar displays in a broader range of applications.

Several companies have developed bistable displays that work differently. E Ink has partnered with Philips to create a display that uses electrostatic charges on tiny spheres suspended in a plane. One side of each sphere is black, the other is white, and each side is attracted to an opposite electrical charge. When a charge is placed across the front and back layers of the panel, the spheres respond. Run the charge one way and the white sides show; run it the other

How Bistable Displays Work

Bistable display technology is one of the newest technologies to become commercially available. There are a number of different approaches, but they all share the ability to retain an image even when the power to the display has been turned off. This makes them especially useful for portable, battery-powered devices where the information on the display changes relatively infrequently.



E Ink uses microscopic electrophoretic particles encapsulated in tiny spheres (A). These particles respond to the application of a charge across a cell: Negatively charged black particles (B) or positively charged white ones (C) are drawn to the viewing surface, depending on the charge between the electrodes (D and E). They stay in position when the charge is eliminated, resulting in a display that retains its image with the power turned off.

Brighter Ideas

- A variety of other bistable display technologies are being developed. At press time, Sony just announced an e-book reader, Libri'e, that will use a Philips electronic ink display.

way and the black sides show. Turn off the power and the spheres stay in their current orientation.

Philips has started up a subsidiary, Polymer Vision, which creates bistable displays using E Ink technology on active-matrix plastic substrates. E Ink displays is used in a new Sony e-book product that shipped in Japan this April.

A different route to bistable displays comes from the French company Nemoptic, which has developed an approach using standard liquid crystal material. This material normally loses its image when the electrical charge is removed. The company has developed a way to break the alignment bond of the bottom layer of the liquid crystal substrate, so that it can come to rest in its alternative state. Nemoptic has licensed the technology to Picvue in Taiwan, where mass production for an e-book began last year.

Building an HD Home Theater PC

ExtremeTech

PC Magazine

The early 21st century has increasingly become the era of digital media. While the word "convergence" has come to elicit yawns among the technologically savvy, the fact is that the world of the personal computer and the world of consumer electronics is actively colliding like two massive galaxies – partly passing through each other, but also creating cataclysmic intersections that have far reaching consequences.

We've seen consumer devices, such as the Integra digital music server we reviewed back in March, use a PC-like architecture and embedded Linux. We've seen HP and others ship PCs based on Windows XP Media Center Edition designed to bring the PC into the living room or family room.

More consumer devices are also getting built-in networking, such as the Onkyo TX-NR900 THX-select AV receiver with its built-in Ethernet port. This enables it to act as a digital music playback client. The increasing pervasiveness of wireless networking has tempted users and manufacturers to create wireless media servers or clients without the need for expensive home rewiring. Devices such as the Gateway Connected DVD player epitomize this crossover. It's a DVD player that acts as a digital media playback client and is sold by Gateway, a tier one PC manufacturer. Other PC companies are stepping into the consumer electronics fray, some wholeheartedly, such as Hewlett-Packard, and some in small steps, like Dell.

For the do-it-yourself crowd, the answer has been the various flavors of home theater PC. The HTPC, as it's commonly called, can act as a high end DVD player, repository for digital media and, as we'll see shortly, a PVR for HDTV.

The HTPC Dilemma

We've touched on building home theater PCs in the past, in this two part series and in later articles on building a PC-based PVR (Roll Your Own "TiVO" and Extreme Personal Video Recorder). In fact, we've generally been a fan of home theater PCs.

In the past, the reasons have been pretty straightforward. For DVD playback, a PC with a good graphics card can be an excellent substitute for a DVD player / high end video scaler combination. If you embed a TV tuner, you add PVR functionality, allowing you to time-shift your TV viewing. The HTPC can also act as a media repository, storing digital music files, digital photographs and captured TV content.

Recently, several HDTV tuner cards have become commonly available for the PC as well. This opens up a new realm of possibility, as you can theoretically record HD content to the PC in all its high definition glory. Currently, only one high definition PVR exists on the market, the Zenith HDR-230, but reviews have been mixed. The HDR-230 has a puny 80GB hard drive, limiting the amount of HD content you can actually save, and there's no built-in, TIVO-like buffering, so you can't auto-rewind or pause live TV.

So we naturally thought that building in an HDTV tuner card into our home theater PC would be a good idea. In practice, it turned out to be less than perfect. But before we dive into specifics, let's take a look at our components.

Gathering PC Gear

We assumed that most users would want to integrate their home theater PC into their home theater. This isn't always the case. Someone in a studio apartment or dorm room might simply want the PC to be the main media hub, with high end PC speakers handling audio chores. In our case, though, we wanted to integrate the system into a **mainstream home theater**.

An increasing variety of cases exist for this purpose. We had been pining for the **Antec Fusion** but alas, Antec never shipped the product. Coolermaster is another case we've used, and the ATC-620 now accepts a full-sized ATX motherboard. However, for this particular iteration of our HTPC, we chose the **D.Vine 4 from Ahanix**. Although bulky, it looks much like a piece of gear someone would integrate into a midrange or high end home theater rack. As we found out later, looks are only skin deep – more on that in a bit. We picked the black version, to match our current Onkyo TX-NR900 AV receiver.

After we settled on appearances, helpful in the critical "spousal acceptance" arena, we looked at the processor and motherboard. We picked up a **2.4C GHz Pentium 4** processor, which supports Hyper-Threading and the 800MHz frontside bus. The companion motherboard is the **Intel D865GLC**, though we eschewed the integrated Intel graphics for an AGP-based solution. The D865GLC is actually a micro-ATX motherboard, with one AGP slot and three PCI slots. Our alternative choice was going to be the Abit IC7-MAX3 board, but we weren't able to get hold of one in time. Rounding out the core PC was a pair of **Kingston HyperX** 256MB PC3200 modules, for 512MB total. The Ahanix case has no provision for a floppy drive, so we left that out.

We also used an **ATI Radeon 9800 Pro** 128MB graphics card. This card is probably overkill, and a Radeon 9600 Pro might be a better balanced solution. ATI's Radeon line in general has become the darling of the Home Theater PC set, at least if you follow the **AVS Forums Home Theater PC section**.

For audio functionality, we used a **Creative Labs Audigy2 Platinum SE**. The Audigy2 supports DVD-Audio playback, as well as being a robust audio card for amateur music creation and PC gaming. The external breakout box is relatively compact, and can sit alongside the case. It works better than the standard Platinum, as the internal breakout box would have to be mounted behind the flip down door on the case.

Note that you don't need a sound card at all if all you want to do is use the HDTV card to output a DTV signal to your home theater AV setup. The card we used has a digital audio output, which will send a digital bitstream to your AV receiver or preamp/controller to be decoded.

The storage chores were handled by a Maxtor DiamondMax Plus 9 200GB, 7200RPM IDE drive. Maxtor's firmware tends to be tuned for throughput over random access, which we figured would be ideal for recording HD video content. We also added a Samsung SM-352 52x/24x/52x combo DVD-ROM / CD-RW drive. We weren't planning on doing any DVD recording on this unit, but if we were, we've like what we've seen in the Pioneer DVD-A06 multiformat recorder.

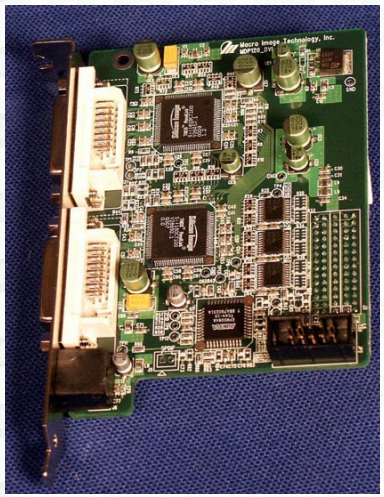
Noise is a big concern for any home theater PC integrated into an AV rack. We had a couple of interesting power supplies on hand. The first was a Zalman ZM300A-APF power supply. Zalman builds in some beefy internal heatsinks to facilitate cooling. The alternative is a Seasonic Super Tornado 300W power supply. The Super Tornado, despite its somewhat inappropriate name, proved to be somewhat quieter. A Vantec Aeroflow cooling fan took care of cooling the CPU.

Finally, we used a Logitech Cordless MX Duo for our input. The keyboard, in particular, is well-suited for a media center style PC. Although we like the Logitech MX700 mouse a lot, we also experimented with the Microsoft Bluetooth mouse, which worked quite well, and seemed to have a greater range than the Logitech's 27MHz radio. Another wireless pointing device that would be well-suited for a living room PC is the Gyration Ultra GT, reviewed by Robyn Peterson.

HDTV Enters the Picture

Once the main PC components were chosen, we needed a good HD tuner card. A few of them are out there, but one of the more popular and well-regarded cards is the MyHD 120 PCI HDTV card, available at online shops such as Digital Connection and Cinefx. Interestingly, the MyHD card uses an ATI NXT2002 demodulator chip. MyHD is manufactured by Korea-based Macro Image Technology.

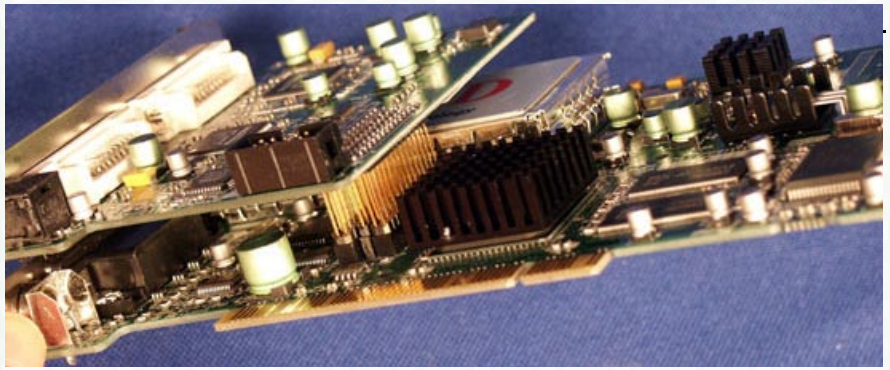
The MyHD 120 is capable of off-the-air reception of digital and analog TV signals. As such, it does require an antenna connection. We used a Terk TV55 HDTV antenna, which resembles a skinny cruise missile more than your typical TV antenna. The TV55 comes with mounting gear to simply attach the antenna to your house, underneath the eaves, if you don't want to go to the trouble of mounting it on a pole.



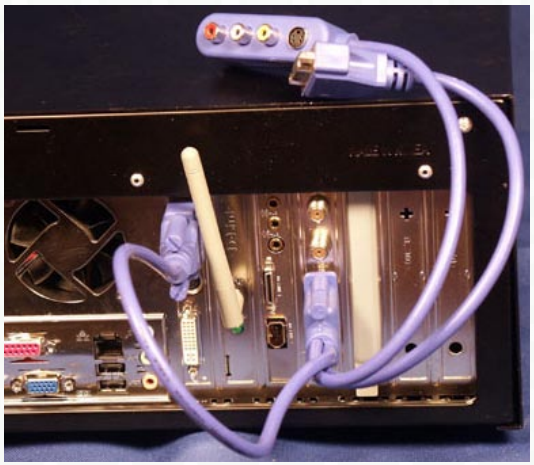
One of the cool aspects of the MyHD 120 is that it accepts an optional DVI daughtercard. We were quite interested in testing this on our DVI-equipped Samsung HDTV. The DVI daughtercard contains both

Silicon Image receiver and transmitter chips, allowing you to pass through a DVI signal from a DVI-equipped graphics card.

The DVI card attaches via a fairly lengthy, exposed pin array. You need to exercise extreme care in assembling the MyHD120 – DVI daughtercard pair, as it's quite easy to bend the pins.



Once installed in the PC, the affair takes up two slots. Since we were using a micro-ATX motherboard, we mounted the card in the third slot; the DVI daughtercard took up a PCI bracket that had no slot present. You either need two displays – one for the HDTV card and one for the graphics card – or you can use the pass-through cables supplied with the card. The DVI daughtercard ships with a 2 meter DVI cable, which you can connect directly to the DVI input on the display device, but you'll need a second DVI cable if you want to pass a DVI signal through from the PC's graphics hardware.



.The physical setup is surprisingly easy, even given the fragile nature of the DVI daughtercard. The breakout dongle is also one of the more compact types we've seen, even though it integrates a VGA pass-through (if you don't want to use DVI).

The MyHD 120 also ships with a compact remote, complete with tiny black text imprinted on the silver-grey shell. The small keys do offer fairly good tactile feedback, and the buttons are well laid-out. The choice of a serial port IR receiver instead of a more modern USB dongle seems like an odd choice for a device likely to go into current generation PCs, however.

Assembly Considerations

We've covered the process of assembling your own PC in ExtremeTech's How-To section, and all of the tips and techniques we've offered hold true for assembling the high definition PC. However, the Ahanix D.Vine case has some quirks you should be aware of.

First, it uses tiny screws throughout, so you need to take some care when using a screwdriver. Even the screws that mount PCI cards are extra small.

You should also take some care in installing the optical and hard drives into the drive bays. Small metal moldings actually protrude from the case front into the area where the hard drive bay mounts. If you mount the hard drive flush with the front of the bay – something that seems like an obvious thing to do – you won't actually be able to mount the hard drive. Worse, you can't see the cause of the problem. All you need do is mount the drive so that the front is a couple of millimeters back from the bay edge.

The door that covers the DVD drive area seems solid, but the mounting gear – particularly the hinge – is somewhat flimsy and jams quite easily. We've heard reports of people breaking the hinge by trying to jiggle the door back into place. The front window is an interesting location to mount an IR receiver, should you have one that can be mounted internally.

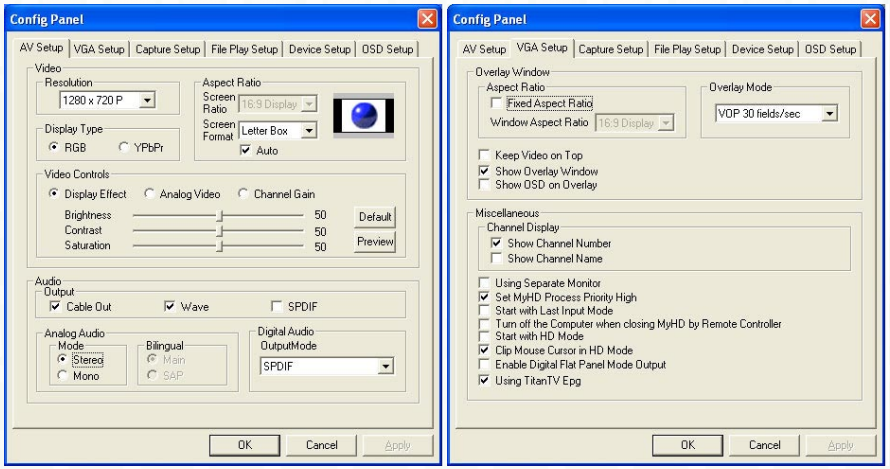
Perhaps most annoying is that the case doesn't have a full complement of ATX motherboard mount points. Ahanix seems to have assumed you'd always be using a full-size ATX board, and the center row of micro-ATX mount points are missing.

In the end, the Ahanix D.Vine 4 is really a basic, desktop PC case with some interesting cosmetic features. It's very much a sheep in wolf's clothing, which is really unfortunate. So we're still looking for something that's as elegant as the Antec Sonata.

When you set up the hardware, you need to allow for fairly substantial cable clutter behind the PC. This is especially true with all the cordless keyboard and mice – you'll need room for the base station receivers.

Using MyHD

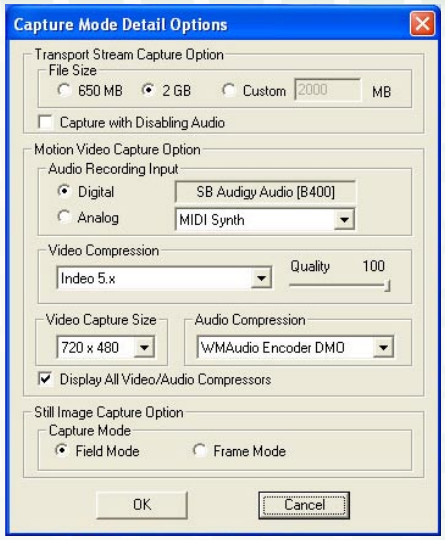
The MyHD HDTV card represents everything that's both right and wrong with the PC as a home theater device. The MyHD 120 offers a great deal of flexibility, like many PC devices, but gets tripped up by it. For example, the user interface for setting up the card seems to be a relatively poor clone of ATI's pre-8.5 software. The screens are cluttered, and the designer seems to have assumed that the user would understand all that nifty DTV jargon.



For example, there are two different screens for the display – one for "AV setup" and the other for "VGA setup". However, the AV setup is where the resolution of your output device is set. The VGA setup screen defines how you want the MyHD playback window to appear on your monitor. Confused yet?

If you're not confused, or if you assume that you'll really only use these preferences screens once anyway, then the capture setup screen may cause your to brain lock up hard. There are endless sets of options and no real guide as to which is best. Further, there seems to be no option

for capturing at full 720P or 1080i resolutions; the best offered is 720 x 480, or enhanced DTV resolution. You can, however, set file sizes to greater than 2GB, which is a good thing – capture files can grow huge pretty quickly.



HD Capture Considerations

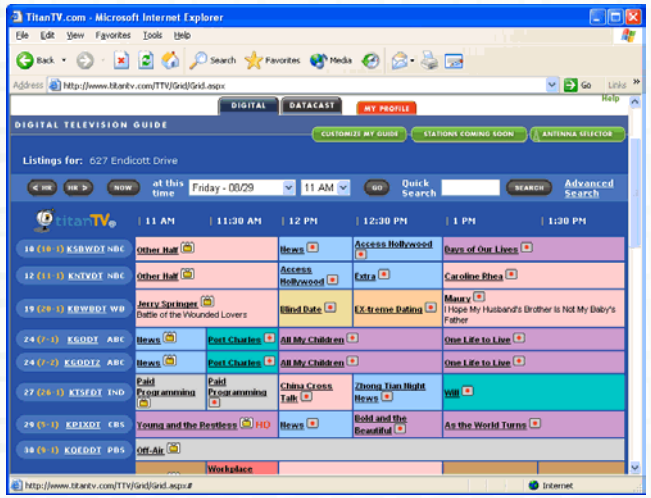
The primary reason for using a PCI HDTV card is for time-shifting your HDTV viewing (PVR functionality) and archiving your favorite high definition shows. Secondarily, you can use the MyHD 120 to capture analog TV as well. If you use an IR blaster solution, you can even capture from a digital cable or satellite TV box, but that will be analog only.

The native capture format for HDTV signals is an HDTV transport stream, and has the file suffix '.tp'. The transport stream contains both the digital video and audio signals, which then need to be demultiplexed for playback.

You can play back .TP files in the MyHD player software, which resembles most TV tuner card software on the surface.

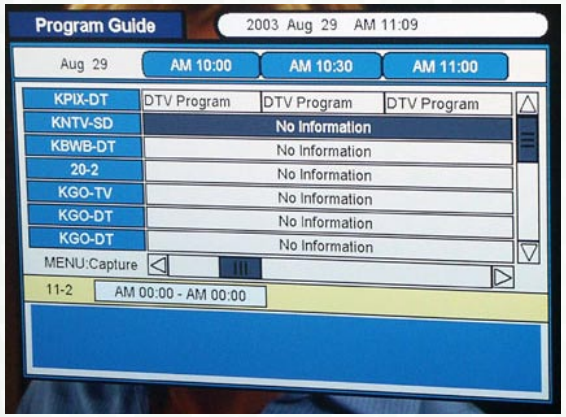
It's also possible to play back a .tp file in some DVD player software, such as WinDVD 5.0. You can perform analog capture to an AVI file that can be played back in Windows Media Player. Perhaps the single most confusing aspect of all this is to properly set up the video and audio codecs so that you use codecs that actually exist on your system. Otherwise, you may get audio, but no video or vice versa. Much depends on your sound hardware and the video codecs installed.

What about scheduling playback? MyHD uses TitanTV as its primary TV guide. The good news is that MyHD is well-integrated with TitanTV, and you can set up one-click recording of shows.



If you use the option to download up to eight days of guide information to your local PC, you can also use the guide software within MyHD 120's on-screen display (OSD) when in full screen, HD mode.

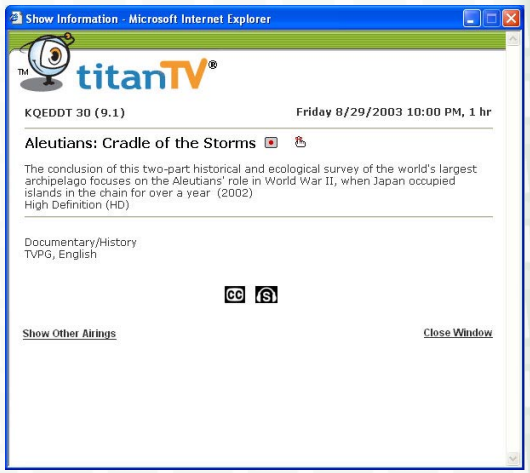
The bad news is that you need to first set up a favorite show list within TitanTV before you can download the information, but this is a one-time task. TitanTV's user interface is more streamlined since the last time we took a look at it nearly a year ago. The pop-up screens for scheduling are easy to understand, once you get used to the fairly tiny icons.

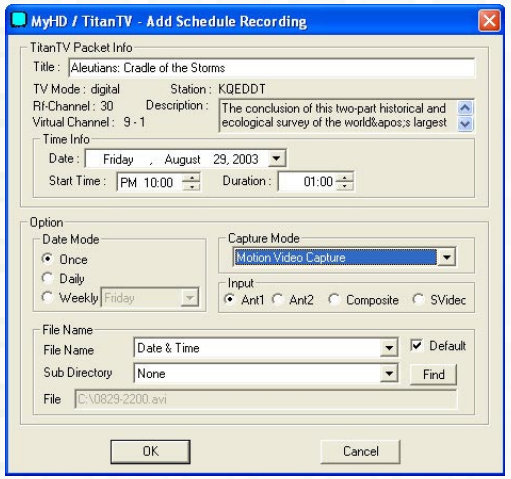


The downside is that when you schedule a show, you end up inside a MyHD scheduling dialog, which looks completely different than the cleaner TitanTV interface.

Once you get used to the system, recording shows is a straightforward process. What's not straightforward is what occurs afterwards.

The first thing you encounter is an unfortunate bug in MyHD that will sometimes cause it to lock up during recording if you have a Hyper-Threaded CPU and have Hyper-Threading enabled. This affects many current generation Pentium 4 systems. The second problem you encounter occurs during playback. Playing back transport stream files we recorded was an iffy process. Sometimes we'd get a black screen within the MyHD player, although the time indicator would be moving. Sometimes we'd get video, but no audio. Sometimes the system would lock up hard. Note that we were using the 1.61 software, so it wasn't an issue of running an old revision. Macro Image Technology has





been releasing software updates at a steady pace, but we certainly haven't been encouraged by the lack of stability in the record and playback software.

HDTV Viewing Considerations

The MyHD 120 card worked quite well as an HDTV source, but viewing perfection was still somewhat elusive. Initially, we used the DVI daughtercard, but the DVI connection on the Samsung DLP TV fed oddball information to the PC system as to its capabilities. The upshot was that if you want to use DVI, you'll need to download a utility such as **Powerstrip** in order to tweak your monitor timings. It's a labor-intensive effort, but you'll eventually be rewarded by a great looking picture.

If you have a 1080i (but not 720p) capable TV, the users over at AVSForum have put a substantial amount of effort into **setting up 1080i timings for powerstrip**. However, for owners of Samsung TVs who simply want to plug and go, there's an easier solution.

Use the Samsung's VGA input.

It may seem like a step backward to use an analog connection to view digital television that's running on a PC, but this worked "out-of-the-box" for us. The one thing we did need to do was to use Powerstrip to allow for 1280 x

720 resolution on ATI hardware. The Catalyst 3.6 drivers we tested didn't have a built-in setting for 1280 x 720. Alternatively, you can use Rage3D Tweak, which is a bit simpler to use than Powerstrip. If you're using an Nvidia graphics card, then you'll get 1280 x 720 as an available resolution in the last few driver releases.

In either case, viewing HDTV content was stunning. We caught a Tory Amos concert on the local PBS feed, and the image quality was amazing when compared to standard TV.

Is It Worth It?

If you're an inveterate tweaker who likes fiddling with your AV and PC setup, then the answer is a qualified yes. We say "qualified" because we're not happy with the buggy nature of the MyHD record function. You get the other benefits of a home theater PC, including upscaling of DVD movies, playing PC games on the big screen, archiving your digital music files, viewing digital photos, and surfing the web from your couch if you have an Internet connection.

For users who simply want an HD PVR that works "out of the box", the answer is a resounding "no". Even if you're comfortable building your own system, the effort required isn't worth the reward and the frustration level is pretty high. This is particularly true if you're not interested in other potential uses for a PC in the living room. You either need to wait for more robust HD-PVR solutions that will be coming late this year or early 2004, or settle for the currently available Zenith unit.

We were ultimately disappointed with the MyHD 120, which does show a lot of promise. The core of a great off-the-air HDTV recording solution exists. The hardware works well, and image quality was excellent, even with relatively weak signals in the 40-50% range. But the company really needs to work out the bugs in the recording software before we can recommend this as a good solution for recording or time-shifted viewing of HDTV content.

Product: *Ahanix D.Vine 4 HTPC Case*

Price: $199 street

Pro: Attractive appearance

Con: Internal ergonomics are minimal; really just a stock desktop case with a pretty face

Summary: The D.Vine 4 is a basic desktop PC case with an attractive outer skin. The inside is minimal, and somewhat difficult to work with.

Score: 6 (1–10)

Product: *MyHD 120 PCI HDTV Card*

Price: $289 street

Pro: Works well with relatively low signal strength; good flexibility; superb image quality

Con: Recording software very buggy; clunky interface; must use TitanTV for time-shifted viewing

Summary: The MyHD 120 is good hardware marred by buggy software that's also not easy to use. When it works, it works well, but the experience can be frustrating.

Score: 6 (1–10)

Product: *Seasonic Super Tornado 300W Power Supply*

Price: $65 street

Pro: Quiet; runs cool

Con: Still not completely silent

Summary: This is a solidly built, quiet power supply that's reasonably priced. Seasonic also makes a 400W model for people who need more power.

Score: 8 (1–10)

Other Hardware Used: Motherboard: *Intel D865GLC*; CPU: *Pentium 4 2.4 GHz*; Video Card: *ATI Radeon 9800 Pro*; Hard Drive: *Maxtor DiamondMax Plus 9 200GB ATA133*; DVD/CD-RW Drive: *Samsung SM-352 52x/24x/52x*; Memory: *Kingston HyperX PC3200*

ExtremeTech Rescinds Rating for ATI's HDTV "Blunder"

Our June review of ATI's HDTV Wonder add-in card, designed to allow viewing, pausing and recording over-the-air HDTV signals was cautiously positive. We called the overall product a "solid offering," and despite a top 10 list of improvements needed, our final judgment was that this product was a "good first generation OTA HDTV offering."

With Dish Network and DirecTV and TiVo's HDTV DVRs costing a $1,000, we saw the $200 add-in-board as a fascinating bridge to time-shifting HDTV for the rest of us. However, based on our experiences over the past week with the shipping version of the HDTV Wonder, and supplemented by user experiences chronicled on AVS Forum and Rage 3D that mirror our results, we cannot recommend the HDTV Wonder at this time. In fact, the product is now widely referred to as the HDTV "Blunder" by users on both forums. Even though we gave it a good rating of 7 out of 10, based on subsequent testing, we've lowered that to a 5. Here's why, from editor-in-chief Jim Louderback's first-hand experiences.

About two weeks ago, the much-anticipated HDTV Wonder card showed up at my door. I'd been dying to build a Home Theater PC around the card—in part because I'm too cheap to add a $1,000 TiVo HD unit to my three regular TiVos– I set out to build a killer home theater PC. Designed around an Opteron FX CPU, ASUS motherboard, oodles of disk and RAM, and an ASUS 9800XT, with the HDTV Wonder as the crowning touch, I was sure I'd be ready to pause and time-shift all the important football games due up in early September.

Building the unit itself was fairly straightforward– despite my inability to find a heat-sink to mate with the odd processor. But the real problems started once I dropped the HDTV Wonder into the system.

Things seemed okay at first. The card appeared to work fine out of the gate, picking up the local HDNet broadcast on San Francisco's KRON channel. The other network HD offerings delivered well over 80% signal strength, using ATI's own software.

And in fact I already knew over-the-air signals would work fine here at home. I've had a Samsung T-160 HDTV /DirecTV receiver for months, and I can receive most of the local channels with ease. Perhaps because I have line-of-sight, over the Pacific Ocean, to the broadcast towers.

But once I started actually trying to watch TV, things got dicey. Only about a quarter of a screen's worth of the local ABC affiliate, KGO, displayed when I switched to that channel. And that was on a good day. More regularly I'd switch to the channel and nothing would come up at all—while the freeze-frame of the prior channel displayed.

I was understandably upset. As a football fan, I was eagerly anticipating time-shifting Monday Night football. Alas, that was not to be.

As I dove into the hardware, more problems resulted. Even on channels that came in fine, there was so much freeze-frame stuttering as to make the video unwatchable. ATI uses an obscure data store on a PC's hard drive—called the library—to store recorded and time-shifted program material. My library rapidly filled up with hundreds of entries, none of which could be deleted. Even if the

programs I'd selected to record had been watchable, it was nigh on impossible to find them.

But the frustrating inability for the system to tune into the key ABC and CBS stations were what really frustrated me. PBS came in just fine, but these two local channels—with the bulk of NFL coverage—came in haltingly if at all.

Even recorded material from PBS looked terrible on my 42" plasma. I eventually figured out how (after painstakingly searching through all the myriad setup screens) to display full-screen HDTV content live on my wide-screen set in full-screen mode. I never did figure out how to do the same with recorded material. ATI's playback function naturally assumed that my 1024 x 768 plasma was a 4:3 screen, and letterboxed the material. The applet was woefully unprepared for the concept of rectangular pixels.

After spending pretty much every night for a week uninstalling, reinstalling and tweaking drivers, I'd had enough. I even went and purchased a $50 bow tie HDTV antenna—perhaps the bundled indoor antenna and tuner simply sucked. But even that did no good. What with the stuttering, inability to tune in key stations and odd software quirks, I'd concluded that this product was just not ready for prime-time.

As a last resort, I clicked over to the awesome AVS Forum, where I've uncovered great help, tips and advice in the past. Obviously I should have stopped by sooner, because the assembled masses had all uncovered the same problems I had, and even figured out workarounds for many of them. Here's what I learned there.

- **Can't See ABC TV:** Turns out that the HDTV Wonder has trouble with certain 720p transmissions. Although some work, others cannot be interpreted by the hardware or the software. A number of California Bay Area early adopters ran into the same problem, and one expert even uncovered a fix. Jump from a 720p station that can be recognized, like the local Fox channel, directly to the unintelligible one, and for some reason it actually works. A kludge, but a successful one. The Fox fix may not work for long, though. A number of users have run into reception problems with Fox channels that have upgraded to a new delivery capability—which should be implemented at all Fox outlets by early September. So my fix may be temporary at best.

- **Stuttering playback:** This one was widespread. For many users, who attempted to add a "Blunder" card to system using nVidia chipsets, or non-ATI DirectX9 cards, the choices were grim. Using the original drivers worked in some cases, others were hopeless—only substituting an ATI 9600 card seemed to fix the problems. Mine seemed to be a bit more prosaic, as my graphics card—the 9800XT—was as ATI vanilla as they come. One suggestion on the boards—allocating a dedicated IRQ to the card– solved the problem. Once I determined the problem, fixing it was fairly easy. My ASUS SK8V had assigned interrupt 18 to both the internal Promise RAID controller and the "Blunder." Since I wasn't' using RAID, simply disabling the feature in the BIOS fixed the stuttering problem.

- **Inability to Delete Recorded Material:** Eventually my 160GB hard drive will fill up with time-shifted and buffered HD material. And there's nothing I can do about it. None of the entries in ATI's TV storage area, called the library, can be deleted. This is a more obscure problem. I ran into only one other user on the AVS Forum site that had the same issue—and others parroted ATI's suggestion to me that I simply right-click and delete. That might work for them, but it sure doesn't work on my system (nor on at least on other person's PC). No fix here yet.

Reading through the forums uncovered a wide range of other problems, incompatibilities and other issues. Many other users, like me, spent the better part of a week or more trying to get this frustrating product working right. Some users found that adding an older ATI DirectX 9 card, like the 9600, solved the problems. Others found that they needed to rollback their Catalyst graphics card or nForce motherboard drivers to an earlier version for everything to work. Still others found that the "Blunder" would work in their Intel-based systems, but not in the AMD models.

As for me, now that I've put in a beefy antenna, tweaked the BIOS, and arranged the channels to progress from viewable to confusable, things seem almost OK. I still can't play back material on my plasma in native resolution, and eventually my hard drive will fill up with video that cannot be deleted—but at least tomorrow's football game should be recorded accurately.

Note: It did record correctly, but due to a Fox HDTV problem, only the first quarter was actually broadcast in HD– more issues in HDTV land than just balky hardware, apparently.

Still, even for us tweakers, no product should require 20 hours, innumerable software reloads and regular visits to forums to get working correctly. And to ATI's credit, they did release new drivers last week that fixed many of the egregious problems—although none of my particular issues.

But the upshot is: ATI released a product that was not ready for prime time. They failed to test it on many of the common platforms, including nForce and other AMD-based systems, and with non-ATI graphics cards. They also failed to test it with the wide-range of HDTV signals being broadcast across the US, which also led to big problems.

Jim's problems were certainly serious. We can't say for sure whether his AMD-based platform was the culprit. In our review, the original test system was a small form-factor Intel 865-based platform, and we didn't encounter these issues. We certainly found fault with the HDTV Wonder, including our top ten list of the things the product needed. But that, compounded with the additional problems we (and many others) have uncovered has compelled us to lower the product's rating by two stars, to five out of ten.

In short, the HDTV Wonder has terrific potential. It's just nowhere close to production quality. And that's too bad, because the triangular boxes are peeking out from shelves across the country now, from Fry's to Best Buy and more. When ATI delivers a solidly working product, we'll let you know. Until then, we cannot highly recommend for the HDTV Wonder.

Buying Guide and Product Reviews

ExtremeTech®

PC Magazine

The HDTV tsunami continues to wash over the consumer electronics industry, and these big-picture machines are fast becoming everyday mainstream products. Last year's holiday season saw HDTV sales take off, and this year will likely continue that trend. So, if you missed the HDTV Express last year and have decided to get onboard this time around, we've got some general buying tips, as well as several HDTV recommendations to fit just about every budget.

We start off with a set of buying choices you should make before you ever set foot in an electronics store. Then we present quick review of the upsides and downsides of each HDTV display technology. This piece is an update to our original The ExtremeTech Guide to Buying HDTV, which you should check out if you'd like a deeper primer on HDTV technology.

If you've decided this is the year your life goes HD, put the checkbook or credit card down for now and let us walk you through the following decisions:

1. **Consider your budget.** HDTVs have come down significantly in price, but they are still a substantial investment of several thousand dollars or more. You should set a hard price ceiling for yourself and resolve to stay under it. This price should include all your accessories like a stand, cabling, and hanging hardware if your HDTV is going to be wall-bound. You should also factor in the added cost of getting some kind of HDTV cable or satellite service, since it will likely necessitate a new receiver box.
2. **Consider how much room you have and whether you want to wall-mount your HDTV.** Where are you planning to deploy your HDTV? If it's in an entertainment center, get out the tape measure and figure out what your maximum dimensions are. You should allow at least an inch or two above the unit, since almost all HDTVs, irrespective of underlying technology, generate a fair amount of heat.
3. **Consider light– not from the HDTV, but from the room where it will live**. Think about whether the room gets a lot of sun during the day and whether you can easily control the room's ambient light.

Having answers to these questions will help guide your choice of display technology. Several technologies are available, including plasma, LCD flat-panel, rear-projection TV (RPTV), and CRT. Each has its unique set of trade-offs. The choice comes down to what looks best to your eyes, and no two viewers see exactly the same thing. But beware: Most HDTVs in stores are dialed up to showroom settings, so be sure to check the color and brightness before you buy. Here are some key points about each technology:

Direct-view CRTs

These deliver the best bang for the buck today. Some 26-inch widescreen units cost under $700, such as the Samsung TXP2675WH. A higher-end, 34-inch unit will cost about $2K, and should offer exceptional image quality. But that same unit will be over 24 inches deep and weigh close to 300 pounds.

CRT Rear Projection TVs

These can be exceptional deals, with some 42-inch units costing less than $1,000. However, if you want the image quality that CRTs can deliver, you'll need to spend closer to $2,000. They're also bulky and heavy. CRT rear projectors have three tubes, and burn-in can be an issue.

Plasma Display Panels (PDPs)

They can look gorgeous and offer the best image detail of non-CRT technologies in darkly lit scenes, but they aren't especially bright. Previous generations have had problems with image burn-in and relatively short life spans. Improvements in the technology have rendered burn-in much less of an issue than in the past, and panel lifetimes have been substantially extended, with current units offering up to 60,000 hours to half-brightness. Keep in mind that half-brightness now is as bright as the full brightness of earlier generations. Larger panels can get very expensive, with prices topping $10,000. The least expensive plasmas offering true high-definition resolution still cost $4,000 or more.

Top 10 Buying Tips

1. **Look for true high definition resolution—at least 1280 by 720 native or better.**
2. **Make sure the unit has DVI or HDMI digital inputs, and that the digital inputs support HDCP content protection.**
3. **Also make sure the HDTV has component video inputs. You'll want them for DVD playback.**
4. **The TV should have individual video settings (color, contrast, brightness, etc.) per input. Allowing custom labels per input is a plus.**
5. **If you want a unit with a built-in tuner, make sure that tuner is CableCard ready.**
6. **When budgeting for HDTV, budget for audio, too. If you don't already have 5.1 audio in your home, you will when you install your HDTV.**
7. **Take along a few DVDs you know well. In particular, take a movie along that has some dark scenes. Don't buy an HDTV unless the store lets you play your own content. Also, make sure the store feeds real HD content into the HDTV as well. Never buy a display until you can see content you know and like on it.**
8. **For units with moving parts (for example, color wheels), consider an extended warranty.**
9. **If the unit has discrete codes for remote control support, that's a big plus if you're using a universal remote.**
10. **If the HDTV needs occasional maintenance—projector bulbs needing replacing, for example—make sure that it's user-replaceable to avoid service call charges.**

Front Projectors: Size Does Matter

What do you do when you want a really big TV? You go with a ***front projector***, of course. The consumer electronics moniker for a projector that shines light onto the front of a screen, front projectors are similar to the ones most of us use when we have to show PowerPoint slides to a crowd. But manufacturers of home theater projectors add video processing electronics to their projectors in order to maximize video image quality. That's a pretty serious challenge if you're projecting onto a 100-inch screen or bigger.

Front projectors have typically been viewed as high-end products. The higher-resolution units can cost in excess of $12,000, and those with three DLP chips can run over $30,000. But an emerging generation of lower-cost, lower-resolution projectors makes front projection an option for a wider audience.

Imagine you don't want to spend a lot of money but simply want to watch movies. You don't have a lot of space, either. You can opt for a lower-cost projector, like the **Epson PowerLite Home 10+**, which retails for $1,299. Add an old white sheet and you have an instant portable movie theater.

If you want to step up a bit, consider the **InFocus ScreenPlay 5700**. Available for around $3,500, the ScreenPlay 5700 uses TI's Matterhorn chip, with a native resolution of 1,024 by 576. The unit does a great job of scaling HD content down and scaling movies up to its native 16:9 aspect ratio. Toss in excellent Faroudja deinterlacing circuitry, add a **Da-Lite InstaTheater** portable screen, and you have a home theater setup you can store in a closet.

In the past, if you wanted high-definition front projection, you would have had to take out a second mortgage. Now, however, a number of LCD projectors, such as the **Panasonic PT-AE700**, offer true 720p resolution at under $3,000. If you prefer DLP, the **Sharp DT-400** offers TI's HD2+ chip at 1,280 by 720 resolution and is priced at $4,495. With these projectors, you might want a more serious screen, like one of **Stewart Filmscreen's GrayHawk** models.

Also note that not all movies from a front projector need to be viewed in the dark. Sony recently introduced its dark-screen technology, which is a black screen that lets you view projected video in a room with ambient light. Sony has no current plans to bring this to market any time soon, however.

The trickiest part of front projection, though, is the installation, particularly if you want it to be a permanent fixture in your home theater. You'll need to spend some serious time running cable and mounting screens. Screen manufacturers offer a variety of options, including powered screens that fully retract into the ceiling. These will likely require professional installation. Once done, however, you'll have a truly large TV that makes a 63-inch plasma look tiny.

Recently reviewed and recommended:

Pioneer PureVision Elite PRO-1110HD

The Skinny: Expensive as all get-out, but the best looking display we've seen come through our HDTV test lab yet. If you can stomach the tab, the 1100HD provides a visual feast you can savor for years to come. Full Review.

Syntax Olevia LT30HV

The Skinny: A relative newcomer to the HDTV game, the Syntax Group's Olevia LCD panel delivered impressive performance that exceeds its $1,700 price-tag. If you're looking to dip your toes in the HDTV waters, the Olevia LT30HV will help you ease your way in. Full Review.

NEC 61XM3

The Skinny: If you can afford it, this display offers exceptional image quality in a thin form factor. If you crave a big high-definition display, but want the simplicity of a flat screen, be sure to check this out.

Sharp Aquos LC-37G4U

The Skinny: Sharp makes some of the best LCDs in the business, and the 37-inch LC is no exception. Expect to pay a bit more for the Aquos name, but this panel delivers very impressive performance for around $3,500. Full Review.

Samsung HL-P5063W

The Skinny: With a street price around $2,600, the HL-P5063W is a good value for a 50-inch rear projection HDTV. The chassis is still fairly compact so this set won't consume your entire living room. Just be sure to set the vertical viewing angle so that watching it straight on gives best results. Full Review.

Fujitsu Plasmavision SlimScreen P55XHA30WS

Click for Full Review

BOTTOM LINE: In the grand scheme of things, Fujitsu's 55-inch plasma display has a very good picture. A display this expensive should be brighter, though, with more user-friendly amenities like a better remote, more inputs, and a friendlier OSD.

PROS: Amazing picture uniformity. Great black levels. Sharp picture detail.

CONS: Brightness levels too low. Not enough inputs. Remote and OSD are too basic.

COMPANY: Fujitsu Computer Systems

SPEC DATA

Price: $11,999.00 List

Screen Size (Diagonal): 55 inches

Video Inputs: Component, Composite, DVI, RF, S-Video

PC Interfaces: Digital (DVI-D)

Native Resolution: 1366 x 768 pixels

Supported EDTV and HDTV Resolutions (HD Ready): 1080i

Built-in TV Tuner (Type): NTSC

Rated Maximum Viewing Angle: Horizontal: 160 degrees

Rated Contrast Ratio: 900:1

Individual Settings per Input: Yes

EDITOR RATING: ● ● ● 1/2

Panasonic Viera TH-50PX25U/P

Click for Full Review

BOTTOM LINE: This is one of the less expensive 50-inch plasma TVs, so we can forgive a few small issues, but it simply isn't bright enough for quality daytime viewing, and the lack of 720p support is simply inexcusable.

PROS: Built-in ATSC/QAM tuner, CableCard, SD card reader, and plenty of connections. Nice on-screen menu system. Truly excellent black levels.

CONS: Terrible full-bright levels. No 720p support.

COMPANY: Panasonic Matsushita Electric Corp. of America

SPEC DATA

Price: $7,999.00 List

Screen Size (Diagonal): 50 inches

Video Inputs: Component, Composite, HDMI, RF, S-Video

PC Interfaces: Analog VGA

Native Resolution: 1366 x 768 pixels

Supported EDTV and HDTV Resolutions (HD Ready): 1080i

Built-in TV Tuner (Type): CableCard

Rated Maximum Viewing Angle: Horizontal: 160 degrees

Rated Contrast Ratio: 3000:1

Individual Settings per Input: Yes

EDITOR RATING: ● ● 1/2

Pioneer Elite Pro-1110HD

Click for Full Review

BOTTOM LINE: Pioneer serves up a truly rich visual feast but only the truly rich can afford it. The $15,500 price may make you blanch, but the plasma's screen's picture quality will captivate your eyes and maybe make you deaf to the whimpering of your credit card. It doesn't win in the specs race, but it was our hands-down favorite for watching movies and HDTV.

PROS: Gorgeous picture quality, excellent connectivity.

CONS: Very expensive.

COMPANY: Pioneer Corp.

SPEC DATA

Price: $15,500.00 List

Screen Size (Diagonal): 50 inches

Video Inputs: Component, Composite, HDMI, 1394

PC Interfaces: Analog VGA

Native Resolution: 1280 x 768 pixels

Supported EDTV and HDTV Resolutions (HD Ready): 480p, 720p, 1080i

Built-in TV Tuner (Type): ATSC

Individual Settings per Input: Yes

EDITOR RATING: ● ● ● ● 1/2✓

Samsung LT-P468W

Click for Full Review

BOTTOM LINE: The largest LCD HDTV on the market right now, it's big and bright, and delivers very good image quality in brightly lit scenes. Its performance in darker scenes isn't quite as impressive, but the overall picture is big, and the profile is slender. Not for the faint of pocketbook.

PROS: Good picture quality, very bright.

CONS: Loss of some dark scene detail, some color shifting in dark scenes.

COMPANY: Samsung Corp.

SPEC DATA

Price: $9,999.00 List

Screen Size (Diagonal): 46 inches

Video Inputs: Component, Composite, DVI, HDMI, RF, S-Video

PC Interfaces: Analog VGA and Dual-mode (DVI-I)

Native Resolution: 640 x 480 pixels

Supported EDTV and HDTV Resolutions (HD Ready): 1080i

Built-in TV Tuner (Type): NTSC

Rated Maximum Viewing Angle: Vertical or Horizontal: 170 degrees

Rated Contrast Ratio: 100:1

Individual Settings per Input: Yes

EDITOR RATING: ● ● ● 1/2

Sharp Aquos LC-37G4U

Click for Full Review

BOTTOM LINE: Sharp has made a reputation with its Aquos line of having the best-looking LCD HDTVs in the business. But with the accolades comes a higher price tag, so be prepared to pay

for the Aquos cachet.

PROS: Very good picture quality, best-looking LCD panel going

CONS: Black levels not as deep as those seen on plasma panels

COMPANY: Sharp Electronics Corp.

SPEC DATA

Price: $4,999.00 List

Screen Size (Diagonal): 37 inches

Video Inputs: Component, Composite, DVI, HDMI, RF, S-Video

PC Interfaces: Analog VGA and Dual-mode (DVI-I)

Native Resolution: 1366 x 768 pixels

Supported EDTV and HDTV Resolutions (HD Ready): 720p

Built-in TV Tuner (Type): NTSC

Rated Maximum Viewing Angle: Vertical or Horizontal: 170 degrees

Rated Contrast Ratio: 800:1

Individual Settings per Input: Yes

EDITOR RATING: ● ● ● ●

Syntax Olevia LT30HV

Click for Full Review

BOTTOM LINE: At $1,700, this represents one of the very best entry-level HDTVs we've seen to date. The combination of its low price and generally solid performance make this a great way to get your HDTV party started.

PROS: Generally good picture quality, good connectivity; great price / performance.

CONS: Black levels are its main weakness.

COMPANY: Syntax Groups Corp.

SPEC DATA

Price: $1,699.00 List

Screen Size (Diagonal): 30 inches

Video Inputs: Component, Composite, RF, S-Video

PC Interfaces: Analog VGA and Dual-mode (DVI-I)

Native Resolution: 1280 x 768 pixels

Supported EDTV and HDTV Resolutions (HD Ready): 720p

Built-in TV Tuner (Type): NTSC

Rated Maximum Viewing Angle: Vertical or Horizontal: 170 degrees

Rated Contrast Ratio: 700:1

Individual Settings per Input: Yes

EDITOR RATING: ● ● ● ● ✓

JVC HD-61Z575 HD-ILA

Click for Full Review

BOTTOM LINE: JVC's three-chip LCoS-based rear-projection TV offers up leading edge technology. Picture quality is lacking, however, with substantial mosquito noise visible in many images from DVD source material. The JVC unit had the poorest dark levels of all the units we tested. For a good price, it might be worth considering, but it was the weakest TV in our roundup.

PROS: Leading-edge technology; HDMI support

CONS: Noisy image, black levels too bright

COMPANY: JVC Co. of America

SPEC DATA

Price: $5,499.00 List

Type: LCoS

Screen Size (Diagonal): 61 inches

Built-in TV Tuner (Type): CableCard

Individual Settings per Input: Yes

Discrete Codes for Universal Remotes: Yes

Rated Contrast Ratio: 1000:1

Height: 42 inches

EDITOR RATING: ● ●

Samsung HL-P5063W

Click for Full Review

BOTTOM LINE: There are definitely better 50" HDTVs out there, but they typically cost at least twice as much. Samsung has delivered a lot of quality for a DLP at this price.

PROS: Relatively inexpensive. Smooth, detailed picture. Good color controls.

CONS: No ATSC/QAM tuner. Mediocre brightness and contrast ratio.

COMPANY: Samsung Electronics

SPEC DATA

Price: $9,999.00 List

Type: DLP

Screen Size (Diagonal): 50 inches

PC Interfaces: Analog VGA

Built-in TV Tuner (Type): NTSC

Individual Settings per Input: No

Discrete Codes for Universal Remotes: Yes

Rated Contrast Ratio: 1500:1

Height: 47 inches

EDITOR RATING: ● ● ● ●

Sony Grand Wega KDF-60XBR950

Click for Full Review

BOTTOM LINE: The Grand Wega uses older LCD projection panels. Overall performance in lab tests was weak. The technology may not be cutting-edge, but Sony has used its expertise in the video arena to create a well-crafted TV viewing experience. Image quality suffers from light scatter, and the video processing seems a bit heavy-handed at times.

PROS: Good standard-definition picture quality; good color rendition

CONS: Image looks overprocessed; some softening of standard TV; slightly washed out in bright light.

COMPANY: Sony Corporation

SPEC DATA

Price: $5,499.00 List

Type: LCD

Screen Size (Diagonal): 60 inches

Built-in TV Tuner (Type): ATSC

Individual Settings per Input: Yes

Discrete Codes for Universal Remotes: Yes

Height: 40 inches

EDITOR RATING: ● ● ●

✓ = Editor's choice

HDTVs: How We Tested

Just in case you don't trust your eyes, here are the nitty-gritty tests we used to see which HDTVs performed best. We divided our test methodology into two broad areas: objective and subjective. For the measured, objective portions, we test four major areas of performance: contrast ratio, RGB color response, gray-scale and color temperature linearity, and black and white uniformity.

We tested via the component video input (Y-Pb-Pr), using Milori's ColorFacts measurement software with a Minolta CA-210 colorimeter. The CA-210 is aligned so it's perpendicular to the display and positioned at point-blank range. For contrast ratio, we used an ANSI-9 nine-point measurement pattern, in a three-by-three grid. For the RGB color response and linearity measurements, we took one measurement at dead center.

We used a PC equipped with an ATI Radeon 9800 Pro graphics card and an ATI DVI-to-component video adapter to generate Milori's test patterns, as well as a wide variety of test patterns from DisplayMate.

Contrast ratio is the difference between the lightest and darkest values in two test images, one pure black and the other pure white. For this test, we use a black-and-white checkerboard pattern. A high contrast ratio indicates that the display is capable of color subtleties and a very high degree of detail. Contrast ratio can be thought of as the dynamic range of a display.

For white and black uniformity measurements, we used the VESA 2.0 DFPM uniformity method, which takes the minimum white value from the nine measurements and divides it by the maximum. We did the same for black values. The ideal panel will have a uniformity value as close to 100 percent as possible.

We used Radiant Imaging's ProMetric 8.1 image analysis software and a Radiant temperature-regulated CCD camera to measure luminance. With it we can take a full-screen image that consists of tens of thousands of measurement points. We measure both full-field white (IRE 100) and full-field black (IRE 0) test images and then take the standard deviation of the luminance values from a test image and divide it by the average for that same set of values. What this tells us is how dispersed (or nonuniform) the data points are compared with the average; the lower the value, the better the uniformity.

For our subjective testing, we used Microsoft Windows Media high-definition clips from our PC test system, high-definition video clips and test patterns from a Sencore VOP-920 HD video player, and VOOM satellite HDTV content. Finally, we used a Yamaha DVD-S2300MK2 DVD player to watch selected scenes from Gladiator, Shakespeare in Love, and Lord of the Rings: The Two Towers. Here we looked for visual defects and other issues.

What the Numbers Mean

Not one HDTV here rises head and shoulders above the rest. The Pioneer and Fujitsu plasma panels fared well, as did the Sharp Aquos LCD panel. But the Syntax Olevia LCD also turned in some impressive numbers, especially considering its low price. Here's a breakdown of results from each of the tests.

Contrast ratio. The Panasonic had some of the worst brightness values of any unit tested. But its dark values were the best of any unit tested, and as a result, it does well on contrast ratio. Next in line were the LCD panels, thanks in large part to their bright white values. RPTV-based sets fared the worst here because of a combination of internal light scatter, which caused blacks to become lighter, and lackluster bright levels.

Dark/white levels. LCD- and plasma-based panels trade wins here, with LCDs exhibiting the best brightness and plasmas achieving the best black levels. Rear-projection TVs wind up in the middle, unable to match the black levels of the plasmas or the brightness levels of the LCDs.

Uniformity. Plasmas fared the best here, particularly on black uniformity, although the Sharp Aquos LCD actually showed the best black uniformity of the panels tested. The other LCDs were next in line, followed by the RPTVs.

It's important to remember that what a colorimeter sees and what our eyes see aren't necessarily the same thing. While the RPTVs generally didn't fare as well as other technologies, the Sony and Samsung RPTVs actually did fairly well on our subjective tests of image quality.

GLOSSARY

1080i: The highest quality HDTV standard. Each video image is sliced into 1080 separate horizontal lines, but only 540 of them are drawn for each 1/30 second video frame. No need to worry about flicker, however, because there are more than twice as many lines as a standard TV signal.

16:9 format: The ratio of width to height for wide-screen HDTV.

4:3 format: The ratio of width to height for analog TV.

480i: This is the analog TV broadcast standard. 480 horizontal lines are interlaced, meaning 240 of them are drawn for each 1/30 second video frame.

480p: The lowest HDTV standard quality. This is what a "progressive scan" DVD player delivers. It's still only 480 horizontal lines of video, but all of them get drawn 30 times a second.

720p: For some broadcasters, notably ESPN, this is the best resolution. Here the screen is broken up into 720 lines, 50% more than a standard TV image. Each line is also drawn 30 times a second, or once for every video image.

ASTC: The Advanced Television Systems Committee, who developed the new digital standards for broadcast and reception.

Bistable: Picture elements, or pixels, that are stable in two (or more) states. The display needs power only when the content changes.

Composite Input: The yellow cable which carries the complete video signal. The lowest quality method of analog transmission.

Component Input: The video cables which carry three distinct signals (red, blue, green), the highest quality of analog transmission.

CRT: Cathode ray tube— the standard analog display that is most common.

Direct View: A fancy way of saying CRT.

DLP: Digital Light Projection, a system using LCDs and rapidly moving micro mirrors, developed by Texas Instruments.

DTV: Digital Television, like the signals from satellite or digital cable. Not necessarily the same as HDTV.

D-VHS: VHS for HD content.

DVI: Digital Video Input, a protocol for transmitting digital video. There are two versions: **DVI-D**, which only carries a digital signal, and **DVI-I**, which carries both analog and digital signals.

DVR: Digital Video Recorder, like TiVo.

EDTV: Enhanced Definition, see **480i**.

Front Projector: A projector which casts its image on the front of a screen, usually two separate elements.

HDCP: High-bandwidth Digital Content Protection, a protocol to prevent unauthorized copying of digital content. Developed by Intel.

HD-DVD: High Definition DVD, holds about two to four times the data of a non HD-DVD.

HDMI: High Definition Multimedia Interface, a new standard which is replacing DVI and incorporates audio.

HDTV: High Definition Television, see **720p** & **1080i**.

HTPC: Home Theater PC.

Interlaced: Alternating horizontal display output lines (e.g. 1…3…5…, 2…4…6). The opposite of **Progressive Scan**.

LCD: Liquid Crystal Display.

LcoS: Liquid Crystal on Silicon.

Media Hub: A new type of PC which controls audio and video functions in addition to normal PC functions.

NSTC: The National Television Standards Committee, who developed the original analog standards for broadcast and reception in the US.

OLED: Organic Light Emitting Diode- pixels are illuminated when voltage is applied. More efficient and brighter than LCDs.

OSD: On-screen display.

OTA: Over the Air, as in non-cable, non-satellite broadcasts.

Pixel: An individual picture element.

Plasma: A type of display that contains a low-density gas. Plasma bubbles are activated by applying voltage which turns them red, green or blue.

Progressive scan: Output that displays and refreshes all the horizontal scan lines every cycle. The opposite of **Interlaced**.

PVR: Personal Video Recorder.

QAM: Quadrature Amplitude Modulation, a method of encoding and transmitting digital data in an analog signal.

Rear Projectors: A projector which casts its image on the rear of a screen, usually all in one unit.

RPTV: Rear Projection TV.

S-video: A high quality protocol for transmitting video signals, better than composite, but lower in quality than component.