



# HARKNESS SCREENS™

GLOBAL LEADERS IN CINEMA  
SCREEN TECHNOLOGY

# LEADERS IN SCREEN TECHNOLOGY FOR OVER 85 YEARS

From its humble beginnings in 1929, Harkness Screens has grown to employ over 100 people across five countries. Harkness Screens has thousands of large screens installed in more than 130 countries throughout the world. Harkness serves the cinema, film production, special effects and live events markets. Harkness makes screens for 2D and 3D digital projection and for 35mm film projection, as well as screens for rear-projection.

In 1929, founder Andrew Harkness first entered into the screen-manufacturing business with his 18-year-old son Tom. The business operating out of the then bustling UK film studio lots of Borehamwood in the UK rapidly grew and became hugely successful manufacturing woven screens and then washable woven screens.

During the early 1940s, Tom Harkness discovered plastic (PVC). A new material which seemed to possess all the properties required in an ideal screen, however this new material still needed to be joined. Harkness spent significant time developing a revolutionary method of welding the plastic together called the Tearseal method which was later patented. Where other manufacturers had failed to produce invisible seams, the Harkness Tearseal method produced a flat seam, and this made all the difference ensuring that Harkness' new screens were a huge success.

Much improvement was made to this new material and by the mid 1950's as cinema continued to evolve, small perforations were incorporated into Harkness screens enabling behind-screen speaker placement, creating a whole new cinema experience.

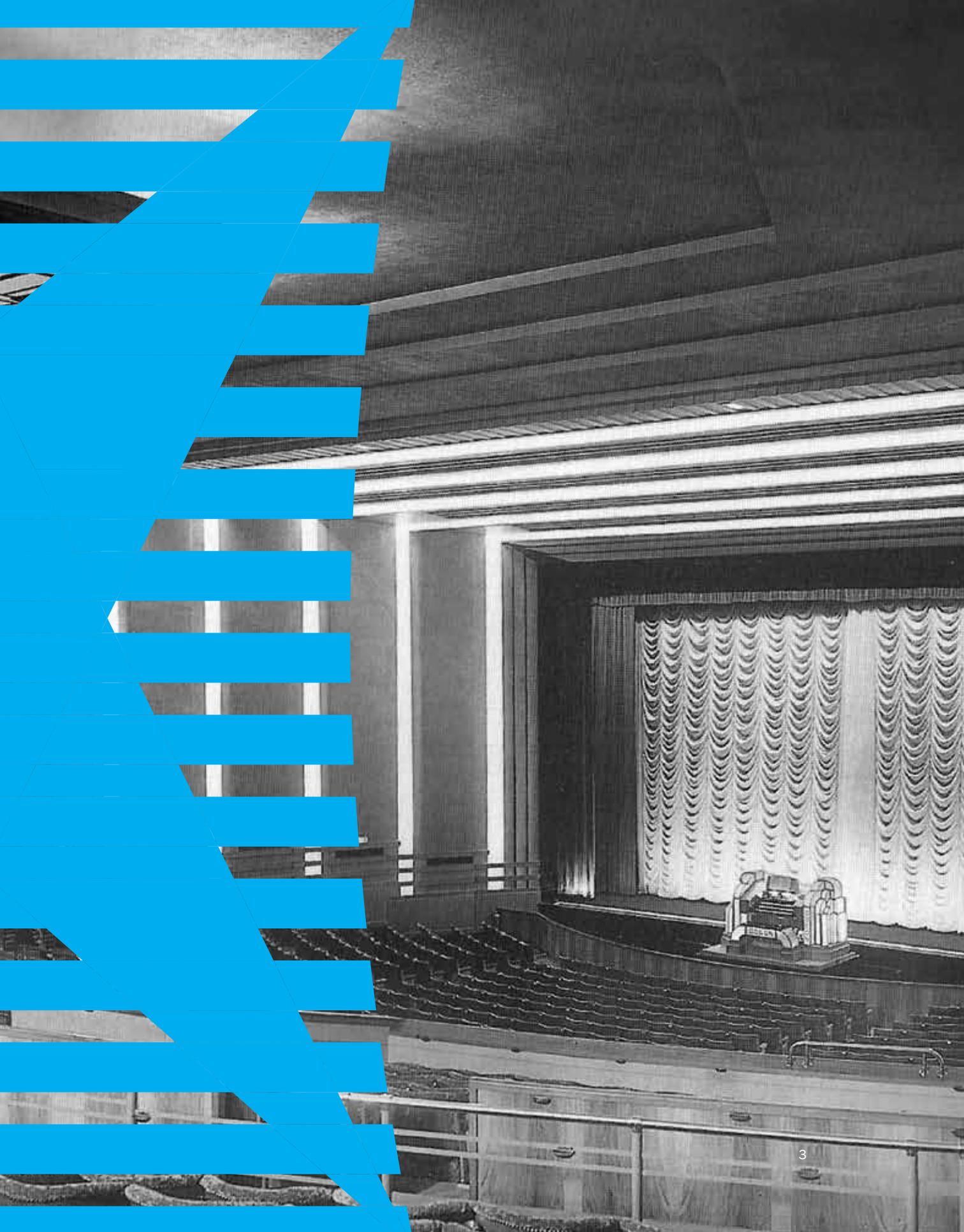
With larger screens desired by cinema exhibitors and limited technology available for putting sufficient light on screen, Harkness developed its first coated gain screen in Perlux® a screen capable of providing a brighter and more vivid presentation. This technology helped transform Harkness into the world's leading screen maker.

In the mid-1990s with the multiplex boom accelerating globally, Harkness had already identified that there would in the future be a demand for 3D projection in cinema. Harkness invested heavily in research and development utilising its knowledge of coating screens to produce what by the end of the first 3D boom (in 2011) would become the world's leading polarised silver screen brand in Spectral™.

Recognising the global leadership status the business had acquired, Harkness quickly expanded its overseas operations purchasing a European competitor based in France and creating new manufacturing facilities in the USA, China and India.

Since 1929, innovation has been at the heart of Harkness and this remains important and visible today be it through the development of Harkness' latest screen technology in Clarus XC or the development of Harkness' tools and apps for digital cinema. As well as innovation, continuous improvement is also key to Harkness' success and whilst constantly looking for methods to improve products, Harkness is already undertaking significant research and development into the future of projection using laser technology.

It is this innovation, foresight and creativity along with the enthusiasm and dynamism of its staff that makes Harkness the global leader in projection screen manufacture and thought-leader in screen technology.





# WORLD LEADING SCREENS FOR CINEMA

According to industry data (iHS Screen Digest 2014) there are over 140,000 cinema screens globally. Of these, it is estimated that 60% of these have been manufactured by Harkness Screens. Today Harkness' products are installed in over 130 countries and are widely recognised as the premium brand.

Harkness' products feature a proprietary and unique seam welding process that ensure that all screens have no visible seams under projection conditions. An advanced coating technology and application processes ensures a smooth finish and consistent performance and brightness across the entire screen surface while minimising visible blemishes or hot spotting. Only the highest quality materials are used helping Harkness' screens avoid discolouration or loss of structural integrity over time.

## Matt Plus

Is a versatile uncoated white screen surface intended for a variety of 2D auditoria where sufficient brightness levels exist. The flexible PVC-based material is manufactured to a unique formulation and specification providing wide viewing angles, high contrast, bright pictures and excellent colour temperature.

## Matt Preview

Is a versatile coated white screen surface intended solely for a preview theatres and screening rooms. The flexible PVC-based material is manufactured to a unique formulation and specification providing wide viewing angles, uniformity, high contrast, bright pictures and excellent colour temperature.

## Perlux® HiWhite

Are a popular range of coated white projection surfaces considered by leading cinema exhibitors worldwide to be the premier surfaces for 2D and active 3D cinema. Perlux HiWhite screen are designed to reflect more light back to the audience than traditional matt white surfaces, while still offering high contrast and wide viewing angles. Screens are available in range of gain levels to meet the needs of any auditoria including those with challenging brightness levels, particularly for 3D exist.

As well as providing optimum performance for 2D and 3D projection, Perlux® HiWhite screens can assist in reducing digital cinema operating costs significantly, without compromising on viewing performance by enabling reduced power consumption, lower powered laser light sources or smaller xenon lamps and less frequent lamp replacements.

## Spectral

With over 28,000 screens installed around the world, Spectral is considered the industry standard for polarised 3D screens. The unique aluminium flake-based coating materials are considered by cinema exhibitors to provide the optimum 3D projection surface for "passive" 3D applications using polarised light such as systems manufactured by RealD, MasterImage or Volfoni.

## Precision White for RealD

Precision White technology combines leading RealD coating technology with Harkness' high quality screen materials to form a premium screen offering exclusive to RealD customers. Designed to deliver enhanced 2D and 3D presentations with wide viewing angles similar to white screens of equivalent gain, Precision White Screen technology features edges substantially brighter than a standard silver screen. The improved screen efficiency results in 40% more total light coming off the screen, providing more uniform brightness than a standard silver screen. Precision White Screens also feature a smooth, white surface, which generates better image contrast for improved image quality in 2D and 3D.



## Clarus XC

Clarus XC is Harkness' latest screen technology for 2D and polarised 3D.

Clarus XC technology is the result of significant work by Harkness' Research and Development team and brings together a number of proprietary technologies to create a screen surface for the age of immersive cinema which has been approved by major Hollywood film studios and 3D manufacturers including RealD.

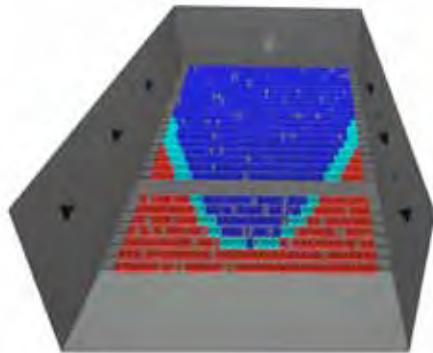
Designed to work with all passive 3D systems, Clarus XC screens create visibly deeper 3D content which is designed to draw in the audience creating a more captivating viewing experience. A whiter look under projection mean that colours look visibly richer and more accurate both in 2D and 3D resulting in a more defined, sharper and crisper picture.

Harkness' proprietary and unique seam welding process along with Harkness' brand new d-smooth coating technology means Clarus XC screens have no visible seams under projection conditions and most importantly a smooth visual finish.

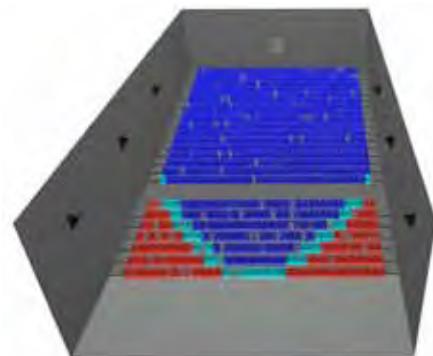
The 4th generation d-smooth coating technology has specific properties more commonly seen in white screens. This technology enables Clarus XC screens to benefit from significantly improved light distribution compared to traditional 3D silver screens.

Through this, visible hot-spotting is reduced and uniformity is greatly increased, making compliance with 2D industry standards such as those specified by SMPTE more easily achievable.

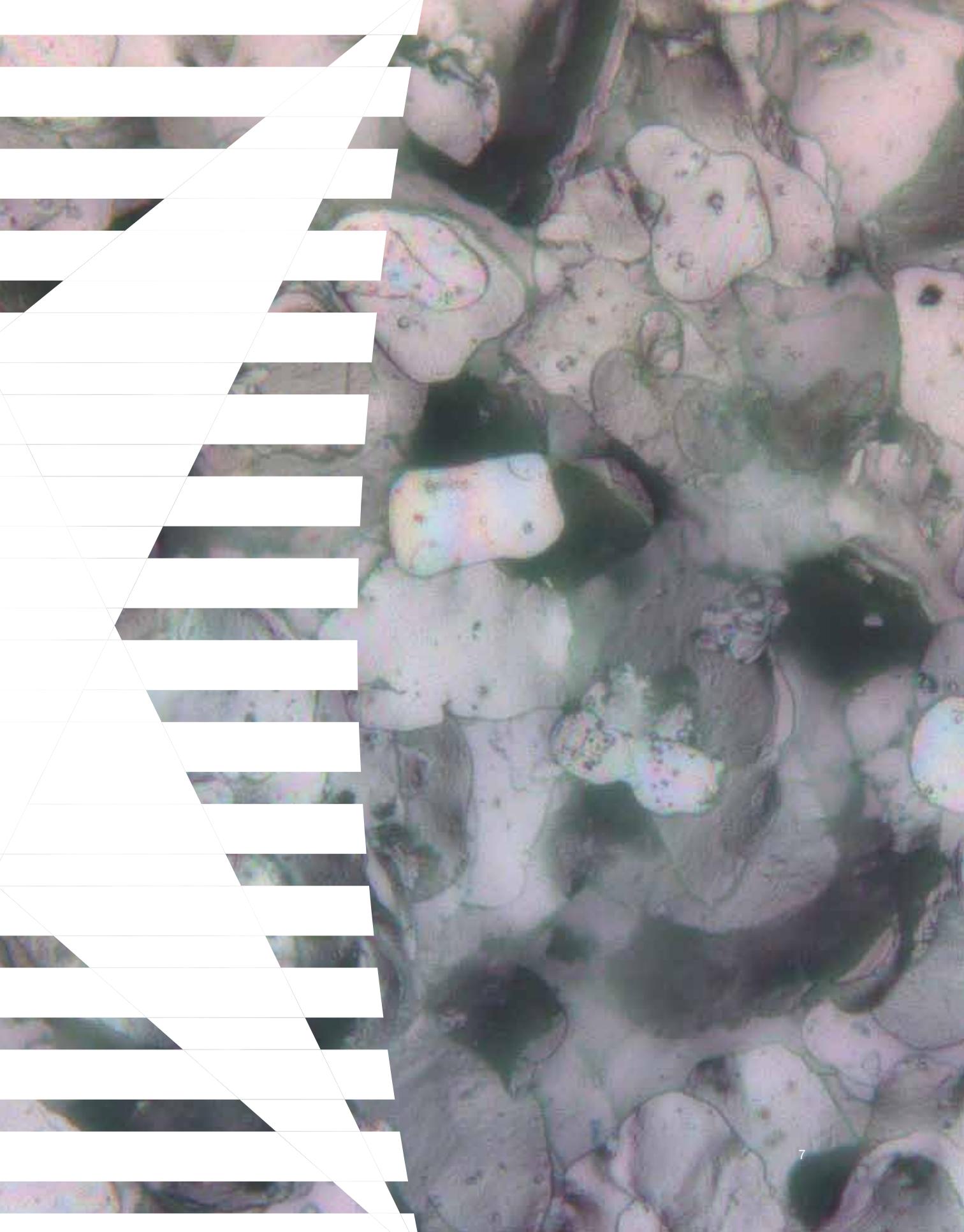
Clarus XC screen technology has become the screen of choice for cinema conventions, movie premieres and premium large format theatres as well as the exhibitors choice for those wanting a true 2D/3D screen.

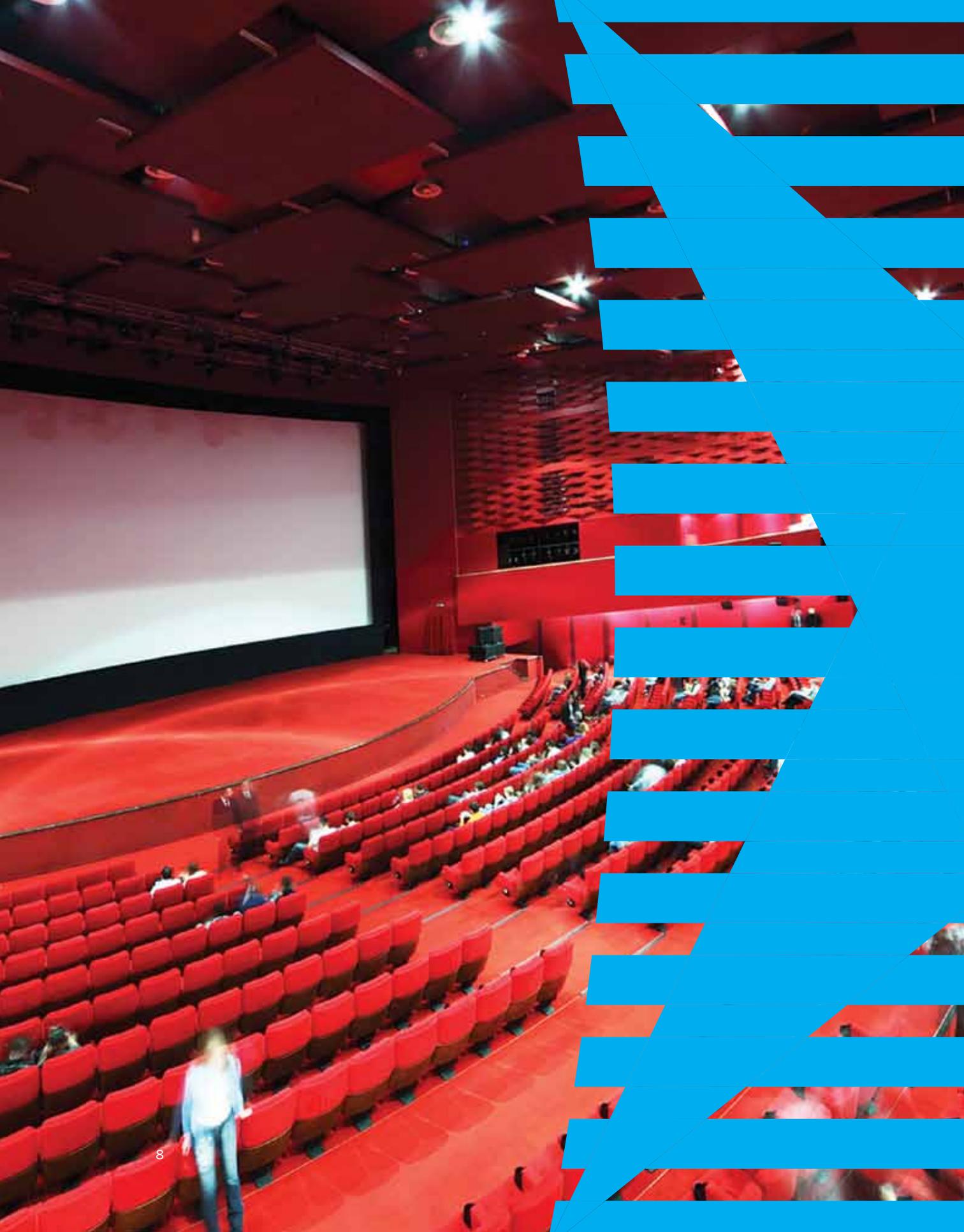


Standard 3D Screen  
Light Distribution



Clarus XC  
Light Distribution





# A TRULY GLOBAL COMPANY

## LOCATIONS

Harkness Screens has a truly global reach with manufacturing and commercial operations across three continents.

This global reach allows customers throughout the world to receive industry leading products and services in a timely and cost effective manner.

As well as these operations, Harkness' European facilities also contain Harkness state-of-the-art research and development facilities. The Harkness screen technology centre in the UK undertakes research and development on new products and existing product improvements. Harkness' screen laboratory enables full scale simulation of cinema conditions for testing of cinema equipment including screens, 3D systems and projectors.



### LOCATIONS:

Fredericksburg, USA  
Stevenage, UK  
Dublin, Ireland  
Amilly, France  
Bangalore, India  
Beijing, China

## RESEARCH & DEVELOPMENT

Harkness' research and development team aims to improve the performance of the Company's screen products through technological advancements and to enable these improvements to be realized in manufacturing.

The team is based in the UK and works closely with its raw material suppliers to enhance existing product quality and to research and develop new screen materials and specialist coatings.

In addition to its in-house research and development and cooperation efforts with suppliers, Harkness also collaborates with universities, research institutions and companies, with the aim of developing the next generation of screen products. As an example, Harkness has in the past undertaken Knowledge Transfer Program (KTP) development projects with educational institutions on optics and nanotechnology.



HARKNESS SCREENS™

## QUALITY ASSURED MANUFACTURING

Regardless of where a Harkness projection screen is manufactured, it is manufactured to exactly the same standard.

Each manufacturing facility operates strict quality procedures from personnel training and material handling through to cleanliness procedures and post production conformance testing. All of these are aimed at ensuring that the quality of the final product remains the same.

Part of assuring quality within manufacturing facilities involves utilising the same proprietary raw materials to create screens. These raw materials are subject to regular checks and each batch is subject to certificate of conformance testing before entering the manufacturing process. This stringent control on raw materials enables Harkness to boast a quality rate of 98.5% on screens installed in cinemas around the world.



Manufacturing  
Facilities

## FIRE TESTING & CERTIFICATION

All of Harkness' cinema screen products are independently tested and certified to meet local fire regulations.

These include: UK BS 5867 Part 2, USA NFPA 701, France M1, Germany B1, Spain M2, Italy Class1, Japan BT-08-050, Korea and Australia. Fire certificates for individual products are available on request. Harkness is also able to provide small samples for local fire testing should this be required.



Fire Testing





## SOUND PERFORATIONS

All of Harkness' cinema screen products are available either perforated or unperforated. Screens are typically perforated to optimise the acoustic performance of behind-screen speakers.

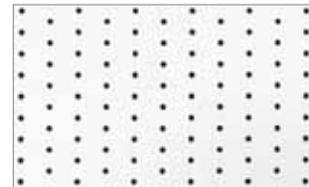
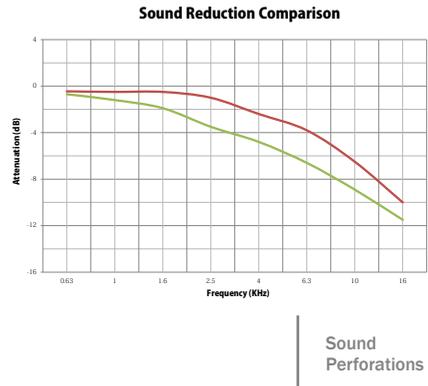
Harkness' 4K digital perforation pattern has been specifically designed to help offset Moiré interference where pixels align with regular perforations. Smaller perforations allow for closer viewing on standard perforation screens.

For most cinema auditoria, Harkness' custom digital standard perforation (SP) is used. For close viewing situations such as preview theatres or premium auditoria where seats are typically close to the screen (less than 5m/16ft), Harkness always recommends the use of its custom mini-perforation pattern (MP) products.

Harkness' 4K digital perforation tools allow wider rolls of base material to be perforated meaning substantially less vertical seams in all Harkness cinema screens.

The mini-perforation pattern has smaller diameter perforations (less than half the diameter of Harkness' standard perforation pattern) but a greater density of holes to provide the best surface type for close viewing conditions. Non-perforated screens are available for use when there are no speakers situated behind the screen.

Harkness' perforation patterns have been independently tested by audio companies to ensure that they perform suitably inside an auditorium.



Digital Perf Pattern

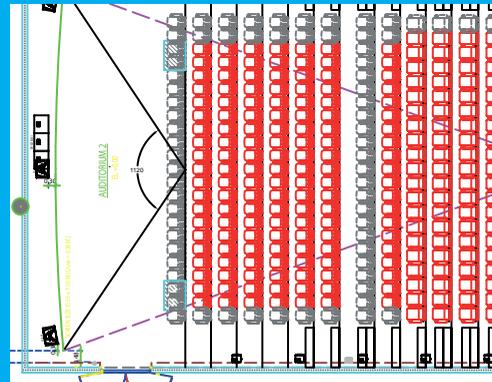


# VALUE ADDED SUPPORT SERVICES

What makes Harkness the leader in screen technology is its ability to add recognisable value to its range of proprietary leading screen surfaces by applying its expertise and knowledge in the field of light-on-screen.

That added value is aimed at ensuring that Harkness' customers obtain the best return on their investment in digital cinema technology.

Harkness' technical consultancy team delivers a range of services to cinema exhibitors around the world including pre and post-sales support on a variety of topics:



Auditorium  
Design

## AUDITORIUM DESIGN

From pure geometry through to seating rake, seating configuration or projection port height there are a number of factors which can influence the quality of on-screen presentation. Harkness' technical consultancy team is able to assess potential impacts from proposed new-build or refurbishment designs by interrogating either technical information or 2D/3D CAD drawings and make recommendations for improvements accordingly.

## EQUIPMENT SPECIFICATION

Ensuring that on-screen presentation meets industry-standard levels for brightness and uniformity is vital. Due to Harkness' close relationships with equipment manufacturers (projectors, lamps, 3D systems, etc), Harkness technical consultants are able to make recommendations on proposed equipment specification allowing customers to make informed decisions on their proposed configurations.

## SCREEN MAINTENANCE

Maintaining a clean auditorium environment can ensure that screen performance is maintained. In the event that screen become dusty/dirty or is in need of a minor repair, Harkness' consultants are able to advise on cleaning or repair procedures to enable the screen to be returned to the best possible condition.

## SCREEN OPTIMISATION

Harkness has long argued that the screen is one of the most important parts of a cinema auditorium. Optimising the screen by adding a curve or tilt can help reflect the maximum amount of light back into the seating area in the auditorium and improve brightness uniformity both of which can have a significant impact on visual performance. Harkness' consultants are able to assess proposed 2D or 3D CAD designs and provide recommendations on screen optimisation.

## SCREEN INSTALLATION SUPPORT

Large cinema screens, particularly coated 3D screens are by nature somewhat fragile and prone to damage when appropriate care is not taken during unpacking, handling or installing the screen. Harkness' technical consultants are able to provide guidance on best practice for screen installation or in some cases able to attend site to supervise installation.

## LIGHT MEASUREMENT PROGRAMMES

Given the significant light output degradation that occurs in digital projection, maintaining on-screen brightness levels can be extremely challenging for cinema exhibitors. Implementing regular on-screen brightness monitoring programmes can ensure that

remedial action can be taken to ensure that high quality on-screen presentation can be maintained. Harkness' technical consultants are able to advise on best practice for measuring on-screen brightness, how best to implement light measurement programmes and train exhibitors staff on how to take light measurements.

## INTERPRETING LIGHT MEASUREMENT DATA

From underperforming, defective or ageing lamps, through to dirty or ageing screens or 3D systems left in situ for 2D presentation, there are many reasons why on-screen brightness levels might fall below the expected levels. Harkness' consultants are able to examine light measurements taken in the auditorium along with equipment specifications and auditorium geometry to suggest areas of concern or remedial fixes.

# CASE STUDY

## LOTTE CINEMA WORLD TOWER - SEOUL, KOREA

In 2013, leading Korean cinema circuit Lotte Cinema embarked on its most ambitious project to date: the Lotte Cinema World Tower in Seoul, which is the largest multiplex in Asia with 21 auditoriums and 4,600 seats.

At the centre of the project was a 622-seat "Superplex G," billed as the world's largest cinema auditorium. The auditorium featured a 34.07 m x 13.84 m (112 ft. x 45 ft.) Harkness Spectral 240 3D screen optimised and configured by Harkness' technical consultants. Harkness' consultants examined 2D CAD drawings submitted by Lotte's architects and ran a full simulation of the chosen auditorium geometry before and evaluating the chosen equipment specification.

Based on the results Harkness' consultants were able to recommend a 6% curve on the screen to improve brightness uniformity and a small forwards tilt to direct more light back into the centre of the seating area.

On 3rd July 2014, the Lotte Superplex G screen entered the Guinness Book of Records as the largest permanent cinema screen installed in the world.

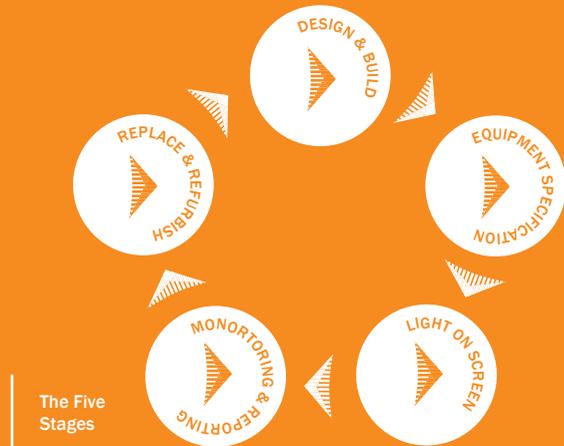




# TOOLS FOR SCREEN LIFECYCLE MANAGEMENT

Being the world's leading screen technology company, Harkness has long recognised that there is more to a cinema screen than just the manufacture and installation of the product.

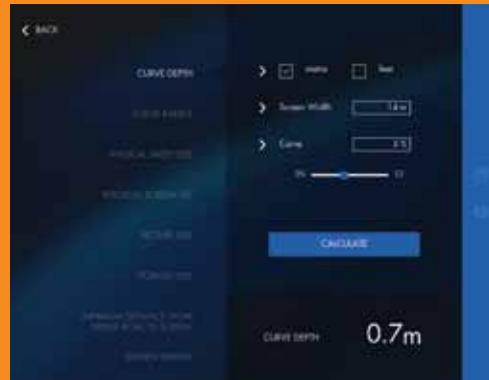
To that end, Harkness has invested significant resource in creating a range of tools and utilities for every stage of the lifecycle of a screen. These tools and utilities are aimed at ensuring cinema exhibitors get the most out of both their digital cinema equipment and particularly screen investments.



## DESIGN AND SPECIFICATION TOOLS

Aimed at architects, engineers, installers and exhibitors, the Digital Screen Planner from Harkness Screens is a free utility for iOS, Android and available via the Harkness website. The tool allows those specifying cinema screens to carry out complex mathematical calculations quickly and accurately.

From physical screen curvature and tilt through to specifying the physical sheet size, the Digital Screen Planner is an ideal tool for ensuring that these key construction design elements and the actual screen specified are correct prior to the project, helping to prevent potentially costly on site delays or mistakes from occurring.



Digital Screen Planner



Quick and easy to use, the Digital Screen Calculator tool enables engineers, installers and exhibitors to calculate the capabilities of varying equipment choices and provides recommendations on projector, lamp and screen choices based upon chosen screen size and light levels for 2D and 3D.

It also calculates theoretical operating costs and shows how screen choice might reduce these dramatically. The Digital Screen Calculator is available via the Harkness Screens website ([www.harkness-screens.com](http://www.harkness-screens.com)) and also on the Apple iOS and Android platforms.



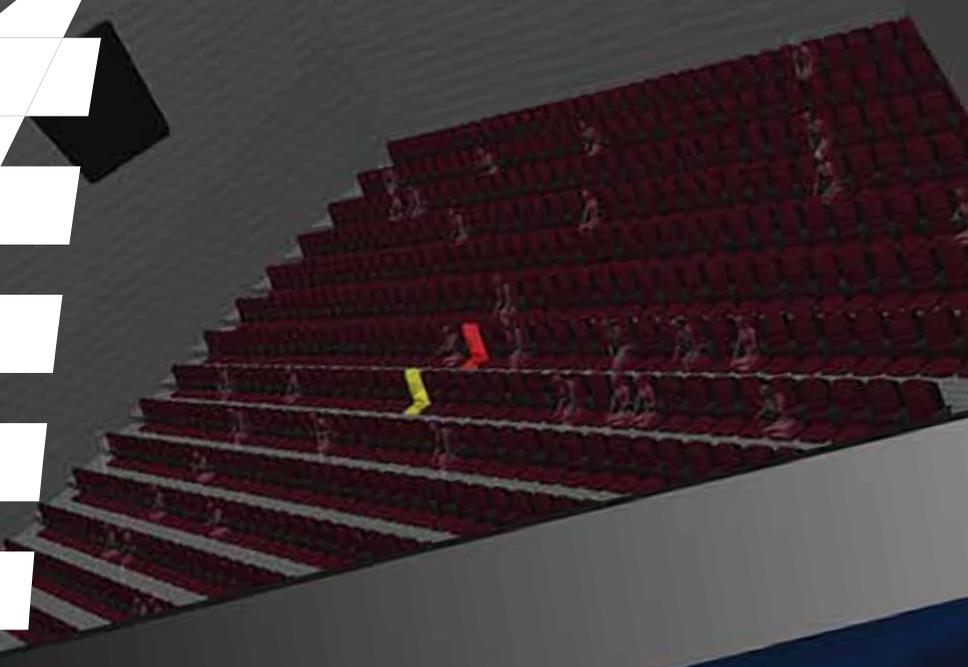
Digital Screen Calculator

The Digital Screen Modeller is a real-time 3D simulation tool that allows architects, engineers and exhibitors to visualise and optimise digital cinema scenarios in a virtual environment.

The information-rich 3D model enables cinema designers and interested parties to make more informed decisions about auditorium design as well as screen, projector and lamp choices before they're even installed or as part of planned retrofit/refurbishment projects. Like the Digital Screen Calculator, the Digital Screen Modeller is available via the Harkness Screens website and also on the Apple iOS and Android platforms.



Digital Screen Modeller



### Results

	Spectral	Clarus	Clarus	Clarus
	2.40	2.70	2.20	1.70
	DP2K-23B	DP2K-23B	DP2K-23B	DP2K-23B
	3000W BARCO	3000W BARCO	3000W BARCO	4000W BARCO
	6.16 fl	6.87 fl	5.63 fl	5.60 fl

780.00

1900

70.00

0.17

780.00

1900

780.00

1900

1005.00

1400

Operating Life Hours:

Week:

Operating Hours:

Year:

3350.72

Select

3350.72

Select

3350.72

Select



## CUROLUX PRESENTATION MONITORING SOLUTIONS

With over 4,000 units deployed globally from small exhibitors through to large multiplex chains, the Digital Screen Checker is a low-cost, hand held luminance meter that projection managers, projectionists, theatre managers or service engineers can use to monitor centre-screen brightness and check lamp life.

Quick and simple to use with simple point and click functionality, the Digital Screen Checker helps exhibitors to ensure that presentation quality is maintained along with industry-standard brightness levels.



Digital Screen Checker

Utilising pioneering proprietary technology, the Digital Screen Verifier from Harkness Screens is a unique utility for iPhones that allows cinema engineers and exhibitors to ensure that brightness levels in digital cinema are regularly checked and maintained.

Quick and easy to use, this relatively accurate low-cost light measurement tool allows brightness readings to be taken (in foot lamberts) using white test patterns from a digital cinema projector. Its unique functionality allows light readings taken in the field to be directly imported into Harkness' cloud-based Digital Screen Archiver tool in real-time to form a semi-automated entry-level solution for screen monitoring and auditorium maintenance.



Digital Screen Verifier

Whether the Ultimate, Optimizer or Lite, Qalif technology enables cinema exhibitors around the world to automatically monitor their screen portfolio remotely through a Network Operation Centre (NOC).

As well as taking light readings, these discreet wall mounted units typically placed at the rear of an auditorium can allow improved management of projected light, focus, colour convergence and perform audio checks.



Qalif monitoring tools

Aimed at ensuring brightness levels are closely monitored and maintained, the Digital Screen Archiver is a secure cloud-based data management tool that allows data such as auditoria geometry, power settings, lamp life and on-screen brightness to be captured in a standardised format during maintenance visits

Extensive back-end reporting tools allow those responsible for maintaining cinema auditoria to monitor the performance of their entire screen portfolio through one source, schedule planned and reactive maintenance visits and benchmark screen performance against key industry-standards. The Digital Screen Archiver is available via the Harkness Screens website and also on the Apple iOS and Android platforms.



Digital Screen Archiver





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