3D at NAB 2010

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Since my report on 3D at NAB 2009 the 3D industry has picked up speed and the range of products and projects is simply amazing. To assess what was at the show and where the industry is going we have to look at the whole world of stereoimaging. Driven originally mostly by the 3D cinema, 3D has now become the darling of the broadcast and electronics industries with everyone rushing to implement 3D hardware and software and many progams planned over broadcast, cable and satellite.   Korea seems to be the first with regular 3D programs on a satellite pay tv channel (though some will recall the satellite broadcasts of C3D in the USA and of Japan 3D a decade ago (to both of whom I provided hardware, software and consulting) when CRT's and shutter glasses were the only available means. Live 3D broadcasts of sporting events to limited audiences (i.e., to theaters equipped to receive and display 3D) are occurring and FIFA has committed to 3D broadcast of the 2010 World Soccer Cup from South Africa. Sony has stated that they will broadcast 25 matches from FIFA 2010 with seven stereo rigs with Pro HDC-1500 cameras processed via their MPE-200 (with automatic parallax control) and 3D Outside Broadcast trucks. As I write, the French Tennis open and various USA baseball games will be 3D cast soon.   Contrary to many announcements in the media, none of these were the first live 3D sports broadcasts, that honor belonging afaik (as far as I know- a webonym   to the Milwaukee Brewers game done in anaglyph in 1953.

This reminds me that even if uptake of new 3D ready TV's (i.e., polarized or shutter glasses displays) follows the most optimistic projections there will still be only a minority of households with a 3D set 5 or 10 years from now, even in the rich countries.   The only way to solve this is anaglyph broadcasts or simulcasts with anaglyph on one channel and other 3D formats on others.   It would be easy to include one or more anaglyph outputs as a format choice in the new TV's, STB's, BR3D players etc but I doubt it will happen (however anyone with a pc can playback any 3D program-including recorded broadcasts- in SpaceSpex yellow/blue format using Suto's or Wimmer's stereoplayers).   The perception seems to be that anaglyph is so bad that it's not a real choice, which in my view (see the SpaceSpex article on my page www.3dtv.jp) is mistaken--a result of the fact that few in the broadcast industry have ever seen a properly done amber/blue anaglyphic video on a TV properly calibrated for amber/blue anaglyph.   In any event, everyone wants to sell new TV's, new DVD players, new STB's, and other hardware. Well done anaglyphs will obviate at least some of this demand so there is less money in it for most of the food chain, but presumably a lot more for broadcasters.   Money talks so anaglyph walks!   Of course some will say "quality talks so anaglyph walks" but this leaves 6 billion people out of 3D at home for the indefinite future. At least STB and DVD players might provide 50 and 60hz field sequential output for shutter glasses used with CRT's (i.e., the Home 3D Theater system intro'd by 3DTV Corp in 1990) which will remain the dominant display in most of the world for a decade or two.   Failing this, it seems likely that cheap boxes which can covert the side by side format to field sequential will appear. Field Alternative is in the HDMI specs as an output format but this is no guarantee the TV's, STB's or BluRay players will support it.

This is probably the last year in which it will be possible to see 3D hardware, software and broadcasting as arenas separate from their 2D counterparts.   In a year or two everyone will assume that products, program producers and distribution channels are 3D ready, as the alternative is that they are planning on going out of business. There are of course stumbling blocks--the wretched economy, the high cost of new hardware, the insistence of hardware and

software producers in providing inferior products rather than waiting until they have it right, poor quality 2D to 3D conversions in some TV sets and computer software, unacceptably dim projection in many theaters and, worst of all, fake 3D that is advertised as real 3D in major commercial films (Alice in Wonderland, Clash of the Titans, Pirhana 3D and doubtless many others to come).

It is also the last year in which the 3D industry will be driven largely by films. 3D broadcast is growing so fast that it will soon become the tail that wags the 3D dog. Although broadcast by the preferred high quality methods greatly limits its spread, cinemas are also lagging behind demand. Here is a graph showing the penetration of 3D ready cinemas worldwide as of the beginning of 2010 and you can see that those without greatly outnumber those with 3D. As of mid 2010 there are about 11K 3D digital, 9K 2D digital, 200 3D film and 130K 2D film cinemas. About half of the 3D theaters have RealD systems and another 5k or so are under contract.
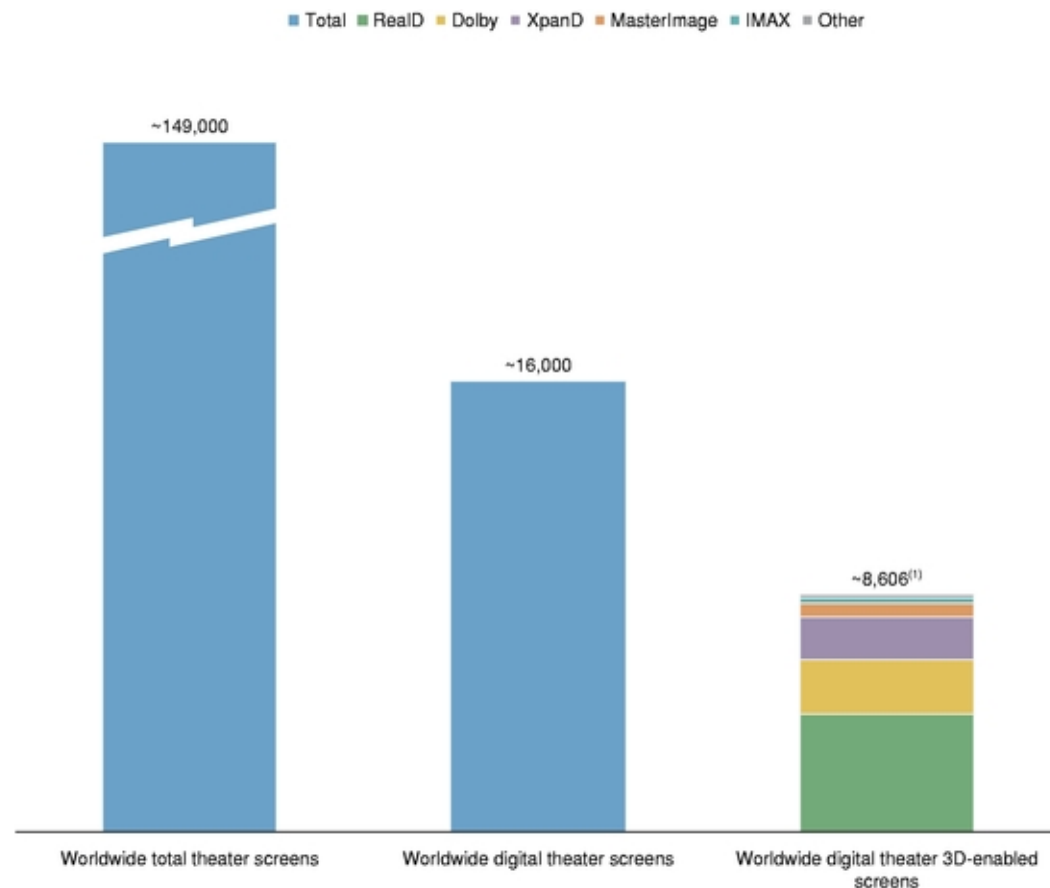
Worldwide 3D Cinema installs as of the end of 2009. From the RealD filing with the SEC preparatory to going public this year http://www.sec.gov/cgi-bin/browse-edgar?action=getcompany&CIK=0001327471&owner=exclude&count=40 . This document may be fascinating to some as it shows that just a couple years after buying StereoGraphics Corp, they paid $31M for ColorLink (in order to get their tech and eliminate competition for their XL screen), get almost half their revenue from one theater chain (presumably Regal), arranged stock options for the three biggest USA theater chains, lost ca. $18M/year and continue to lose ca. $1.5M/month even while earning almost $100M in the previous 9 months (in large part projection systems and CP glasses for Avatar). However as long as they stay tight with Disney, AMC, Regal and Cinemark they will maintain their virtual

monopoly in the USA and should have a rosy future. In any event the 3D world would very likely be years behind without their heroic efforts. Since they will become a billion dollar public company and dominate many aspects of 3D some may be interested to know who owns them. The following persons and entities each own ca. 14% of the stock: Shamrock Capital Growth Fund II, L.P. which is affiliated with and partly owned by the Disney family, William D. Budinger, inventor and electronics entrepreneur,CEO Michael V. Lewis has a financial background as well as producer on two IMAX 3D movies, Joshua Greer with a film and media background and Andrew Howard and Stephen Royer, financial execs with Shamrock. More details at http://www.reald.com/Content/Management.aspx.

Last year there were about 25 booths which had some hardware or software directly relevant to stereoscopic imaging and about 15 3D displays in use. This year there were almost too many to count with about 100 showing new 3D products and at least that many with polarized, anaglyph or shutter glasses displays for their legacy 2D products. It is amusing beyond words to see the widespread and mostly enthusiastic adoption of both passive and active (i.e., shutter glasses) displays for everything from tiny PDA's to giant cinemas after listening to people badmouth glasses and 3D for the last 40 years--insisting that 3D would never happen or at least not until autostereoscopic displays were available.

Live 3D netcasts (web streaming) are also beginning, with at least parts of the USA Master's Golf Championship available in 3D during NAB to anyone with an Nvidia 3DVision system--http://www.nvidia.com/object/3D_Vision_Requirements.html3D Movies (for 3D ready displays as of 4-2010). I expect this could also have been seen with polarized or shutter glasses with other hardware than 3D Vision and presumably with the Zalman TriMon with their GeForce Driver and CP glasses (also with anaglyph glasses on any monitor or TV). Their system analysis tool told me that my year old GeForce 9500 was not up to it: Minimum: GeForce 8800 GTX or above, GeForce 9800 GT or above, or GeForce GTS 250 or better. Nvidia also gives you a list of DLP shutter glasses monitors and HDTV's and since the latter all have the VESA stereo jack (see the most comprehensive list in the FAQ on the 3DTV page), owners of the 3DTV Corp Universal Emitter (www.3dtv.jp) can view such webcasts (or satellite or cablecasts) with nearly any kind of shutter glasses. Contributors to the Nvidia blog were not uniformly successful with this but their comments are instructive and useful since it appears the Masters will be available in 3D subsequently and webacasts will likely be done frequently http://blogs.nvidia.com/ntersect/2010/04/masters-golf-streaming-3d-vision.html .

Just a few days before NAB, Britain's SKY launched the SKY 3D channel with a live broadcast of a soccer match. They have committed to another half dozen live 3D soccer games and daily 3D programs beginning immediately. Anyone who has their HD and Top Channels pack gets these free and over 1000 clubs and pubs have already subscribed as of April. For their xlnt QC on 3D broadcasting see http://introducingsky3d.sky.com/a/bskyb-3d-tech-spec/. "The Stereoscopic encode format is Side by Side compressed within a 1080i25 frame BSkyB utilises Linear or Horizontal Line based encoding (Not Quincunx based) as detailed in HDMI 1.4 Annex H – 3D Video Format Extensions (3D_structure = 1000, 3D_Ext_data = 0000)/ Main subject point should nominally be the screen focus point or convergence point of the two images. Positive disparity or image separation at distant points (into the

screen) should not exceed 2% for majority of shots. Negative disparity Image separation at close points (Out of Screen) should be used with care and not nominally exceed 1% for shots. Care should be taken for images breaking the frame edges with floating windows utilized where appropriate. Conversions of 2D, HD content to 3D is not acceptable and may only be proposed by prior agreement with understanding of the editorial techniques and conversion process involved. Automated systems may not be utilized at this time."   BRAVO! In the 100 year history of 3D Movies there were never any standards and much of it was unwatchable.   How things have changed in just a few years!   However, as it appears they used side by side squeezed, half the H pixels needed for 3D are lost and that's really too bad and could be avoided by using the top/bottom squeezed which loses the less essential vertical pixels.

As this makes clear, the satellite companies themselves are promoting high quality 3D, as could be seen in the large booth of SES World Skies (www.ses.com   based in Luxembourg with head office in the Hague) who have 18 channels on their 44 satellites that can be simultaneously 3D active.   The two 3D panels in their booth, one with active glasses and one passive were being fed realtime on separate two channels from their uplinks on the East Coast (see photo).
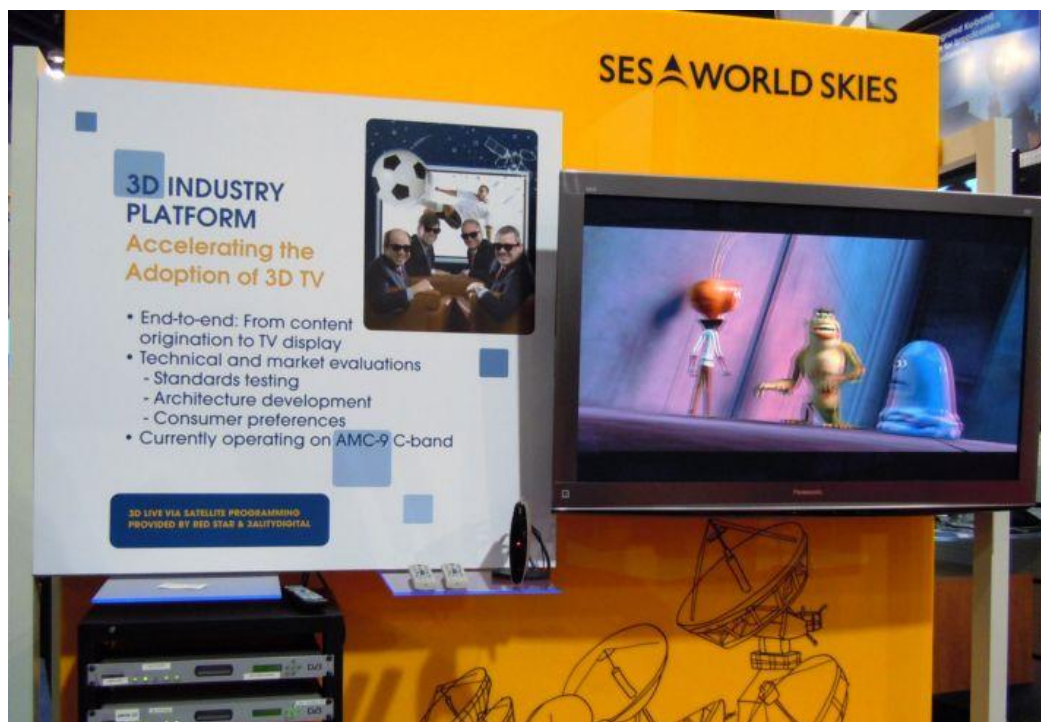
Satellite company SES Worldskies used two satellite channels to send programs from the East coast USA to NAB in Las Vegas.   One was on a Panasonic shutter glasses monitor and the other on a JVC CP monitor.

Korea is possibly the most wired country in the world and it is not surprising that first to market with regular satellite 3D broadcasting seems to be SkyLife, who began including 3D programs in their HD package on Jan 1st while CJ HelloVision has had limited 3D VOD programming since the end of 2009.   Some will recall the satellite broadcasts of C3D in the USA and of Japan 3D in off hours on the Home Shopping Network a decade ago (to both of whom I provided hardware, software and

consulting) when CRT's and shutter glasses were the only available means. CRT's will remain the dominant display for home TV in most countries for at least a decade and there is a resurgence of interest in the 50 and 60hz shutter glasses Home 3D Theater systems which 3DTV Corp marketed in the 90's.

Another media transport giant GlobeCast--a France Telecom subsidiary, which transports over 10M hours of media/year over its satellite and fiber networks, featured its 3D readiness in the booth it shared with it's management arm Netia. Sweden based Net Insight, which is originating and transmitting media to 100M people in 35 countries over its Nimbra network with IP and optical emphasis, also demonstrated its readiness with live 3D broadcasts at the show.

Perhaps of more immediate interest are the plans of many cable providers to begin 3D programming since this is far easier and cheaper to do than satellite. Whatever the broadcasting means, it seems that current compression is able to achieve about 25% file size reduction so that 3D images will have about half the resolution of a home 3D BluRay system which it seems has reduced 3D file size from twice that of 2D to 1.5x. There is of course lots of info on the BR3D format on the net but if you want to see what they have actually patented look at US 2010/0092148, US 2010/0086285, US 2010/0020158, US 2010/0067873 and US 2010/0104262.

Presumably the worst broadcast format is the side by side favored by Sensio and many others (now an HDMI 1.4, 3DTV and broadcast standard), as this discards the H pixels needed for stereo depth, whereas the top/bottom or line alternate (interleaved as used in the CP panels) methods sacrifice vertical pixels. The side by side squeezed format has been used many times for film, photography, graphics and video for half a century including various video cards in the 80's and the 3DTV Corp SpaceStation 3D format converter in the early 90's and suggestions that it is protectable by patent are preposterous.

Some providers are discussing the use of two full HD channels (Simulcasting), but in addition to doubling the bandwidth and presumably the cost, this requires a device to multiplex and display full dual bandwidth signals at the consumer end. BluRay 3D does not afaik lose anything since it stacks the two images in full res top/bottom (frame packing), if played out on suitable TV's, but if e.g., it is played out in the checkerboard on 3D Ready DLP or Plasma TVs and some projectors or in interlace, field sequential or some other formats on other TV's, it may have half res/eye.

It appears if one counts all the 30 or so 3D Ready models of DLP and plasma tv's from Samsung US 2010/0007722 and Mitsubishi -US 2010/0045784 for their laser DLP TV-over the last 3 years, there may be 5 million in circulation with sizes up to 82 inch diagonal, and new or used they are selling for far less than the new 3DTV's. It appears that the new BR3D players and even some older BR players will support checkerboard out from the older field sequential 3D DVD's that are widely available. HDMI 3D spec1.4a supports output in checkerboard (called quincunx to show they are educated) so even the new BR3D DVD's should be playable on them. For those who don't want to buy a new player, or cannot play old field sequential 3D DVD's in checkerboard, Mitsubishi has finally awakened from their slumbers and will shortly intro a $100 3D format converter -the 3DC-1000 -to enable 3D viewing on these 3D

Ready DLP's.   It appears XBOX and PS3D will also support this format soon since all consumer video devices ought to become HDMI 1.4 compliant.   See the FAQ on the 3DTV page www.3dtv.jp   for the latest on how to get 3D on your TV at home.

The Japanese giants have committed totally to 3D with both Panasonic and Sony making various announcements regarding major 3D efforts and both had huge booths dominated by stereoscopic hardware and software.   Panasonic's 3D Theater had two 103 inch and one 152 inch plasma screens (PDP's) showing mostly Olympic highlights with their new LCD shutter glasses running at 120hz.   These were very bright and I did not notice any ghosting but the out of sync footage so evident in the Olympic sports shots was very noticeable here and in other booths.   Panasonic has said it developed ghost reduction and maybe preprocessing of their footage was one reason it looked pretty good.   If so, this may be featured in the software that goes with their editing systems but conceivably it could be put in the displays firmware where it would be necessary to reduce ghosting of broadcast and BR3D inputs. However they have done much (maybe $100M in R&D!) to reduce ghosting in the construction (drive electronics, phosphors etc) of the panels and it's not clear if they do software ghost reduction as well.
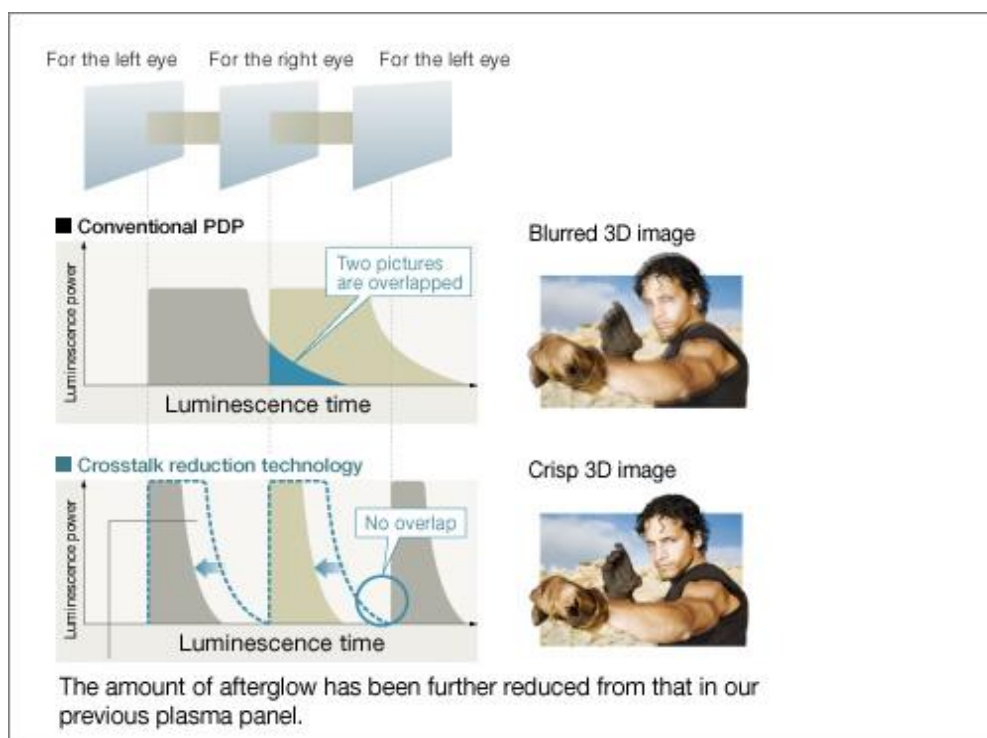
Panasonic's Illustration of ghost reduction in their new PDP's

  I saw the 3D PDP first prototyped by NHK in Japan a decade ago and the one released by Samsung about 2 years ago, but they had intolerable ghosting.   Having invested a huge amount in PDP, Panasonic has continued to improve brightness, (said to be 2X that of 2009 models) phosphors, and electronics so that in 2D or 3D they seem to have an edge on current LCD's.   However the weight, fragility (one hard knock and the vacuum is broken) and production costs of larger sizes seem major disadvantages to me and I still expect the rapidly improving LED lit LCD's
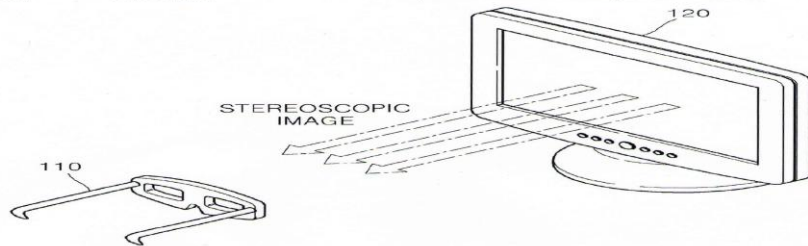
(confusingly marketed as LED TV's) and maybe LEDs, OLEDS, TOLEDS, TOUPLEDS, EL's, DLP's etc to replace them.

Having invested a huge amount in PDP, Panasonic has continued to improve brightness, phosphors and electronics so that in 2D or 3D they seem to have an edge on LCD's. For details on the 3D tech see http://panasonic.net/avc/viera/3d/technology/index.html and for more on their whole Panasonic 3D biz see http://3d.panasonic.net/en/#outline . Regarding the diagram on this page, display expert Prof Vasily Ezhov tells me that closing the shutters before the image has totally decayed will lead to eliminating or fading the lower part of image because it appears no displays (except afaik DLP's) show all pixels simultaneously and the phosphor decay time is not the time axis of the image scan. It is the time axis of each pixel or image line including pixels of the last line of image that matters. So there is something wrong with their explanation of ghost removal--probably the glasses are shuttered as normal and the fast phosphor decay is the reason for ghost reduction. Of course RealD WO 2010/019922, US 2010/0040280 and numerous others US 2009/0244266, US 7,558,320, WO 2010/015868, to cite only a few recent patents, have been working on algorithmic ghost reduction- which could be incorporated in the firmware of all types of displays, video editing software and processors. In related work, NEC describes how to prevent beat frequencies by driving panels at exact multiples of the ambient fluorescent illumination in US 2010/0060723.

Ghosting was evident in all the Samsung shutter glasses displays I saw but not as obvious in those from Sony or Panasonic (but one really needs to see the same software on them). However like nearly everything electronic these sets are updateable and several companies that were showing the Samsung 3DTV's released only weeks before the show told me they had already updated the firmware twice with noticeable image improvements.

Incidentally, neither the displays nor the shutter glasses from any of these displays really run 3D at 240fps as this is beyond the ability of the glasses and the panels. They run at 120hz and turn off the image display earlier in 3D mode giving the image time to decay in order to reduce ghosting-- so you have 120fps alternating with black US 2010/0066820, US 2010/0091207, US 2010/0066661, US 2009/0237495, WO2010/032927. This of course reduces brightness but new drive electronics and phosphors (in PDP's) provide adequate compensation. There is lots of noise on the net about the relative merits of the motion compensated 240fps displays from Sony and Samsung (supposed "real" 240) vs those of Toshiba, LG and Vizio which are "fake" 240 . LG has responded by announcing the imminent release of their new 3DTV's with 480fps -the LG INFINIA 55LX9500 55" Class 3D 1080p 480Hz LED LCD TV.

A recent Samsung patent describing the field sequential shutter glasses technique with back lit LCD panels that is now appearing in 3DTV's.

It is interesting (to me) that at least some of these means to reduce motion blur seem to divide the frames into 3 subframes horizontally with frame one occupying the top and bottom 1/3 and frame 2 occupying the middle third and the reverse for the next frame.   This is one of the methods I diagrammed 30 years ago when looking for a method for reducing flicker on field sequential CRT's, but the rest of the display tech available then was not up to it-- e.g., the shutter glasses would have had to do microsecond switching without a line missing in the video.   I thought of rolling the line down the screen etc., but never implemented it.

Sony has shown (e.g., CEATEC JAPAN 2009) the above true 240fps single lens 3D camera but I don't know of any commercially available monitor to display it. I assume the 240 fps TV's in current release would have intolerable ghosting. Presumably the image could be projected in the cross polarized method with their

SRX projectors or demuxed into two projectors and possibly DLP projectors could be made to work at this speed but afaik no current consumer shutter glasses nor the CP switching mechanisms (e.g., the RealD screen) can work at this speed but maybe the Masterimage wheel or the Dolby wheel might do it. In Sony's words "Optical tests have shown that a frame rate of 240fps represents the limit of human visual perception, and beyond that it becomes difficult to detect differences in terms of blur and "jerkiness" of moving images (where images that were continuous are now seen as a series of distinct snapshots). By developing a 240fps frame rate CMOS image sensor with properties close to the human eye, which is capable of capturing natural images of even fast moving subject matter, Sony has succeeded in further enhancing the quality of 3D video images."   Historians please note the photo of Bull's high speed stereo camera from over 100 years ago at the end of this article.

Sony is constantly updating new cams, decks and switchers for 3D compatibility and the new 5800/2 HDCAM deck can operate at twice speed to record two full HD streams and playback 4:4:4 at twice speed.   Now that a standard has been set for 3DBR they will soon release Blu-Print 6 Blu-Ray 3D compatible authoring software. Those wishing to check out the latest Sony patents on 3D hardware and software should see WO 2010/027971, US 7,659,934, US 2009/0262184, and US 7,605,776 (a most unusual patent as it is issued jointly to Sony, Sharp and Sanyo).
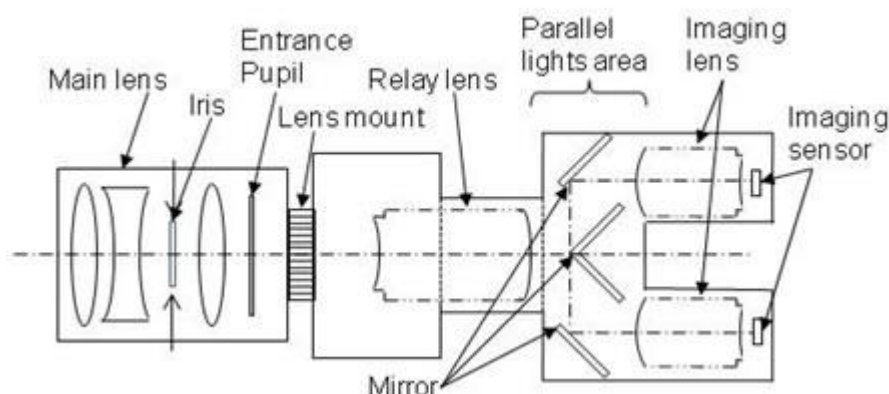

Diagram of the dual sensor and mirrors in the Sony 240fps single lens 3D camera.

Though Panasonic showed a variety of hardware and software for capturing, editing and playing back 3D, I think their Professional Twin Lens AVCHD camcorder probably got the most attention.   In spite of a huge effort by dozens of companies to make 3D video with mirror boxes or side by side rigs, its still lots more effort to shoot 3D and every video producer would like to see an easy to use 3D camcorder.   Even though it's not slated for release until September, the AG-3DA1 ($21K srp) was in many booths with some featuring footage from it on 3D panels.   Panasonic has shown prototypes of a high end P2HD 3D Camcorder with much larger lenses but afaik it was not at the show and I have not seen any release info.   Also for September release is the BT-3DL2550, a 25″ production monitor with 3D support. It has two HD-SDI and a DVI-D input with the HD/SD-SDI inputs able to display the left or right 2D or 3D input in line-by-line or side-by-side modes viewed with CP (circular polarized) glasses. One thing made clear by this show is that nearly all of the 3D monitor and TV manufacturers are hedging their bets by making both shutter glasses and CP 3D monitors and most of them continue also to work on PDP's and auto

stereo. Panasonic gave out a clear 12p brochure with all the details and you can find the latest at http://www.pro-av.panasonic.net/en/3d

The mystery Panasonic P2HD 3D camcorder has been shown periodically for a year.

In spite of the greatly improved images on the newer panels, the weight, fragility (one hard knock and the vacuum is broken and you have a paperweight that will cost a fortune to ship and repair), and production costs of larger PDP sizes seem major disadvantages to me and I still expect LCD's and maybe OLEDS or better TOUPLEDS (US 2010/0096617), and EL's and DLP one piece and two piece projectors (esp. when the TI 4K chip arrives along with white LED "bulbs" for home apps) to replace them.

The Panasonic 3D ready AG-HMX100 mixer will be available this summer. It has four HD/SD-HDI inputs/outputs, two HDMI inputs, and two analog composite inputs and seems to be the first reasonably affordable 3D ready mixer, but as they tell you, it cannot yet do all the effects in 3D.

World leading large venue projector manufacturer Christie (owned by #2 US theater chain AMC) was presenting their digital signage capabilities but sadly had no 3D to show. They have recently released a new active stereo projector with a special dark interval adjust for shutter glasses at 120hz --the Christie Mirage WU7. This brings to mind an odd omission at NAB- the absence afaik of even one 3D DLP front screen projector. There are about 50 models from a dozen companies http://dlp.com/projector/find-dlp-projector/default.aspx?p=0-0-0-0-0-0-0-0-0-0-1-0-0-0-0-0-0-0-0-0-0 and they cost as little as $250 or about a tenth or even twentieth the cost, size and weight of 3D capable flat panels. These are now ubiquitous, made by many companies and well promoted by TI http://dlp.com/projector/dlp-innovations/3d-ready.aspx so their total absence here was bizarre. Of course there are about 20 new models of onepiece 3D Ready DLP TV's from Mitsubishi (and about 10 from Samsung) that work with shutter glasses, and at least one at NAB (in the Nvidia booth), but Mitsubishi's booth only showed their

large LED signs in 2D!

All of these devices have the DLP link emitter built in so they need no outboard emitter for wireless glasses, but so far the glasses are rather expensive ($150 vs. $40 for 3DTV Corp Model X or $15 for wired) and with limited availability and it is still necessary to play files at 120hz on a pc. However, using the 3D pc system from 3DTV Corp enables use of these with ordinary shutter glasses and external emitter, provided the dongle (glasses sync cable) is triggered with appropriate code present in 3D video software such as Neotek's TriD or educational CD's www.neotek.com , the very common H3D, I/O, X3D, 3DTV, dimensional, iZ3D or older Nvidia game drivers, or the Wimmer or Suto 3D videoplayers. However the 3DTV manual dongle does not need software triggers.   Free downloads of 3D game drivers and of TriD and Neotek players and images are   now available from 3DTV Corp for those who want to try and you only need the common dongle and wired glasses (ca. $35 as a new kit, but about a million in circulation). With TriD, files of nearly any type can be rectified and compressed for TriD playback without need for page flipping so this makes it ideal for 3D Ready DLP projectors. Check the articles, faq and downloads on our page www.3dtv.jp for the latest info.

The new (mid 2010) displays from Samsung, Panasonic, Sony etc have wireless glasses emitters built in, but in all cases you need the over $100/pair glasses and all these systems are currently incompatible.   I have started to change that by making multistandard glasses and emitters available, but none work yet with the newest 3DTV's.

Also absent from the show was Digital Projections line of 14 active stereo projectors which can be used with any of the four 3D cinema projection methods (though not currently certified by the monopoly as DCI compliant because that costs $millions/year), as well as the oldest method (dual xpol projectors) which, in spite of making most sense from an economic and quality standpoint, seems totally unused in DCI compliant theaters.   Many thousands of 3D venues have both active and passive 3D setups with DP projectors.

Digital Projections Lightning series of 3 D capable DLP projectors http://www.digitalprojection.com/Accessories/Total3DExperiencesystem/tabid/111/Default.aspx . They have recently released the M-Vision Cine LED --a 600 lumen home theater projector with an LED light source capable of running eight hours a day for over 20 years without changing the bulb http://www.digitalprojection.com/BrowseProjectors/SeriesList/ProjectorList/ProjectorDetail/tabid/87/ProjectorId/161/MarketTypeId/11/Default.aspx. A crosspolarized pair of these with a silver screen and suitable demux for HDMI signals and you would have lifetime 3D cinema. However the smaller home theater projectors from DP are not capable of active stereo as that requires a dual link DVI port. The least expensive choice for that seems to be the iVision 3D at $27K but for my birthday present I'd settle for a pair of cel phone stereo projectors US 2010/0103379.

An exciting shutter glasses capable display shown (but not in 3D) at NAB was Christie's MicroTiles,DLP driven LED illuminated cubes http://microtiles.christiedigital.com/microtiles.php. The 720x 540 pixels/ 12inch by 16inch by 10 inch deep cubes can be stacked in nearly any size array for bright, durable hires nearly anywhere. Of course this tech is being developed by many others as well. A polarizer overlay would permit passive 3D viewing and anaglyph can be done with any display. It could also form the basis for autostereo with lenticular or barrier technology.

MicroTiles are a LED illuminated miniturized version of the Texas Instruments DLP (Digital Light Projector or DMM for Digital MicroMirror) projection engine which dominates and made feasible the 3D digital cinema and is also present in many TV's including the 3D Ready line of Mistubishi's. and Samsung's. The one piece rear projection DLP TVs have not had great success versus total flat panel sales, but with LED lighting, other improvements, and the coming 4K version of the DLP chip this may change. Hats off once again to DLP inventor Larry Hornbeck, his colleagues and the TI management responsible for this breakthrough technology that blindsided Asian LCD manufacturers and led directly via StereoGraphics, RealD, ColorLink and Disney to digital 3D movie projection and the revolution in 3D imaging. As I have noted, the Sony 4K SRX projector with the RealD lens enabled the surprise deal with huge American cinema chains AMC and Regal that has resulted in almost 500 3D 4K installs in the USA in less than a year, but TI will soon release the Cinema Enhanced 4K DLP engine and this will put them back at the top of the market as it can do field sequential (i.e., RealD, MasterImage, Dolby, Xpand) as well as simultaneous 3D (i.e., top/bottom cross polarized dual lens).

Many other pro video companies, including Sony, were showing twin rigs side by side or with one or more of the 15 or so models of mirror boxes now available from at least a dozen companies (and many had both). I was hoping to see 3D videocam pioneers Toshiba (a consumer 3D camcorder in 1988!), Canon (a prototyped but never released prosumer 3D camcorder in 1999) and Ikegami (a pro 3D zoom camera in 1995-see my article from last year) showing new 3D cams, but the latter two had only rigs from others using their cameras and lenses and afaik Toshiba (in spite of the fact that they continue to work on 3D--US 2009/0237495, US 2010/0066661) showed no 3D at all. Ikegami gave out a very slick CDROM catalog with exquisite details

on a very wide range of world class broadcast products but not a word about 3D. When we have spoken to them about it their personnel only say that they were not successful with their 3D Camera (15 years ago!) and so no interest. Very sad. But I bet it changes in a year or two.

One of the stereo rigs in the Ikegami booth featured the Musashi Optical device that I gave Best of Show in 3D hardware last year (see photos). This nifty optical instrument permits variable and small interoculars on side by side cameras without convergence--i.e., the parallel shooting which I have suggested as the best option when possible (see my page) and presumably would see wide use if they make a sustained marketing effort. But in spite of NHK's and my promotion few 3D experts seem aware of its existence or maybe just don't appreciate its practicality (but it was used on Avatar).

The Musashi Optical TL-3DA/1a Lens Shift Adapter (interaxial reducer) www.musashi-opt.co.jp was in several booths this year. This shot of the rig in NHK Cosmomedia America booth shows how close you can get two big cams (61mm) without convergence or beam splitters. The max lens diameter is 61mm and it can reduce from max 167mm for these 2/3 inch B4 mount cams, but of course the principle could be adapted to fit any lenses and cameras.

Two of their broadcast cameras in the Ikegami booth in a side by side rig using the Lens Shift Adapter   by Musashi Optical (two small black boxes with white labels on top and larger black boxes behind them).

German based Element Technica has been so successful with their lovely but pricey mirror boxes and associated equipment (see last years article) that they have fielded 3 different rigs and opened a Los Angeles office and a new page www.technica3d.com. Their original Quasar has baby brothers in the Neutron and Pulsar--so that nearly any camera can be used and, though all 3 rigs can be adapted for side by side shooting, the Neutron enables this to be done in just minutes.   Their THC-S (Technica Hand Controller Stereo) is a very intuitive device with slider and wheel that can control devices such as the STAN (see below), v3 or Sony MPE-200 when these are used with the rig.   The THC is customizable for 6 axis control and is user configurable to link various parameters such as focus, zoom etc from the latest OTS (off the shelf) servo lenses from Canon, Sony, Angenieux etc.   Last year I mentioned my meeting with Christopher Mayhew of v3 in the Angenieux booth, his method of getting 3D out of a single 2D lens (see patent image below) and my discussion with him of its possible use in 3D dual format.   This has now been done and the THC now controls the v3 lenses for an extra level of 3D image capture. http://www.inv3.com/index.html http://en.wikipedia.org/wiki/Vision_III_Imaging,_Inc .
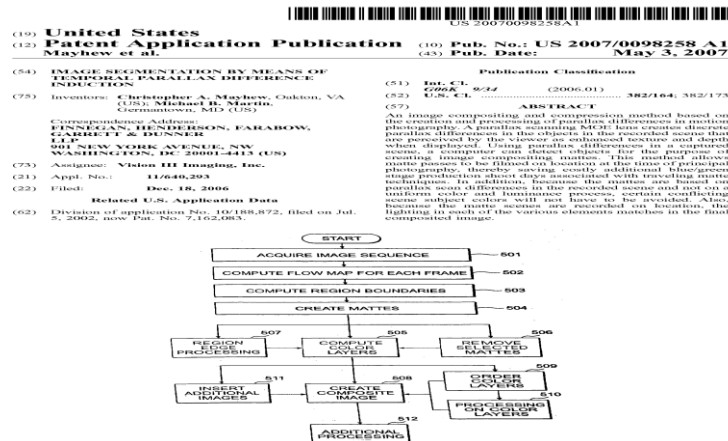
Fujinon is famed for their industrial strength pro video lenses and in their booth was the latest creation from Vince Pace featuring a modest sized side by side stereo pair of cameras with Fujinon HA18x7.6 BEZD-T4DD 7.6mm zoom lenses with the new quick framing function mounted on top of a large pro Fujinon lens on a pro camera . I respected his wishes and so no photos but those who want to see details on their rigs can consult the recent patents US 2010/0098402 and US 7,643,748.   The point is that all the lenses were synced so that a single operator could make the 2D and 3D video at the same time with one set of controls--a great savings in cost and space.   There is often limited space for cameras and this type of rig is likely to find considerable use. Fujinon has gone to a great deal of trouble to QC lenses and spec them for dual camera 3D HD rigs and has a whole section in their catalog just for 3D qualified precision servo lenses.   They have also developed special dual lens hardware (ERD-10A-DO1 Zoom Controller and HJ-303A-06 Synchronizer/Focus Controller) for maintaining precise control over parameters of zoom and focus.

Preston--producer of industry standard remote lens controllers FI+Z and others-- has a FI+Z 3D unit and Lens Tweak software that will control two Fujinons (and I assume the many other lenses normally controlled by their 2D units) for 3D sync http://www.prestoncinema.com/products.html . Adding their HU3 and MDR2 controllers permits interaxial and convergence control, which can be locked to keep convergence as the interaxial is varied and software adapts it for both mirror or parallel rigs.

Fujinon's latest catalog has several pages devoted to lenses and accessories for 3D and they gave out a slick 4 page brochure "Lenses and Control for 3D Production".

Re cam accessories that are now becoming standard on high end 3D productions I will note the Telecast Copperhead 3200 (3400 due soon) Camera Mountable Fiber Optic Transceiver System which has been used by Cameron/Pace, 3ality and many

others www.telecast-fiber.com .

The British firm Calibre was showing one of their range of broadcast quality processors (blenders, scalers, converters, synchronizers, noise reducers etc) displaying 3D on a panel www.calibreuk.com .   Teranex, famed for their image processors and format converters, some of which can convert 122 formats in any direction (expandable to 275!) announced the imminent 3D compatibility of several of their top processors http://www.teranex.com/company/news/3D-Encoding-Decoding .   For-a www.for-a.com showed new tools for 3D production and live calibration and parallax adjust such as the CEQ-100HS color equalizer and the HVS300 HS Hanabi series production switcher able to do 3D DVE transitions.

MultiDyne, whose LightBox pro fiber optic video/audio transport and routing hardware, has been widely used for sports and ENG (electron news gathering) for years, introduced a new version specially configured for 3D the LightBox 3D.   They told me it had already been used in many 3D productions including Avatar.

Last year Mikrom was ahead of the game with tiny 3DHD capable recorder/players and they showed the latest version at the show but many companies are getting into the market with Convergent Design's Nano3D being one of the tiniest.   It consists of twin nanoFlash's which provide on-set pixel synced recording (native Quicktime or MXF at 35 to 280 Mbps) and playback of two HD-SDI or HDMI streams with linked filenames and timecodes. It merges dual streams into popular 3D formats such as side by side, top and bottom, and line by line (interlace). The merged video is output over a single HD-SDI cable for display on professional 3D monitors. A low-cost HD-SDI to HDMI converter enables the 3D HD-SDI stream to be displayed on consumer 3D TVs.   Two   nanoFlashes   plus   the   nano3D   kit   costs   ca $5800. www.convergent-design.com.

Convergent Design's NanoFlash 3D HD-SDI recorder.

There are now so many mirror box rigs (i.e., metal boxes with 50/50 semisilvered mirrors for mounting two cameras at right angles) in use that nearly any camera or

lens pair can be accommodated.   Of course the very large or very wide angle lenses are still not feasible (though remember that the huge IMAX film cameras have been so used for decades).   This is so in spite of the fact that everyone knows of their many limitations (e.g., 50% light loss, reflections, color distortions etc).   In fact several of the 3D editing packages now available include specific tools to conform nonmatching portions of the image made with such rigs.   Cameras are normally mounted top or bottom with the other in the back (i.e., towards the operator) but one neat variation had the second one side mounted.

Some booths had the 36MPixel Canon Mark 5D in a stereo config and it is becoming so common to use this and other high end still cams in video mode that you see the phrase stereo DSLR (i.e., Digital Single Lens Reflex) used routinely.   There is so much demand that at least one company now offers them with 35mm PL mount for cinema lenses www.hotrodcameras.com .   The Canon was chosen by David Niles of Niles Creative http://www.nilescreative.com/ for a 360 degree 3D Super HD exhibit he is currently doing.   Director Peter Jackson is also making a 360 deg 3D program for the new King Kong show at Universal Studios.

  Although panoramas have occasionally been done in 3D for many years, it is only recently that the tools for registration, edge blending and camera sync have been perfected to the point where a very high quality result can be obtained.   Many of the purveyors of edge blenders and other image processors now emphasize their ability to process 3D images in various formats and these were abundant at the show.

A contestor for best of show regarding intuitive promotion of the 3D capabilities of their products is Miranda, whose high end video processors are used by broadcasters worldwide.   Not only did they have 3D displays in their booth, but they handed out a 16p brochure http://www.miranda.com/prod-spot/2010/3DPRODS/3D.pdf entitled Stereo Image Processing with Miranda.   Unlike some who merely noted that their processors could do 3D in the side by side or anaglyph formats, Miranda was one of several who made new hardware with multiple 3D I/O formats (they left top/bottom out of their brochure but told me it worked).

Pascal Carrieres of Canadian broadcast video mfr Miranda www.miranda.com showing 3D processed by their Densite 3DX-3901 in the side by side Sensio format displayed on a JVC CP monitor.

360 Systems new MAXX 2020-HD reference recorder brochure headlines "Two Uncompressed HD Channels for 3-D and Multi-Screen" and notes it's one of the first that can record/play two full HD streams.   The newly released 3D HDMI formats will be supported Q2 2010.   Those who are interested can download the 3D HDMI specifications at http://www.hdmi.org/manufacturer/specification.aspx.   They were careful to support nearly all 3D formats including the top/bottom (over/under, above/below) that Neotek, 3DTV Corp and others have favored for almost 20 years, but it seems the importance of supporting what will likely remain the dominant formats-50 & 60hz field sequential on CRT's and anaglyph--escaped them.   They have designated a field sequential output option but its not clear what frequency and whether anyone will support it.

Last year. I mentioned well known broadcast hardware vendor Evertz, who had a small stereo display to advertise their unreleased card that could be used with some Sony cameras to record dual 3DHD.   This year they had a whole section of their booth and catalog featuring video processors, displays, 3D Advanced Dual Test Signal Generator, 3G Miniature Stereoscopic Display Processor, HD/SD JPEG2000 Decoder or Encoder with optional 3G (i.e., Gigabits/second) support and others.   Since this changes frequently those interested should track these at http://www.evertz.com/products/production/#ThreeD .

Harris, another top maker of broadcast hardware had nothing 3D in their booth last year but this time it was a major theme.   Harris is a huge (currently 371 in the

Fortune 500 and rising fast) intl. media company and anything they do re 3D should be worth attention. As they put it: "Harris Corporation is an international communications and information technology company serving government and commercial markets in more than 150 countries. Headquartered in Melbourne, Florida, the company has approximately $5 billion of annual revenue and more than 15,000 employees — including nearly 7,000 engineers and scientists. Harris is dedicated to developing best-in-class assured communications® products, systems, and services." They showed 3D IP via their newest soft and hard such as Inscriber TitleOne™ XT character generator, the G5 XT production graphics system, Inscriber Connectus™ media management tool, Inscriber G-Flow™ workflow tools, the new G-Flow Titler, and switchers, monitors, etc throughout the broadcast chain. Though it says little about 3D those who want a clear, concise summary of the emerging 3GB/sec video transport schemes should get this 7p brochure http://www.broadcast.harris.com/media/3Gbs_25-5669.pdf .

Tektronix, a classic name in high end video and electrooptic test equipment and a pioneer in LCD glasses (remember the Atari 3D system ca. 1984?), CP switching polarization plates, 3D HMD's etc. was at the show but sadly sold off it's 3D line long ago. It wasthe leading LCD technology technology firm in the USA but poor management led to its being sold off to Asian companies, some of which passed via NuVision and McNaughton to XpanD--the dominant name in theatrical shutter glasses. Afaik NuVision/MacNaughton were able to survive the last 20 years largely by selling compatible stereo products into the market created by StereoGraphics Corp--the company I started in 1979. I wonder if anyone at XpanD or RealD realizes a good case could be made that they owe their existence to the fact that I saw Bwana Devil (the film that started the 50's 3D craze) in 1952? But one could also say that they would not exist if one of Michael Lewis's (RealD's CEO) great great grandparents had taken a wrong turn on the day they met.

I mentioned last year the stereo tools in the Ocula plugin to Nuke, a leading visual FX and IP software from The Foundry (used in e.g., Avatar, Alice in Wonderland 3D) www.thefoundry.co.uk . The subtitle of the Ocula section of their 50p color booklet says it all: "Taking the headache out of stereo post-production". It now has the ability to generate disparity maps from CG depth maps as well as from live action stereo. Such maps give you 3D position and movement info that permits pixel level control (e.g. warping, zooming) of any portion of the image in any frame, as opposed to manipulating the entire frame. The unprecedented 2500 stereo VFX shots in Avatar were handled as a Nuke stereo workflow by the VFX houses, with Weta Digital and Framestore using Ocula. Weta used Ocula's ColourMatcher, DisparityGenerator and NewView to match local areas of L/R images and VerticalAligner to correct convergence-caused keystoning and vertical parallax on nearly all live and some CG shots. Free 15 day licenses are available on their page www.thefoundry.co.uk.

A lovely little app I saw that every 3D shooter could use for determining the parameters of stereo shooting and screening is Leonard Coster's Stereographer's Interocular Calculator . Here is the description from his page www.speedwedge.com

"It calculates the inter-ocular distance needed for each camera setup based on

measurements from the actual set.   Provides handy sliders and nudge buttons to set the distances to the nearest and farthest objects in the scene, as well as the desired convergence point - whether or not you converge in camera or post.
The sliders are logarithmic so you get finer control at the short end - nice!

- Calculates the foreground and background divergences as percentages and actual distances for your chosen screen size and limits the background divergence to infinity.
- Also computes roundness factor so you can match the apparent depth from shot to shot even when changing lenses and setup.
- Operates in metric and imperial.
- Suitable for Motion Picture and Stills work, Film or Electronic cameras.
-Best of all it's fast and intuitive.
Settings for:
- Camera sensor size, with a whole bunch of presets for both film & electronic cameras.
- Lens kits - enter the focal lengths in your kit for fast selection.
- Screen Size - with handy presets for TV, cinema etc.
- Maximum permitted overall divergence - typical is 3%.
- Maximum background divergence in actual mm on your chosen screen size - typically 65mm."

You can buy it on Apple's online store:
http://itunes.apple.com/au/app/iod-calc/id359080381?mt=8 and you can get a copy of the new RealD stereocalculator there too.

Of the many newer companies with shooting products, a superbly engineered line from Germany stands out. Screenplane (www.screenplane.com) is named with reference to the appearance in the plane of the screen of stereo pairs with zero H parallax. Their cutting edge selection of hardware and software was presented in one of the slickest brochures at the show. This includes of course two mirror boxes, the Production Rig for larger cams and the 3-Flex meant for small cams, macro and SteadiCam work. These have a variety of useful special features but, like their new custom LM-1 lens motor, will not be available until summer 2010 and then through rental houses. Following the universal trend, they have incorporated digital motor control software and hardware for remote realtime adjustments.

A beam splitter rig by Screenplane

Screenplane's DPC (Direct Plane Control) of interaxial, convergence and focus via the cmotion remote (see last years article) permits input of screen and farplane distances as absolute values (absolute mode) or via direct readout of lens focus (relative mode) with a slider for H shift of the plane. They have also created

HISCON (Horizontal Image Shift Control) as a supplement or alternative to manual or motorized convergence or interaxial changes--i.e., digital shifting/cropping to make use of the extra H pixels in modern cameras (as discussed in my other articles and implemented in my 3D work for the last 20 years). HISCON--done by percent and so resolution independent--supports DPC, is incorporated in the cmotion 7 axis wireless controllers and so can not only be used for previewing shots with such multiplexing/viewing devices as their new Merger, but via their USB device 3D Log it makes the all 3D camera and lens data timecode stamped and available throughout the postproduction stereo workflow via a USB ports on both mirrorbox rigs.

All Screenplane devices are supported by German software company IRIDAS's SpeedGrade, and FrameCycler (mentioned in last years NAB article and also presented this year) and soon will be by ClipFinder-the software created for the RED cameras (see the latest on ClipFinder at http://www.daun.ch/hamingja/ . Also available by summer are the X-Y lens mount for REDs, tiny XS-HD cams, the Snuggle Puggle (no missprint!) a tiny handheld rig for small cams, and the Merger which has the full set of 3D format mux/demux functions, web interface (i.e., LAN jacks) and image display and/or ipod support now becoming standard.

A scene captured by the Kronomav camera rig shown below, composited realtime with computer graphics with Brainstorm software and a FOR-A switcher and displayed on a Mitsubishi DLP monitor viewed with Nvidia shutter glasses. Brainstorm www.brainstorm.es is a Spanish software company which provides realtime broadcast 3D graphics solutions and they recommend the 3D Ready Nvidia Quadro cards (most with the VESA stereo glasses jack for the 3DTV Emitter) for output.

Venerable Chyron Corp www.chyron.com, whose tools for broadcast graphics

creation, management and playback are industry standards, had nothing on 3D last year but this year it was their main theme and it's the first thing you see on their page. Their upcoming Lyric Pro 8 software has full stereoscopic support and they even podcast the tutorials.

The author with the Kronomav   www.kronomav.com side by side rig in the Nvidia booth.   The Kronomav control box has the orange stripe on the side and Kronomav shared a large booth with TDVision (see below).

EVS booth featuring their 3D Live system fed by the Panasonic 3D Camcorder at the right. EVS is well known for its video servers and other hardware used in production and on site broadcasting and 3D Live continues the revolution in sports broadcasting started by their Live Slow Motion system. It is the first realtime live 3D HD slow motion system, has full timcode sync and is based on their XT[2] Production Server.

Representatives of Class Manufacturing of Spain with one model of their Kubok 3D Vision series of cross polarized displays viewed through the dual polarized glass plates.   They have many sizes and of course paper or plastic polarized glasses could be used as well, especially in venues such as movie theaters lobbies and trade shows where people already have them.   With the spectacular growth of 3D films and displays many companies such as MicroVision are now offering classy designer CP glasses and it is quite possible that many people will soon carry around their own. Some are starting to sell sunglasses that double as viewers.

A healthy sign was the presence of at least four companies showing stereoscopic QC hardware and software.   UK based Hamlet (www.hamlet.co.uk) was demonstrating its VidScope software with anaglyphs created live with a stereo rig provided by my friend the renowned British stereographer David Burder.   The ITU photosensitive epilepsy test is one of many stereo relevant functions built into VidScope.   Their Reel-Check EV analyzes nearly any AV stream and runs automatically or manually on any Windows PC, including network modes and they also have their own test and measurement hardware such as vectorscopes.   They also gave out one of the nicest CDROM catalogs I have ever seen with intuitive diagrams of their products in a page turning book format.

Robin Palmer demo'd the Hamlet VidScope 3D software for realtime stereoscopic analysis. UK based Hamlet Video www.hamlet.co.uk, with worldwide distribution of their hardware and software for live or file based video testing/monitoring/measuring shows its applicability to live 3D via the stereo rig at the left and the Minolta 3D webcam at right.
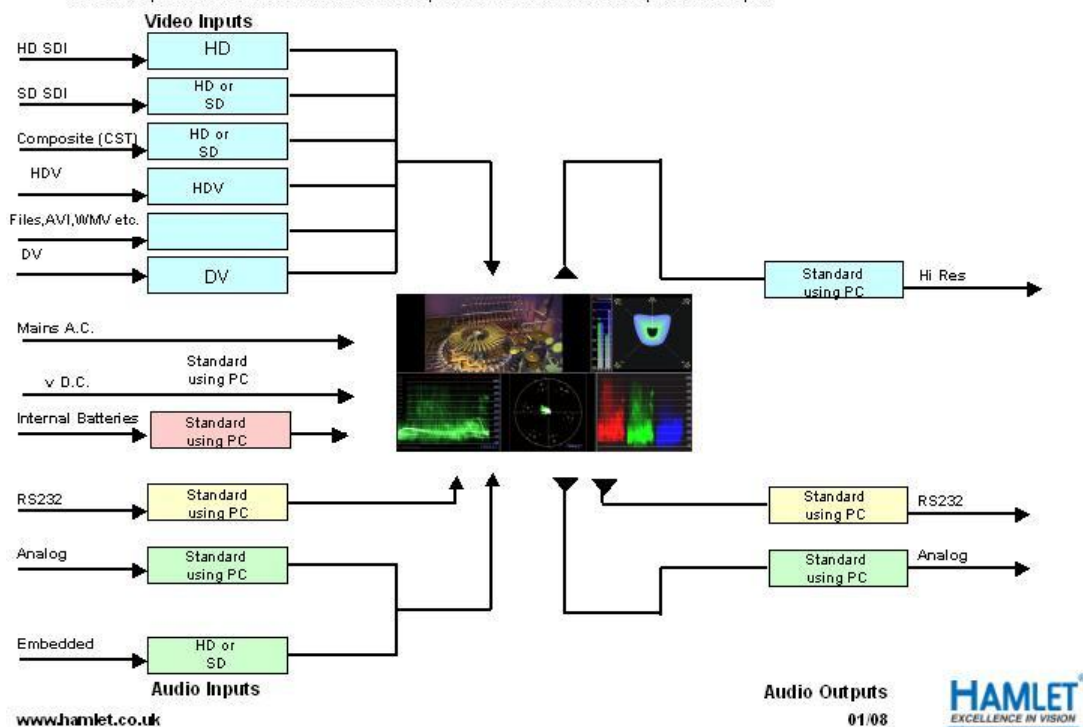
Flow diagram of the Hamlet VidScope from their CDROM brochure (above).

3D Switch http://www.3dswitch.eu/, a 9 year old concern which is an R&D associate of Italian patent portfolio company Sisvel http://www.sisveltechnology.com, and working closely with Eutelsat and OpenSky, was showing 3D Ready--software for

multiformat stereoscopic I/O with the metadata in the video band and hence transparent to all hardware and software regardless of compression, bit rate etc and immune to transcoding WO2010/046739.   The bit mapping of color blocks (384 bits/frame) permits switching 3D formats or into/out of 2D in one frame and is extensible to new formats and higher level frame packing description, such as subsampling method, phase, eye locations in packing subsections, parallax and other camera settings etc.   The 384 pixels may be invisible even in the viewing area or they can be hidden in the borders or extra lines.   It conforms to all CM-3DTV specs but is still a work in progress.   To put it succinctly in their terms "3DSwitch is a set of libraries for set top boxes, FPGA and ASIC that allows 3DReady format decoding and 3D to 2D or 3D to 3D format conversion to allow any 3D format to be displayed on any existing display technology".

Hiding metadata in the video stream is a sufficiently well traveled art that RealD has filed an application that looks a lot like 3D Switch -- US 2010/0026783.   In spite of the virtues of this method (e.g. no requirement for HDMI 1.4a, H264 SEI messages etc and so seamless transition to 3D-- provided the decoder device such as STB has 3D ready software to decode the image metadata) its virtues may be lost due to rapid adoptions of the HDMI 1.4a spec.   A related patent for watermarking 3D images is US 2010/0098326.

Giovanni Ballocca (right) of Sisvel Technologies   and Dario Pennisi of ipTronix http://www.iptronix.com/ (who did the programming) with a CP Hyundai monitor showing 3D content with the 3D Switch codec.   This codec embeds the 3D format and other info in hidden areas of the image and is very similar to a recent RealD patent app.   There is of course a huge prior art.

The 250 member international consortium of DVB (Digital Video Broadcasting) booth had info about the upcoming 3DTV standards and you can get some info at http://www.dvb.org/news_events/press_releases/press_releases/DVB_pr192_NAB_3

DTV.pdf

Video card manufacturer Nvidia pioneered in 3D support and released new 3D cards, drivers and the shutter glasses/LCD panel 3D Vision system over a year ago. Their booth was dominated by 3D with new cards in their famous Quadro line (see the Wiki for the best discussion I know of with complete list of all the cards having the stereo vesa connector that will drive the 3DTV Corp Universal Glasses Emitter http://en.wikipedia.org/wiki/Quadro).

Nvida's booth (above)was nearly all about 3D apps with two mirror box rigs and Quadro cards for 3D capture and editing. Since someone from the EditShare booth is shown in the photo I will mention that they are a Boston based provider of integrated crossplatform storage and workflow management for post, DI and

broadcast.

Leading maker of video hardware Blackmagic Design www.blackmagic-design.com featured their new HDLink Pro 3D box for DisplayPort monitoring of 3D via the new

HDMI 1.4 port.   It is shown here displaying interleaved (line alternate) CP 3D on a Miracube panel.   Miracube has been making such panels for at least 5 years and was also at the show--see below.

EEG Enterprises www.eegent.com   featured the ability of their hardware and software to do end-to-end 3D closed captioning authoring, encoding, and on-screen decoding on the brand new Samsung 240fps 3D TV.   Their DE280-3D supports titling functions in three different 3D formats.   As noted here there were many at this show with hardware and software supporting 3D titling or menus to some degree and this capability is also in the Motorola STB (see below) and in some of the new 3DTV sets.

1 Beyond booth featuring the new Wrangler DDR (silver box with blue screen in center) for uncompressed dual recording from SI (Silicon Image) cameras in the

CC3D rig on the left via dual ethernet.

1Beyond of the USA www.1beyond.com , which makes low cost tapeless workflow systems for editing and storage in all video formats including the latest cameras and 4K, showed anaglyph video coming from a sided by side rig provided by the well know Toronto rental firm 3D Camera Company www.3dcameracompany.com. Here is the suggested workflow for this setup using 3DCC   SI's and the Wrangler.

They make it easy for the stereographer by providing a page with pdf's of all their latest products configured for 3D production and post http://www.1beyond.com/products/3dproduction.asp?search=3dproduction.   Here is their description of the Wrangler DDR (which I saw in several other booths):

Industry's first DDR for SI uncompressed. Portable and Ruggedized.
The full-featured, all-in-one portable 1 Beyond Wrangler™ DDR Stereo Direct-to-Disk Recording & Playback System is unique in the industry and is a perfect complement to the Silicon Imaging SI-3D digital cinema class 2048x1152 resolution camera. The 1 Beyond Wrangler DDR enables the recording of either stereo 2K 12bit Uncompressed RAW or CineForm RAW™ from the SI-3D and together with IRIDAS color-management technology delivers a direct-to-disk stereo recording platform supporting unprecedented image quality and shooting flexibility. It can also offload an SSD to dual 1 Beyond GoHDCart™ cartridges using the 1 Beyond Wrangler Software for auto-ingest and verify.

Cineform www.cineform.com, longtime leader in hifidelity compression based acquisition, post and archiving, showed Neo3d with stereoscopic editing functions. The newest addition to their software line, it "delivers a comprehensive 3D editorial workflow on both Mac and Windows to improve efficiency and reduce end-to-end costs for creating 3D content. Neo3D is compatible with most NLE and effects software that support QuickTime or AVI files such as Final Cut Pro, Premiere Pro, Sony Vegas, After Effects, and others. During editorial, Neo3D allows for choosing 3D display modes for an external monitor, real-time adjustment of convergence (horizontal, vertical, rotation), keystoning, and color controls, all performed in real time and implemented as Active Metadata." They were also showing the extremely handy Cinedeck platform agnostic camera mountable recorder with realtime 3D playout, which weighs 4 pounds and fits inside a cigar box with all cables and accessories. Worth a visit to their page just to see the lovely layout and demos www.cinedeck.com .

Cineform's suggested 3D workflow using the famous Nvidia stereo ready Quadro cards, most of which have the stereo VESA plug for shutter glasses emitters (such as the 3DTV Corp Universal Emitter).

One of the biggest surprises of the show for me was not in high tech but in paper 3D glasses.   Although I have done 3D continuously for 37 years and UK based Cotech Sensitizing http://www.cotech-uk.com   has been making filters and 3D glasses for almost as long, I had never heard of them until now.   Mostly they have made glasses for other people but they are making an effort at marketing under their own name and I am sure they will see some serious 3D business soon.

Stereoscopic codec leader TDVision Systems www.tdvision.com and Spanish (but with US rep) 3D camera hardware company Kronomav www.kronomav.com shared a large booth with numerous 3D displays fed live or from servers with high quality 3D content.   Another   TDVision   partner   Magnum   Semiconductor www.magnumsemi.com   had a booth and a viewing room where they showed more 3D being displayed by the TDVision 3D codec now incorporated into their chips.

Another of Kronomav's 3D rigs with tiny cams mounted on an agile boom and rail system.

A wide variety of 3D relevant hardware and software was on display at the booth of 2020 3D Media--a government funded (ca 15M Euros for 4 years) research project on 3D media.   http://www.20203dmedia.eu/

Hdlogix showed their realtime 2D to 3D conversion software on a beautiful projected laser display from CEO Ingemar Jansson, my old friend Ed Sandberg and colleagues, who have been working on laser projectors for over 20 years.   The 3D naturally had variable results depending on the scene but the polarized image on the 100 inch laser projector was lovely.   For more on HDI's LCOS laser scanning polarized 3DTV system   see   http://www.hdi3d.com/   and http://www.avsforum.com/avs-vb/showthread.php?t=1180558.   Since it uses LCOS I assume that
like SONY's SRX 4k cinema projectors and JVC's DILA projectors it will not work with shutter glasses or other fs systems like RealD, MasterImage, or Dolby. For a nice chart   comparing   it   to   other   3DTV   displays   see http://www.hdi3d.com/technology.html.

Anaglyphs were abundant here and featured in many booths as their only stereo display or and is an optional output format for most hardware and software 3D tools. The orange/blue anaglyph method of ColorCode www.colorcode3d.com was on display   in   the   APO   booth   (world's   largest   mfr   of   paper   glasses www.3dglassesonline.com) as always and if one has a fiercely bright display its not too bad but as readers of my articles know I prefer my own SpaceSpex version of orange/blue as it gives about twice the brightness and hence better color and a more realistic image www.3dtv.jp .   However ColorCode does have lower ghosting so if its not possible to keep H parallax under control or to use ghost reduction then it may be a reasonable choice.   They now have a box that can be used to convert dual streams into ColorCode realtime, but of course it works just as well with SpaceSpex, as do their offline software converters.

APO booth showing a few of their 3D glasses projects--over a billion served!

Cine-tal Systems   http://www.cine-tal.com was again present with their reference quality image processing hardware and software featuring 3D support.   To get the latest on the Davio processor, which I discussed last year see http://www.cine-tal.com/products/PDF/Davio_lo.pdf. Much of the 3D video (e.g, films) you have seen has been processed with it--e.g., they make the Dolby 3D Color Processor that does left eye/right eye color balancing in thousands of Cinemas.

C_T_S www.c-t-s.com specializes in 2D to 3D conversion and image enhancement and had some nice examples in their booth.

Nautilus Studio Ltd has been providing broadcast graphics with their Nemo software in Hungary and worldwide for 17 years and they demo'd their latest version with stereoscopic options.

Masterimage 3D LLC has over 1500 3D Cinema installs of its spinning wheel frame sequential circular polarized system (see next photo). Here they were presenting their plastic CP glasses and autostereoscopic cel phone displays. Started by Korean inventor Younghoon Lee,
they were acquired by a USA company in 2009 and have offices in California and 3D luminaries such as former IMAX stereographer Paul Panabaker on their staff.

The Masterimage MI 2100 3D Digital Cinema System rotates a divided RL Circular Polarized wheel in front of the projection lens to create 144hz CP fields when viewed with CP glasses on a silver screen.   This idea was first patented in the 50's for 3D film projection.   They say they have 381 cinemas in North America but there is no list on their page.

Quality control is long overdue in an industry famed for poor image quality and QoE Systems of California is making their long experience and new Q Master 2 software available for stereoscopy.

Few have the long experience in 2D to 3D conversion of DDD www.ddd.com and their realtime conversion software is good enough that Samsung included it in the firmware in their new 3D TV set.   I have seen the Samsung converter and it was similar to the 3D in their booth--reasonably good and without eyestrain but of course far from the real thing. The conversion provided by JVC's box or by HDlogix can be better or worse depending on settings and material.   If you want to try the JVC it will cost you $30K but you can download the TriDef converter for a mere $50 http://www.ddd.com/cart/product.php?productid=3&cat=2&page=1.   The realtime conversion done by the box I bought from Sanyo 15 years ago appears to me better than any of them but I would have to see them all with various settings on the same video and on the same 3D display.

They also offer offline conversion and the clips they did of Alien and the X Files

almost 15 years ago were probably as good as anyone has done and certainly better than the fake 3D in the recent films "Alice in Wonderland" and "Clash of the Titans". It's hard to be sure as I would have to see them all at the same time on the same display with the same original 2D scene. I have a unique take on their realtime 2D to 3D since my work in this arena, beginning in 1989, antedated theirs (and afaik everyone elses too) and they (i.e., the persons who ran their company 15 years ago) were going to license my patent but decided to pretend 3DTV Corp did not exist.   In any event it looks to me like nearly all the current work in 3D conversion depends to a significant extent on my 1996 patent application now US 6,108,005 (you don't need to read the whole thing-just look at the drawings of the mesh grids and compare). There have been about 100 distinct patent docs on 2D to 3D conversion in the last 20 years with dozens in the last 5 years and those interested can consult a few of the very recent ones here   US 7,660,432, US 7,646,907 (to Sanyo), US 7.573,475(to ILM), US 2010/0104219 (to Samsung), US 2009/0315884(to Samsung), US 2010/0026784 (to Philips), US 2009/0256903, US 7,660,432, US 2010/0033554, US 2010/0086199, US 2009/0322860 (to Thomson).

Sean Fairburn with the PX3 Renegade Solution Camera Rig of PLLX3 (Parallax 3) in the Panasonic booth http://www.pllx3.com/px3.htm .   It has a wireless remote, for cam and lens controls, a DVI 3D out in 3 formats,and 2 configurable 3D outs including subtractive overlay (for alignment).   Based in California, they (principally Bradley Nelson who also helped design the 3D laser projector in the Hdlogix booth) also made the 30 x 90ft 3D LED video wall for Michael Jackson's ill fated This is It

tour.

Rob Albano of 3ality Digital and the author discussing their latest mirror box rigs www.3alitydigital.com .   They had about a dozen rigs, both mirror boxes and side by side, in various booths and with Technica were the dominant rig manufacturers at the show.   Afaik the realtime control by their SIP (Stereoscopic Image Processor) makes their systems (grouped under the name 3Flex) the easiest to use but everyone is improving their products at lightspeed. The SIP, which I discussed last year, is used in post as well.   It captures metadata from the camera every 6 milliseconds to keep zooms coordinated. You can use the metadata from lenses and camera position to integrate the 3D video into your computer generated environments, as is fast becoming the norm in 2D and 3D.   However, they have lots on offer besides their rigs and production abilities.   3 Play manages image stream geometry while scaling and removing compression artifacts to deliver content at low bit rates.   It also permits realtime depth compositing for subtitles and captions.   Like most of the purveyors of 3D hard and soft they offer comprehensive training under their 3DIQ program.

Neil Clark of California based rental firm Intervideo now has 3D packages available http://www.intervideo3d.com/ or www.intevideo24.com shown here in the booth of DVR maker Fastforward Video (whose DVR's they represent www.ffv.com)   with the mirror box rig he designed and built.   It lacks the fancy automated controls of some others but it's a fraction of the cost. They also have a unique horizontal format beam splitter rig but its too new and not on their page yet.
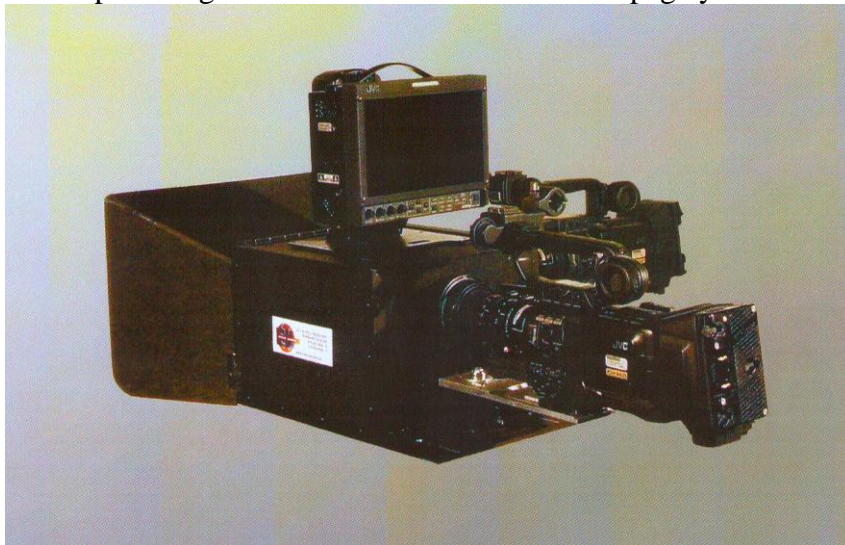
The Intervideo www.intervideo3d.com horizontal 3D rig weighs 16lbs and training is included in the rental price.

Toshihiro Ishii of Astrodesign with his 3D zoom camera (intended primarily for security apps) being wirelessly transmitted with the VubIQ hardware.

I first saw Tokyo based Astrodesign at a show there a few years ago with a 4k lcd panel they built themselves from 4 2k panels.   They showed their first 3D products at last years NAB and have several new and upgraded products for acquisition, recording, and transmission. They design and build the 3D camera and polarized panels but the realtime 60Ghz uncompressed dual link 3D transmitter is from Nevada company VubIQ   www.vubiq.com .   You can see a video of the VubiQ 3D   3D at http://cornwalltube.com/view.php?video=f38Wio0KHzk&feature=youtube_gdata&title=VubIQ+at+NAB+2010+in+the+Astro+Design+booth+shows+3D+Wireless+HD+video+link.   They also make world class reference panels and waveform monitors and other eqpt.   Look here for their English summary of 3D related products http://www.astrodesign.co.jp/english/product/g_list.asp?cid=35.
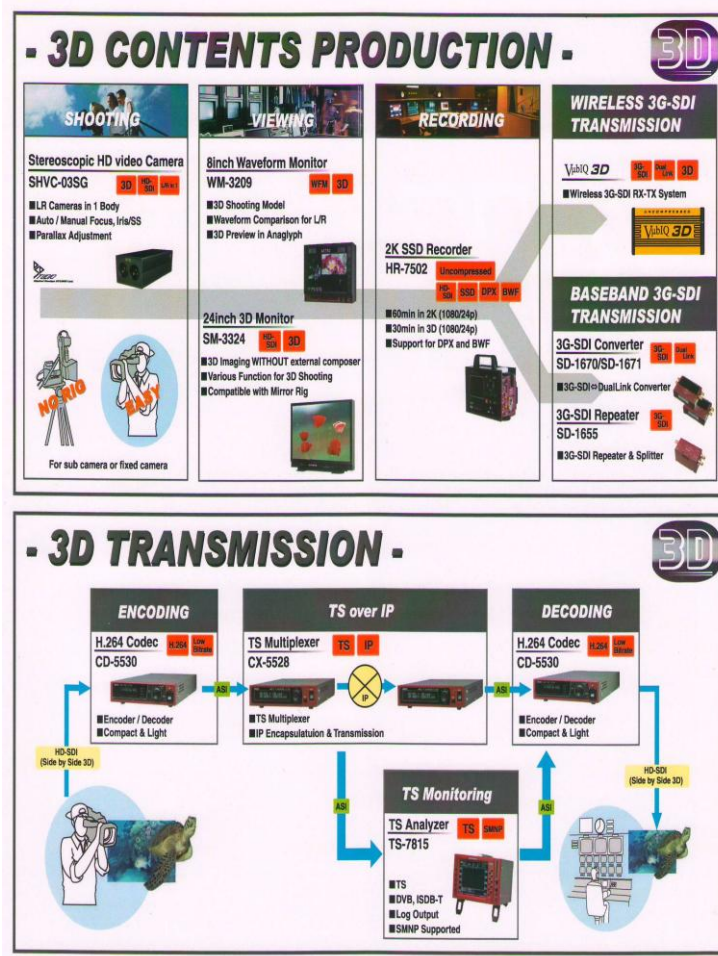
The Astrodesign product flowchart from origination to delivery.

Martin Reinhart of Austrian company IndieCam GMBH http://www.indiecam.com/ which makes small high quality cameras, recorders, monitors etc. Shown here is their dual HD-SDI RAW recorder the IndieShuttle, HiRes IndieScreen monitor, and twin IndiPov cams with rolling shutter able to do full HD up to 90p or 1280x720 up to 180fps. The IndiShuttle not only records the dual uncompressed 4:2:2 (4:4:4 optional) streams up to 200fps from any video camera in any format but controls all camera functions with 3D preview. Their soon to be released modular IndiTwin is a fraction of the size and weight with full remote control of all camera/recorder functions--my Christmas wish. Most impressive of all, he was able to discuss Wittgenstein and Godel with me.

Since I reported on them last year, the New York based HD and 3D television production company NHK Enterprises America, Inc merged with Japan Network Group to be come **NHK Cosmomedia America, Inc.** www.nhkcosmomedia.com and built a whole new truck full of the latest hardware and software for 3D production-Atsushi Murakami (above) is the most experienced 3D videographer in the world and has worked on over 500 (no it's not a typo) 3D projects during the last 19 years. He also built their first real 3D camera and helped in the design of other equipment. Behind him is a massive parallel rig of the type used on Avatar, with full size Sony cameras and the unique Musashi optical device (see other photos here) to decrease the interaxial www.musashi-opt.co.jp. This device was also featured in the Ikegami booth (see photo above), but in spite of my giving it best of show in 3D hardware last year, the rest of the world ignores it. Probably they don't know about it or maybe they make too much money selling and renting mirror boxes. NHK CMA still have the encoder/decoder boxes LR Composer and the 3D Side by Side Encoder/Decoder from **FASE** (FA System Engineering Co. LTD) http://www.fase.co.jp/en/index.html . These products output line alternate for display on CP monitors (i.e., those using circular polarized passive glasses) and were designed by NHK MT (NHK Media Technology of Japan) and FASE and can be purchased in the US through NHK CMA. They also have a dual camera designed for use in surgical settings and a 3D BluRay of a heart operation. Their Japanese affiliate NHK Media Technology, which shared

the booth, has built the first 3D production truck in Japan and it comes with up to 6 3D camera rigs.

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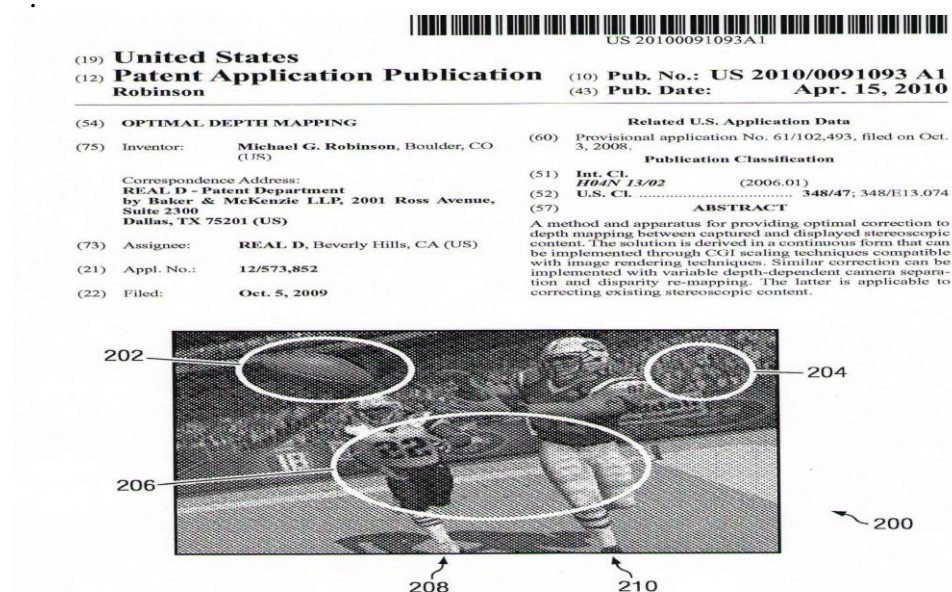
Depth mapping for stereo image rectification by inventive genius Michael Robinson whose company ColorLink was acquired by RealD in 2007 for $31M. A large number of patents on rectification, view synthesis, depth mapping etc have been filed by many companies in the last few years.

Above- Jeanne Guillot (right) and Remi Ronfard (left) of French 3D production company Binocle www.binocle.fr with one of their own mirror rigs. They have done about 15 3D projects in just over a year including Rugby 6 Nations Tournament 2010 for France Television (France/Italy and France/England) broadcast live in more than 30 cinemas in France and Great-Britain which used 8 Binocle Rigs. This year they had their own booth as well as rigs in several others. They also are patenting an interface for controlling 3D rigs with an eyetracker US 2010/0118141.

Jin Ho Kim of Korean firm Redrover www.redrover.co.kr makes a wide variety of 3D hardware and software including the full HD dual LCD xpol monitor and mirror rig shown here which are covered by their patents such as US 2010/0091368. As in other high tech countries there are quite a few small companies in the 3D arena, most of them virtually unknown outside their own territory. I am aware of many of them due to longtime presence in Asia, continual patent sweeps, and a wife who speaks Chinese and Korean. I have been consulting for Korean 3D companies since 1992 and have visited half a dozen 3D firms there in the last few years. Various 3D technologies such as wireless glasses using RF to transmit the sync which are considered advanced and under development by Nvidia and others were designed and made in Korea and sold by 3DTV Corp in 1994.

Not surprisingly the autostereoscopic displays are riding the crest as well and several well known and not so well known companies appeared at NAB. No less than two French entities, 3DTV Solutions (www.3dtvsolutions.com) and Alioscopy (www.alioscopyusa.com) were present. Alioscopy, founded by Pierre Alio, has been gradually improving their lenticular displays for a decade and I have seen them many times before. The 42 inch panel in the Matrox booth was brighter and had less moire than I have noticed before. Many smaller efforts in this arena now have more chance since Philips terminated their products completely and NewSight has greatly diminished its marketing efforts since being acquired by a mobile phone company. The other notable USA effort http://www.magnetic3d.com/ was absent but has been appearing at the digital signage shows. Anyone wanting to check out Alioscopy can attend Infocomm 2010 where they have a huge booth in the 3D Pavilion.

Pia Maffei of Alioscopy's San Diego office with their display in the Maxon Booth where they are located due to due to their use of Maxon's graphics software for image creation www.maxon.net

Ralf Tanger of the HHI (Heinrich Hertz Institute) branch http://www.hhi.fraunhofer.de of the world famous German R&D institute Fraunhofer (both with long histories of 3D projects) showing their new autostereoscopic server software playing from one file on 42 inch panels from four different auto panel makers--Tridelity www.tridelity.de (5 view barrier), Alioscopy www.alioscopyusa.com (8 view lenticular), NewSight www.newsight.com (8 view barrier) and Philips (terminated this product line a year ago) (9 view lenticular). Fraunhofer has been researching 3D for at least a decade and the HHI long before that. They also showed multiview synthesis from two views (e.g., from a stereo

video camera) but it's not currently realtime. Such programs have been done many times, mostly not related to stereo. Although RealD has discontinued the lenticular SynthaGram displays, they still patent for it including one on view synthesis US 2010/0103249. NewSight demo'd realtime converter software running on a laptop at FineTech Japan in 2008. Though not a completely finished product, it gave an excellent image from a pair of cameras on a 42 inch display without any noticeable pseudo or dead zones (normal problems with such auto displays). See photo below. You can download a brochure on Ralf's multiview work here http://www.hhi.fraunhofer.de/fileadmin/hhi/Bilder/Abteilungen/IP/Events/Flyer_Dokumente/2010/Flyer_WEB3D_Multiview.pdf

This work reminded me of the current project of my former colleague at NewSight Rolf Henkel who has formed a new company www.impactmedia.com with Michael Kronenberg (who has high tech media services and digital signage worldwide) and is continuing with his decade of work on media players, view synthesis and other advanced IP efforts. You can clik "rf Technologies" on their page for the latest on the RealPlayer or just read this description from a recent email to me:

"The RealityPlayer is a fast and easy to use 3D media player for autostereoscopic 3D displays. It is able to play back any major 3D multiview format on a wide range of autostereoscopic displays. With its unique 3D controls the user is able to adjust 3D clips during playback for optimal impact. It is available for all Windows versions (WinXP/Vista/Win7) as well as for most Linux distributions.
The property of universal 3D playback allows you for example to play legacy Philips 3D clips on other hardware, including Magnetics, Tridelity or Newsight screens. With the 3D controls, you can adjust the 3D volume of any 3D clip, for flat to exaggerated 3D, or to the change the optimal viewing distance from the one the manufacturer designed. Badly produced 3D displays can be re-centered by the RealityPlayer.
Our player is designed to render 3D material in an optimal and very precise way - no comparison to other players on the market! "

Finally, my friend Kiyoto Kanda of Japan has introduced several autostereoscopic products recently: a 70 inch barrier monitor selling for ca $34K and a 2 view to 8 view converter http://www.newsightjapan.jp

Of course a large and now accelerated effort on auto stereo displays continues from countless entities large and small. For a few of the recent efforts see US 2010/0123952, US 2010/0110164, US 2010/0097545, US

FineTech 2008 showing realtime 2 view (the two small cameras in the center) to 8 view stereo synthesis with a program running on the laptop my friend and former colleague at NewSight www.newsight.com CTO Keith Fredericks (right) and displayed on the small screen next to him. This was also due principally to Rolf Henkel who was their director of R&D in Jena.

There is a

Isabelle de Montagu of French (but with offices on both coasts of USA)

autostereoscopic company 3DTV Solutions www.3dtvsolutions.com shows their 8 lens camera for capturing multiview images. Combined with their custom software they offer complete tools for capture, compositing, editing and broadcasting of 3D images. 3D Tricks software is an editing and post tool that converts images from their 8 camera rig (or other sources) and renders them for realtime display on stereo or autostereo displays, while 3D Shot permits multiimage formation with a single SLR. In either case a solid model may be built for 3D or 2D use.

An 180 degree 2D or 3D panoramic camera system prototyped by Fraunhofer. They also developed the cameras and the mini-recorder shown in the background. You can find info on their work on immersive media and 3D video here http://www.hhi.fraunhofer.de/en/departments/image-processing/immersive-media-3d-video/

Florian Krassow (right) and Peter Kauff were demonstrating the latest version of Fraunhofer's STAN (Stereoscopic Image Analyser) live with a mirror box rig. You

can find the latest on STAN here http://www.hhi.fraunhofer.de/en/departments/image-processing/applications/stan/. It is probably the most sophisticated realtime stereo camera controller but of course 3ality and many others big and small are also constantly updating their products.

STAN is about the size of a cigar box and has an intuitive interface with dual screens for the R and L images.

Michael Schmid is shown with two other Fraunhofer developments--the newest

version of the MicroStorage multiformat HD flash recorder (small red box lower left) and the DVB-T ultra compact multiformat wireless camera (center with black antenna). The recorder gets 8 hrs with a 32GB card and has integrated ASI streaming and multiplexing for long distance low data rate apps (e.g., underwater remote cams in 3D). The camera has up to 2048x1080, 1080p at 5 frequencies and remote control via its integrated transmitter and telemetric receiver www.iis.fraunhofer.de

I must also mention a very useful MAC based editing software called the Stereo3D Toolbox by Tim Dashwood, who gave a talk on it at NAB (I have not covered the many talks on 3D including the show and tells of 3D film and video clips as it is just impossible to attend them and the show too!). It is included in the latest version of FxFactory, the widely used free plug-in management system. Download and Install FxFactory v2.0.9 or later to gain instant access to the Stereo3D Toolbox filter. You can download a full version at http://www.timdashwood.com/stereo3dtoolbox/Download.html but it will put a logo on your video which you can remove by paying ca $390 for a license. Stereo3D Toolbox works in all hosts currently supported by FxFactory:
Final Cut Pro 6 and 7, Motion 3 and 4,
Final Cut Express 4, Adobe® After Effects® CS3 and CS4.

One of the numerous Element Technica www.technica3d.com mirror box rigs at the show--this one the Quasar model for large cameras. At least some of them

incorporate STAN and in spite of their high price tags 3D is so hot that they have shipped over 50 of them to rental houses in the last 6 months (as of April 2010).

A smaller Technica rig in the Sony booth. Like this one, many of the rigs had personnel present to provide info on its operation and of course all the manufacturers are making smaller rigs for the many compact HD cameras coming into use.

Silke Stubel of Munich-based sales and service house Gekko-Cam GMBH http://www.gecko-cam.com with Arri Videocameras mounted on a Tango mirror box. They are the European distributor for Canadian Sebastien Laffoux's Tango

http://www.tangohead.com/3dtango.html

German Engineer Florian Maier, whose work via his service 3D Consult I reported on last year, is now operating as Stereotec http://stereotec.com/ and has a line of hardware which has already been used on various 3D projects including some for the Shanghai World Expo. Andrea Wiskow is shown here with one of their mirror box rigs --the 3D Live rig Carbon. Get a lovely color brochure including photos of the China shoot at http://stereotec.com/STEREOTEC_products_2010-01.pdf. I mentioned his nice Stereocalculator software last year. I have already mentioned Leonard Costers stereocalculator app above.

Speaking of stereocalculating, all stereographers will want the slick new Pro Stereo 3D Calculator from RealD http://www.reald.com/Content/proProducts.aspx?pageID=28, available as an ipod/iphone/ipad app for $300 http://itunes.apple.com/us/app/reald-professional-stereo3d/id362539528?mt=8#.
This is a custom version of the premier Stereo Calculator, the FrameForge Previz Studio, Stereo Edition which can run you over $1000 with all options http://www.frameforge3d.com/Purchase/Stereo3D/.
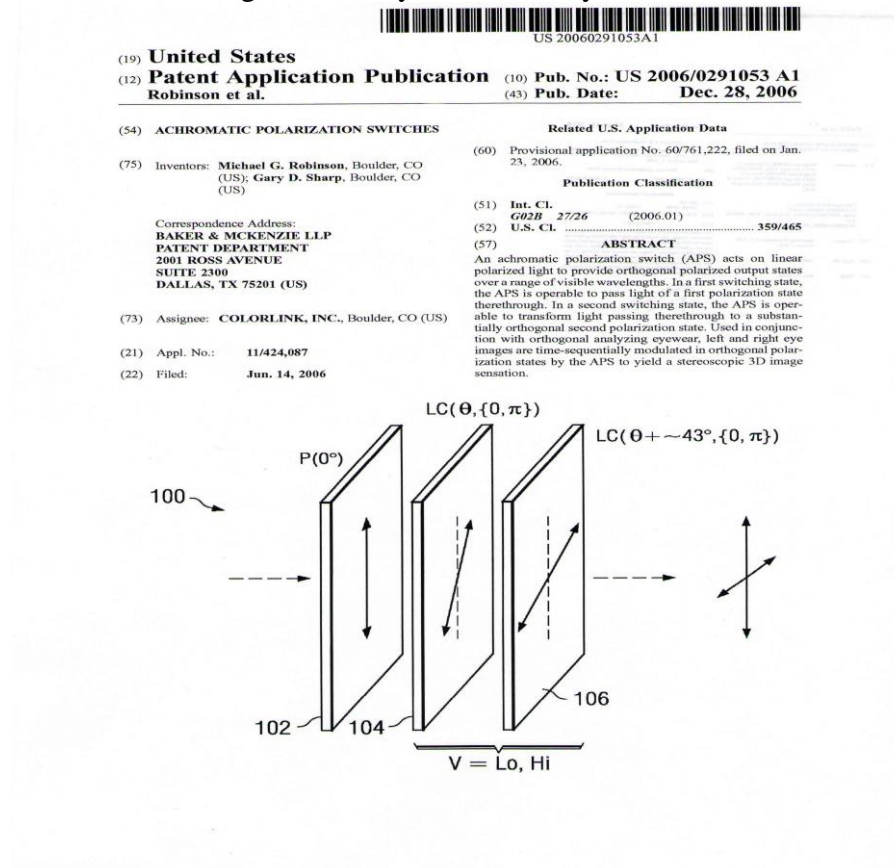
Daktronics www.daktronics.com, a leader in LED displays, had a large shutter glasses screen but, though it worked fine in the lab, ambient IR interfered with the sync and they gave up on the 3D half way through day one.   LED or OLED displays are fast enough to work with shutter glasses and bright enough to work with an overlay of crossed polarizers so they are destined for wide use in 3D.   Daktronics is over 40 years old and was started and still has its HQ in South Dakota.

The booth of Nationwide display specialists IGI www.werigi.com had Sony's latest SRX-T420 21K lumen 4K LCOS projector http://pro.sony.com/bbsccms/assets/files/mkt/digicinema/brochures/SRX-R320-LMT-300-STM-100_3.pdf with a RealD dual lens (the XLS system) rear projected onto a 6M Dalite 3D Black rear projection screen via a front surface mirror (see photo) but gave a somewhat dim image.   Dalite personnel were also puzzled by the dimness but of course cinemas use front projection which is much brighter. I suspect just reducing the screen size slightly would solve the problem, which is an issue with all types of

3D projection.

The RealD polarizing plate with DLP projectors (the XLS system) can be brighter on the same size screen (depending mainly on the projector) and shutter glasses (provided by XpanD, 3DTV Corp and others) ought to be brightest of all, so when TI's eagerly awaited 4K DLP appears (presumably this year) they may have a good selling point to replace the Sony 4K systems and even the RealD XL systems on DLP's, since they can be used with shutter glasses for 2K or even 4K 3D or with the same type of XLS lens from RealD or others to give a brighter 2K 3D image. Of course MasterImage and Dolby 3D cinema systems will also accommodate the 4K's.

US 20060291053A1

(19) **United States**
(12) **Patent Application Publication** (10) Pub. No.: US 2006/0291053 A1
Robinson et al. (43) Pub. Date: Dec. 28, 2006

(54) ACHROMATIC POLARIZATION SWITCHES

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(21) Appl. No.: 11/424,087

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Related U.S. Application Data

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Publication Classification

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G02B 27/26 (2006.01)
(52) U.S. Cl. 359/465

(57) **ABSTRACT**
An achromatic polarization switch (APS) acts on linear polarized light to provide orthogonal polarized output states over a range of visible wavelengths. In a first switching state, the APS is operable to pass light of a first polarization state therethrough. In a second switching state, the APS is operable to transform light passing therethrough to a substantially orthogonal second polarization state. Used in conjunction with orthogonal analyzing eyewear, left and right eye images are time-sequentially modulated in orthogonal polarization states by the APS to yield a stereoscopic 3D image sensation.

Another of Michael Robinson's long series of impressive looking patents--this one on

what is now the RealD XL circular polarization switcher in over 5,000 (soon to be 10,000) cinemas--which shows why RealD felt it necessary to acquire them the next year.

RealD top/bottom polarized lens set (XLS) on the Sony 4k projector--now common in Cinemas in the USA.   For a list of 4K 3D theaters (but of course none of the lists on anyone's page are up to date) see http://pro.sony.com/bbsc/ssr/mkt-digitalcinema/resource.latest.bbsccms-assets-mkt-digicinema-latest-4KTheaterLocationsAll.shtml, and for the USA first check the two separate listings for the AMC and Regal Chains.   It is noteworthy that most of the 500 or so USA 4K's are 3D but none of the 6 in Japan and only two of about 25 in Korea are (as of May, 2010).   This shows how critical the deals with AMC and Regal and the availability of the RealD lens was to Sony's cinema penetration with the 4K projector.   Yes, I notice the color difference in the two CP lenses and also wonder if this imbalance could be bothersome.   It is not a defect but a universal, though presumably slight, problem with CP.

A relative newcomer (i.e., less than a year old) in 3D camera rigs is the beautiful beamsplitter (mirror box) from SwissRig http://www.swissrig.com/ or www.s3dfactory.com, which now has distributors in the USA .

The Sony booth had a spectacular polarized 8M diagonal 3D LED display which was

still xlnt 30M away. I mentioned elsewhere the giant 3D LED wall made by pllx3D for the Michael Jackson tour.   Perhaps only cost and power consumption prevent its implementation in cinemas.   However the Sony 3DTV set I would most like to see is the smallest possible -a pair of contact lenses-- which will probably never get beyond the patent stage   US 7,626,562.

Japanese Telecom giant KDDI had a booth to show technologies for license (via their US rep Sentosa www.sentosatech.com) and they noted "Free Roaming Through 3D Video" in their brochure, though I did not see it there. However they showed it last year at NAB and it is a 3D telepresence system with multiple cams and view synthesis which lets the user take any viewpoint in a scene. This is a 3D version of the famous Eye Vision system that was developed by Takeo Kanade and his associates at Carnegie Mellon Univ. for CBS and first shown at the SuperBowl in 2001 but since faded into oblivion due to the rapid aging of its technology http://www.ri.cmu.edu/events/sb35/tksuperbowl.html. Several years ago   I put together a business plan to make an updated 3D version of it named SeeAll which would enable realtime 3D pan and zoom from any viewpoint for any sport or security or entertainment app.   I had the two programmers who did all the work ready to go but lacked the energy to run around trying to get financing.

California located BandPro www.bandpro.com supplies a very wide range of hardware for film and video and demo'd its 3D readiness with a Technica Quasar

mirror rig with Sony HDC-P1 cams, a 1 Beyond Wrangler recorder, Silicon Imaging's 3D cams and with 3D software, and an AstroDesign 3D CP monitor

California sports camera company GoPro www.gopro.com introduced the latest in their 3D Hero line with the smallest ruggedest, waterproof (to 180 ft!) full HD (1080p at 30fps) camera in the world with a dual 3D configuration displayed on a Samsung shutter glasses 3DTV. The images from a surfboard mount were spectacular. The do NOT currently sell the 3D version.
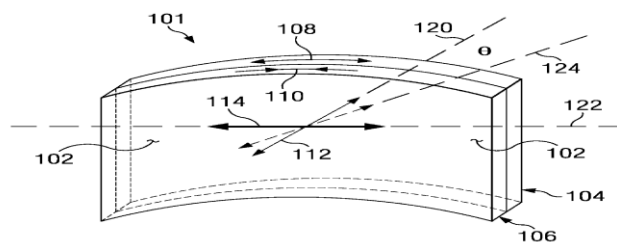
Ian Henry of 3ality Digital in the Ikegami booth showing a realtime depth mapping function of their SIP processor live from a 3ality mirror rig. A glance at the grey scale display shows you where everything is relative to the screen and how you may need to adjust parallax.

Takeo Hiroshi of Ikegami with side by side cameras shooting with the Musashi interaxial reducer. Its nice to see that somebody appreciates this useful invention.
A wide variety of Circular Polarized glasses both paper and plastic were available at the show, mostly the familiar cinema ones by RealD who seem to have ordered 100 million recently. Here is a patent showing


RealD's idea of how to make higher quality CP passive viewing glasses with curved lenses. Coleman is with ColorLink, the company RealD bought when they realized it had better technologists than StereoGraphics. The aim is to make curved lens CP viewing glasses by careful orientation of the half or quarter wave plates and the use of special adhesive and mechanical methods to precompensate for birefringence of the final lens so as to have maximum cancellation at all angles. They have another app on the mechanical means. One point here is that active and passive 3D glasses are becoming a very large market. Many others are making glasses now and innovations such as glasses with different interoculars US 7,568,798, custom diopter CP's which differ for the two eyes by Hoya US 7,677,726, and 2D/3D segmented glasses for surgeons US 2010/0053311 are being pursued.

JVC's IF-2D3D1 is a $30K box that can convert 2D to 3D in realtime.   User controls permit varying the effects.   The setting they were using gave both images a slightly different concavity to set its middle back into the monitor.   I have seen it several times and of course I have worked on "solidizing" for many years so there were no surprises.   Relative to the DDD (TriDef) "solidizer" I think it is capable of giving more dramatic effects, but the price for this (in addition to $30K!) is obvious unnatural looking artefacts.   None of the realtime or offline converters (including my own) pose any threat to well done dual camera 3D.
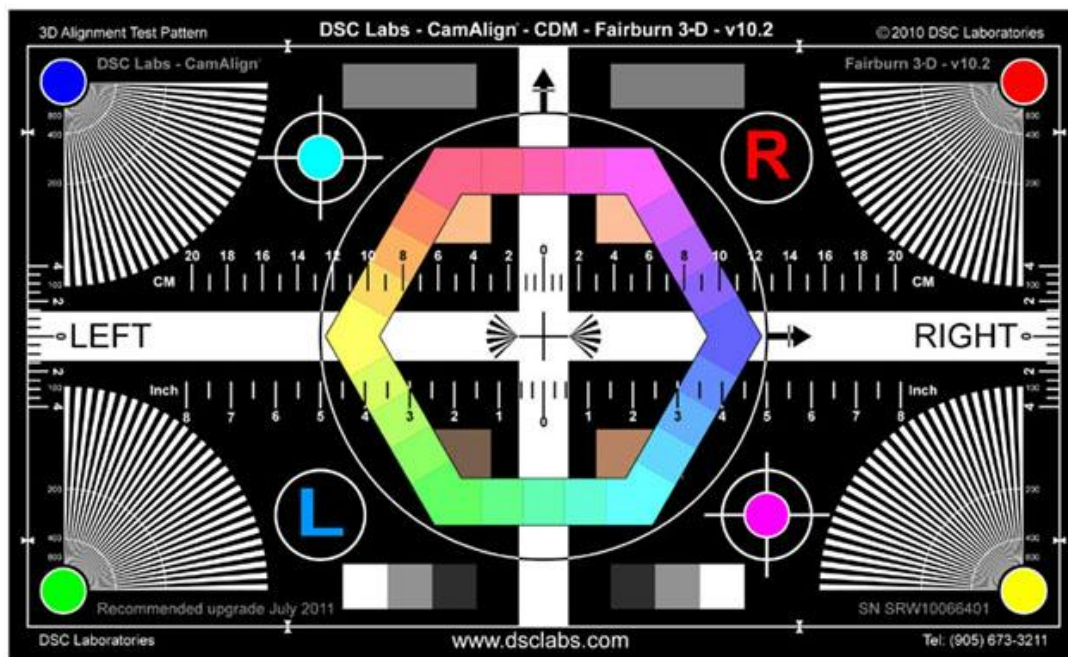
All the lovely cameras are no good without calibration and Canada based DSC Labs www.dsclabs.com was showing The Fairburn 3D-- a 3D version of their classic test

charts. Copyright 2010 DSC Labs.

DVS of Germany and USA www.dvs.de , but with offices worldwide, was again showing their 3D Ready Clipster DI (Digital Intermediate) workstation along with their many industry standard video I/O boards and other products.

Australian company Bluefish was showing their broadcast quality video I/O cards including the new Epoch with full duplex uncompressed stereo capability http://www.bluefish444.com/downloads/Brochures/Epoch_range.pdf .

Cobalt Digital, a presumed spin-off from my alma mater the U. of Illinois in Urbana, demo'd their newest 3D ready cards and much else.   You can get all the info on these and a truly stupefying array of video hardware at http://www.cobaltdigital.com/assets/catalog/Cobalt_4-2010_Catalog.pdf but beware--the catalog is 37mb and 117p.   Anyone ever heard of the djvu document format? It would give similar quality at about $1/10^{th}$ the size and is spreading rapidly.

AXON, well known for their signal processing equipment, showed the G3D100 stereoscopic format converter, synchronizer and color corrector which does up to 3Gb/s, HD or SD http://www.axon.tv/EN/products/3/49/563 .

Transvideo had many of their HDSDI CineMonitor HD Field Monitors mounted on 3D rigs with anaglyph displayed throughout the show http://www.transvideointl.com/pages/english/products/index.htm . They make them up to 15 inches and have the superb Titan wireless video transmitters as well.

Among the almost endless others showing some 3D app for their stuff were Eyeon, Hitachi, Snell, CrystalVision, and Digital Vision.

Technica splitter with RED cameras and Angenieux lenses in the Thales-Angenieux

booth   www.angenieux.com --at ca $120K image quality doesn't get much better but you can spend twice that if you want.   Searching 3D or stereoscopic gets you nothing on their current page but I bet that changes soon. Thales is a fortune 500 company that also owns Technicolor which owns   Grass Valley, so it makes sense to pay close attention to what any of them do in 3D.


Norwegian software company vizRT www.vizrt.com showed the realtime 3D features of their broadcast compositing and titling products with a live camera overlaid with 3D graphics projected on a 3M diagonal screen (top right) with the dual projector passive Infitec system using Infitec's patented notch filter anaglyph glasses. The image quality was excellent.

Dolby bought the world cinema rights to Infitec several years ago (Dolby Digital 3D) but for this trade show and other non cinematic apps Infitec has the rights and supplied flat lens glasses much less classy than the curved lens ones Dolby uses in theaters. Dolby is the only one using the active tech since it was developed and patented by them   (i.e., Dolby 3D color filter wheel inside a single projector--for flash   movies   of   how   this   works   see http://www.jdsu.tv/view1_3d/jdsu3dtechnology.html and for a little more info and a dynamite   Angelina   Jolie   car   chase   sequence   see http://www.dolby.com/professional/solutions/cinema/3ddc-solution-flash.html).
Dolby   however   has   almost   nothing   on   their   page   about   3D http://www.dolby.com/professional/technology/cinema/dolby-3ddigital.html.   Infitec and everyone else uses twin projectors--that is, a passive system without the rotating filter wheel.   In 2009 Infitec (a German Company) started a new company with fancy   DualColor   glasses   and   a   new   page http://www.infitec-global-sales.com/german/infitec-anwender.html   (i.e.,   not   in English yet).   In any case the original team from Daimler-Chrysler (which I assume owns the patents) continues to work to improve the product for better color, decreased

color flicker and increased brightness US 2010/0066813, as does Dolby US 2010/0060857, US 2010/0073769, 21010/0013911 and others US 2010/0039352, US 2009/0257120. For a list of Dolby 3D theaters see http://www.dolby.com/consumer/product/movies/theater/find-a-cinema.html.

In addition to its well known Cinema audio systems, Dolby also has a line of Pro Cinema authoring tools and playback systems for 2D and 3D Cinemas such as the SCC2000 Secure Content Creator for authoring DCP's (Digital Cinema Packages) , the Dolby Show Library (DSL100) for storing and managing digital films in multiplexes, and the Dolby Screen Server (DSS200) for playback.

One of their competitors in providing DCI (Digital Cinema Initiative--i.e., a Hollywood monopoly created to protect their films and guarantee quality) compliant film delivery and playback in theaters is pioneer in cinema quality JPEG2000 playback Doremi Labs www.doremilabs.com (over 6K installs worldwide), who were showing their latest DCP-2K4 2k/4k Digital Cinema Servers, DoremiAM and CineAsset authoring software and broadcast hardware. They have the Dimension 3D for converting Dual Link HDSDI into the common 3D playback formats, the Nugget to stream 3D in SBS or OU formats, the DSV-J2 which intakes edited 2D or 3D from CineAsset in MXF wrapped JPEG2000 format via ethernet or USB and outputs it as dual HDSDI to the Dimension 3D, or even as dual 4K streams to Media Blocks (i.e., cinema servers) which deliver it to dual 4K projectors such as the Sony SRX's or (for small theaters) the JVC DLA-RS4000's or the newer DLA-SH4KNLG.
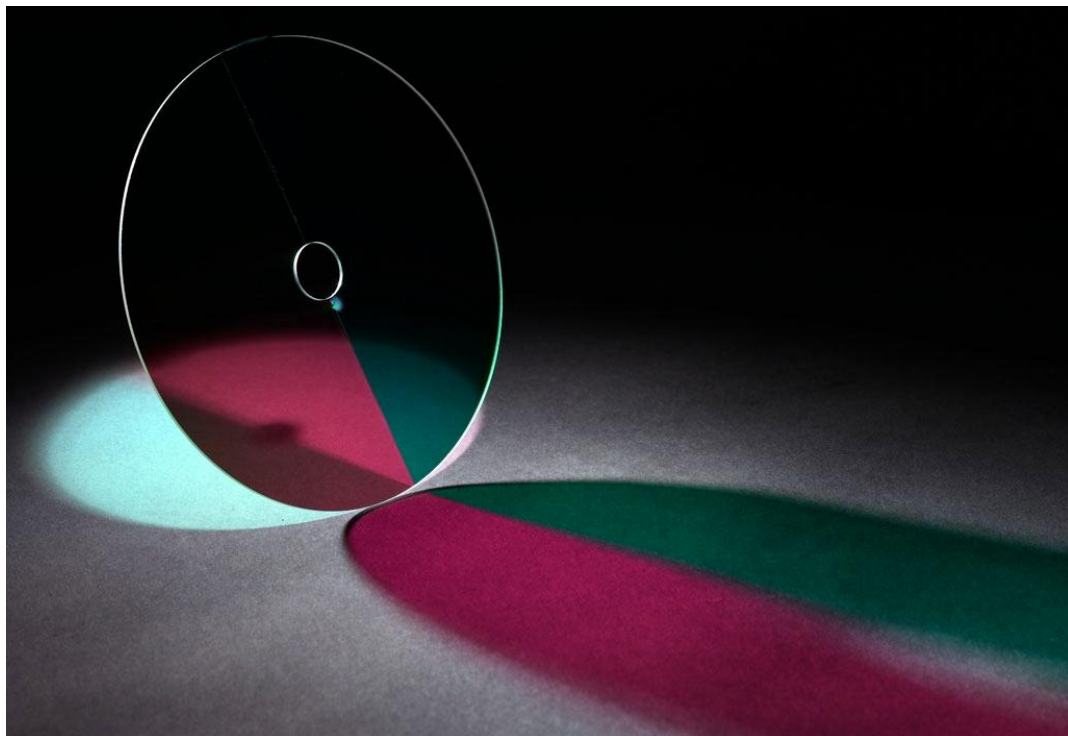
Th

e Dolby Color Filter wheel (above) and glasses used for the Dolby Digital Cinema system is made by electrooptics giant   JDSU.

A small Texas Co. has also begun using laser projection with Infitec glasses for 3D shows http://www.prismaticmagic.com/index.php.   And Ed Sandberg (see HDI laser discussion above) and longtime 3D enthusiast Bradley Nelson have recently figured out how to get polarized or triple notch filter anaglyphs (the type now common in Dolby 3D cinemas) from a pair of lasers- US 2009/0257120.

Correct 3D compositing of this 2D camera in vizRT's booth was achieved by input into two VizEngines which was keyed on the graphics as an input cutout.

The white balls are the Thoma WalkFinder http://www.thoma.de/en/index.html and were also shown in the Thoma booth. They have an emitter inside them that flashes periodically enabling IR cameras on the ceiling to provide x, y, z tracking info to the VizEngine virtual camera. Pan, tilt, zoom and focus (now often called lens mapping) is provided using traditional encoders mounted in the camera head and lens.   Many other such systems exist such as Intersense which was shown by Lightcraft Technologies in their PreVizion system http://www.lightcrafttech.com/.   The capture of all the camera metadata is becoming routine in 2D and 3D production and recent lenses have sensors built in.   Even cranes and dollies are sometimes encoded -e.g., with Encodacam http://www.encodacam.com/

Lightcraft technologies advanced camera tracking system (photo above) does much more than just tracking--including previewing camera moves with motion scaling by putting sensors on a monitor and moving around it.   See an amazing sample of this at http://www.lightcrafttech.com/previzion/features/motion-scaling/

Jason Goodman of 21st Century Media USA explains the operation of his beamsplitter rig, fitted with dual REDs, to Arthur Berman PhD, display expert and writer of many of Insight Media's exhaustively detailed reports on current display tech.   Jason was solely responsible for hardware and stereography on one of the first totally live action 3D features in recent years--Call of the Wild 3D, which I favorably reviewed in the

article on the 3DX 3D film festival in Singapore over a year ago. A fan on Fandango says it all: "Beautiful 3D throughout the whole film not just here and there, like so many other movies, You really feel like you are out in the wild for the whole movie." It has had limited release but I bet we can get in on BluRay soon and it should do well as it's one of the few 3D live action family films.

Gregg Wallace and Griff Partington of Netblender www.netblender.com were in the 3D Pavilion with their state of the art 3D BluRay authoring software. As they say "NetBlender's new 3D capabilities will be available options with the new DoStudio EX Edition, which will ship in Q2 2010 at an expected starting price of $4,995.00. DoStudio EX also includes workgroup productivity features and offers customers the option to include third party interactive apps and bootstrapping for BD Live" They also have BD Touch for interaction with BluRay via iPhone and Android phones.

Chris Chinnock and Dian Mecca of Insight Media, which produces a steady stream of exhaustive reports on display technology. Chris also created the 3D@home consortium which produces conferences and reports on the 3D industry and which had its own booth nearby. Essential products and services for anyone in the 3D biz.

Adam Little of Canada based I0 Industries   www.ioindustries.com, purveyors of high performance DVR's, introduced its latest product the DVR Express Core/3GSGI with dual solid state drives (the little black box by his hand) for simultaneous twin 1080p/60hz recording in the field. Nearly everyone at the show was touting current or coming compatibility with 3G-SDI, which is a single 2.970 Gbit/s serial link standardized in SMPTE 424M that is replacing the dual link HD-SDI(http://en.wikipedia.org/wiki/Serial_digital_interface).

Canada based Ross Video   www.rossvideo.com   has their realtime broadcast hardware in over 100 countries and is ready for 3D with their Xpression 3D capable character and graphics generator (box at left) which did live 3D Graphics on the JVC 3D panel in their booth.   Their huge booth debuted the Vision Octane production switcher, whose 8 MLE's (Multi-Layered Effects) can handle multiple 3D streams. They pioneered the most flexible and advanced terminal equipment solution ever developed --the 2RU (2 rack unit) openGear modular frames.

Jens Wolf of German media company Wige www.wige.de with two of the tiny but superb Cunima MCU[1] cameras www.cunima.tv on a Stereotec rig.   Last year I had them in my NAB booth as prototypes but now they are in wide use.

Cunima's featherweight 33.5mm x 38mm x 111.5 mm, 182g,
 full   HD/SD   multiformat   cameras   use   only   3   watts
http://www.cunima.tv/sites/WIGE_factSheet_CUNIMAMCU[1].pdf

My friend, the hyperactive California based stereographer and multimedia whiz Bruce Austin in the Technica www.technica3d.com booth showing the agility of one of their smaller beamsplitters, which he has recently used on several major projects (e.g., a week in the Amazon).   Several of the rigs now flip down to side by side format in seconds (see below).

Clay Platner of Technica operating one of their beamsplitter rigs with a remote. They seem to be the dominant 3D camera rig company to date with over 50 delivered worldwide (April 2010) but I don't know the stats for Pace, 3ality and PS Technik.

Mobile TV Group www.mobiletvgroup.com is one of the largest onsite video producers with a nationwide fleet of vans (currently 24) and over 4000 events/year. They had live 3D feed from a 3D rig outside the 26HDX truck (a 53 foot HD Expando) with a full 3D record/edit/broadcast suite inside with stereo displays including the polarized panel top center of photo above. The live feed here is from a pair of Ikegami HDL40's with custom Canon primes, a GVG (i.e., Grass Valley Group) Dyno 3D replay system, Chryon HyperX3 switcher, Davio SIP (stereo image processor made by CineTal), and GVG Kayenne switcher to the CP JVC 46 inch 3D monitor. One point of this set up was the ability to simultaneously originate 2D and 3D broadcasts.

Of course everyone who does mobile origination is "3Ding" their trucks and Pennsylvania based NEP-a 25 year industry veteran- showed their readiness with the SS3D-a van equipped with Pace-Fusion 3D rigs. All Mobile Video www.allmobilevideo.com will soon have ready their Epic 3D 3G Van with six 3ality Digital rigs (with capability up to 9) featuring Sony 1500R cams with T Blocks for 3D. Onsite sports 3D has been done at least a dozen times to date with the NBA All Stars game in 2007 (to 14K people in one arena) and 2009 but this year we are talking about worldwide broadcasts to hundreds of venues and over satellite and cable.

In dustry veteran Harmonic Inc www.harmonicinc.com of California demo's the 3D capacities of its wide range of hardware and software for IP based codec, processing and delivery via every avenue to every type of user.   Featured at the show was the frame based full 3D HD Electra® 8000 -- the world's first 1-RU (one rack unit or 1.75 inches high) encoder with multi-resolution, multi-standard, multi-service and multi-channel capabilities.   The image on the Panasonic Viera frame sequential PDP was xlnt. DirecTV will use their Harmonic encoders to launch 3 3D channels in June and will also carry ESPN 3D and eventually others. Customers will receive an automatic software upgrade for 3D but of course will have to buy new sets.

The electronics arm of Japanese Telecom giant NTT was showing the capabilities of their realtime codec hardware MPC1010-3D for perfect GOP (Group of Pictures-an mpeg 2 coding term) sync and PTS (Presentation Time Stamp) of two full HD channels or of one 4K x 2K by using 4 synced channels.

Jihoon Jo of Korean polarized 3D display manufacturer Zalman http://www.zalman.com/ENG/3D/work01.asp shows a prototype 3D laptop. Afaik (As Far As I Know) they have been the only company other than Japan's Arisawa that makes their own polarizer for their panels (and by a less costly means) so theirs sell e.g. for about 1/5th the price of those by Miracube (but there is much work on this now by the giants --e.g., WO2010/044414). These have so far been smaller sizes sold to gamers, scientists and 3D video professionals but they now have several new FHD (Full High Definition) panels up to 32 inches and may intro the 32 this year as a TV set. With the 3D market going insane many manufacturers are making their own polarized panels now but Zalman has experience and a good product at a remarkable price, so I have decided to distribute them and am showing them at Infocomm 2010.
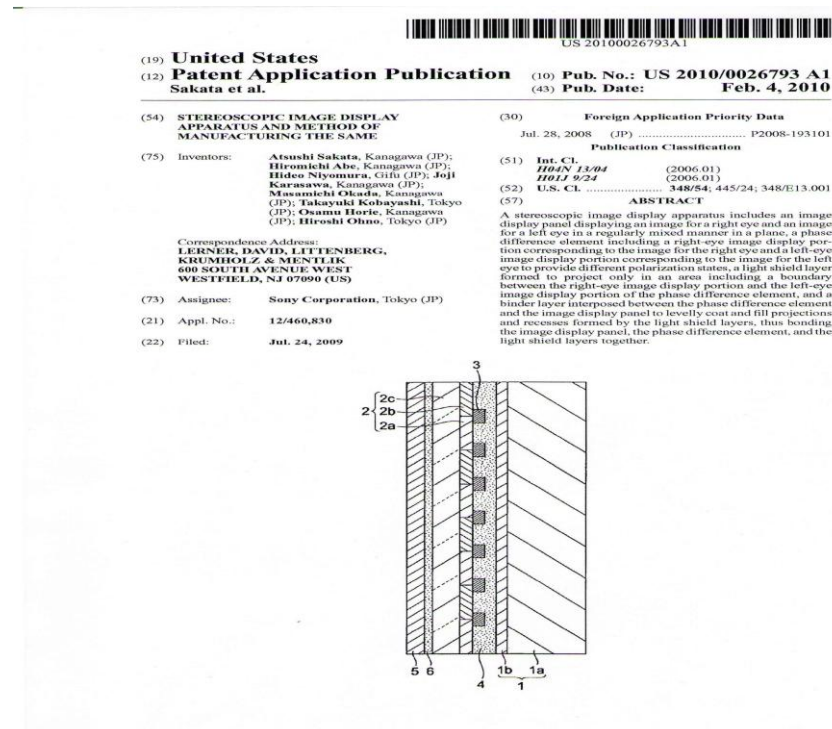
Line alternate circularly polarized panels first became common from Kalman, Miracube and Hyundai but all the giants are now interested and this is one of Sony's latest patents.

Dr. Inge Hillestad of Norwegian pro video transport company T-Vips www.t-vips.com demo's their JPEG2000 over IP codec on a Hyundai CP panel.   Station to station, DTT, live broadcast, etc-- they let you deliver high quality content at low cost.   A pioneer in JPEG2000 over IP based origin and transport of video worldwide, they used NAB to launch their 3D ready JPEG2000, ATSC, switching and transporting solutions.

In the ATSC (i.e., the 195 member intl. consortium Advanced Television Systems Committee) booth Korean electronics giant LG shows an ATSC 2.0 NRT (Non Real Time--i.e., stored on USB etc) VOD (Video On Demand) 2D/3D compatible monitor-- the LG XCanvas. This system has been tried with terrestrial Korean station SBS and will be publicly tested soon.   The video is downloaded in extra bandwidth while watching other programs.   This is a facet of the Korean OHTV (Open Hybrid TV)   initiative which seeks to set standards for nextgen interactive broadband and RF delivery which includes VOD, EPG, NRT, CE-HTML and DAE with enriched services such as the ability to select clips from programs and give feedback.   For recent related 3D codec work by Korean research group ETRI see WO 2010/053246.

Craig Lutzer of Korean 3D CP and 3D barrier panel maker Miracube www.miracube.net shown with two of their products. Miracube (a spinoff of Pavonine) has been making these for about 8 years and I have seen them many times. Good image quality on both CP and auto monitors. Their smaller ones are being used as onset 3D production monitors. Input supports– Side by Side, Top and Bottom, Interlaced and Frame sequential. A 2D/3D button allows you to use the monitor in 2D mode. Minimum crosstalk due to use of Wire-Grid Polarization (WGP) with 178 degrees viewing angle and resolution up to 1920x1200. They also have a beam splitter rig of their own.

Wisconsin USA based Weather Central www.wxc.com introduced their live weather graphics 3D ready program 3D:Live Fusion here shown on a Sony shutter glasses monitor. Live Fusion is the world's most viewed on air broadcast weather platform and so we have all seen it countless times as various versions are also online, in print and in pda's, mobile phones and cars.

As reported last year Avid was one of the first to incorporate stereo capabilities into its world famous editing tools and they showed the current capabilities on two CP monitors from JVC. However the RED camera was not being used to shoot live 3D.

Quantel's expensive (in the $500k range depending on the box and options) video editing hardware has been an industry standard for about 20 years. The Pablo Neo color corrector showed its updated stereo tools by editing RED 4K displayed on CP monitors. It was extensively used on Avatar where its Resolution Coexistence feature enabled the 2K film to be easily prepared for release in other formats such as 4K for IMAX. Most of this work was done by Modern VideoFilm for conforming, Stereo3D checking, adjustment of all parameters, QC and 3D subtitling of the Na'vi language. Find the brochure here http://quantel.com/repository/files/brochures_Pablo_nab08.pdf. A used one is on the net as I write for a mere $275K. However you might be able to find the SID Stereo 3D workstation or the iQ for less http://www.quantel.com/page.php?u=179a76e77017de7ea9d5a630e40f6523 and http://www.quantel.com/page.php?u=7bb3fa7666b4fea8207089f7b70b0ebd For a nice 29 page whitepaper on 3D see http://quantel.com/repository/files/whitepapers_s3d_aug09.pdf They also showed the latest incarnation of another industry standard--the Enterprise sQ Server doing Stereo 3D Workflow. Here is the url for it http://www.quantel.com/page.php?u=81d679affb82e612a56008d06192a0af and here is the overall workflow diagram.

3D Workflow for the Quantel Enterprise sQ Server

There were other high end S3D (now the common abbreviation for Stereo 3D) editing box options at the show, such as SGO's www.sgo.es Mistika that may cost half the roughly equivalent Quantel box and also now does 4K and 3D http://www.sgo.es/products/sgo-mistika-4k-2k-hd-sd/ . Another Spanish company that makes camera rigs S3D http://www.s3dtechnologies.com/ had their beamsplitter in the SGO booth. Get a four page brochure here http://www.s3dtechnologies.com/docs/rigs.pdf. S3D also has a stereocalculator, CGI plugins for Maya and Max and a 2D to 3D video converter.

Screenshot   of   the   S3D   calculator.

The S3D beamsplitter rig in graphic form with cameras shown as transparencies.

Motorola has been working on 3D capable STB's for years and showed their latest one here. You can find a very simple but clear guide to 3DTV and other info at http://business.motorola.com/3dtv/index.html.   They feature floating 3D Menus with automatic detection of 3D content and 3D format   and seamless switching between 2D and 3D channels. They support 3D TV over both MPEG-4 and MPEG-2 and are capable of 1080p 24/30 output.

Upon detection of 3D, it automatically reformats on-screen text and graphics to match the format.   It supports all on-screen displays such as closed captioning, emergency alerts, application graphics and text overlays, electronic program guides and other apps.   Notice the top/bottom format on the 2D monitor on the right.   This was called over/under and side by side and subfield for decades and was almost always half vertical res in each eye.   A top/bottom format is now officially defined as two full (no missing pixels) HD frames, one for each eye and termed   "frame packing". It is essentially the format used in Neotek's www.neotek.com TriD 3D video system for the last 6 years. It is one of those (including side by side, interleaved and nearly every 3D format you can think of with space left for ones you can't) mandated in the new HDMI 1.4a 3D specs

http://www.hdmi.org/manufacturer/specification.aspx.   HMDI   1.4   permits handshaking between signal origination (e.g., DVD, STB, DVB, Cable) and the TV set to send only 2D if it is not 3D and the correct 3D format if it is.

Korean Pro monitor maker TVLogic shows the world's first 3D OLED monitor viewed with shutter glasses--the TDM-150W with 1366x768 res. Image was excellent but perhaps not as bright as one would like.   This new tech is coming on fast and we should see both polarized and shutter OLED becoming common.   Asian manufacturers have shown large sizes for several years and I saw a spectacular OLED TV in Japan 3 years ago.

Mr Lee of TV Logic with their new full HD polarized monitor consisting of dual LCD's with semisilvered mirror.

Bart Stassen of leading Canadian hardware, production and distribution company International Datacasting www.datacast.com showing live 3D going through the up/downlink chain via their Superflex Pro Video Coders/Decoders

http://www.datacast.com/Media/Content/files/DataSheets/superflexSheetBrochure.pdf
and the Sensio box (small black box on the left) whose side by side compression tech
they use.   Get the latest brochure on their Superflex Pro Cinema 3D Live Decoder
here   http://www.datacast.com/Media/Content/files/DataSheets/IDC_ProCinema.pdf
.

During the show they announced that Sensio www.sensio.tv   hardware (presumably
with their Superflex boxes) will be used by Aruna Media AG, which owns the FIFA
World Cup live broadcast rights for out-of-home 3D HD, to distribute the broadcast to
stadiums and cinemas worldwide.

Sensio hardware was in many other booths (e.g., in the Miranda Densite 3DX-3901
Stereoscopic 3D video processor and in the Grass Valley booth) and hidden inside
others, and in a private suite.   These coups for a tiny company were possible due to a
decade long R&D which produced the needed multiformat 3D codec hardware and
they richly deserve their recent success.   Those interested in their tech may see   US
2010/0111195, US 7,580,463 and US 7,693,221.

Though famed broadcast video hardware company Grass Valley had an anaglyph
demo, they also had polarized displays evincing their 3D readiness.   You can get all
the latest on their 3D with whitepapers, 3D posters, brochures and a lovely

downloadable anaglyph animation on themes (real products) in the above poster at http://www.theycamefromgrassvalley.com/. Be sure to clik the 3D button at top right of the pages and have your red/cyan glasses ready. Broadcast video hardware company Grass Valley showed the 3D readiness of their products with stereo displays driven by the VIBE family of contribution encoders and Elite transmitters able to encode and transmit 3D from remote locations with user variable codecs and compression ratios. They are owned by media giant Technicolor which is owned by the Fortune 500 company Thales--the French based international electronics, aerospace and defense entity, were formerly owned by Tektronix, and now are up for sale.   The company originated in Grass Valley, California in 1958 and is famed for a long line of leading edge products and have won 22 Emmy's for their video products.

Though they did not have a booth, giant (20K employees worldwide) film and media company Technicolor is deep into the 3D biz with everything from their new over/under 3D Cinema lens -i.e., for film based 3D in nondigital theaters (150 installs as of April 2010)- to 3DBR disc authoring http://www.technicolor.com/en/hi/about-technicolor/technicolor-news/all-news-articles/2010/technicolor-brings-3d-to-the-home-and-beyond. Since there are over 100K 35mm (i.e., nondigital) cinemas, this lens may greatly speed up the 3D cinema installs and hence the growth of the whole industry. Major reasons are cost and convenience --ca. $12K since it uses the classic (i.e., since Warhol's Frankenstein etc in the 70's) over/under projection format) and a similar lens is being promoted by at least one other entity.   This format has it's problems such as vignetting and easy production of pseudoscopic images with the projector framing knob or incorrect splicing and so Oculus 3D www.oculus3d.com has recreated another classic format with side by side twisted images, but I doubt they can compete with the giant Technicolor.

The famous filter company Tiffen www.tiffen.com acquired the revolutionary Steadicam years ago and continues to put out new models such as the Smoothie being demo'd here-- with a PS Technik Freestyle beamsplitter rig that is specifically designed for this use http://www.pstechnik.de/en/3d.php. It stays balanced when interaxial is changed, holds cams up to 14kg/pair, can be used upside down, and works with other balancing systems such as Artemis http://www.artemis-hd.com/index.php?id=2.

Speaking of camera stabilizers I will mention 5 other new slick devices any shooter will want.   The Tyler MiniGyro is a handheld battery powered device with four gyro wheels that supports cams up to 30 lbs www.tylerminigyro.com.   The Eagle (L'Aigle) is a French made system similar to the Steadicam but with its own unique features www.laigleparis.fr. Polecam www.polecamusa.com now offers special versions of its widely used supports for stereo camera use.

I also saw the xlnt, inexpensive and highly adaptable Nano rigs for small cameras from Redrock Micro www.redrockmicro.com/ .   From Japanese company Rocket www.rocketjapan.com we have a variety of devices of which the most impressive is the spring loaded Spring Stabilizer XY Damper which is so cool I have to show it to you (ca. $3000) and this photo does not do it justice.

And finally a few reminders that people have been thinking about 3DTV for a long time. Firstly, all true afficionados must buy the new SPIE DVD Selected SPIE/IS&T Papers on DVD-ROM: Stereoscopic Displays and Applications 1990-2009: A Complete 20-Year Retrospective", SPIE Volume 51, ISBN: 978-0-8194-7659-3. A fully searchable DVD-ROM containing over 1000 technical papers from the famous conferences which I helped to inspire, attended and spoke at.
Incidentally, those seriously into the engineering aspects may also enjoy Ozaktas & Onural "Three-Dimensional Television" 629p (2008) Springer.

Lastly some images from 3DTV history to put things in perspective.
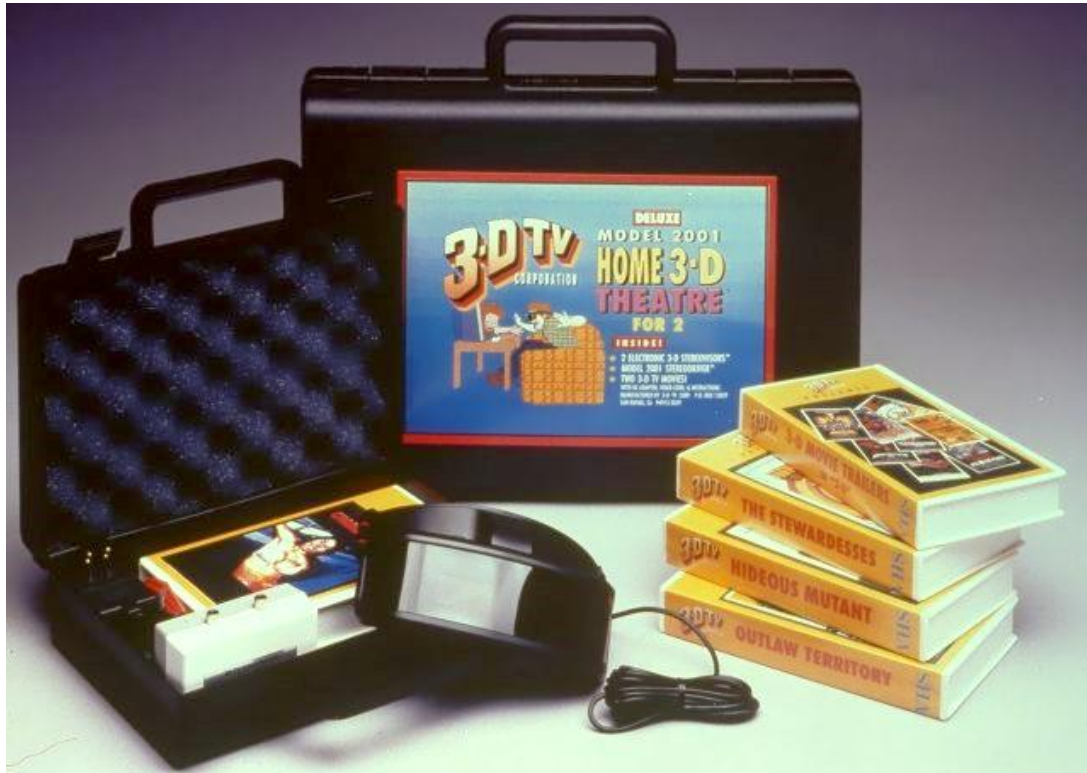
World's first commercially available home electronic 3DTV system--Model 2001 Home 3D Theater introduced by 3DTV Corp at the January CES, Las Vegas 1990.


Toshiba 3D Camcorder system of which 500 were made in 1988. I still use them occasionally with recording on digital via its composite video out. I converge and focus the lenses as close as 8 inches using single 72mm diameter closeup diopters on

a modified lens hood.

Four models of shutter glasses in use in 1990. From top left--Nintendo glasses for their 8 bit Famicom system, Toshiba's for their 3D VHS-C Camcorder, Korean made glasses sold by 3DTV Corp (grey) which appeared many places including a long vanished kit from an adult video company, Sega glasses for their 8 bit gaming system (lower right).
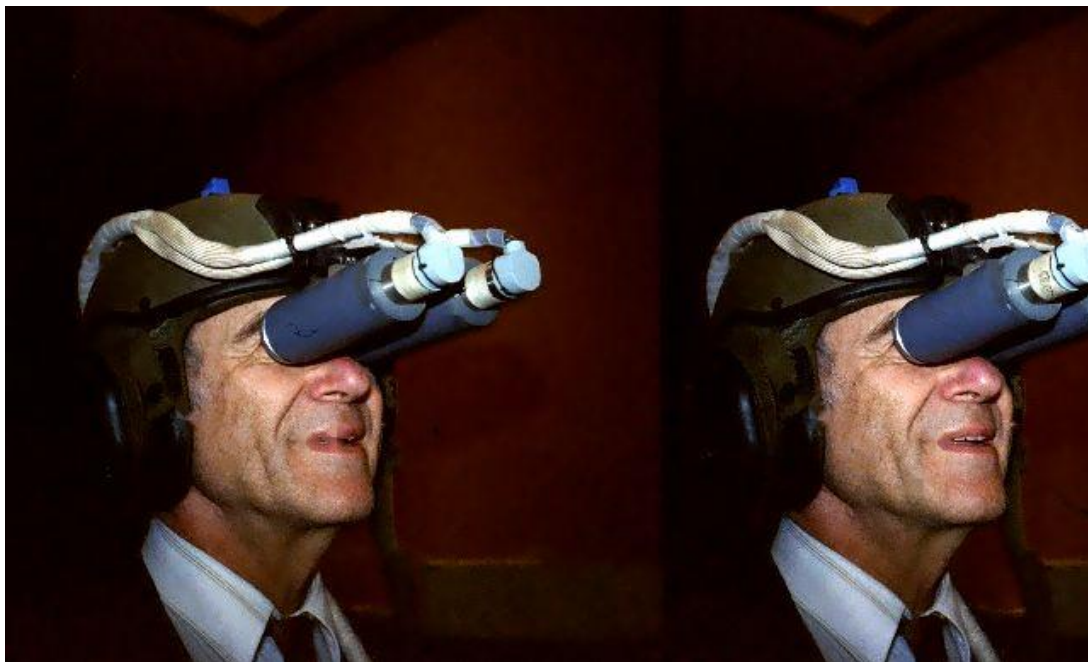
Tektronix was a world leader in LCD and VR in the early 90's. I shot this stereo photo of their 3D LCCS (Liquid Crystal Color Shutter) hires frame sequential color HMD at a trade show ca 1991. Now you can do it with a Vuzix, Zeiss or other pocketable

HMD and an iPhone or PDA for less than a tenth the size, weight, power consumption and cost.
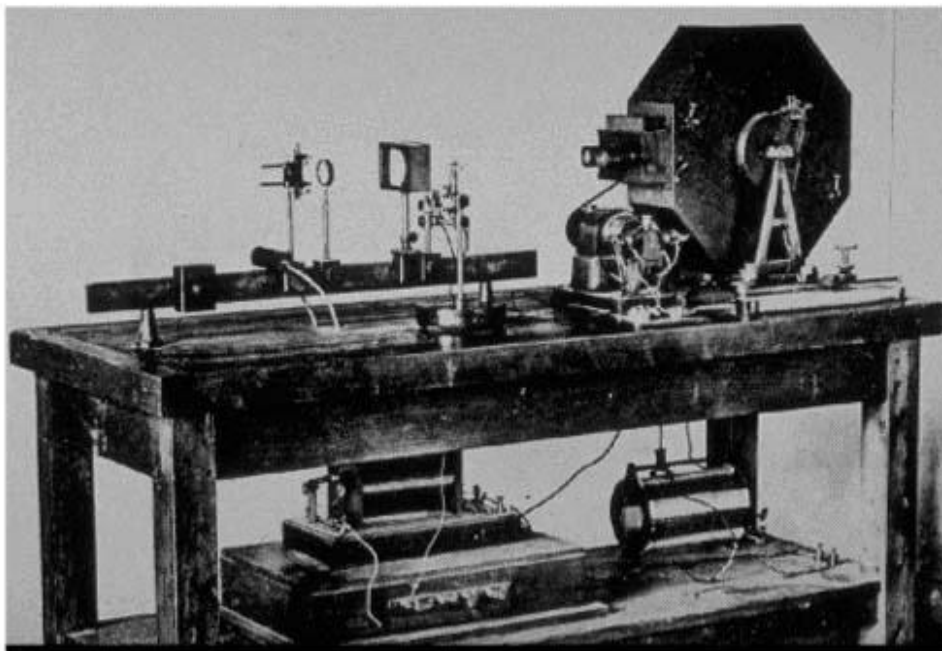

Engineer Minoru Tsutsumi of Ikegami Corp. with their $90,000 3D zoom video camera at the National Association of Broadcasters show in Las Vegas in 1992. Other than in Japan, it has been most used by Anthony Coogan in the USA & Chang Lee in China.

NHK engineer in front of booth with protoype autostereoscopic lenticular videoprojector at NAB 1992. The image was good but restrictions on viewer position were severe.


3D camera and lenticular photo inventor Allen Lo in front of the giant Sony Jumbotron at Expo 85 in Japan. Made of thousands of very bright CRT's, it was later covered with strips of polarizer & used to project 3D video.

П. В. ШМАКОВ
1885—1982
Герой
Социалистического
Труда,
один
из основоположников
советского
телевидения

Russian postcard featuring Prof. Shmakov of Leningrad(now St. Petersburg) Electrotechnical Institute who wrote the first book on stereoscopic television in 1953(published 1958) and trained hundreds of students in the stereo art.
(BELOW) The world's first high speed stereo motion picture camera invented by Bull ca. 1900.

I have what is maybe the only copy in private hands of Shmakov's extremely rare book.
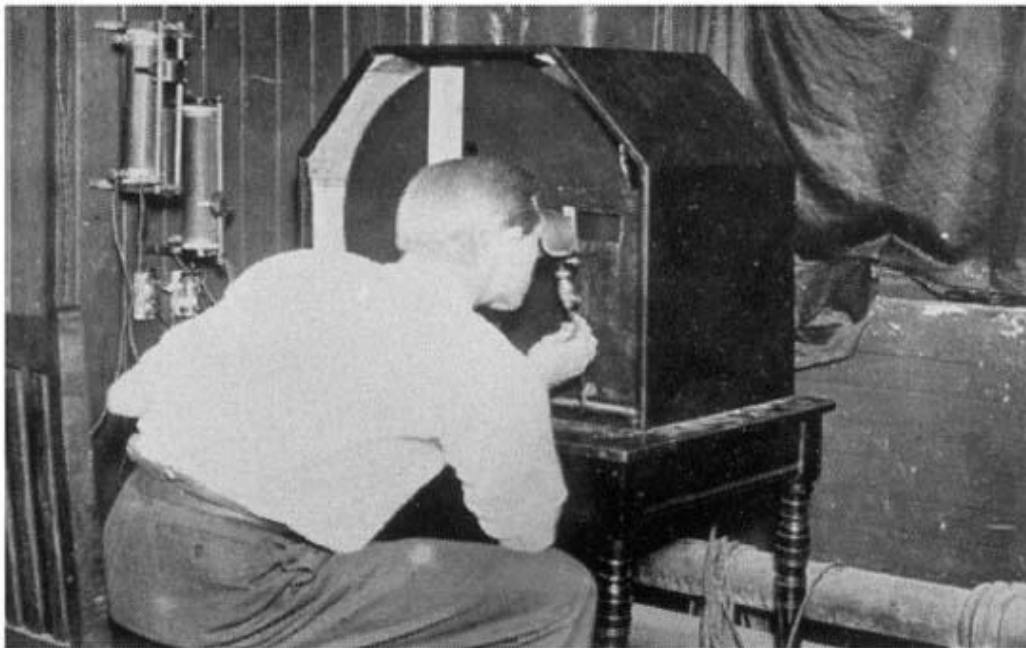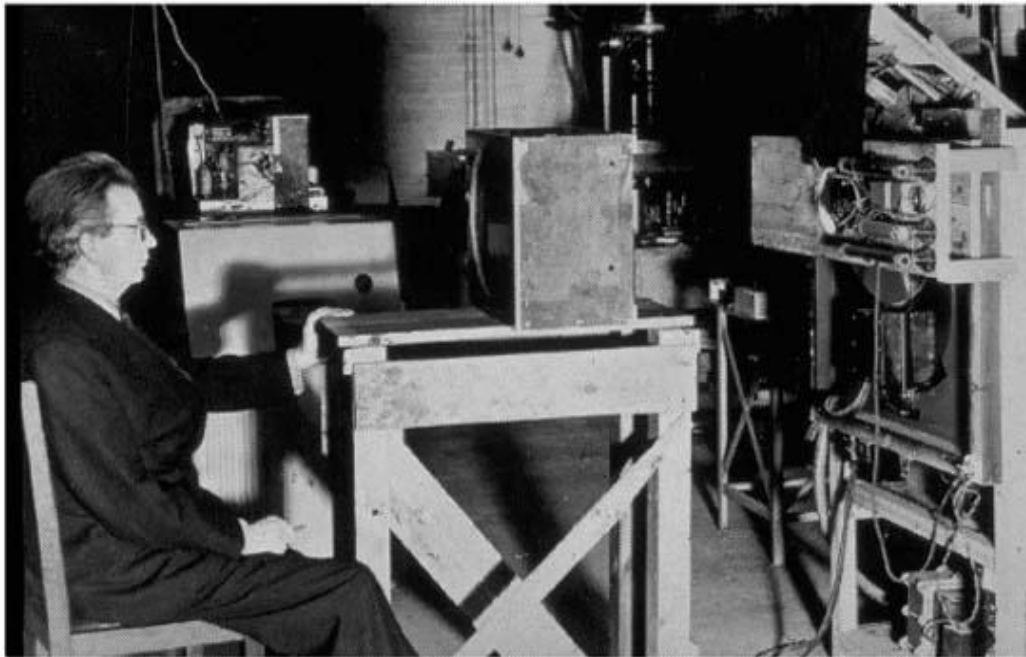
(ABOVE) Scottish television pioneer & the father of stereoscopic television John Logie-Baird in front of one of his creations in London ca. 1929. (BELOW) Observer viewing 3D TV image with a stereoscope on one of Baird's sets ca. 1935. Like most systems prior to WW2 they used spinning perforated discs to make & display the image.

Yes, some of Baird's 3DTV's were autostereoscopic but from only one position.