

3D at Infocomm 2010

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Infocomm is one of the biggest and best international display shows and I expected most of the major players to have their latest 3D offerings there. Although it surely took an attendance hit from the economic chaos, it was the second largest ever and I was not disappointed.



3DTV Corp booth with the two new FHD Zalman CP monitor prototypes showing Anthony Coogan's Alcatraz documentary and an Optoma 3D Ready projector with 3DTV Corp's wireless IR glasses and emitter, showing a 3D demo in Neotek's TriD format. The 3DTV Corp midrange emitter worked perfectly in the bright ambient lighting up to 60ft(20 M) in all directions. We also showed our 3D kits for CRT's and the anaglyph SpaceSpex glasses.

Adjacent to us were Chris Chinnock's 3D@home consortium and Insight Media—for which please see my 3D at NAB article.

Near the 3DTV Corp booth in the 3D Pavilion were five large enclosed 3D Technology Theaters featuring cinema projectors from Barco, NEC, Christie and Sony and one featuring UK based (but with offices or reps worldwide) Harkness Screens www.harkness-screens.com and RealD's XL polarizer, now present in about 7000 cinemas. Harkness handed out a very nice data sheet on their 3D screens which you can also get on their page.



The newest NEC Staurus 3 Chip DLP Cinema Projector with a RealD XL CP switch—currently the world’s brightest 3 chip.



Another NEC projector in their floor booth –this one using active glasses.

Christie-world leader in digital cinema installs- was showcasing both an active system (they have recently released a new active stereo projector with a special dark interval adjust for shutter glasses at 120hz --the Christie Mirage WU7) playing Avatar with XpanD shutter glasses and a passive one using CP glasses with silver screen and the new CP Modulator from DepthQ <http://www.depthq.com/modulator.html>.



DepthQ's CP Modulator on a Christie projector in the Christie 3D Theater.

The CP switcher market has been the exclusive preserve of the RealD XL , which is headed for a total of about 10K Digital Cinema installs by the end of the year. Although such switchers are not a new concept (see my previous articles) and have been available in a limited way from 3DTV Corp, Idemitsu (who made a plastic one a decade ago) and others, this is the first serious challenge to RealD and comes just as RealD did it's public offering. However, RealD has a huge installed base and the name and contracts and money and allies, so it will likely be a long hard path for anyone to make inroads with a CP switch in the DCI compliant cinema. RealD has not offered their switcher to the non-DCI cinema market and it is for that reason that Christie was using the LightSpeed/DepthQ Modulator. Even with the huge investment of time and money by StereoGraphics and then ColorLink (now both part of RealD), it is essential to reduce crosstalk (ghosting) with software (see patent refs in my previous articles) and this is what DepthQ thinks they have now achieved. CEO Chris Ward told me that he expected to get DCI certification later this year. The big modulator is for cinema and the smaller unit is much lower cost and intended for consumer/pro 3D Ready DLP projectors with silver screens. For about 6 years LightSpeed/DepthQ had almost the exclusive market for small 3D DLP projectors with active glasses with their custom modified DepthQ unit, but when 3D Ready DLP's became available over a year ago this market disappeared.

RealD did their IPO recently and sold 12.5 million shares netting ca. \$200M but only about half of this is available to the company since half of the stock sold was owned by previous investors, mainly Budinger and Shamrock(see 3D at NAB for details). CEO Lewis and VP Greer each netted about \$5M (in addition to their previous \$1M or so from selling shares to private

investors and or course their huge salaries(ca \$1M for Lewis and \$700K for Greer). Those interested in the details can consult their SEC filings:

<http://www.sec.gov/Archives/edgar/data/1327471/000104746910006463/a2199426zs-1a.htm/>. About \$25M will go to pay off debt and though they say they expect to have profitable quarters soon, substantial profits are only guaranteed if AMC and Regal are willing to stay cosy with RealD until they can cash in on their stock options. The point is that there is nothing else to prevent their major clients from installing someone else's 3D Cinema system. As a result of the release of more 3D films and more installs of their cinema systems, RealD's net revenue in the fiscal year ending in March quadrupled to \$150 million, they still doubled their previous years loss to \$40 million. A factor that could affect their stock price is that they induced loyalty in their major clients, AMC and Regal-the two biggest theater chains in the USA by giving them options to purchase stock (currently around \$16) at less than a penny per share. These options affect net revenue, and this could worsen if installs and revenue rise since the options are pinned to this.

Also affecting RealD's future is the fact that the basic tech in the XL polarization switcher used in cinemas is public domain (as of course is that in their XLS glass lens used in Sony 4K theaters) and the small American company Lightspeed Design(see above) managed to get an exclusive license from a small Swedish company and is now selling a very similar CP (Circular Polarization) switcher which they expect to have cinema certified soon. CEO Chris Ward told me they have now finished their ghostbusting algorithm, which CP switchers must have . This is a disadvantage of CP switchers relative to shutter glasses, rotating CP wheels and the notch filter anaglyph systems.

Certification in North America (also possible in Italy and Japan) must be done by CineCert <http://www.cinecert.com/>, which is in turn licensed by the monopoly Digital Cinema Initiatives, LLC (DCI) that was created in 2002 by Disney, Fox, Paramount, Sony ,Universal and Warner Bros. For details on DCI including a stupifying 580 page pdf of the Compliance Test Plan (mostly authored by the Fraunhofer Institute which I have commented on in previous articles for their work on 3D) see <http://www.dcmovies.com/compliance/>. You can get the DCI Specs and the Stereoscopic addendum here: <http://www.dcmovies.com/specification/index.html>.



CEO Chris Ward of Lightspeed Design with the new DepthQ CP Modulators which, like the RealD XL devices, produce alternating CP fields with DLP projectors for viewing on silver screens with CP glasses. It is an obvious move for RealD to make him an offer he can't refuse but who might appear next?

Other than leasing projector/XL CP switcher packages (and the top/bottom XLS lens for Sony 4K theaters) RealD's main revenue is from selling plastic CP glasses, with very minor revenue from the famous CrystalEyes shutter glasses, the development of which began when I cofounded StereoGraphics Corp in 1979. However XpanD stole the world market for cinema shutter glasses away from RealD (who stuck with their CP switcher), selling some 2 million pairs and grossing perhaps \$100M in the last few years. There have also been suggestions that the RealD CP switcher infringes on other patents, but this is obviously a very complex legal issue that only years of litigation could resolve, and who has the money to fight RealD? Re XpanD, their major Asian distributor was the Singapore based GDC, whom I mentioned in my article on digital projection several years ago, but GDC began producing their own glasses and XpanD sued them for design patent violations. This however seems pointless as slight changes are simple.

Multiprotocol glasses and/or emitters are a good idea since there are at least 8 infrared protocols in use now (and the DLP Link, BlueTooth and RF glasses as well) and they will become common in 2010. I had this idea many years ago and began work on it in 2005. After I announced the Universal Multiprotocol glasses and emitters in my articles I received a letter from XpanD's attorney saying that they wanted to be assured that I would not copy their IR protocol or glasses. I was quite amused since it is an easily defensible thesis that XpanD's glasses borrow heavily from the tech which StereoGraphics developed and NuVision/MacNaughton (whom XpanD aquired a few years ago to gain entry to this field) would likely not exist if it had not been able to parasitize the market for 3D shutter products

pioneered by StereoGraphics Corp. It also reminded me of a similar letter I received from StereoGraphics in 1992 telling me that they owned shutter glasses and that I should stop making them. In both cases I responded with a summary of the patent history in this field going back at least to the 50's and wireless LCD shutter glasses at least to the 70's, and all now in the public domain. For XpanD, I detailed the reasons why the many protocols used are now PD and further variations fail one the basic tests of patentability--they ought not to be obvious to one skilled in the art.

In addition, the electronics of modern glasses are now pretty much modular with off the shelf components and the real differences limited to programming of the chips used. In both cases I never heard back but a few months later XpanD announced "Universal" glasses, but this was a cheat as they were not multiprotocol. However, they did take my comments to heart and started R&D on multiprotocol glasses which they began selling in September. Technically I don't think they are superior to the new 3DTV Corp models E, S or U which will appear in October and will be cheaper and of course we can be sure the Chinese will jump on this very soon. Even their Universal glasses will have to go toe to toe with the RF synced ones being released by Monster Cable, who also read my articles or maybe just XpanD's press releases. So I will not be surprised if XpanD and then RealD slowly fade to black in the next few years, but all 3D enthusiasts owe them gratitude for their roles in bringing 3D into theaters and homes.

XpanD's patent application (i.e., one patent with 8 versions) was published recently -see US 20100166254, 20100165085, 20100157178, 20100157031, 20100157029, 20100157028, 20100157027, 20100149636.



Equipment rental company VER www.verrents.com had a very nice polarized 3D LED display (with a few pseudoscopic segments in the demo--the fault of their supplier). Note also the

Mirror box 3D camera rig at the left.



A section of the polarized LED screen in the VER booth. Like all such displays it is modular and can easily be made in any size.



The VER (Video Equipment Rentals www.verrents.com) booth also had a lovely volumetric display (blue cube in the center) but alas, it had no 3D image.

Large screen LED displays polarized for 3D with passive glasses are becoming common and Basictech Co www.basic1.com of Bucheon, Korea showed a large bright 3D display. This reminded me of the 6 months I spent in Bucheon in 2002 as a consultant for Forvis Corp., which was too early and too underfunded to persist in the 3D game.

UK based Calibre www.calibreuk.com was again present with their line of scalers and scan converters with notes in their ads and brochures on their use for 3D.



Texas Instruments (inventor of the DMM technology behind DLP) featured 3D DLP projection with XpanD DLP Link shutter glasses and various educational 3D contents. They and many companies are pushing the educational use very hard and it is long overdue. They presented some data the kids learn faster and retain better and I believe it. Over 300K 3D projectors have been sold in less than a year and there will be about 80 models from 15 companies by 2011.

I previously commented on the total absence of the smaller consumer type 3D Ready DLP projectors at NAB 2010, but here they were the dominant 3D projection means with half a dozen companies showing very recent models. <http://dlp.com/projector/find-dlp-projector/default.aspx?p=0-0-0-0-0-0-0-0-0-0-1-0-0-0-0-0-0-0-0-0> but the list is seriously out of date. They cost as little as \$250 or about a tenth or even twentieth the cost, size and weight of 3D capable flat panel TV's (but there will probably not be a true 1920x1080 FHD version in 3D until 2011-but see the comments on DPI below). These projectors are becoming ubiquitous, are made by many companies and well promoted by TI <http://dlp.com/projector/dlp-innovations/3d-ready.aspx>. Of course there are about 10 new

models of one-piece 3D Ready DLP TV one piece rear projector units from Mitsubishi (and older ones from Mits and Samsung) that work with either IR synced glasses with the 3DTV Corp emitter, or with DLP LINK glasses without an emitter, and they are about 1/3 or even 1/5th the price and weight of plasma or LCD TV's.



The Belgian display giant Barco--long a leader in stereo display installs--had a large 3D projection in their booth in addition to their theater in the 3D Cinema Hall.



Educational and corporate trainer CTS showed a DLP Link system with Vutek screen.

Some of the glasses being used for DLP Link projectors at Infocomm were from XpanD but

most were private labeled for Viewsonic, Optoma, etc by Asian companies. Several other Chinese companies will field their own models soon so the price for these and all 3DTV shutter glasses should drop a lot in 2011.



Tristan Yates of the Chicago Office of Stewart Filmscreen www.stewartfilmscreen.com with the new Daily Dual screen system for 2D-3D projection. The second screen rolls down with the push of a button and is shown here halfway down. This gives higher quality images in both 2D and 3D and is essential in France where the laws prohibit use of the same screen for 2D and 3D in cinemas.



Adam Hanin of Viewsonic with their DLP Link glasses and a short throw 3D Ready DLP projector. They were one of the first companies with a 3D Ready 120hz LCD monitor (sold with the nVidia 3D Visions shutter glasses system for PC's).



Sanyo, now a subsidiary of Panasonic, also showed ultra shortthrow 3D ready DLP projectors Both projectors feature compact designs about half the size of other short-focus projectors. The PDG-DWL2500 with WXGA (1280x800) and the PDG-DXL2000 with XGA (1024x768; 4:3 aspect ratio) both with ca. 2K lumens and \$1.8k prices. The 2500 can produce an 80-inch image at a mere 12.6 inches from the screen, making it the shortest-throw unit available. The photo shows the unit projecting 3D on the floor for viewing with DLP Link active glasses. <http://us.sanyo.com>



ADI booth with a Sharp 3D DLP projector and XpanD DLP Link glasses which are a tiny part of their huge product line www.adiglobal.com

I have previously praised the principal inventor of the DMM (Digital MicroMirror) technology behind DLP projection Larry Hornbeck, but those most responsible for its becoming a revolutionary display technology were physicist Brian Critchley and his team. Twenty years ago the DMM technology was developed by TI as a single line scanning device and it was Critchley and his team from Rank—then a heavy hitter in film related technology—who saw its potential and did the work to get it into an imaging form for DLP. Nanotechnology was then so far out in the ozone that physicists were thought necessary to try to figure out whether it was really possible for nanomirrors to pivot on their axes hundreds of times a second for tens of thousands of hours in a reliable fashion. Rank bought and then sold the rights to DMM back to TI for a song, and then sold the company they had formed to develop it-- Digital Projection International (DPI) to IMAX who then sold it to DPI's management in 2001. I assume both Rank and IMAX are kicking themselves to this day. DPI's superb line of pro and home theater projectors includes the widest available range of 3D capable machines, but sadly you won't find them in the Theatrical cinemas. Apparently TI gave the exclusive for this market to NEC, Christie and Barco, and so the creators of DLP are forced to sit there and watch the revolution in digital cinema go by. It seems utterly unfair.



Physicist Brian Critchley-- CEO of DPI in front of an ad for one of their new lines of smaller home/pro DLP projectors—a field they entered in 2009. More than any other, he is responsible for developing the DLP projection technology that led to the digital cinema and the current revolution in 3D imaging.

Although the basic DMM tech is now public domain (and I recall patents from Japanese companies on it), TI continues to make improvements and has announced their 4K cinema chip, which should enable them to leapfrog Sony's 4K projectors since it can do full 4K active stereo, unlike the LCOS Sony tech which only does 2K stereo with the XLS glass lens from RealD. Incidentally, some may not know that the DLP engine has also become critical in many other scientific and technical applications as a spatial light modulator.



DPI leads the world with their wide range of active stereo projectors and the new Titan Pro Series 2 is impressive.

DPI had perhaps their biggest and best booth ever, where they showed many models of upgraded active 3D projectors. Among the many improvements is the ability to accept legacy content in field sequential 50 or 60hz with automatic field ("dual flash") and line doubling on all inputs in the TITAN and LIGHTNING 3D models. The pro projectors now support direct "Dual-Pipe" input (i.e., R and L streams from dual head PC cards etc). The TITAN and LIGHTNING 3D series also now accept sources running at up to 144 Hz (i.e. the standard "triple flash" rate of cinema projectors) with up to 12 bits grayscale resolution per color and they have on screen display for all 2D and 3D frame rates on all inputs. They also have Triple-flash processing (i.e., 24P 3D content at 1080- 24fps/eye is converted to 72fps/eye-the cinema 3D DCI standard) for all inputs. In their new FastFrame technology, moving edge sharpness is increased and motion blur reduced. Finally, all the TITAN and LIGHTNING 3D's now are HDMI 1.4 compliant so they can accept any common 3D format with automatic conversion from any other HDMI 1.4 device.

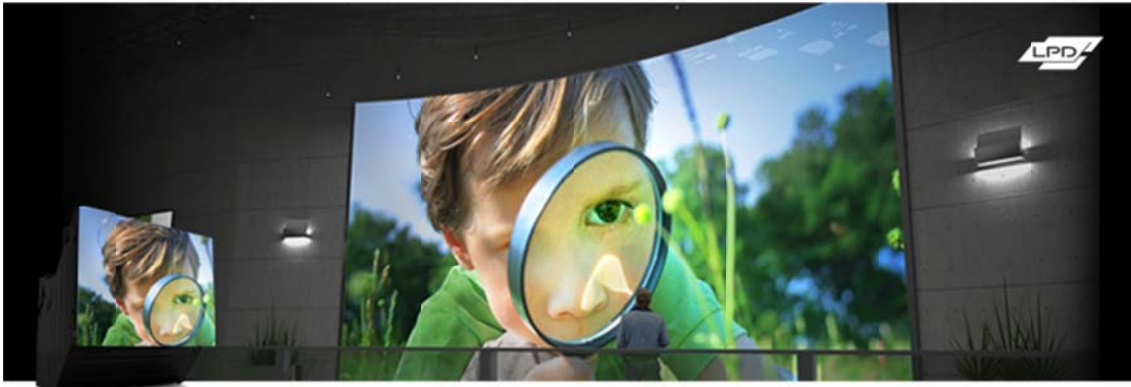
They also had new MultiBlend boxes such as the Fusion for edge blending of multiple projectors. This was demo'd in 3D with shutter glasses and four projectors on the curved screen shown in the photo.



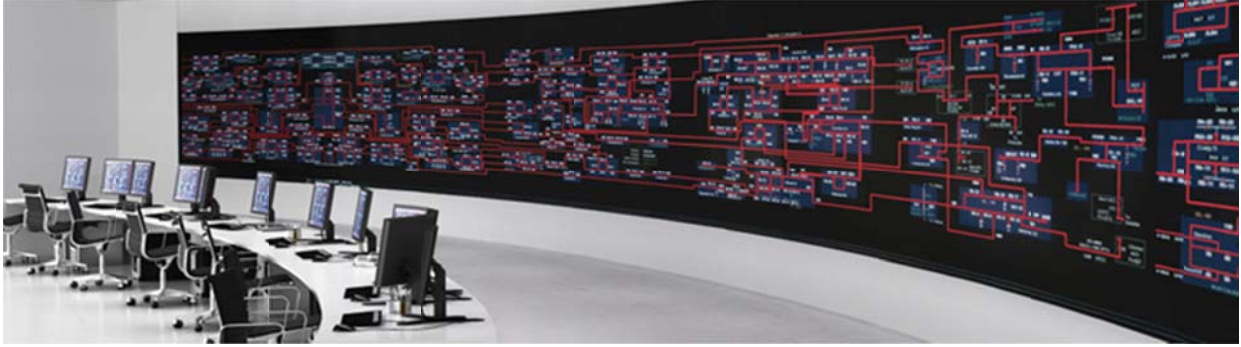
Another impressive 3D display in DPI's booth—Edge Blended 120hz field sequential with four Titan WUXGA (1920x1200) projectors and active glasses. Their new Fusion 3D near zero latency Blender can handle the 2560x1600 images from their new dVision 35 projector.

Also at the show with a highly sophisticated 6 channel FHD edge blender was Mersive www.mersive.com who provides the photo below to show just how good it can be with merging six

front or rear projectors. (with one Sol Harmony unit-more or less can be accommodated).



One of the more intriguing new technologies was the 240hz solid state laser-excited phosphor display from San Jose, California company Prysm www.prysm.com (shown here as a simulated composite image). It uses small solid state lasers to address a phosphor coated plastic or glass screen which can be tiled to any size. Though it should be able to do any kind of 3D, there is not a word about it on their page.



One of the more interesting screen companies at the show was Denmark Based DNP www.dnp-screens.com. Shown here is a control room installation of their high tech rigid optical screens which are available for front or rear projection in standard sizes up to 156 inch diagonal and custom at least up to 200 inch. They used a DPI Titan to project active 3D on one at the show, though I suspect polarized 3D is not possible—but one must guess as there is not a word in any of their brochures nor on their page. In spite of the very high image quality, some might pass them by as just another screen company, but keep in mind that they are a subsidiary of Dai Nippon Printing Co which has 48,000 employees and \$18 Billion gross.

While Projection Design showed the new TI 2560x1600 chip in a grey scale only 3D capable projector meant for BW photography, architecture and graphics, DPI has use it to develop a full 1080p native res. color home theater projector that is lit by LED's only (i.e., no bulb)

<http://www.digitalprojection.com/BrowseProjectors/SeriesList/ProjectorList/ProjectorDetail/tabid/87/ProjectorId/175/MarketTypeId/10/Default.aspx>. As it has only 700 lumens, screen size is limited. It is one of their Lifetime series of home theater projectors, so called since the “bulb” should not have to be replaced for about 20 years, and most projectors will die or be replaced long before that. The RGB LED's also dispose of the need for a color wheel, and since they have microsecond switching 3D should be easy, but there is not a word about it on their page, perhaps because all 3D methods eat most of the light and that would limit any current LED lit unit to a very small screen.

Most (all?) recent fast 3D LCD displays are based on OCB technology (optically compensated bend—a version of ECB --electrically controlled birefringence-- where only splay and bend deformations of the LC layer are used (twist

deformation being excluded) by modulating the transverse electrical field (between pixels on the same substrate plane) and not only by longitudinal fields.(i.e.- between substrates). OCB combines the fast speed of the pi-cell with the optical properties of IPS (in-plane -switching). With the addition of a scanning white LED backlight, crosstalk can be less than 2% at 120hz and with overdriving one can get an addressing speed of ca. 4msec or 50% of the frame duration. Temporal crosstalk is reduced by removing the voltage across the panel for the last 25% of each frame, known as black-frame insertion or panel reset. Overdriving is transiently exceeding the voltage required for the transition in order to reduce the response time.

Veteran screen maker Vutech Corp showcased its high-definition active 3D SILVERSTAR (i.e., for active LCD shutter glasses) and the new passive SILVERSTAR 3D-P for bright image and low crosstalk with passive polarized glasses. Curiously the brochures they handed out had not a word about 3D!



Bob Guenther of Optoma with their 3D DLP Link projector and glasses.

Optoma is owned by Taiwanese company Coretronic <http://www.coretronic.com/en/company01.php>, who also make the DLP Link glasses, which are private labeled by Viewsonic and many others. They appeared more recently than those from XpanD and RealD but have a lower price and are more consumer friendly, so are becoming very common. I had a good chance to evaluate them side by side with the XpanD version here and at other shows and at home and since I have not seen a good review I will digress a moment.

At Infocomm (under very bright lights) I tested them both on two different home/pro 2000 projectors with about 2K lumens and with quite different imagery and got the same results—the Optoma's worked up to about 70ft away while XpanD's only to about 20ft. However at other shows the XpanD also worked to at least 70ft so perhaps this is a mystery.

Neither Optoma nor XpanD has polarity reversal, so you have to do that with the projector, but Optoma has a very strange feature that their glasses manual does not mention. When you press the button to turn it on you come up in 3D mode, but another press and you go to only left eye (in both eyes) then another for only right eye (in both eyes) and then back to 3D! In the LG booth the button was disabled to prevent this. I assume this is to enable the watching of two different 2D programs with one projector (or two different 3D programs at 60hz field sequential each)—an idea that has been mentioned in the patent literature for many years. It reminds me of patents (I think by Dumont) from the 50's for a his/her dual polarized TV set provided with pairs of orthogonally polarized glasses. It is however a disaster in the consumer market and even for educational or professional use. I think many people will find either one rather uncomfortable for prolonged viewing due to weight and design.

I did a test at home with an Acer 3D Ready DLP Projector and discovered that with a small very bright image (ca. 1M diagonal) neither pair would work at all unless I got at least 20ft away and even then performance was erratic. With a larger image they were happy at my normal viewing distance of 8ft. but I noticed a slight red tint with the Coretronic and a slight green one with XpanD. Of course one can compensate for this with projector or DLP TV controls but it's annoying (and not necessary with IR glasses). On almost any DLP TV or projector it's easy to simultaneously run the 3DTV Corp Universal Emitter and Infrared Glasses since the glasses and emitter have a polarity reversal switch to match them with DLP Link or other IR glasses. Another problem is the difficulty of battery changing (relative to IR glasses which I have found easy and of course several kinds like our Model S are rechargeable). XpanD requires a special tool to change and you have to buy the expensive batteries in a carrier, while Coretronic requires the removal of two screws and then an IQ test to figure out how to change them since the manual is quite opaque. RealD was not tested since it is four times the cost and out of the running.

Another issue to consider is that, unlike many glasses now becoming available, DLP Links can only be used for 3D Ready DLP TV's (Mitsubishi being the only current maker) or the recent 3D Ready DLP projectors (from many companies) and cannot be used with any other 3D display. They are also about twice the cost of some models of IR glasses. In addition to the issues with Tint, some users have complained about blacks being washed out and the failure to work if the image is too bright, necessitating turning down the brightness or moving further away than your normal viewing distance. Some people find they have to turn off the TV's automatic contrast or brightness controls. You can find all these issues discussed on the net. Finally, though originally they referred people to XpanD/Coretronic for DLP Link glasses, when Mitsubishi released a 3D adapter kit for their DLP TV's recently, it included a Samsung IR emitter and IR shutter glasses, not DLP Link (and they refer people to Samsung for more glasses). I am sure they had a good reason for doing so. Those who want more details on this issue and consumer 3D may consult the articles on my page www.3dtv.jp.



A pair of the Optoma PK301 pico projectors can fit in a cigar box and they can be cross polarized for a very portable 3D projected display. Pico's are becoming very common and are made by at least a dozen companies.



Sharp booth with one of their 10 brand new 3D DLP projectors and XpanD glasses, which was pseudo both times I saw it (i.e., pseudoscopic or image reversed). It was however not the only booth where I saw this problem. LG solved it by disabling the button on their custom branded Chinese DLP Link glasses (which go from 3D to 2D left image, 2D right image and back to 3D with sequential pressings). www.sharpusa.com/projectors



I can remember when I used their super8 film projectors for 3D but now famous projector manufacturer Eiki is selling 3D Ready DLP (but only one model as most of their line is LCD).

Mitsubishi showed their EW230U-ST (short throw) and EX270U WXGA 3D Ready DLP projectors with the now industry standard six-segment color wheels (red, blue, green, white, yellow and cyan). Like most current good quality projectors they are WXGA (1280x800 resolution) and about 2500 lumens. In keeping with the current trend to very short throws, the 230 can project a 60-inch image from 26 inches <http://www.mitsubishi-presentations.com>.

Speaking of color wheels, Ocean Thin Films, one of the companies specializing in optical coatings, had a booth in which they showed their version of the Infitec (Dolby Digital 3D) passive cinema glasses on a small screen and a good selection of color wheels and other coatings they have produced (see photos).



Trond Solvold, Business Development Manager of Norwegian industrial DLP projection company Projection Design with one of their 3D Ready projectors. Perhaps their hottest new item was a WQXGA gray scale projector based on the new TI chip. They have both shutter glasses and Infitec Dual Projector Models. Though they may look like your mothers DLP projectors they are very high quality with special features like dual lamp, changeable color wheels (for graphics or video), remote light source, and some like the F82 have 3 chips and 10,000 lumens—enough for a medium sized cinema.

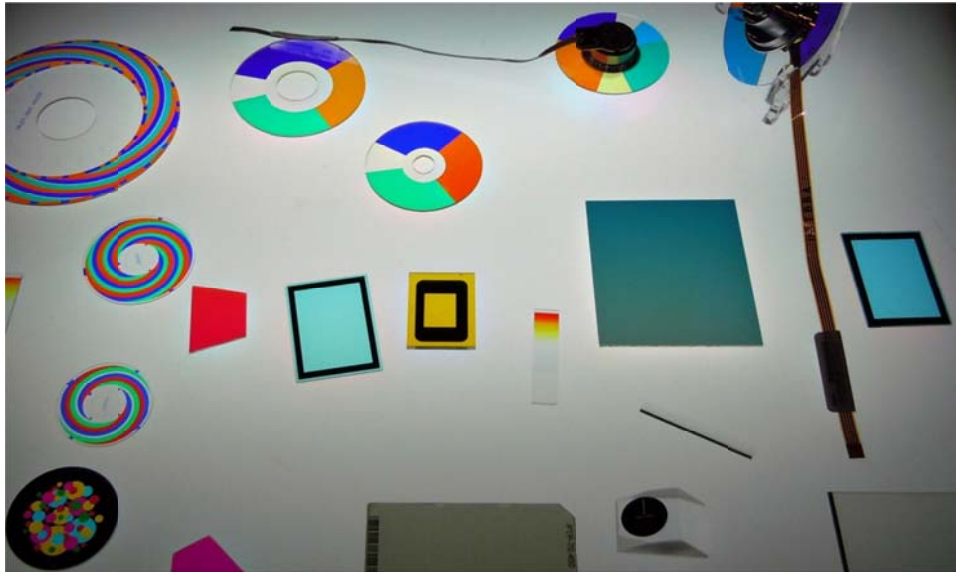


The newest Projection Design 3D Ready DLP projector with CrystalEyes CE5 DLP Link Glasses (the RS232 port on the side is for external sync). Some of their units have no bulb—the light being delivered by fiber optics from a remote light. Like DPI they introduced a 2560x1600 image blender called the MIPS.



Todd Jennings of Ocean Thin Films with their Infitec anaglyph glasses. They had a ground breaking new 6 segment color wheel one chip active infitec projector prototype in their booth. This is the one chip analog of the 3 chip Dolby Digital 3D projectors common in cinemas worldwide and, when the new Full High Def HDMI 1.4 compliant 3D DLP projectors appear, opens the door to low cost high

quality large screen hdef 3D at home. The major problem is that the Infitec system loses over 90% of the light.



Some of the optics recently made by Ocean Thin Films, including several types of color wheels used in one chip DLP projectors.



T.B. Kim, Manager of Hyundai Korea's 3D Department, with their new 55 inch CP display prototype. It will be the latest addition to their other four ranging from

22 to 46 inches. I used one in my booth at NAB 2009 and it was excellent but the art has evolved since then at least 6 companies have shown them. So far their displays have not appeared in US stores but I saw one for sale over 3 years ago in a Japanese electronics shop.



Sony's lovely 42 inch passive CP glasses display. All such displays have only half the FHD vertical resolution, which I presume is why they have not yet been marketed for home 3DTV where FHD shutter glasses systems dominate.

Sony also showed their active glasses 3D-capable BRAVIA HDTV's (40 to 60 inch models starting at ca. \$2000) which are much in the news and available on the net and at BestBuy <http://www.sony.net/united/3D>.

However, Sony has made a huge mistake with its Bravia 3DTV's--just a few degrees head tipping and the ghosting gets intolerable --incredible but true and I have not seen anyone comment on this. It was very noticeable just standing in the store a few minutes-and I wasn't looking for it as none of the other brands have this issue. This is due to the fact that to eliminate most flicker (i.e., that from room lighting but not from the TV itself which may still have a trace of it) they put the front linear polarizer (usually in front of shutter glasses lenses) over the front of their TV. This is an old idea present in various patents and discussed in my articles 20 years ago (but this didn't stop Lipton from trying to patent it) and the reverse idea (i.e., switcher on the screen and passive glasses) has been used for decades by CP switchers from Tektronix, NuVision, and

StereoGraphics and in the RealD XL cinema system. Sony compatible glasses from other companies should not have this problem, though they will have a dimmer image unless they happen to have the front LP at about the same angle as the Sony one.

Although room flicker at 120hz is not especially noticeable for most people, especially in low ambient light, it is possible that it contributes significantly to eyestrain (see my previous articles for detailed comments on human factors research) and it would be desirable to increase the rate of all home displays to the 144hz standard in 3D cinemas. However, it may not be feasible with either the LED/LCD or Plasma approaches so there is still room for DLP and other tech. I am not aware that there has been any effort to do 144hz with home DLP projectors or TV's.

I get asked frequently about which is the best home 3DTV and as of Sept 2010 I would say that for price size and weight the Mitsubishi DLP's have it hands down, provided you can accept they are not FHD in 3D mode. There are various image quality issues in 3D but to be fair you really have to look at the very recent 2010 models, preferably those made after about March which should be HDMI 1.4 compliant. Without side by side comparisons with the same program and live action it's not possible to get a precise idea and I don't think you can find that anywhere. The manufacturers force the stores to only show their own demo and incredibly most of these are very poor with lots of BS you have to stand there and watch (no fastforward possible), little or no good live action showing people up close so you can check out skin tones, texture etc and some, such as LG's as of Sept 2010, have only animated movies. At home you can go online and get all the available demos from a rapidly increasing # of sites, so you can get a reasonable amount of demo content and compare but it's not happening in stores and there is not as of Sept even ONE good 3D live action film you can see on 3DBluRay. Most stores are now displaying live 3D from cable or satellite but it's not on all the time. It's of course possible for them to record these 3D broadcasts but it's very hit and miss now and broadcasting may create image issues not present in 3D DVD's.

Ghosting is an issue with all 3DTV's except the DLP's where its zero (except for the glasses, all of which have a slight ghosting for every kind of 3D). Lowest ghosting appears to be in the Panasonic plasmas. My impression is that the Samsung 3D Plasmas have slightly more ghosting. A 60 inch 3DTV costs over \$4K but you can get the 82 inch Mitsubishi DLP for that. The big Samsung LED LCD TV looks great with animation but a live DirectTV 3d football game seemed to have an awful lot of ghosting and overall poor image--but again without side by side who knows—as it could possibly be something in the broadcast chain. As noted above, due to ghosting Sony's Bravias are only in the running if you buy compatible shutter glasses from one of the other companies.

Vizio has many modest priced TV's and has also announced a passive 65 inch 3DTV (in addition to their 55 inch active glasses 3DTV announcements) but as of Sept 2010 I have not seen either on sale anywhere. Nor have the Sharp, Toshiba, JVC etc 3DTV's appeared yet.

When the new HDMI 1.4 compliant FHD (i.e., 1920x1080 native) 3D ready DLP projectors are out in 2011, they are a serious contender due to price and convenience. Maybe the first one (if you can deal with its 700 lumens) is the DPI LED bulb DLP model (see above) available very soon. At the moment all 3D Ready DLP projectors require 120hz field sequential 3D input and the only way to get this is from a PC with a 3D Media Player (see the FAQ on my page for details). I assume the newer projectors will solve this or someone will put out a box to convert side by side into field sequential. As noted above it would be desirable to have 144hz and simple to implement but I doubt it will happen soon.

So, unless you have money to burn and must have the state of the art in image quality (for this month), I would go for DLP two piece projection myself (i.e., with separate screen) with PC input, and next if you don't want projection or a PC in the setup, a Mitsubishi one piece in one of the recent HDMI 1.4 compliant sets (like the 60 inch in Costco now for \$800).



Well known high end video card maker PNY featured new cards compatible with the Nvidia 3D Vision consumer system as well as the Pro Quadro cards, most of which used to have the standard 3 pin stereo VESA plug for shutter glasses emitters which are absent on the newer Quados, probably because Nvidia has developed the USB interface in their 3D Vision system.

Planar 3D Stereo Display



Planar's FHD dual LCD polarized display has excellent image quality but its bulk and relatively high price will likely lead to rapid obsolescence as other FHD flat panels appear. There are 3 other companies with similar displays. They announced their intent to test market a range of autostereo displays.

PopBox <http://www.popbox.com> says they will be offering (for \$129) a set-top box media player which supports Real D (and so presumably any 9 view multiview display) from a wide range of file formats from the net or your media

collection but as of Sept 2010 neither their page nor their Amazon ad says a word about 3D.



Equipment distributor RPM showed dual CP projection with their Stacker Mounts and images from a PC via two eyeVis openWarp processors.



RP Visual Solutions specializes in rear projection <http://www.rpvisuals.com/> and they can do it with passive 3D projection shown here or active shown in next photo.



Teresa of RPV showing one of their HoloScreens with active shutter glasses and rear projection.

Readers of my articles will recall that I have been proposing (and put together a detailed business plan) a realtime PTZ (pan tilt zoom) 3D sports system

composed of multiple cameras able to synthesize any arbitrary camera position. This is an extension of the now obsolete decade old EagleVision system developed by famous Carnegie Mellon Professor Takeo Kanade and his colleagues. In anticipation of getting the 2022 FIFA world cup, Japan has finally picked up the idea and is proposing a system with 200 cameras for live 3D broadcasts.

Many are aware that a Finnish company has for about 6 years been selling the Fogscreen www.fogscreen.com , a display consisting of a screen made of fine water droplets upon which is projected an image. Sizes range from about 4.5ft to 9ft diagonal. A similar system has recently been created by researchers at the Carnegie Mellon Robotics Institute. Water drops refract incident light in the same way as wide-angle lenses and if this is done so that no two drops occupy the same line-of-sight, with at least ten drops per second (though they use 60 to get enough brightness) you get a very passable screen. They intend to market it as Aqualux 3D

http://www.cmu.edu/news/archive/2010/July/july6_waterdisplay.shtml.

Perhaps they never heard of Fogscreen but I suspect they will get a letter from Fogscreen's patent attorney re US 6,189,487.



The Fogscreen projects on a very fine water mist and has been used in 3D with

anaglyph and active glasses.

I have reported before on the 3D activities of the famous German Fraunhofer Heinrich Hertz Institute <http://www.hhi.fraunhofer.de> whose countless R&D projects include software for stereosynthesis from a stereopair on any type of multiview display (see my 3D at NAB). Alioscopy now has a formal relationship for this with an emphasis on creating multiview 3D movie trailers. This has been an obvious market and I proposed it to Newsight Corp 5 years ago. Newsight did make a multiview trailer for one of the Starwars 2D films but that was as far as they went.

Magnetic 3D of Manhattan, New York, whose glasses free displays range from 22 to 57 inches, more or less a spinoff of the recently deceased Newsight, showed a new autostereoscopic 3D application in conjunction with digital signage software content management company UCView, in the booth of Stampede, a display distributor. Their displays will be offered in packages including Peerless mounts and UCView software by all four companies. <http://www.magnetic3d.com>.

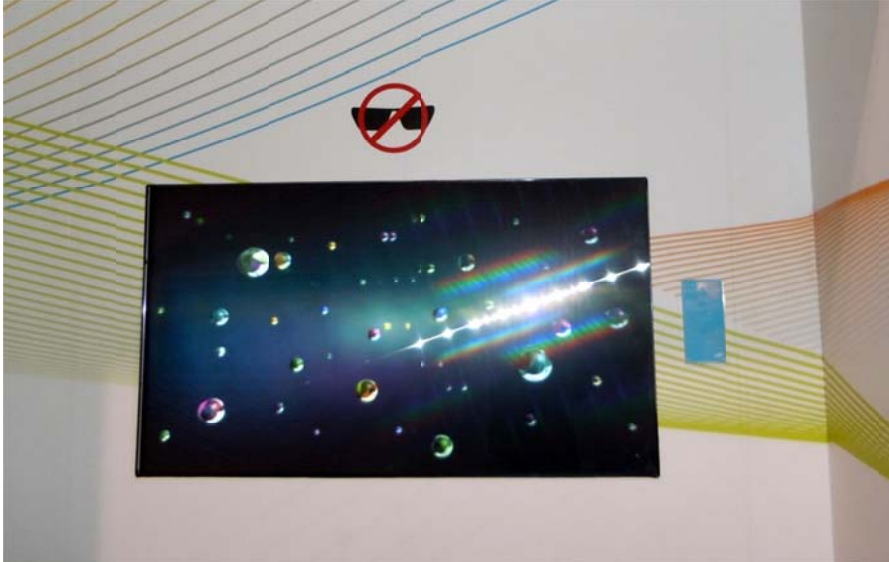


Mike Egan of Magnetic Media presented their 42 inch no glasses display in the Stampede booth.



Another legacy of Armin Grasnik and colleagues at 4D Vision GMBH is Visumotion of Jena, Germany www.visumotion.com and its USA software partner Stinova www.stinova.com of Orlando, Florida. 4D Vision was bought by X3D Corp of Manhattan in 2004. X3D was renamed Opticality and then NewSight, and a group split off and became VisuMotion a few years later. Newsight fell on hard times, was acquired by media company ViaOne in 2009 and went out of business in 2010. Manuela Fischer at the left is a veteran of the entire sequence. They were showing what was advertised as an entirely new technique for presenting no glasses 3D (i.e., neither parallax barrier nor lenticular) and it looked pretty good. They have excellent software for making, editing and displaying 3D images and gave out an very nice brochure.

A major problem for digital signage in many locations is a tiny, reliable, updateable (preferably by WiFi) media player in or on the display and it has been a major headache until recently. Many companies now have tiny media players which fill the bill. A few which caught my eye at the show were SpinetiX's HMP100 www.spinetix.com, the Visix UltraMini HDMP www.visix.com and the Habey Bis-6620 www.habeyusa.com.



Sanyo's 52 inch lenticular autostereo monitor had a nice image but of course the same need to find the sweet spots of all such displays.

Panasonic has been showing their large full HD 3D Panasonic TH-152UX1, TH-103VX200U, and TH-85VX200U for over a year. Top of the line is the TH-152UX1, a 152-inch diagonal with 4K x 2K (4096 x 2160) resolution with a reputed tag of about \$350k. This is roughly equivalent to nine 50-inch screens, and should be available in early 2011. The TH-103VX200U and TH-85VX200U, are 3D versions of its 103-inch and 85-inch displays and should be available in December 2010 for \$65,000 and \$45,000, respectively. The images are extremely good but until I see them side by side with the latest 3DTV's from LG, Samsung and Sony with the same program, I cannot say which is best. But I have seen the same live action demo on the Sony Bravia and Panasonic Plasma and they are about tie (provided you don't tip your head—see below).

Taiwanese company Daxon www.daxontech.com showed their FHD lenticular no glasses panels in which they say exist in sizes from 7 to 42 inches. However, there is not a word about it on their page and I think they are just testing the waters. They are a subsidiary of the BenQ group which also showed their well known 3D DLP projectors at the show in the 3D AV Rover—a tamper resistant cart including computer, projector, mixer and shutter glasses www.avrover.com. It was one of several systems at the show which promotes front or rear projection including 3D as a next generation white board.



Panasonic showed their giant shutter glasses 3D Plasma's in their booth but to see them in 3D you had to walk half a km upstairs to their private room--but worth it! This is the 152 inch and it will take a crane and four bodybuilders to install it and you can buy a very nice house in most places for what it costs.



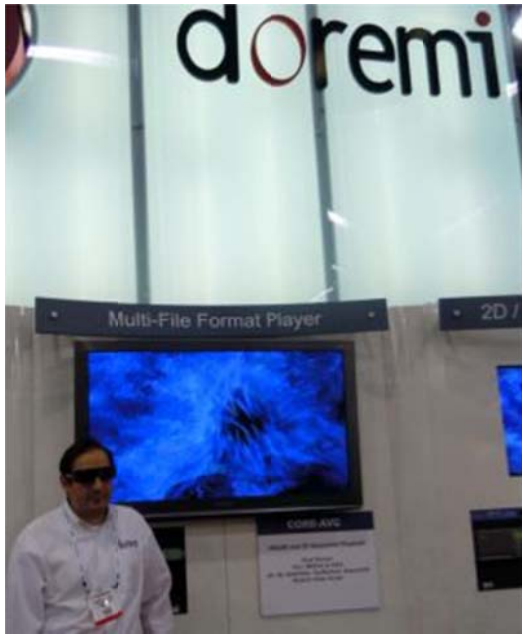
Panasonic's \$21K 3D camcorder looks lovely but as of Sept 2010 a camera expert I know who used one said it is really not ready for prime time. Those on a budget can try their consumer version which is supposed arrive in October for about \$1300.



LG's booth had their new lovely new 480hz Infinia shutter glasses TV's (which reached Best Buy the next week) as well as their one piece polarized projector the LG CF3D, which had bad ghosting (it was not the glasses, so must be the projector and/or the screen). It uses Sony's SXRD LCOS (Liquid Crystal On Silicon) technology, which has been a great success for Sony in the 4K cinema projectors, but a horrific flop in home one-piece units (totally discontinued after two class action lawsuits over optical block failures).



Doremi V1-HD 2K , Delta, Generator 3D, Nugget-Pro 3D and Dimension 3D capable image processors and 3D format converters. For details on their offerings see my 3D at NAB and www.doremi.com



Maurice Sawaya, technical support manager with Doremi , Burbank Ca. with Xpand Panasonic Compatible Shutter Glasses and a Panasonic plasma tv showing the Doremi multiformat file player.

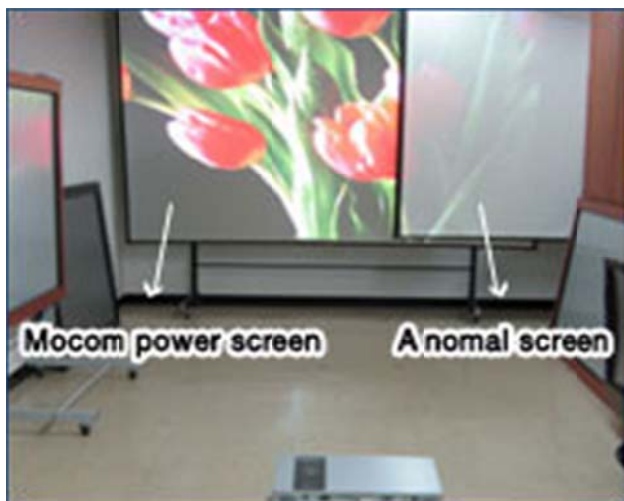


Doug Bragdon of Superimaging Inc- Fremont, Calif. USA www.superimaging.com demonstrates their UV laser addressed two color displays made by applying a special fluorescent nanoparticle film to any clear medium. The small sized HUD TransPlay projector is shown here in the Smart

Windshield they are marketing to the automobile industry and the larger retail/theater MediaGlass projectors can use one or two color UV lasers or a DLP projector with a UV bulb. It could also be done with front projection on opaque media, and 3D with polarization, anaglyph or shutter glasses should be easy.



A new Korean organization 3D International Image Alliance is looking for members to promote 3D worldwide. 3D@home was also at the show but I have not seen the Japanese 3D Consortium at a show in the USA.



Mocomtech Co Ltd of Korea showed their 3D Power Screen--the brightest 2D and 3D screens in the world with gains up to 20 due to concave shape and high

tech surface. Get the brochure here

http://www.mocomtech.com/en/news1.htm?id=39&show=view&board=e_news. And I recommend a look at the very informative info and table on their Power Screen page here <http://www.mocomtech.com/en/mocom1.htm> where you will find e.g., that they have four times the brightness of a plasma TV.



A new entrant in the 3D DLP TV set market is Taiwanese Home Theater company VEA <http://www.lavea.com.tw/spec.html> (nice page but all in Chinese) who were also promoting their 56 and 74 inch sets as 3D whiteboards. They were made in Taiwan by Da2 Technologies Corp. (see their 2007 design patent US 29248428) but it's possible they are a mod of a Mitsubishi, the only major maker now that Samsung has abandoned DLP. They sum up the 3D scene pretty well in the only English sentence in the Chinese version of their brochure: DLP Display Boundless Come On The Scene!



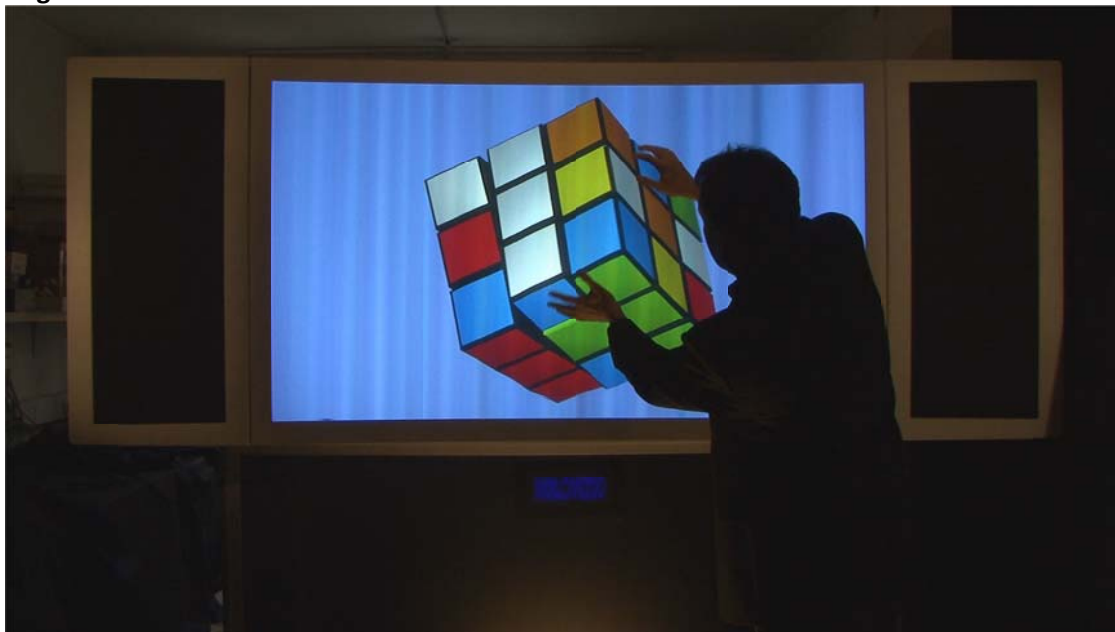
Although not in 3D yet, Kinoton's www.kinoton.de Litefast 360 degree spinning LED displays could clearly be adapted for any method including glasses free. An old German projector company, which still has a sizeable film projection business, they made a deal with Barco to buy their 3 chip DLP light engines and make their own DCI compliant digital cinema projectors. With clients worldwide, they were recently the first to install one in Mongolia.

3LCD of Long Beach California www.3lcd.com showed their 3 chip LCD projectors in a dual polarized version, but I think all the LCD models of every company are on their way out since only in this inconvenient format can they do 3D.

Giant video/computer/audio hardware company Extron had a giant booth but not a word about 3D and two employees I asked looked like I had wanted a delivery to Mars. Maybe Extron will wake up next year.



Hungarian company Holografika www.holografika.com showed their no glasses display utilizing 28 cameras in the silver bar and 27 DLP projectors behind the holographic screen. Data is processed realtime and delivered by 16 Dual Link DVI connectors. They have larger units with up to 80 cameras and projectors but they are inconvenient to exhibit. It gave a good continuous (i.e., no bad zones) 3D image with about 120 degrees horizontal and at least 10 M distance.



A photo from the excellent Hologvizio CD showing a Rubik's cube on one of their displays. They have a wide variety of sizes from about 24 inches up to 72 inches. Because of the large number of images and the holographic screen, they can have continuous stereo pairs spaced less than the interocular, so there are no bad or pseudoscopic zones. In some respects it is reminiscent of Robert Collender's work beginning in the 1960's, though he used quite different projection means.

French lenticular autostereoscopic display maker Alioscopy had a fantastic pavilion all to

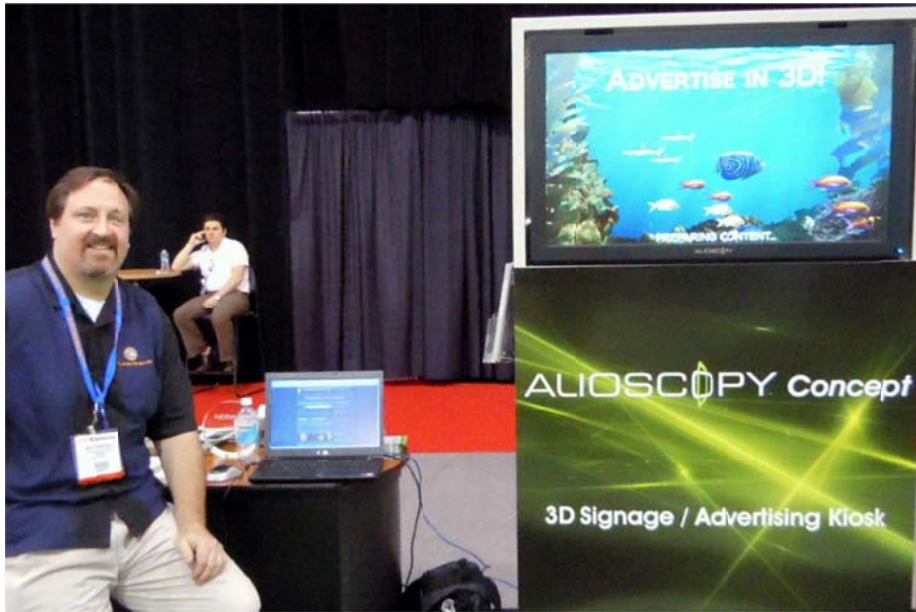
themselves featuring 12 companies using their displays with various applications. In addition to those in the following photos were NavTech www.ndgi.com a knowledge management company from Alabama, Creative Digital Images www.cdi-animate.com an animation house, Freeman Audio Visual Solutions, a branch of Freeman www.freemanco.com that organizes a large number of major conventions including Infocomm, and Toronto, Canada based Numerix www.numerix.com which, among other things, is the Canadian reseller for Alioscopy.



Bruno Deschandelliers of French autostereo specialists 3DTV Solutions in the Alioscopy Pavilion showing their software. For details see my 3D at NAB 2010.



Engineer Florian Koenig of French visual computing company Useful Progress www.usefulprogress.com in the Alioscopy Pavilion showing their medical imaging work on an autostereoscopic monitor.



Beau Perschall of New Orleans USA media sales and service company TurboSquid www.turbosquid.com , a major provider of 3D solid models that can be used for stereo or autostereo applications. They are also used by Applied Ideas in their UGC-3D multiview (i.e., 8 view autostereoscopic) templates for rapid no glasses ads—see below.



John Barnett of Georgia, USA based multimedia services company N4D www.n4d.us in the Alioscopy Pavilion. They have done conversions of 2D to 3D, 3D video production and stereo to multiview for major clients such as CBS and Visa.



Animator Trey Davis of SIMT (Southeastern Institute of Manufacturing and Technology) in South Carolina www.ftcd.edu and www.simt.com , USA was in the Alioscopy Pavilion showing their abilities in advanced design and manufacturing.



Physicist and programmer Ken Maffei www.applied-ideas.com with one of their templates for “instant” multiview ads. Their user generated content application (UGC-3D) shown here and an Alioscopy monitor lets clients make realtime ads. This is a revolutionary advance in 3D digital signage as it permits clients to add their names, logos etc. and have an ad running in hours rather than the months previously required. Totally custom ads can then be created at leisure.



Lovely autostereo promoter Pia Maffei of Applied Ideas and Alioscopy, also featured in my NAB article, was present with her husband Ken showing the displays running their UGC (User Generated Content) templates for “instant” multiview ads.



Joel McLean of Real3DDisplay www.real3ddisplay.com in the Alioscopy pavilion. They have had success marketing no glasses 3D for casinos and games.



Ralf Tanger of the Herz-Fraunhofer Institute demos their new stereo pair to multiview software-a service they now offer in conjunction with Alioscopy. See my 3D at NAB for more info.



Well known video/audio accessories company Gefen showed several HDMI 1.4 compliant splitters, extenders etc. Their new HDMI Detective Plus is a very useful and inexpensive programmable device that will permit many non HDMI 1.4 compliant displays (or HDMI displays that have lost their ID!) to be used for 3D.



Electronics distributor Tri-Net Tech www.trinetusa.com drew a crowd with the Samsung shutter glasses 3DTV. They also handle 3D accessories such as HDMI 1.4 compliant switchers and their catalog and page are very 3D friendly with clear indications of which items are 3D Ready.



TelePresence Tech www.telepresencetech.com showed their latest two way video system. The woman in front of the bluescreen would see the couple at the right while they would see her with a projected background of your choice. They advertise it as 3D but it's just a really good 2D image that looks maybe 2 ½ D. Maybe next year.

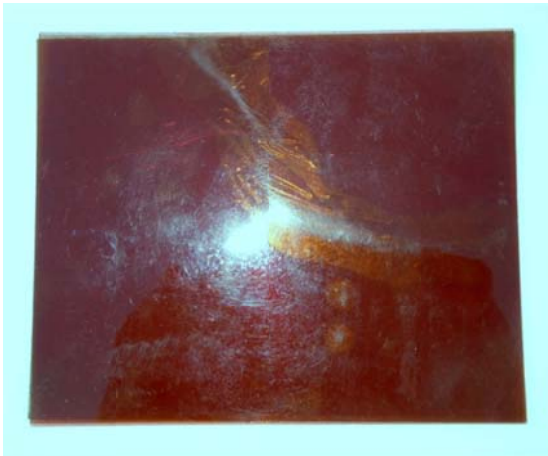


DVE Immersive Podium Telepresence system www.dvetelepresence.com. They also have a Realroom 3D™ option which uses a hidden projector and free standing screen of this type for “face to face” meetings. Like all the telepresence systems at the show it is not currently in 3D-- but maybe next year.



Several exhibitors with telepresence systems used semisilvered mirrors with hidden cameras which gave a very convincing feeling of personal contact, even though they were not in 3D. This one is the TPT Lectern from TelePresence Tech

And last but not least a few more glimpses of 3D history.



A rare bird even for 3D enthusiasts! A dichroic polarizer which will cross polarize two colors so that an anaglyph 3D image can be viewed with polarized glasses. This technology has been around for quite a while and was promoted by 3DTV pioneer James Butterfield starting in the 60's. Even rarer is the color polarized vectorgraph motion picture film created by Polaroid in the 50's. It permitted cross polarized viewing of a single strip 3D film without any special lens. Only tests were done and I have never seen one but late Holographer Steve Benton had a piece of the film and so it's probably floating around MIT.



From the archives of electronic stereoscopy—the 3DTV Corp Model O wired shutter glasses system from 1994 picked up sync from the TV screen with a photodiode in a suction cup.



Wedge prism glasses I made in 1983 for viewing top/bottom stereo TV, or for chromostereopsis (i.e., depth from color alone—a concept later made popular by the ChromaTek glasses developed by Rick Steenblik and marketed by APO). Chromostereopsis was first investigated by the famous German physicist Hermann Von Helmholtz and described in his classic book on Physiological Optics.

