Business & Strategic

Digital Domain Media Group and Samsung Form 3D Technology Patent Licensing Agreement

Digital Domain Media Group (DDMG) (Port St. Lucie, FL), the parent company of Venice, California-based digital production studio Digital Domain, has entered into an agreement to license its patent portfolio for 3D technology with South Korean consumer electronics company Samsung Electronics Co., Ltd. The licensing agreement is non-exclusive and is the first such license granted by DDMG since the recent inception of its 3D technology licensing initiative. – *Cheryl Knight*

Legend3D Gets $19M in Stock Offering

San Diego-based Legend3D is moving 2D-to-3D conversion forward with a $19M cash infusion from a Series E Preferred Stock offering led by both new and returning investors who like what they see in the 3D world. PAR Investment Partners and Augustus Ventures Ltd. are now joined by new investor Northwater Capital Management, known for its IP-based investments, in the new funding deal.

Dr. Barry Sandrew, COO and CTO of Legend3D

Part of the Legend3D strategy is to use the cash to develop 3D content in partnership with content owners, allowing the company to share in long-term revenue streams from the new 3D version of existing 2D content.

David Patterson, chair and chief executive officer of Northwater Capital Management, explained why they wanted in on the new funding deal. "Legend3D has redefined the art of 3D storytelling, allowing audiences to experience entertainment outside the boundaries of a 'flat' world. 3D storytelling is primed to sweep audiences worldwide, making it increasingly critical that the technology behind-the-scenes offers today's content creators a toolset without limits," he said.

Dr. Barry Sandrew, founder, COO and CTO of Legend3D, said, "This funding marks an incredible opportunity to further hone our 3D conversion pipeline and develop advanced 3D structures to benefit our industry partners. Marrying these proceeds to our talented team of stereographers will help us make the 'impossible' possible in a 3D world."

Back in September 2010, Legend3D invested in Southpaw Technology TACTIC 3.0 production and digital asset-management system that includes asset, workflow and project management modules. The company has also been increasing headcount into the hundreds at

their facility in San Diego. For details, see our coverage in Legend3D Grows Up (Sept. 2010 *Large Display Report*, p. 63).

Legend3D said recent 3D film work includes Martin Scorsese's *Hugo*, Michael Bay's *Transformers: Dark of the Moon*, and Rob Marshall's *Pirates of the Caribbean: On Stranger Tides*, as well as scenes from *Alice in Wonderland*.

Legend has created a compelling formula: to take a known 2D quantity (popular film) and add value with 3D conversion to boost downstream revenue. Legend3D will be in a position to benefit from this approach using the cash infusion to do more of these deals. The results add not just to the bottom line of Legend, but boost the overall availability of 3D content, and that's a very good thing for the 3D space. *–Steve Sechrist*

Living 3D Holdings, Inc. Enters 3D Business With Acquisition

Living 3D Holdings, Inc. has acquired Living 3D Holdings, Ltd., a privately held company focused on the marketing and sale of 3D image display devices in China. Living 3D, which is based in China, is in the development stage and has concentrated on the markets for 3D touchpads, 3D indoor and outdoor light emitting diode (LED) displays, and 3D televisions. These products are based on autostereoscopic 3D technology, meaning that viewers are not required to wear 3D glasses in order to experience the 3D effects of the screen, and instant switching between 2D and 3D viewing is enabled.

Living 3D's image display devices are designed and manufactured by third parties using original equipment manufacturer parts and the technology and know-how of two of its directors and officers. While its sales to date have focused on customers utilizing its products in media and advertising, 3D display products are applicable in a wide range of industries, including entertainment, education, consumer electronics, medical diagnosis and scientific research. Living 3D has conducted limited sales marketing efforts to date. All of its sales have been to government and research entities and educational institutions in China and consisted of large 3D LED displays (approximately three by three meters), 3DTVs and 3D panels.

At the point of the acquisition, the company had no operations and was seeking new business opportunities. It was originally named Concrete Casting Incorporated (under which name its stock is now traded), had changed its name to AirWare International Corp. in July 2010, and finally had changed its name to Living 3D Holdings, Inc. in September 2011. *–Cheryl Knight*

3D in Education

How the Success of 3D Movie *Hugo* Might Affect the Education Market

This month's article starts with a look at a fascinating 3D movie, a film still showing in theaters, and likely to return for Oscar nominations. The movie is *Hugo*, the best breakthrough 3D movie I have seen since *Avatar*. This peculiar and enchanting film, based on the Caldecott

award-winning book, *The Invention of Hugo Cabret*, is even better than *Avatar*. (That's also the opinion of James Cameron, *Avatar's* director.) I can only suggest you run (not walk) to a theater and see this film, which has been artfully directed by Martin Scorsese.

Charles Fraresso, the senior manager of Research & Innovation with Christie Digital Systems, often reminds me, "All great ideas work on a number of levels — simultaneously." Such is the surprising case with Scorsese's *Hugo*. In terms of 3D, it is interesting and significant on a number of levels. Let's explore some of most interesting parallels afforded by this analogy-rich film.

People Change

In last month's article, I wrote of a chasm between the media preferences of different generations. I described the interest of young people and teachers in 3D media, while decrying the visible disinterest of parents and technology leaders. Is there no hope? Looking at Hugo, there might be. You may not know it, but Johnny Depp is unable to see 3D movies. But that hasn't stopped him from co-producing this magnificent film. Martin Scorsese is a traditional director, but in *Hugo* he embraced the 3D medium with every fiber of creative passion in his possession. Could the involvement of the likes of Depp and Scorsese portend good fortune for the growth of 3D in coming years?

More Effective 3D Design

Many of my friends and relatives recently have stopped going to 3D movies, citing visual dullness, drab conversions and minimal negative parallax, but this powerful film demonstrates the type of creativity that will certainly bring the doubters back. *Hugo* employs 3D for distinct artistic and visual advantage — a remarkable feat. It features extraordinary 3D portal views, the appearance of multiple layers of positive parallax, and positive parallax that is almost as good as negative parallax. During an interview with cbsnews.com, Scorsese spoke of the initial challenges he faced shooting in 3D, saying, "Everything changed every shot. Every shot. The placement of the actor. The nature of the performance ..." The same attention to detail will be needed to support the continued development of educational 3D content. For the education market, simple 2D-to-3D video conversion will not be sufficient in itself. Running comfortable 3D cartoons for educational customers in exhibit hall booths will not be enough. (For better alternatives, check out next month's article, which focuses on next-generation educational 3D content designers.)

3D Panache

And one more thing about *Hugo*. The movie successfully revives, after an uncomfortable drought, the beauty and importance of negative parallax. Negative parallax is critically important in educational content. In *Hugo*, we see bountiful negative parallax: snow, ashes, dogs, tools, pendulums, guitar necks, hurting feet, hat brims, spit, devices and tools.

In planning a party for her godfather, Georges, the spirited Isobel, declared: "We need to have some … panache!" Negative parallax in 3D is like *panache*. When panache matters, it matters. Educational 3D needs more *panache* (translated, negative parallax). Think of it in this way: Customers will come when content has *panache*. I heard from some key industry leaders in 3DTV sports entertainment recently that viewers are demanding more negative parallax from ESPN … and ESPN is delivering. It sounds like ESPN is delivering *panache*.

A Gripping Story, a Hidden Allegory

Hugo is the tale of a young lad trying to find purpose in his life following the untimely death of his father. But nestled within the plot is a unique story-within-a-story, a look at the budding history of early cinematography. The view is through the eyes of Georges Méliès, a "special effects" cinematographer who was immensely popular and productive, producing well over 500 films in his day. A performing magician turned cinematographer, Méliès somehow never left behind his gift for magic, invention and imagination as he pursued making movies. "I was convinced it was a new kind of magic," he said of cinema.

Now, here's where 3D comes in. This enchanting tale of the inchoate history of cinema creates a softly hidden allegory of today's emerging 3D marketplace. The parallels are striking. Much like early film, 3D today seems like a "new kind of magic" to the consumer. "Movies are like seeing dreams in the middle of the day." I can't think of a better way to describe 3D in the theater or the classroom." It was a gift!" Méliès voiced with delight about moving pictures. I see 3D in the same role — it's a gift for learning and for healthy vision."

Moreover, viewer reactions to these early films then (and 3D movies or classrooms now) are eerily similar. In Méliès' day, people responded with the same, "It's like being there," delight and physical reactions. One of the scenes depicted in Hugo involves a famous moment in film-going history, the brief screening of the Lumière brothers' *Arrival of a Train at La Ciotat*. Here's a second YouTube version of the same film clip. Frankly, the visual surprise reenacted when the audience in Hugo saw this short video is no different than the reactions repeatedly evidenced in classrooms of elementary school students as 3D asteroids whizz by their heads on a simulated journey to the solar system. And it's really not much different than the delight and connection demonstrated last week in Colorado by a group of adult K–12 educators at one of my 3D demonstrations. I guess there is one difference. The surprise and cognitive delight of viewing 3D does not seem to go away over time.

The similarities between the first years of moving pictures and our early experiences with stereo 3D don't stop there. We see in both counterparts the struggles of the early years of making quality productions, the challenges of earning a living by selling something as silly as imagination and wonderment, and the highs and lows of convincing others as to the true potential of the tool.

A Tough Lesson to Be Learned

In *Hugo*, the magnificent and enthralling "world of imagination" created by Georges Méliès and others was driven away when World War I came. "Youth and hope were at an end," lamented Georges. "The world had no time for magic tricks and movie shows … no one wanted

my movies anymore. Happy endings only happen in the movies," he added. Due to the lack of demand for movies, he sold his filming company. Crushed and demoralized, he invested all that he had left in a small toy shop. He felt that, in many ways, movies were just a fad. And the fad was over.

Sometimes I feel the same way about 3D in education. What has become known as our "great recession" has hit manufacturer, software designer and educational customer alike. At times, it seems like the economy has inopportunely slowed one of the most brilliant innovations of our time. Schools and universities that should be investing heavily in 3D learning technologies are instead focusing on keeping staff on the payroll. The critics of 3D are calling it either another fad or a luxury that is ill afforded during tough times. Although I don't want to ruin the movie, let me suggest that, in the end, Georges finds fresh legs. And in the 3D educational marketplace, there is reason for hope as well. You see, the educational market is resilient. It will bounce back. No, the message for 3D's potential in the classroom is not going to wither away. In fact, the unanticipated benefits of 3D in learning and vision health just made the cut in *eClassroom News* as one of the "**10 most significant educational stories of 2011**". See the story here.

Credits and Closing Score

While recently attending the film, I was surprised to see that *Hugo* was so enthralling that most of the audience sat quietly and listened to the closing score well through the credits. The audience, young and old, was too stunned and enchanted to unseat themselves. (Incidentally, these are the kinds of results we are seeing with 3D in the classroom. And there is some research evidence that 3D visual effects are greatly enhanced by a rich audio experience.) This movie shows where 3D is now and what is possible for the future of 3D — and for the future of 3D in education. Like cinema, 3D is also a gift. It's encouraging to note that when Georges offered Hugo a job repairing toys in his toy shop, growling, "You begin tomorrow," Hugo replied: "No, I'll begin now."

In the optimism of a new year, I, too, prefer to start working now, not when the recession is over. By the way — go see the movie. *–Len Scrogan*

Emerging Technology

HD3D Cameras Address the Space Debris

John Junkins of the Texas A&M University (College Station, TX) has proposed an advanced camera technology that can create detailed, high-definition 3D images. The camera is intended to capture images of space debris in the size range that most threatens satellites.

In Junkins view, there are two critical and near-ready technologies needed to produce such a system:

Objects have to be tracked and imaged in three dimensions. More specifically, it is necessary to accurately sense derelict spacecraft.

A fleet of robotic clean-up craft is needed to chase, capture and control captured debris.

The so-called HD3D is a new type of video camera that will take an image of an object and precisely measure its three-dimensional geometry.

Junkins explained that the HD3D is based on a laser radar, which can be thought of as a type of optical radar. In this approach, a pulsed laser beam is very quickly swept over the field of view to capture 3D data. The system makes 12M measurements per second. The device can work over long distances and simultaneously capture geometry and texture.

The depth resolution of the camera is about 3mm. The X-Y resolution is on the order of milli-radians and, thus, depends on the distance to the object.

Junkins believes that conventional ground teams, using his camera and current or nearly ready robotic technologies, can control and maneuver reasonably simple vehicles that would grasp the thruster nozzle of derelict spacecraft and spent rockets. After docking, the capture vehicle would act like an orbital tug and "drive" the space object onto a controlled reentry trajectory to burn in the atmosphere. Any debris surviving reentry would be sent into a precise and safe landing zone in the ocean.

Junkins further believes that the camera and additional technology for deorbiting large spacecraft could be deployed quite quickly — and at a small fraction of the annual costs of the now-retired Space Shuttle program.

The camera system also has potential to help bring next-generation technology to other applications. One is the Simultaneous Localization And Mapping (SLAM) system. SLAM uses sensors on robots or autonomous vehicles to survey the surface of the earth for environmental and defense purposes. The camera could also be used to build a map and navigate in an unknown environment. One example of such an environment is a mine.

Junkins has an industrial partner, SPEC (Austin, TX), that is licensing the intellectual property to build the HD3D. Junkins said that his ideas will be fused with work already underway at SPEC and that this will serve to accelerate development of the first prototype. The device is expected to be operational in the coming months.

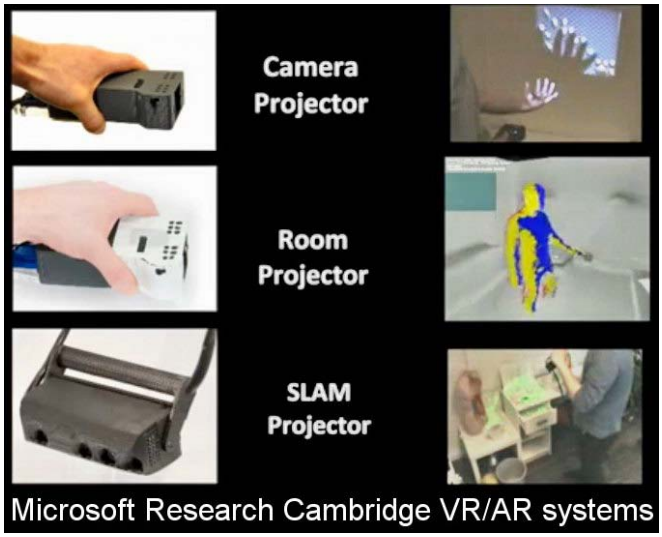
In a telephone interview with Dr. Junkins, Insight Media learned that there will be an important demonstration to the Department of Defense on November 8. The demo will be conducted in a lab environment with the object to be interrogated about 30 feet from the camera.

Beyond these few comments, Jenkins explained that he was unable to offer any further information at this time. *–Arthur Berman*

Texas A&M University, John L. Junkins, 979-845-3912, junkins@tamu.edu

Microsoft Demos Kinect-Based Virtual Reality

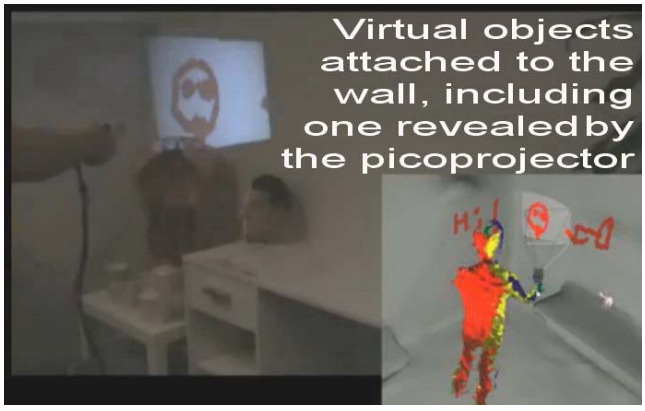
The Microsoft Research Cambridge (Cambridge, UK) Sensors and Devices group released a YouTube video on October 31 demonstrating its three latest virtual reality demonstration systems. These systems all combine the Inertial Measurement Unit (IMU) in the Kinect with a pico projector and an IR camera to generate various Virtual Reality/Augmented Reality systems.



While Insight Media has seen similar approaches in the past, none of them have had the smooth integration of the sensors and images that is shown in the Microsoft video. We suspect this smooth integration is due to good software, something one should expect from Microsoft.

The first system, called the Camera Projector combines a pico projector with the IMC from a Kinect and an IR camera with its light source in a tethered, handheld package. The camera can detect the user's hand and its shadow to control the software. Two examples are given. One is a physics-based simulation of the user playing with a bunch of small balls in the image, and the second attaches different icons to each of the user's finger and allows the user to control the software and start desired programs by manipulating the user's fingers. When a finger is selected, the icon is shown on the palm of the user's hand. Just be careful what icon you attach to the middle finger.

The second system is called the room projector. In this system, the handheld camera projector system is combined with four fixed depth cameras from the Kinect system in the room that can detect the position of objects in the room, including the user and the room projector. Of course, the orientation of the projector can be determined from the IMU. The depth cameras can also build up a realistic model of the walls and furniture in the room. This camera position, camera orientation and room model allow the system software to know exactly where on the wall the pico projector is pointing. The pico projector can then be used as a virtual flashlight to show virtual objects on the walls of the room. Shadow gestures can draw on the wall and attach these virtual objects on the wall. They remain there, to be revealed later when the pico projector points at them again as a virtual flashlight.



The system can also track virtual 3D objects inside the room and reveal them by the shadows they cast on the wall using the virtual flashlight. One example shown of this capability was the user beating at a virtual piñata until it broke and virtual candy fell out of it onto the floor. If you want to see more than an

object's shadow, just place the palm of your hand in the object's 3D position to see the full image.

The third system, called Simultaneous Localization and Mapping (SLAM), mounts a pico projector, an IMU and a depth camera in a single handheld package. The package contains no IR camera, and all feedback to the system is via the Kinect depth camera. By pointing the system at the walls of the room, the system can build up an accurate 3D model of the room with no fixed camera sensors needed. The registration between the real and virtual worlds is accurate enough to allow physics-based modeling of real and virtual objects interacting that provide a realistic view to the person holding the SLAM projector.

This information has been submitted to Pervasive 2012 as a paper by lead author David Molyneaux and his seven coauthors from Microsoft Research, Lancaster University and Newcastle University. Pervasive 2012 is the Tenth International Conference on Pervasive Computing and will be at Newcastle University in the UK in June 2012. This annual conference is the premier forum for researchers to present their latest results in all areas related to the architecture, design, implementation, application and evaluation of pervasive computing. – *Matthew Brennesholtz*

Microsoft Research Cambridge, +44 (0)1223 479 700

HP Introduces "Photon Engine" 3D Display

The HP Personal Systems Group, in collaboration with the company's central research arm HP Labs (Palo Alto, CA), has developed the so-called Photon Engine. This system utilizes polarized glasses in a projection-based 3D display system.

HP claims that the Photon Engine can front- or rear-project 3D images that look good under a variety of ambient lighting conditions and over a wide viewing angle. The technology can reportedly be applied to produce 3D images on either flat or curved surfaces having a screen size up to "hundreds of feet." An 11-foot system has already been prototyped.

HP has revealed few technical details related to the Photon Engine. What is known, however, is that the technology is implemented using an array of commercially available hardware components. The prototype includes four projectors, a screen and an HP Z800 workstation. If additional resolution or brightness should be needed, additional projectors can be added to the system.

Apparently, though, the "real magic" of the new technology comes in the proprietary software that coordinates the components.

Conceptually, the software aspect of the Photon Engine technology is an outgrowth of work originally developed by the company to improve printer quality. The idea was to apply the

software approach used to adjust the alignment of dots in an inkjet printer to the task of simultaneously combing real-time video images projected from multiple projectors. More specifically, the task was to align the images to a half-pixel resolution on big information walls. HP reports that the result is the production of a high-quality 3D display that induces minimal eye strain and fatigue.

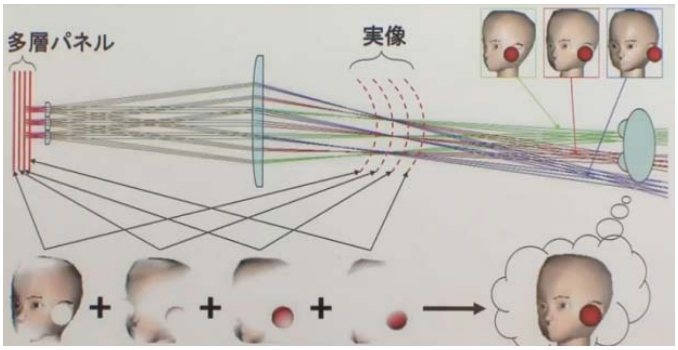
The company has been testing this alignment capability on display systems that produce 2D images. A video in which HP engineers discuss the Photon Engine 3D display can be found here.

The new technology is currently targeted at retail and marketing customers. Other applications might include logistical command rooms, operations centers at hospitals, power plant control rooms and a variety of government agencies. Common to all these applications is the need by the user to manipulate and sift through large amounts of information. While the solution may be very suitable in 2D, the need to wear glasses for 3D will limit its use in some of these applications, especially retail. *–Arthur Berman*

HP, Ann Finnie, 408-873-5656, ann.finnie@hp.com

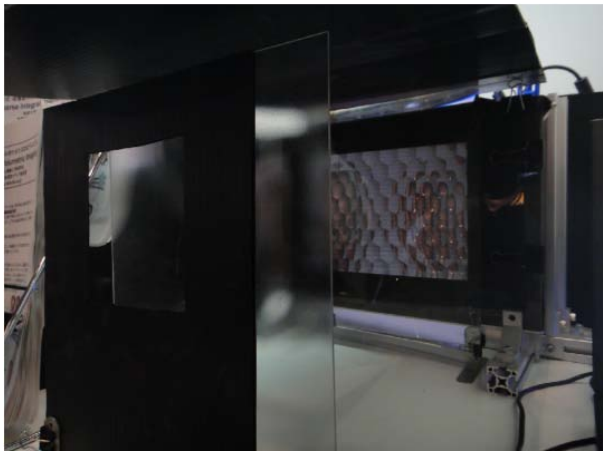
Tsukuba University Refines New Autostereoscopic Display

Researchers at Tsukuba University (Tsukuba, Ibaraki, Japan) are reporting recent developments on a new type of autostereoscopic 3D display technology. It is called Coarse Integral Volumetric Imaging and is based on the use of several layers and lenses to create depth perception.



Insight Media has previously reported on this technology. See the February 2011 edition of the *Large Display Report* (pages 65–66).

Tsukuba is reporting that two somewhat different prototypes have just been developed.



In the first version, the transition between the lens elements in the lens array are smooth and designed to create 76 viewpoints. As a result, when the user moves within the head box, the image variation is smooth and continuous, thus producing motion parallax that seem natural.

In the second version, the display has 50 viewpoints and higher resolution. This is achieved by using lenses with non-aligned centers. The 50 viewpoints consist of 10

horizontal and five vertical viewpoints. With both horizontal and vertical parallax, a user can see a 3D image even if lying down — that is, with their head oriented horizontally.

Shown at the recent CEATEC exhibition, a significant feature of the image is that, as in natural vision, when objects at the front are in focus, those at the back are blurred. When objects at the back are in focus, those in front are blurred.

A video that illustrates the prototype display in operation can be found here.

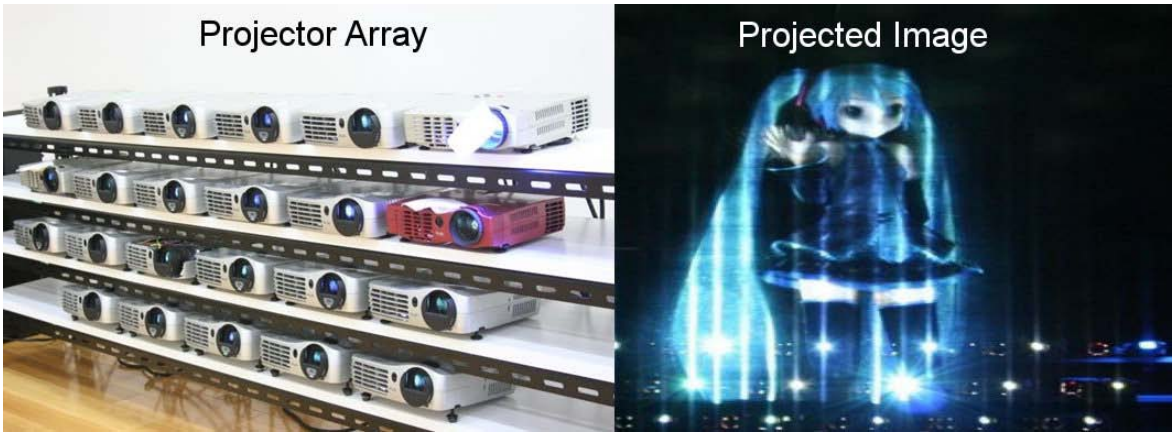
The resolution of the prototype display is about 200 x 200 — clearly inadequate for any real application.

One means proposed to address the resolution issue derives from the fact that it is not necessary to use a single high-resolution display as the image source. Rather, it is possible to use an array of small displays. In this case, the lenses can be arranged to hide the bezels between the small displays. The researchers recognize that, although it may not be difficult to implement this approach, it may be expensive.

The main application currently anticipated for this display technology is remote manipulation of objects by a robot. *–Arthur Berman*

Real 3D Demoed in Japan

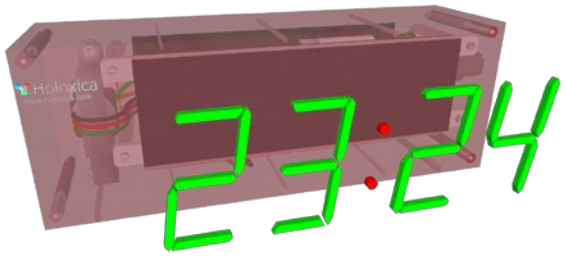
Aono.Y has posted a YouTube video and still photos of a "Real 3D" projection display here. This unit is a light-field reconstruction system based on an array of 23 projectors and is fundamentally similar to the Holografika system, although it is not nearly so well developed. In particular, he does not have either the software to support full-motion video nor the screen to eliminate or significantly reduce the banding artifacts that come from a projector array like this. Still, it is interesting he could get this far without, it appears, major support.



Note how in the projected image, the projector array, is visible through the nearly transparent projection screen. For more information, contact info@polyphonicskies.net or follow Aono_Y on twitter. *–Matthew Brennesholtz*

Holoxica Debuts Dynamic Hologram Display

Holoxica (Edinburgh, Scotland) has debuted a new holographic display that has dynamic moving images. The technology leverages its work in developing static printed holograms for scientific, medical and engineering visualization applications.



The idea is to expose a series of holograms on a single screen that is rear-illuminated by a laser projector. Such multi-exposure holograms have been demonstrated before, showing different views of the scene as the viewer moves from side to side. What is different about the Holoxica approach is that these views are all visible from a stationary viewing position and can be turned on and off with electronic control, creating a series of "flip-card" images that appears to float in front of the screen. Holoxica's holographic screen is about the size of a page and the images are the size of a hand.

Founded in 2008, Holoxica is a high-tech startup company working in the field of holography and 3D displays. For the past three years, Holoxica has been working in collaboration with the University of Edinburgh and Heriot Watt University to develop the technology into more than a simple prototype, but a product that is ready to be commercialized.

Javid Khan, managing director of Holoxica Limited, commented, "The 'mid-air suspension' holographic screen currently embeds up to nine images, but this number can be scaled up. Indeed, we can scale up toward 25 images, where it is possible to get a second of full-3D video or make other kinds of animated characters. Although, color is limited at the moment, the plan is to extend this in the future to give full color images by combining red, green and blue light sources."

In a 2010 SPIE paper on the technology that Holoxica supplied Insight Media, Khan explained that their approach is "somewhere in between volumetric and holographic techniques."

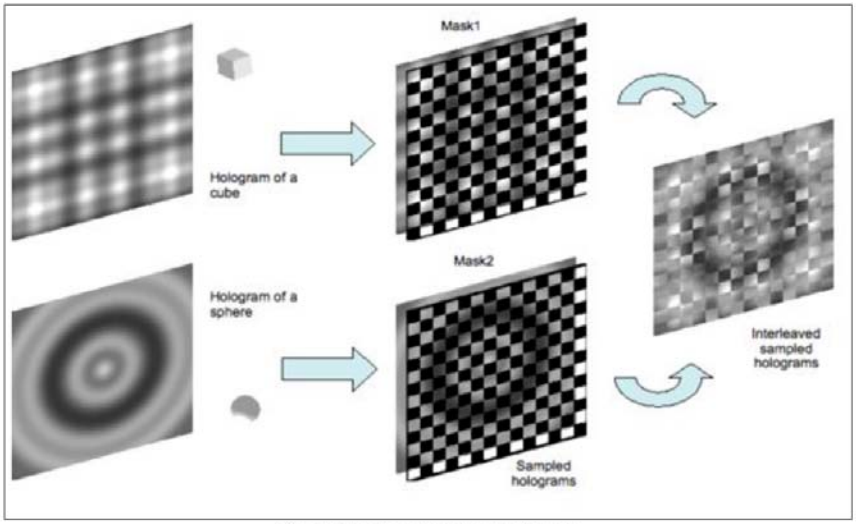


Figure 1: Sampling and interleaving holograms

Full electronic holography based on using laser illuminated spatial light modulators is very compute intensive and limited in size. With the Holoxica approach, they greatly simplified the process by exposing multiple holograms in a diffractive sheet and using fairly simple laser illumination. "However, the trade-off is that the holographic display is limited to simple volumetric shapes such as alphanumeric segments, icons or short animation sequences," noted Khan.

The concept is based on the idea of sampling and interleaving of holograms, as illustrated in Figure 1 from the paper.

The idea is to sample holograms of different objects using spatial masks. These masks reduce the resolution of the final image, but allows a method to interleave multiple holograms using multiple types of masks. In the above example, a hologram of a cube is sampled with a checkerboard mask, while the hologram of the sphere is sampled with the inverse of the same checkerboard pattern. This allows them to be interleaved on a final exposure.

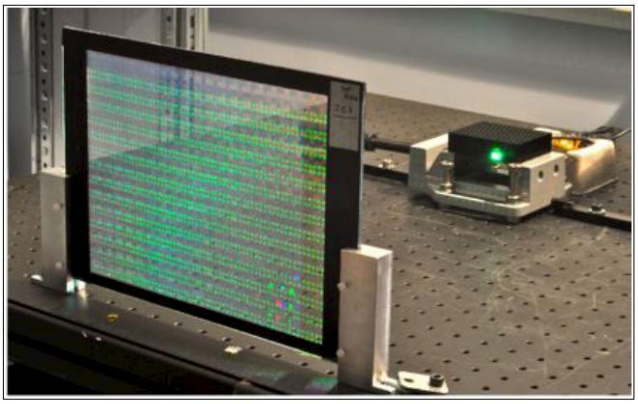
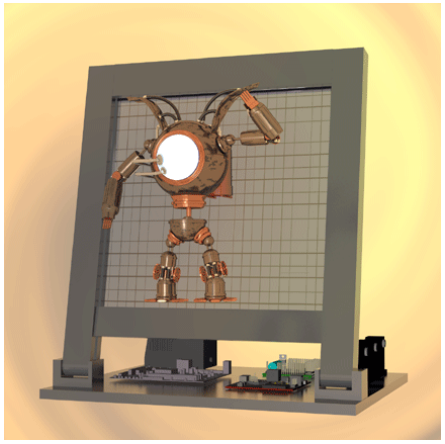


Figure 5: Optical hardware setup with pico-projector

To display this image, a laser-based projector can illuminate the exposed multi-image hologram (from rear or front). The projector replicates the masks to let coherent light illuminate the hologram. By doing this in time sequence, the cube and the sphere can be displayed in time sequence. Laser illumination with no masking pattern would display the cube and sphere simultaneously. This explanation describes two images, but Holoxica's demos create nine images.



To develop the prototype, Holoxica exposure multiple images in conventional film, but with some additional process steps. To illuminate it, they selected a pico projector from Microvision, which uses RGB laser sources and a dual-axis MEMS mirror for x-y scanning of the laser light. The sampling patterns drive the projector to create the desired image.

The laser can use red, green or blue light to create colored images, but illuminating the same pattern with sequential RGB laser light would change the position of the object.

This approach is clever and interesting. While products will be limited at first, we suspect continued development will greatly improve performance and utility of this idea. *–Chris Chinnock*

Holoxica, Kevin Dorrian (Acumen PR), +44 131 661 7027, kevin.dorrian@acumen-pr.com

Broadcast & Distribution

Argentine Broadcasters Cite Breakthrough: First OTA 3D Broadcast in the World

A team of scientists and engineers in Argentina appear to have carried out the world's first successful transmission of a 3D Full HD video signal over a conventional digital terrestrial television (DTT) ISDB-T channel, according to the Argentine Website RedUSERS. Writers capturing the story said that the team succeeded in sending 3D-1080p using the same bitrate as 2D-1080i, getting four times as much information in the same bandwidth and without additional latency.

The Argentine team in early December broadcast and received experimental three-dimensional 1080p images using a modified AVC/H.264 compression encoder built by a team led by Mario Mastriani, who heads the Laboratory of Images and Signals (LIS) within the NeoTV Lab at the Argentine National University of Tres de Febrero (UNTREF). Mastriani's group is also part of CONAE (National Commission of Space Activities), where they developed super-resolution video processing using computationally-intensive techniques.

We spoke with Mastriani, who explained to us the process used for compression. For 3D broadcast, they developed a pre-processing that performs a folding of sub-bands inside the wavelet domain. While details of this process remain a bit unclear, it would seem that the group uses the wavelet technology to essentially transform the image into the frequency domain where certain bands of frequencies can be segmented or "folded" to create an intermediate "image." This image is not viewable, so it must be decoded into something that is more video-like for standard encoding.

This pre-processed signal was then fed to an NEC VC-7301 H.264 High Profile encoder that treats it as a normal 2D-1080i signal; a complementary decoder re-creates the original 3D-1080p signal. The pre-processor thus performs a kind of spectral folding, possibly similar to early analog video compression techniques. This gives them a 4x reduction in needed bitrate, according to Mastriani.

The test was witnessed by engineers and management of Canal 7, the public TV broadcaster of Argentina, who conducted tests of image quality, latency and bitrate. For broadcast testing, a Panasonic 3D-1080p camera was used as the source; the signal was received on a PC equipped with a digital TV USB tuner, nVidia SDI capture card and Quadro 6000 graphics board. The video signal was passed through an HDLink Pro 3D activity monitor, and the output was connected to a 3D TV. Artifacts were said to be "imperceptible."

The technique used by the Argentines is apparently incompatible with a conventional 2D broadcast because of both video signal structure and compression codec. It could, however, be transmitted as a private program, given sufficient channel bandwidth. ATSC members now studying a new transmission system for the U.S. could consider some of the techniques developed by the NeoTV team as well. *–Aldo Cugnini*

Universidad Nacional de Tres de Febrero, Mario Mastriani, mmastriani@untref.edu.ar

Raystream Unveils HD 3D Compression System

Raystream (Dallas, TX), an emerging global provider of HD video services, recently announced its new, Full High-Definition 3D video compression service. Raystream press materials stated that the company's cloud-based architecture enables customers to compress Full HD 3D videos at the same bandwidth requirements as 2D content, and instantly view the compressed video on any 3D video-enabled device, including home theaters, set-top boxes, tablets, game consoles, laptops and mobile phones.

"Raystream's new HD 3D solution enables users to compress live 3D video, or existing 3D video files, for online delivery with a much lower bandwidth requirement," said Raystream CEO Brian Petersen. "Not only does the compressed video retain its crystal clarity, but its smaller size also prevents buffering, stopping and jittering. That means a much better viewing experience and a big reduction in bandwidth costs."

Using Raystream's Full HD 3D compression tool, full-frame left and right HD 3D, videos are condensed into a single, synchronized stream. That single stream can be played by HD 3D devices as full-left and full-right play-out or side-by-side. Raystream said its proprietary video compression technology decreases bandwidth costs by reducing the file size of HD videos up to 90%, with an average compression of approximately 70%, and with no loss in clarity or quality. The technique used is not known to us. *–Aldo Cugnini*

Raystream Inc., Nadia Christian, 972-980-7206, ir@raystream.com

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France's Canal Plus Drops 3D Channel: Orange Adds One

According to a report from http://advanced-television.com, France's Canal Plus is pulling the plug on its 3DTV test channel. Only about 30K viewing homes reportedly bothered to tune in. A Canal Plus spokesperson reported that there were not enough 3D programs available and too few 3D-enabled TV sets in consumers' homes. Broadcasts are set to end on January 18.

A source was quoted as saying Canal Plus will return to 3D transmissions at a later date.

At the same time, France's Orange telco and video sharing platform Dailymotion are joining hands in order to launch a 3D channel that would be available on a number of platforms. The channel can be reached at www.dailymotion.com/fr/3D.

The 3D programs brought by Orange can be viewed as part of 3DTV or VOD services. Programming includes a 26-minute magazine, Mag3D, issued on a monthly basis, that started last November. The magazine came out with documentaries, film, and music.

The contents of the channel will undergo continuous revisions and upgrades with time. It is expected to reach the mobiles by the coming February. *Cheryl Knight & Chris Chinnock*

China's First 3DTV Channel Airs 3D Content

China's first 3DTV channel started a trial run on January 1, 2012, according to a spokesman from the State Administration of Radio, Film and Television. After the test-run stage, the channel will be officially put into operation later in January, stated a report by http://english.eastday.com.

"We have officially started preparations for the country's first experimental 3DTV channel and have issued two technical guidelines on the production and airing of 3D television programs and 3D television signal transmission," said Cai Fuchao, head of the State Administration of Radio, Film and Television.

The satellite channel will offer 3D programs each day from 10:30 a.m. to midnight. Programs will include animation, sports, documentaries, TV dramas, entertainment and live broadcasting of events such as CCTV New Year's Gala and the London 2012 Olympic Games. To watch the 3D programs, consumers need a 3DTV and Capable TV's high-definition set-top box. No viewing fees will be charged by the channel during its initial start-up phase.

The channel will be launched through the joint efforts of six TV stations in China Central Television. *–Cheryl Knight*

2D/3D Digital Cinema

2011 Boom Year for Digital Cinema

In the past year, 10 of the 12 issues of Insight Media's *Large Display Report* have had an article in the "2D/3D Digital Cinema" category. All the *LDR* issues had other Cinema-related articles, such as the "2D/3D Cameras & Rigs" or "2D/3D Content Creation Tools" categories. Digital cinema has become a fact of life, and it is worth taking a look backwards to get an overview of the progress in 2011.

As most Insight Media readers probably know, Sony with its SXRD technology and the OEM licensees of Texas Instruments DLP Cinema, Christie Digital, Barco and NEC supply all the DCI-compliant cinema projectors worldwide. IMAX also has DLP-based digital cinema projectors, but these are a custom design for IMAX. If you want to show Hollywood movies digitally, you must be DCI compliant.

In a December 7 press release issued by Texas Instruments (TI) in the run-up to CineAsia in Hong Kong December 11–13, TI said that between December 1, 2010, and November 30, 2011, the number of DLP cinema screens worldwide had grown from 28,036 to a total of 51,620. Of these, the installed base capable of showing 3D movies grew from 18,367 to 30,290. These totals do not include IMAX projectors, which grew to 410 sites globally, of which 256 are in North America and 154 are in the rest of the world. Since each IMAX site includes two DLP projectors, that's over 800 projectors and is not a trivial part of the total digital cinema installed base. It is believed all IMAX sites can show 3D movies.

In honor of its 50,000th installation, TI gave each of its licensees a commemorative DLP Cinema chip representing the 50,000th three-chipset manufactured, which will be installed at three cinemas. Barco has selected the Cinemark El Tesoro in Medellin, Colombia; Christie has chosen the Shanghai Film Group Corporation (SFG) in China; and NEC has picked the Majestic Cinema in Milwaukee, Wisconsin in the U.S. as the worldwide representatives of this 50,000th milestone.

Meanwhile, Sony announced on September 30 that it had installed its 10,000th 4K SXRD cinema projector since shipments began in 2007. Shipments continue, of course, and recent Sony installations include Regal Entertainment, AMC and National Amusement in the U.S.; VUE and CinemaxX in Europe; Megabox and Cinus in South Korea; and T-Joy, Toho and 109 other Cinemas in Japan.

By the end of 2011, if shipments continue at the present rate, between TI licensees and Sony there will be an estimated 64,728 DCI-compliant digital cinema installations worldwide. This is roughly 48% of the worldwide total of 137K cinema screens. Assuming this rate continues into 2012, Insight Media believes digital cinema penetration will reach the 50% point sometime in early February.

The table gives Insight Media's estimate of the installed base of digital cinema projectors, broken down by the three TI licensees. Note that the projector count for IMAX includes two projectors per venue. There are also a few dual-projector installations in non-IMAX, large-screen venues, but these are not included in the table. Insight Media believes there are only a handful of installations of that type worldwide.

The switch to digital projection has reached an especially fevered pitch in China, with 7,745 DLP cinema screens, an amount that is nearly 60% of all digital screens in the Asia Pacific region, which includes India, Australia and New Zealand. Of these screens in China, 4,409 of the screens are 3D-enabled, or 57%. The latest research from IHS Screen Digest estimates that China will have a nationwide footprint of all-digital commercial cinemas by the end of 2013. In the Asia Pacific region as a whole, between December 1, 2010, and November 30, 2011, there was 92% growth in DLP cinema screens to 13,365 (up from 6,972), and an 82% jump for 3D screens (from 4,583).

DCI-Compliant Digital Cinema Projectors		
As of Dec 31, 2011		
TI DLP Installed Projectors		
Christie	27,405	
Barco	21,830	
NEC	4,351	
IMAX	850	
TI (Total Projectors)		54,436
Sony SXRD		11,142
Total DCI-Compliant Projectors		65,578
Total Film Screens		71,422
Estimated Total Screens Worldwide		137,000
Current % Digital		48%
Estimated by Insight Media		

According to *Screen Digest*, the conversion to digital cinema will be complete with 100% penetration in 2015. If the current torrid installation rate continues, Insight Media calculates it will be somewhat before that date, perhaps as early as July 2014. Many observers predict that the installation rate will slow from the record installations in 2011, pushing the 100% penetration point out to early-to-mid 2015, in

line with *Screen Digest's* forecast. One hundred percent penetration in late-2014 or early-2015 would be personally gratifying, since my first digital cinema forecast in 2007 said 100% penetration would be achieved in 2014.

On the other hand, when there are only a few thousand film-based theaters worldwide, Insight Media expects Hollywood to stop producing film prints for the few remaining theaters, probably with a 3-to-6-month warning. At that point, if you want to show a Hollywood movie at all, you will need a DCI-compliant projector from Christie, Barco, NEC or Sony. This may lead to an abrupt but brief increase in installations in 2015, as the last film screens are converted to digital.

By then, the digital cinema companies may find themselves selling replacement projectors at a much lower sales rate. Laser cinema anybody? Insight Media expects that the first laser cinema installation will be in 2013 in an IMAX venue. One of the promises for laser cinema is lower operating costs, which would provide theater owners a good reason for them to upgrade to laser. While IMAX is planning on using the Kodak laser cinema projector, which was designed from the ground up to use laser illumination, it is also possible to retrofit lasers onto existing digital cinema projectors.

NEC

NEC has performed major development to the software within its Series 2 line, including the NC1200C, NC2000C and NC3200S, with the launch of version 3.3 of its Release Package announced on December 8. This enables the projectors to support the High Frame Rate (HFR) format with the Integrated Media Block (IMB) input, allowing 60 frames per second (FPS) in 2D and 3D, with 48 FPS in Double Flash 3D. This leads to faster movement, sharper images and a much smoother picture. Support of HFR technology will be available for the NC3240S 4K projector in spring 2012.

Hollywood filmmakers, such as directors James Cameron and Peter Jackson, are already backing the HFR format. New films, such as *The Hobbit* and *Avatar* sequel, are expected to be produced in HFR, improving the cinematic experience for theater-goers.

"Higher frame rate movies will enhance the theater experience and increase viewing aesthetics for avid enthusiasts," said Jim Reisteter, general manager for Digital Cinema Projectors at NEC Display Solutions. "NEC's ability to provide our customers with this important upgrade is a testament to our commitment to the digital cinema industry."

Christie Digital

Christie announced at CineAsia that they had installed over 26K digital cinema projectors worldwide, led by the firm's DCI-compliant Christie Solaria Series 2K and 4K projectors, from the popular Christie CP2220 and Christie CP2230 and the high-end CP4220 and CP4330.

Christie has introduced Solaria V.2.2 software application, to include Christie Previsto HFR technology, among other firmware upgrades. This upgrade will allow Christie Solaria Series 2 projectors to accept video content at frame rates as high as 48 and 60 FPS per eye in 3D and up to 120 FPS in 2D. Christie has also introduced a new IMB that can be retrofitted into other Christie projectors to show this HFR content.

Barco

Barco said, "In line with a company announcement released last August, Barco's total projector deliveries currently amount to more than 20K units — the result of a spectacular growth over the last three years." Barco said this represents about 40% of all DLP Cinema sales.

Barco's Wim Buyens, senior vice president of Barco's Entertainment division, added, "Moreover, various big incoming orders from large international cinema chains, as well as regional exhibitors — including Cinepolis in Latin America, SF Bio in Scandinavia and many others — prove that Barco remains a preferred cinema technology partner for the future."

GDC Technology and Barco jointly announced the development of a standalone IMB that was demonstrated at CineAsia with a Barco DP2K-20C DLP Cinema projector. The standalone IMB eliminates the need for an external SMS and file server, which allows for flexibility of boothless installation and theatre management. The standalone IMB also accepts non-DCI inputs, including HDMI, 3G HD-SDI input and 2D and 3D live streaming. This simplifies the showing of non-cinema content in a venue.

Dr. Man-Nang Chong, founder and CEO of GDC Tech, commented, "This innovation reinforces our mission to offer the most cutting-edge technology to enable the exhibitors with even better operational efficiency, not to mention the extreme cost saving in building a digital cinema multiplex. We are confident we will see more innovative research and collaboration between GDC Tech and Barco in the years to come." *–Matthew Brennesholtz*

GDC Tech, Connie Wong, connie.wong@gdc-tech.com
Barco, Nancy Xiao, nancy.xiao@barco.com
Barco, Tyler West, +1-678-512-6107, tyler.west@barco.com