

Empowered by Innovation



NEC DISPLAY SOLUTIONS

THE 3D VIEWING EXPERIENCE

Enter The Next Dimension



3D Digital Cinema | 3D Large Venue | 3D Ultra Short Throw | 3D Value Projection

What is 3D Viewing?

3D viewing is the process of delivering alternative images to each eye and thereby convincing the human brain it is seeing objects from an additional, third perspective.

3D content may be simple images or a series of images, animated movies or the latest Hollywood productions. The reality of the experience depends as much about the 3D image or movie and the projector or screen as it depends on the capability of the mind to combine what it sees with our established understanding of the form of the objects around us.

3D MOVIES: A CENTURY IN THE MAKING

THE EMERGENCE OF 3D

The showing of *L'arrivée du Train*, a 60 second film, by the Lumière brothers in 1895 was not just a brand new cinema experience but laid the path for the 1934 remake, which Louis Lumière shot in full 3D and had the audience leaving their seats and leaving the theatre, because the train actually appeared to be coming out of the screen at them.

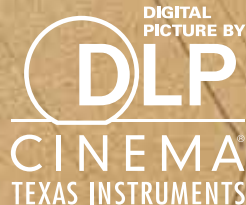
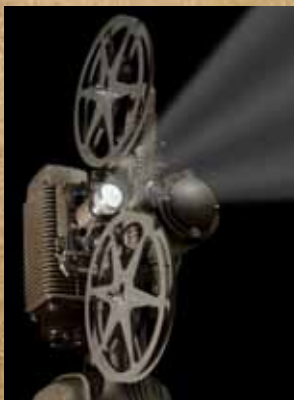
In 1952, *'Bwana Devil'*, the first feature-length motion picture to use 3D was released and started an era that drew audiences away from their TV sets to the movies. However quality and viewing comfort were mainly unsatisfactory.

There were genuine 3D successes such as *'House of Wax'*, *'The Mad Magician'* and *'Son of Sinbad'* starring Vincent Price, but by 1955, the buzz was all but over, hampered by constant technical complications in exhibiting 3D, limited availability of ground-breaking content and most importantly poor quality and an uncomfortable user experience.

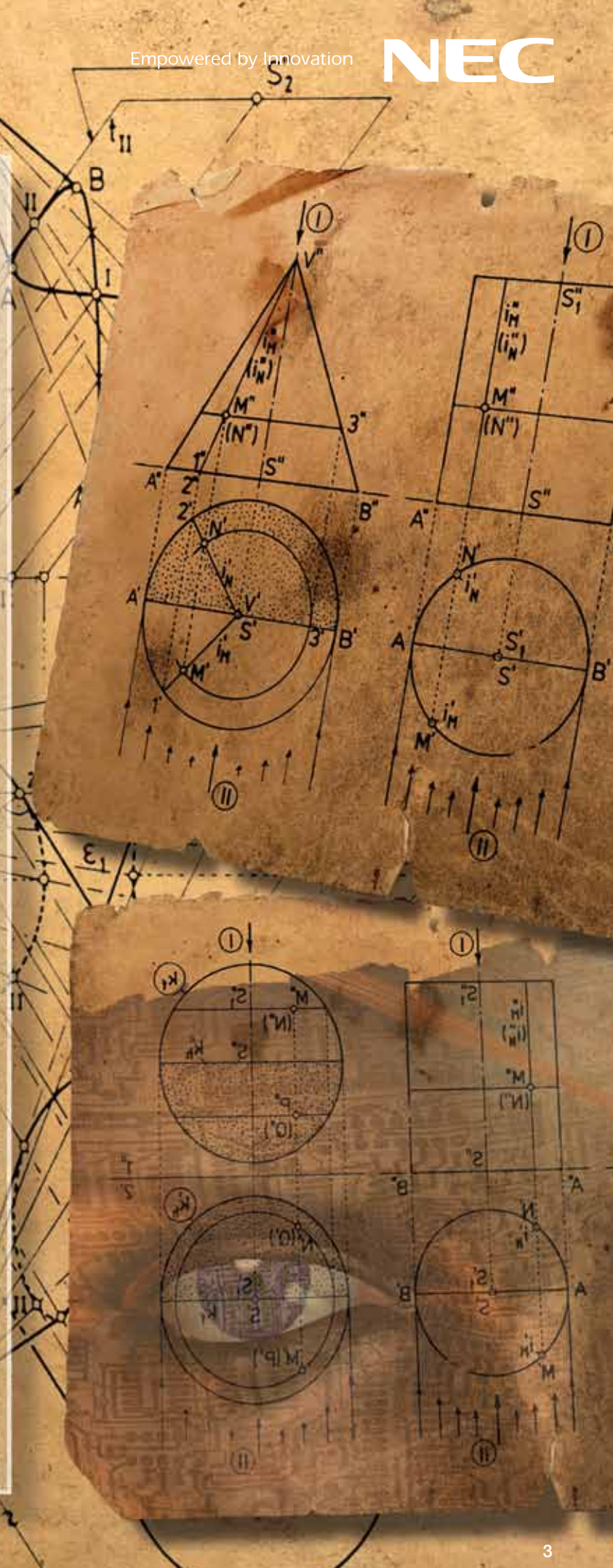
3D TODAY

Today, 3D is again drawing people back to the cinema and generating record-breaking revenues. Technology created by companies like Texas Instruments and NEC create a genuine high quality viewing experience for audiences and an advanced, simple to operate, content management and playback solution for exhibitors. Many esteemed directors such as Steven Spielberg and Tim Burton have already embraced 3D for their upcoming efforts, while James Cameron's *'Avatar'* was filmed in 3D using custom cameras and special effects.

Advances in technology have made shooting 3D films more cost-effective and distribution much simpler, as well as eliminating motion sickness and migraines. Today the technology is there and production houses are rushing to tap into the new revenue streams. In 2010, 3D has rightfully established its leading role in today's Cinema World.



Early attempts at 3D Cinema failed to overcome technical and viewing problems and despite occasional 3D enhanced epics it has not been until the advent of Digital Cinema that 3D Movies had all the ingredients for success.



Why 3D?

Quality 3D media and playback creates an outstandingly enhanced viewing experience.

Provided the 3D content is of a sufficiently high standard and the means of delivery via projection, display or other systems are technically satisfactory whatever the viewer is watching they will enjoy a more engaging and rewarding experience that is essentially incomparable to conventional 2D viewing.

In terms of reality, capturing attention, increasing emotional response and ultimately providing more visual information in the same amount of time, 3D viewing stands alone.

GREATER REALITY

With easier visual understanding of an object's dimensional characteristics, objects no longer appear a fixed distance away, but distances appear between them, with the viewer perceiving themselves physically amongst displayed content.

GREATER ATTENTION

3D is interesting and captivating, it is new and inspiring, in particular Education audiences find the learning experience more inspirational, more enjoyable and therefore more memorable.

GREATER PRODUCTIVITY

In a similar time to conventional filming, 3D passes considerably more information to the viewer in a simple to grasp manner, it therefore effortlessly accelerates learning without making the experience more trying. This is a potential advantage in education and in the commercial world of presentations or modelling.

INCREASED EMOTION

Whether it is interest, admiration, attraction, curiosity, or fear or awe, high quality 3D media powered by the latest 3D projection systems adds to the emotional experience to the extent that conventional viewing can seem comparatively unrewarding.

3D technology is now both convincing and visually outstanding and is set to improve as Studio's become more familiar with making the most from the advances in 3D technology that NEC has helped spearhead.

How Does It Work?

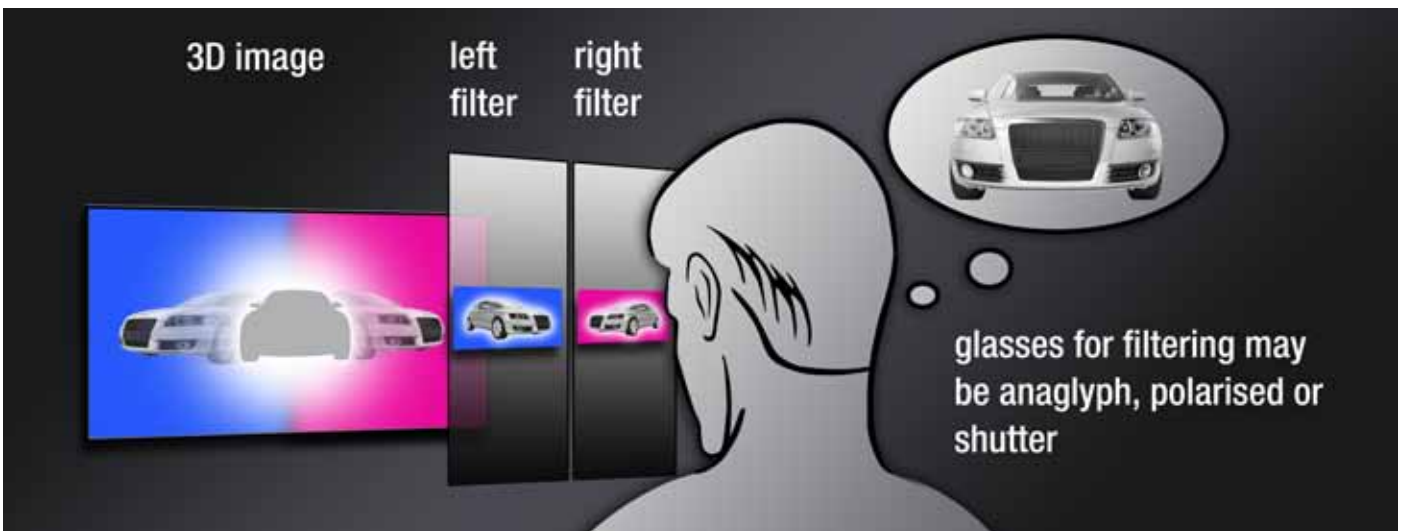
Because of the positioning of our eyes, it is normal for the brain to see a slightly different image from each retina and we have developed the means to perceive the form and depth around these images, this is called spatial awareness.

THE BASICS

Simply speaking the 3D we see today (Stereoscopic 3D) is a visually enhanced two dimensional viewing experience that the viewer believes they are seeing in three dimensions and not in two. This is achieved partly by 3D simulation technology, but the spatial understanding of the viewer is essential to complete a convincing 3D perception. Effectively the human has a learnt pre-conception about the form of objects that the 3D experience taps into.

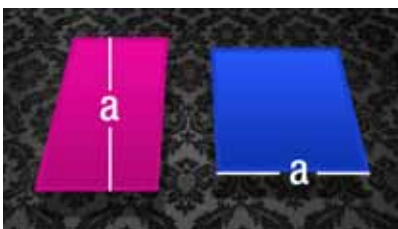
3D playback also works by delivering slightly differing information to each eye using varying methods, thus allowing the brain to see two different views of the same object that it can then use to develop an overall impression of the complete object.

It is essential to ensure that the differing images are perceived simultaneously, for this reason 3D technology has certain minimum standards, such as any active shutter 3D system requires a 120Hz image refresh rate (60Hz per eye), quick enough to ensure the viewer perceives alternating images as simultaneous.



3D SIMULATION PROCESS. 3D Simulation Systems work by displaying two slightly different angled images. The viewer wears glasses that use filters to allow one of these images to pass to the left eye and the other to the right eye, the human brain using spatial awareness completes the picture.

There are different methods of filtering, some are continuous and use polarising or anaglyph filters, others use shuttering, allowing images to pass through each lens alternatively at a minimum rate of 60 images per second per eye.



HUMAN SPATIAL AWARENESS. In the upper left example the purple shape on the left hand side appears longer than the width of the blue shape on the right hand side, this is because the viewer sees a familiar perspective and assumes that the shapes are not irregular four sided shapes but rectangles that are set in parallel positions with the vanishing point to the back of the image.

This being the perception the viewer is aware that the shape on the left must be longer than the shape on the right is wide, however as shown in the lower image both lengths are equal. Virtual 3D uses this human pre-conception to add form to the differing images received by the left and right eye.



DELIVERING A STEREOSCOPIC 3D SIGNAL



As discussed, all formats aim to deliver a slightly different image for the left and right eye, however standardisation of S3D picture formats is in its early phase and unfortunately many different methods exist.

One of the key technical challenges today is to convert various delivery formats into the display format supported by the display or projector. The technologies for separating the images for each eye are explained on the page to the right.

HDMI 1.4A 3D SPECIFICATION: THE NEW PLUG AND PLAY STANDARD

A connected 3D display device (e.g. TV, Public Display or Projector) needs to know the 3D format it is required to display. In the past the user needed to manually configure this between the display and the source, but with HDMI 1.4a 3D Specification, this process is both simplified and automated.

HDMI 1.4a 3D Specification can handle all popular 3D signal formats without any additional setup. It is a 'plug and play' solution, with no additional operation or setup necessary. Speed is also important as Full HD left and right images can be delivered without loss in quality. Display devices with HDMI 1.3 input are not accepted by Blu-Ray players.

STEREOSCOPIC 3D FORMATS

60Hz 3D Formats

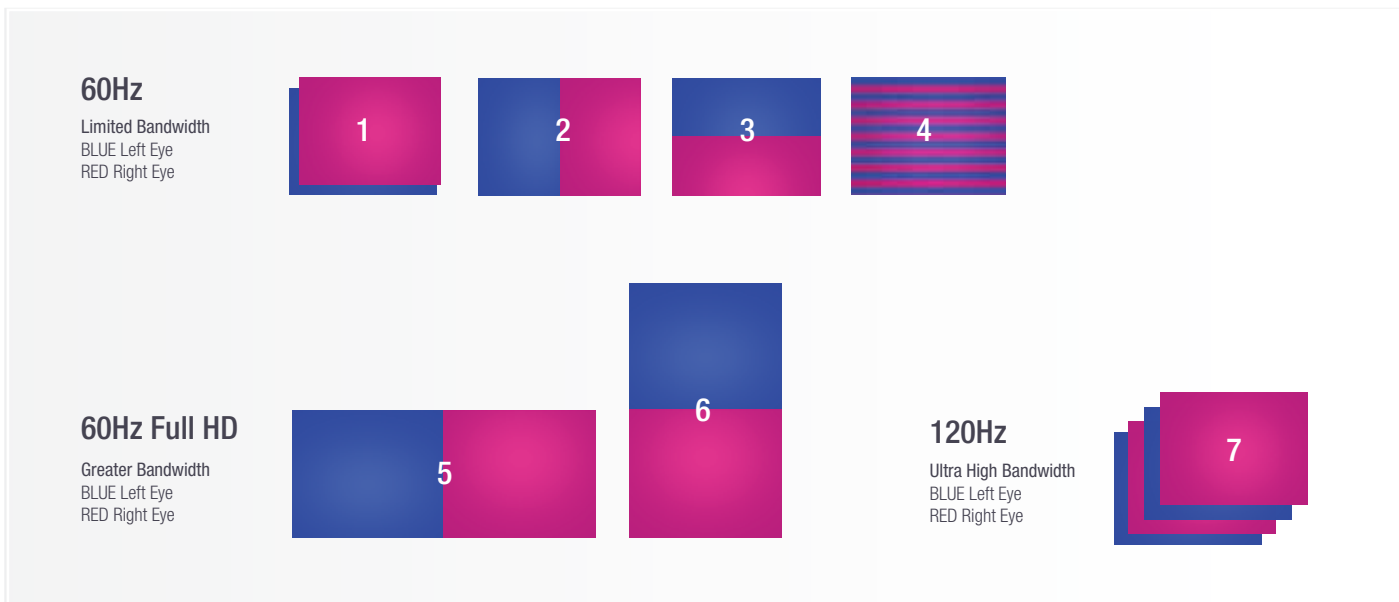
- IMAGE 1 Separate single pictures for the left and the right eye.
- IMAGE 2 "Side-by-Side", half horizontal resolution. Both sub frames for the left and the right eye played out as half horizontal resolution in one file or frame.
- IMAGE 3 "Top-and-Bottom", half vertical resolution. Both sub frames for the left and the right eye played out as half vertical resolution in one file or frame.
- IMAGE 4 "Line-Interlaced", half vertical resolution per sub frame. Both sub frames for the left and the right eye are played alternately one above the other (line by line) as interlaced resolution in one file or frame. This format is exclusively used for the direct output to S3D displays or TV's. It will not be applied for S3D Broadcasting.

60Hz Full HD 3D Formats

- IMAGE 5 "Side-by-Side", full resolution. Both sub frames for the left and the right eye are played out in one file or frame.
- IMAGE 6 "Top-and-Bottom", full resolution. Both sub frames for the left and the right eye are played out in one file or frame.

120Hz 3D Format

- IMAGE 7 "Shutter" ("Field sequential" or "Page flipping"). Separate single pictures for the left and the right eye are played out one after the other.



Which 3D System?

3D technology is all around us, from the ultimate 3D Digital Cinema experience to 3D pocket camcorders that record and display in 3D. Today, even home users can instantly upload their own 3D movies to the web to be viewed in 3D all over the world.

With a multitude of new and differing 3D systems, an absence of commonly adopted standards and a market that develops daily, choosing the right 3D technology for your application is a genuine challenge.

The following are key 3D delivery systems in development today.

3D VIEWING WITHOUT GLASSES

Perhaps the ideal option for 3D viewing is high quality without glasses, but currently systems in development have major limitations.

When the 3D content is small and close to the eyes like on a notepad or the screen of a pocket camcorder or 3D mobile phone, a lenticular effect can be used to direct different parts of the image to each eye. This is achieved by using tiny lenses on screen, which direct the light at different angles – some lenses direct it to the left eye, others to the right, with an assumption made that the viewer will occupy a set position in relation to the device.

These lenticular displays now include multiple viewing adaptation to deliver 3D to a number of favoured viewing positions, but at a normal viewing distance, they generally can only provide 3D to a number of sweet spot locations and therefore are limited in numbers of viewers seeing a good quality 3D image.

Looking to the future, lenticular systems are being developed that use cameras to track a viewers change in physical location and adapt the lenticulation to maximise the 3D experience for each viewer regardless of their location.

LOW COST 3D VIEWING

3D Anaglyph Viewing

Traditional anaglyph 3D viewing is nothing new, it works with glasses that have different colour filtering that eliminate different colour elements of the image respectively, in order to separate the two different images for the left and the right eye.

Viewing is affordable as the glasses are very low cost and are regarded as consumable, but the quality of anaglyph 3D is generally poor. Because colours are impaired by the 3D replication process, viewing for the duration of say a movie can be uncomfortable and unrewarding. Today this technology is more ideal for quick set up, short duration informative 3D viewing than watching movies or playing 3D games.

Entry Level 3D Shutter Viewing

Recently, active shutter technology (technology that is now established as one method in Digital Cinema) has become more affordable and is now a widely adopted 3D mass market solution, setting standards in 3D Consumer Television, 3D Home Projection, 3D Gaming and Education. NEC pioneer 3D DLP® Link projection in their latest 3D Projectors to provide low cost large screen home 3D cinema and gaming or Ultra Short Throw 3D Projection for the classroom. NEC 3D glasses are interchangeable between these devices.

LCD shutter glasses use liquid crystals to make each of the two lenses either transparent or opaque to separate images in alternating order. Due to the high frame rate, the brain however has the impression that it perceives both images at the same time and not in sequential order. The effective frame rate per eye therefore is half of the total frame rate. With 120Hz the viewer receives 60 images for each eye, per second.

QUALITY 3D VIEWING

The quality of 3D you see at your local cinema is still worlds apart from the 3D you can realistically play at home. Aside from the resolution and size of the displayed image, Digital Cinema Solutions such as NEC's NC Series use Triple-Flash technology to provide best 3D performance at 144 Hz.

All typical 3D technologies are available for Single Projector Digital Cinema including polarizing technology, colour separation by different frequency filters and shutter glasses.

There is also a two projector Digital Cinema solution; both projectors have a different polarising filter in the front, each operating with only the left or right side of the visitor's filter glasses.

3D GLASSES WITH IN-BUILT DISPLAYS (VIRTUAL REALITY)

Setting aside the prohibitive cost of this technology, which involves having a different display showing different images integrated into glasses in front of each eye and the current limitations on maximum displayable resolution, because these glasses simulate a very similar experience to the way we do see things, this technology is a promising lateral approach to 3D viewing solutions. There is no need for colour interpolation, or sequential shuttering or polarising or redirection of images, simply speaking each eye sees slightly different images that can be spatially perceived by the viewer to recreate form, nothing more.

Subject to cost and the ability of the manufacturers to create glasses with integrated display panels that are both comfortable and of a high enough resolution, this is an exciting system for the future of 3D.



WHICH 3D?	What's Great	What's Not
Lenticular Screen Solutions	3D viewing without glasses, for accurate colours and allowing viewing from different pre-set positions.	Horizontal Resolution is reduced, there are limited fixed viewing spots or corridors, not ideal for gaming with less colour accuracy. Viewing can be a taxing experience.
Anaglyph Glasses	A good, low cost disposable solution that can show high resolution without loss of quality and is good for gaming or corporate events with large short term audiences.	Colour reproduction is poor in relation to other systems available, longer viewing times result in viewer discomfort and even nausea.
LCD Active Shutter Glass Systems	A good quality mainstream solution for anything from home to large venue applications, produces high quality 3D with excellent colour reproduction and negligible discomfort. Popular in Digital Cinema applications, with high brightness, deep blacks and outstanding whites.	Glasses can be relatively expensive with no industry standard being widely adopted. Requires high refresh rates and associated more costly equipment to operate. With NEC DLP® Link 3D Projection this solution is now becoming more affordable for all.
Glasses with Polarising Filters	Accurate colours, 3D gaming ready, full resolution.	Ghosting effects can be visible when not finely adjusted with noticeable lines when viewed in 2D.
Virtual Reality Glasses	Accurate colours with a genuine look-around experience. Placement of different displays in the glasses provides a uniquely realistic experience.	Expensive, potentially uncomfortable and unsightly with current resolution limitations.

Is 3D Affordable?

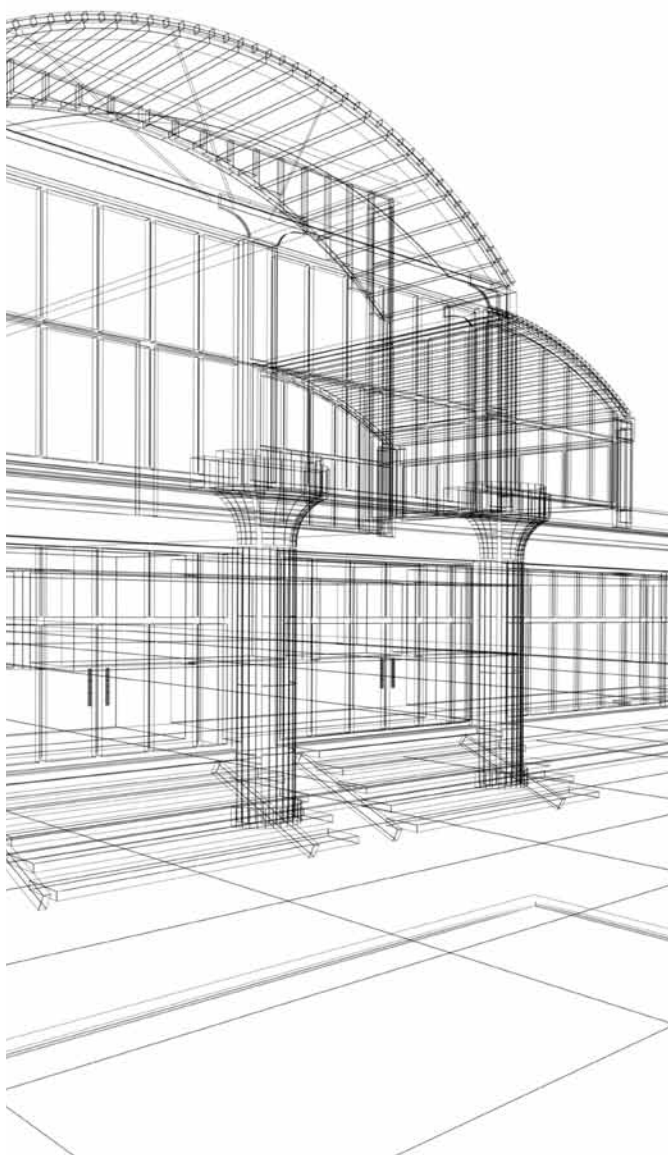
Today, almost any individual or institution can afford a 3D set up and even entry level systems can offer impressive quality. For large screen affordable 3D in the home, classroom or corporate, look no further than a NEC Portable 3D Projector or the new 3D Ultra-Short Throw range that utilise DLP® Link Technology.

In the Box Office, Theatre or Venue business audiences are increasingly demanding 3D and are prepared to pay more for it, whilst production houses are fuelling the 3D market with the release of a growing number of outstandingly produced state of the art 3D titles.

Who Needs 3D Viewing?

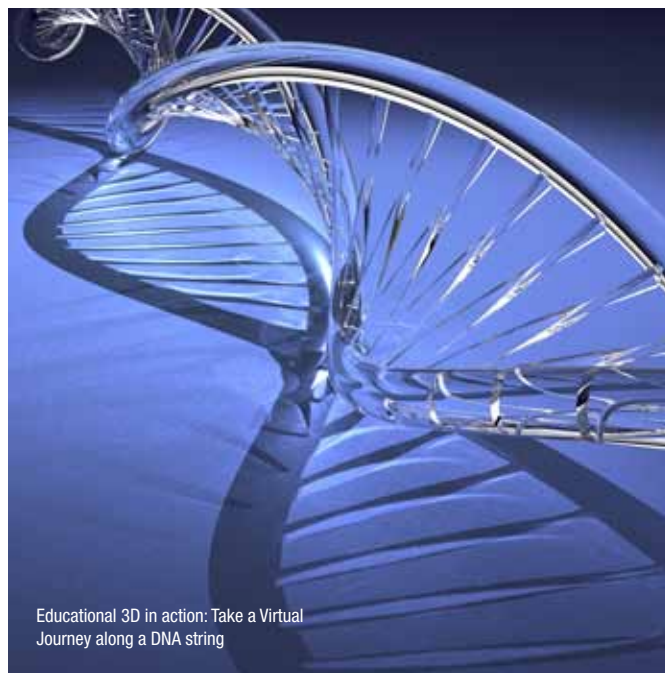
If we're not getting used to 3D now, we soon will be. 3D is a mass market phenomena and is increasingly being adopted in a widening range of applications, with new 3D ready or compatible products being released almost daily.

The way 3D has impacted the world of cinema is clear, but there are other applications where 3D breaks new boundaries, improving the aspirational, viewing, learning or commercial experience for those involved.



EDUCATION

3D modelling and viewing creates informative and captivating learning with its more efficient method of passing on spatial knowledge and the benefits that 3D creates a more rewarding viewer experience and greater interest.



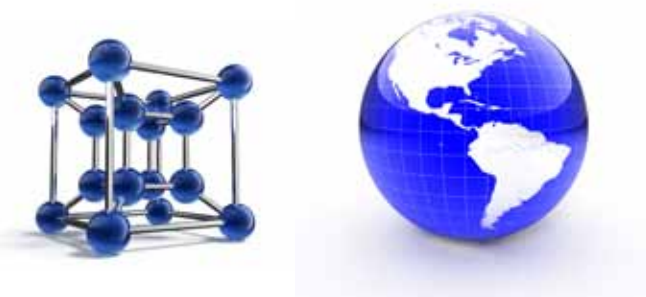
Educational 3D in action: Take a Virtual Journey along a DNA string

POPULAR APPLICATIONS OF 3D IN EDUCATION

Applications include Biology, Physics, Chemistry, Anatomy, Geography, Mathematics, Engineering, Architecture and the Arts.

NEC 3D ready value and ultra short throw projectors together with a NEC 3D starter kit represent the ideal introduction to 3D for the classroom. A simple, low cost PC based solution that includes the projector, viewing glasses, 3D player and other 3D media. Single projector set ups with multiple viewing glasses for the whole classroom are also available.

Working together with Texas Instruments, NEC are piloting 3D installations into educational establishments across Europe.



Educational 3D in action: Explore anything as small as a molecule or as large as our world in fascinating detail.

GAMING

Gaming represents one of the biggest drivers in the growth and more widespread acceptance of 3D viewing, with games consoles also taking a key role in the playback of 3D modelling and playback of 3D educational content.

PC based gaming

Nvidia pioneered Stereoscopic 3D with their 3D Vision Technology. Displays and projectors need to be "Nvidia certified". The Nvidia 3D Vision set includes shutter glasses with an infrared emitter. NEC NP216 projectors are fully Nvidia certified thus providing the ideal large display playback compliment to the home based PC 3D set up.

Game consoles

Games consoles from all the leading names are playing a big part in the move to 3D at home and it is anticipated that playing 3D discs at home will become standard practice.

ENGINEERING SIMULATION

3D is an excellent medium to make more representational models, visuals or movies in Design, Engineering, CAD/CAM and Simulation applications. 3D models enable the viewer to fully appreciate the final appearance of an engineered product.

In markets where style and appearance play a big part in the success of a product's introduction to the market such as the automotive industry or consumer electronics, the ability to view the product in virtual 3D can mean refined adaptations to the design without the expense of creating prototypes, enabling product development workgroups or market research studies to provide more valuable feedback before the button is pushed on product development.

PHOTOGRAPHY

With the release of low cost 3D cameras, as well as professional standard 3D camera solutions, 3D photography is now available to all. Cameras work by taking two images from slightly different angles. The resulting pair of images from a '3D photo' are stored in a 3D file format or can be exported as .jpeg or .wmv format.

Using a special 3D media player the 3D pictures can then be viewed on a 3D display device, such as a NEC 3D projector with 3D viewing glasses.

VIDEO

Capturing and Editing 3D Video

Studio quality 3D video cameras are also available, bringing production quality 3D to the larger market. Like standard 3D cameras, they work by taking two images from slightly different positions, essentially they are a video camera with two lenses. Video editing software already caters for editing in 3D and a standard 3D TV or 3D projector can be used to test output during the creative process.

Broadcasting

Major broadcast channels started to do test broadcasting to limited audiences in venues such as cinemas or pubs and bars during the last World Cup. The additional cost of 3D production, the challenges of providing 3D viewing solutions to all and bandwidth requirements are the major limitations to bringing 3D to the mass market.

Blu-ray 3D standard and Consumer TV's

All major consumer electronic brands have announced big plans for 3D TV models. 3D consumer televisions are already broadly available in retail channels. 3D Blu-ray players will gradually become available with more 3D Blu-ray DVD's being shipped into 2011.





NEC, Pioneering 3D

Making high quality 3D affordable has been central to our product development.

Today NEC not only leads the way with reliable high quality 3D theatre systems used in the worlds leading cinema chains, but we deliver cost-effective 3D solutions for Education, Business Conferencing, Retail and the Home.

NEC is the biggest name in Display Solutions, with a reputation for constant innovation and ecological commitment. Our constantly expanding range of 3D products bring an outstanding 3D experience to the widest audience.

3D PREMIUM DIGITAL CINEMA SOLUTIONS

Our Digital Cinema Solutions are at the forefront of the rapid expansion of 3D Movies at the Box Office, providing the ideal means to display the latest Movies from renowned Directors. 3D Solutions that deliver genuine benefits.

NEC Digital Cinema Systems are able to operate with any 3D Digital Cinema technologies currently available. They work with Anaglyph, Polarising, and Shutter 3D Systems.

When to Choose NEC Digital Cinema

Where a high quality image, up to 32 metres wide screen size, viewed by up to 1000 people is required.

High Brightness | High Quality | Advanced Content Management and Security
| Service Level Agreements | Play any 3D Cinema Technology | Greater 'Per Seat' Revenue

3D LARGE AUDIENCE SOLUTIONS

Based on the respected NEC NP3250 Series Installation Projectors, this innovative solution takes advantage of NEC's stacking logic to produce high brightness colour 3D content for larger venues. Ideal for 3D viewing in Leisure Chains, Corporates or Education, where the venue is larger and the number of people viewing is also large, but lower cost glasses are needed.

NEC 3D Stacking delivers high brightness from a combination of 2 or 4 projectors. It is easy to set-up with SCT software and uses affordable passive glasses.

Set up is straight forward and no different to the "normal" NEC stacking set-up, automated by loop-through of a standard side by side 3D signal separated and re-scaled by the projector with picture separation on the projectors.

NEC Stacking offers higher brightness up to 20,000 Lumen at lower cost than Digital Cinema and works with polarising glasses that cost less than shutter glasses but still offer enviable quality for use with larger sized audiences.

When to choose NEC 3D Stacking Projection

Screen width is between 2.5M and 8M with normal indoor lighting conditions
 There are up to 200 regular viewers
 A lower cost 3D glasses option is required
 Heavy Duty performance is required



3D DUAL PROJECTOR LCD SETUP OPTIONS

PA SERIES	Maximum 12,000 ANSI Lumen	XGA
	Maximum 11,000 ANSI Lumen	WXGA
	Maximum 10,000 ANSI Lumen	WUXGA
PX SERIES	Maximum 16,000 ANSI Lumen	XGA
	Maximum 15,000 ANSI Lumen	WUXGA
	Maximum 14,000 ANSI Lumen	WXGA
PH SERIES	Maximum 22,000 ANSI Lumen	WUXGA

THE NC SERIES 2 RANGE

NC1200C	9,000 Lumen	up to 14M screens
NC2000C	17,000 Lumen	up to 20M screens
NC3200S	31,000 Lumen	up to 32M screens
NC3240S	31,000 Lumen	up to 32M screens



DLP® LINK ULTRA SHORT THROW 3D PROJECTION

Enjoy large 3D images even in meeting rooms with small space. With less shadow and glare, the presenter or teacher has more space to engage with his audience and enjoy an enhanced experience with interactive white boards.

Free installation angles allow additional freedom for eye catching digital signage installations. DLP technology ensures that there is no color decay during long daily operating hours.

The outstanding 3D capability can bring class topics to life and prepare your organisation for the next generation in digital content.

THE U SERIES ULTRA SHORT THROW RANGE

U250X	2500 ANSI	XGA
U300X	3000 ANSI	XGA
U260W	2600 ANSI	WXGA
U310W	3100 ANSI	WXGA

V SERIES DLP® LINK VALUE 3D PROJECTION

THE V SERIES 3D RANGE

V230X	2300 ANSI	XGA	TCO	3D Vision Ready
V260	2600 ANSI	SVGA		3D Vision Ready
V260W	2600 ANSI	WXGA		3D Vision Ready
V260X	2600 ANSI	XGA	TCO	3D Vision Ready
V300W	3000 ANSI	WXGA		3D Vision Ready
V300X	3000 ANSI	XGA	TCO	3D Vision Ready

V Series are a range of competitive entry level SVGA, XGA and WXGA, DLP projector series that are 3D Ready with DLP 120Hz technology.

Ideal for Education and Gaming offering projection on up to 2.5M screens.

Designed for SMB/SOHO and corporate meeting room applications as well as for portable usage and private and professional multi-purpose usage. Network capability and integrated speakers make the V Series very suitable for education. They offer an excellent price/performance ratio, advanced eco-friendly features and very low cost of ownership.



DLP® Link 3D Projection

This 3D Solution is the ideal introduction to 3D with low cost powerful single projection and when combined with the NEC 3D starter kit, is everything you need to enjoy 3D out of the box.

Benefits of DLP® Link for 3D projection include easy installation (no stacking of two projectors necessary), no special screen, no special filters or signal emitter. DLP® Link delivers 3D from one projector rather than the more expensive traditional 2 projector way. With DLP® Link technology, a single projector produces the images for both eyes. The impression of 3D is created by the interaction with the active LCD shutter glasses. This solution is cheaper and more user-friendly than traditional 3D stereo-projection.

DLP® Link Glasses are interchangeable between projectors and with NEC you can add a 3D Starter Kit that includes your glasses, Stereoscopic Player and 3D Media.

When to choose NEC DLP® Link 3D Projection

Where the screen size is up to 2.5M with normal indoor lighting conditions

There are up to 35 regular viewers

Where an easy single projector or mobile set-up is required

Where an affordable, standard projection solution is required for Non-3D content

ADD A NEC 3D STARTER KIT

Adding a NEC 3D Starter kit to your NEC DLP® Link Projector gets you up and running with powerful 3D, without a heavy price tag. The active shutter glasses are exchangeable between any DLP® Link system and also included are 3D software and media.

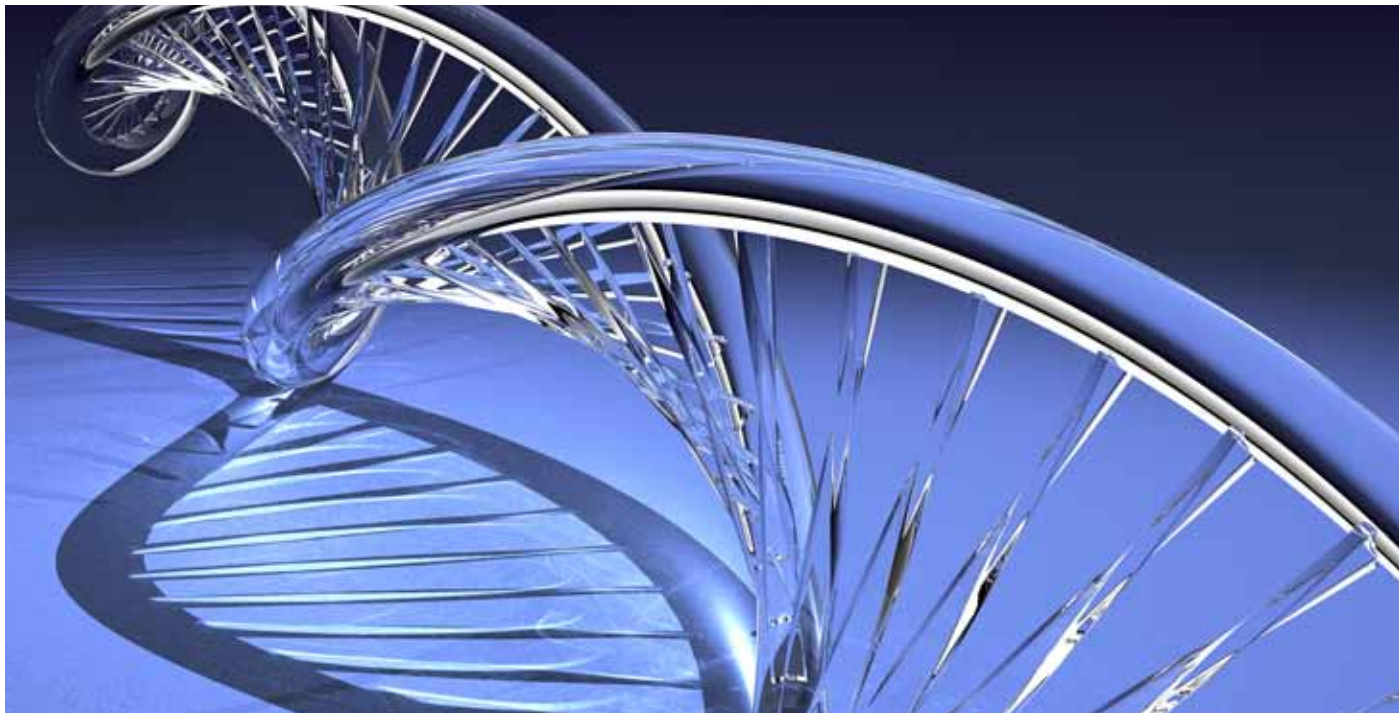
STARTER KIT INCLUDES

NEC 3D Active Shutter Glasses
DVD with Stereoscopic 3D Player
3D Movies and 3D Images
Educational 3D Demonstration
Software





THE 3D VIEWING EXPERIENCE



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