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Issue 3 December 2006

On the cover:
The old (film) and the new (digital) projection equipment in the new Sala Grande at the Venice Film Festival. Could the new boy be pushing out the old faithful servant as they struggle for space at the porthole?

Photo by Dion Hanson - Cineman - see story page 11.

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Publisher  BKSTS - The Moving Image Society
Pinewood Studios, Iver Heath, Bucks SL0 0NH, UK
T: +44 (0)1753 656656  F: +44 (0)1753 657016  e: info@bksts.com  www.bksts.com

Editorial  Jim Slater, Managing Editor
17 Winterslow Road, Porton, Salisbury, Wiltshire, SP4 0LW, UK
T: +44 (0) 1980 610544  F: +44 (0) 1980 590611  e: Jim.Slater@SlaterElectronics.com

Advertising  Bob Cavanagh, Advertising Manager
Kelsall, Potterne Road, Devizes, Wiltshire, SN10 5DD, UK
T/F: +44 (0) 1380 724 357  M: 07854 235280  e: visionplus@onetel.com

Design / Production  Bob Cavanagh,
Visionplus, Kelsall, Potterne Road, Devizes, Wiltshire, SN10 5DD, UK
T/F: +44 (0) 1380 724 357  e: visionplus@onetel.com

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KODAK DEMONSTRATES THEATRE MANAGEMENT SYSTEM

Kodak Digital Cinema introduced its Kodak Theatre Management System (TMS) at Show East, saying that it is the first comprehensive digital system designed to manage all digital cinema content and bring new connectivity to theatres in the future. The system enables standalone cinema components and systems to be networked in ways that provide new efficiencies for exhibitors and distributors, and an enhanced audience experience.

Kodak’s innovative approach is being developed with input from National CineMedia, as well as from Kodak’s extensive market experience in installing 2,200 pre-show and feature systems in the U.S., Canada, Australia, Singapore and Japan. Kodak’s software team is handling the development.

Bob Mayson, vice president and general manager, Kodak Digital Motion Imaging said that to date, most digital cinema systems have been installed on a standalone basis. Each content player is separate. Lobby monitors are separate. The pre-show is handled separately from features. That approach misses the fact that digital is fundamentally ‘connective’ technology and that digital systems are designed to talk to one another, to work together. The Kodak TMS makes that possible.

The Kodak system is interoperable; it will connect to servers, players, and other systems from multiple suppliers.

The new theatre management software, at the heart of the system, includes a standard Application Program Interface (API), the connector that enables different programs to talk to one another. Content received from multiple sources can be ‘connected’ on-site. The TMS links to the facility’s ticketing, point of sale or other programming systems, so content always ‘knows’ what is scheduled to play on which screen – in which auditorium or lobby monitor – at what time, and in what order.

The decryption keys, which unlock the security features of the content, can also be managed over the network.

As Kodak indicated some time ago, when Cinema Technology looked at their pre-show system in London, they are effectively adding new functionality to the capability they introduced in the pre-show applications. The entire show can now be programmed remotely. Trailers, features, and pre-show components arrive, are automatically assembled as directed, and play as intended. It’s a new and simplified workflow for exhibitors with new assurances for the content owners.

At the screen level, the system monitors content receipt and playback and sends electronic reports to the TMS. There, the information is aggregated and provided to the exhibitor and others, as agreed. The system also monitors the health of its components. Potential problems can often be diagnosed and even corrected remotely, before they become disruptive.

A major benefit of the Theatre Management System is that it’s software-upgradeable - tomorrow’s software will work with today’s, and the system will continue to evolve from customer input and experiences. Kodak will begin beta testing first versions of the new Kodak Theatre Management System in multiple sites over the next few weeks.

EDCF NEWS

EDCF WINS BRAVO AWARD IN VENICE

At the recent Venice International Film Festival the EDCF was presented with a Bravo Award for innovation in workflow in Digital Cinema. The photo shows EDCF General Secretary John Graham accepting the award on behalf of the EDCF.

EDCF APPOINTS DAVE MONK AS CEO

As D-Cinema moves into a new phase of deployment, the EDCF Board is re-focussing the organisation to meet the new challenges and expectations as the industry moves forward. To assist in achieving these aims, BKSTS Council Member Dave Monk has been appointed as Chief Executive Officer.

3D LIVE ACTION AT THE CINEMA - REAL D SHOW LIVE ALTERNATIVE CONTENT IN 3D

Here is another use for those expensive Digital Cinema projectors! At ShowEast, Real D, a company which Cinema Technology readers will know for its work in the field of 3D movie projection, went a step further, and staged the first live event ever to be projected in real time onscreen in 3D.

The ShowEast demo featured a percussion band playing outside the theatre, and the images were captured by two Sony Cinealta 950 digital cameras, whose signals were sent via coaxial cable to the digital projection equipment in the multiplex. Real D said that a major 3-D concert event could appear on screens as early as the summer.

It is believed that discussions are also underway for live 3D projection of a major sports event, which might be basketball, Super Bowl or the NASCAR championships. Real D say that the main problems are in selling the idea of the 3D digital screenings to the sports rights holders, who will need to be convinced that 3D live coverage in cinemas won’t stop people attending the games.

SONY 4K PROJECTION GETS MAJOR STUDIO SUPPORT

After many demonstrations of their 4K digital cinema projector at exhibitions, Sony has finally received the approval and support of the major motion picture studios and the creative community for its SXRD™ 4K technology, following a successful side-by-side comparative assessment with 2K technology.

The Entertainment Technology Center’s Technical Advisory Board held the assessment at the Digital Cinema Lab in Hollywood in October, and the result of the three-day test proved Sony’s technical prowess. The SRX-R110 4K projector, which was designed for compliance with Digital Cinema Initiatives specifications, met or exceeded every point relevant to DCI projector requirements for theatrical exhibition, including colour gamut, brightness and general performance. Following the assessments, 20th Century Fox, Warner Bros. Studios, Paramount Pictures and Sony Pictures Entertainment have all expressed approval of SXRD 4K projection technology, which was designed to meet all DCI requirements, for exhibition of their content in commercial cinemas.

Sony say that having satisfied current DCI projection requirements during these assessments, they are committed to complying with every aspect of the DCI’s specifications as digital cinema develops. The assessments accomplished two very specific goals. One was to determine if both SXRD and DLP projection systems supported proper image exhibition for studio motion picture releases; another was to test both systems’ compliance with DCI technical measurement specifications for colour, convergence and uniformity.

Sony showed its SXRD 4K digital technologies at ShowEast in Orlando, including three projectors, a playback system, a screen management system and a secure enclosure that meets FIPS/140 security requirements.
New Formula from Screen Digest for D Cinema Business Case

The unique nature of European cinema markets is such that the Virtual Print Fee model that is being applied with some success in the USA is proving difficult to sell to US studios, European distributors and exhibitors for use in Europe.

The presence of a strong domestic independent sector in some markets, such as France, means that the US studios, who effectively pay for the conversion in the USA, are not prepared to pay for the whole cost of conversion, when they may only be taking a much more limited proportion of revenue out of the market. This fact, coupled with the need to protect smaller players, such as single-screen exhibitors, implies that a new formula needs to be found for digital conversion in Europe, taking into account the characteristics of each European market.

In order to better understand these individual market conditions, and the impact of these conditions on the transition to digital cinema, Screen Digest has developed the Digital Cinema Conversion Index (DCCI). It is intended to provide a clear indication of which countries need to be found for digital conversion in Europe, taking into account the characteristics of each European market.

In the USA rapid progress is being made in the conversion to digital cinema, but Screen Digest suggest that the roll-out of digital cinema in Europe may be stalling due to the fragmented nature of European cinema markets and the failure to agree and apply a single model for paying the costs of conversion.

The DCCI was derived from ten statistical measures used to determine the suitability of each territory. These are: screens per site; Hollywood domination; US share of the market; print market values; exhibitor concentration; distributor concentration; multiplex penetration; distributor level revenues; proportion of single screen sites; number of first-run films. For each measure, each territory was attributed ranking points for how it performed, and these were totalled and converted to the final result, which is expressed as the Index. Although the Index provides a quantitative measure, it can’t take into account factors such as industry and government attitudes, known as X-factors, which can significantly alter the conversion equation.

The average DCCI across all countries was 53.9, with the USA clearly the most suited to digital cinema conversion with a DCCI of 86.7. In Europe, the territory with a market structure most suited to a transition to digital cinema was the UK. At the other end of the scale, the territory least suited to conversion was Finland (33.9).

The wide range of data highlights how diverse markets are. As an example, multiplex penetration as a proportion of the screen base ranges from 78.2 per cent in Spain to 22.6 per cent in Switzerland, with an average of 47.4 per cent across Europe. The number of screens per site ranges from 1.4 in Sweden to 5.8 in Ireland (average of 2.8), whereas first-run films releases are as high as 569 in Spain and as low as 150 in Luxembourg.

As at end first half 2006, there were 1,474 D-cinema screens in the world, of which 53 per cent were in the USA and 24 per cent in Europe. Between June 2005 and 2006, over 1,000 new D-screens were added, but it is important to keep this growth in perspective - only 1.5 per cent of the world’s modern screens are currently digitised to a high standard. The USA is the leading territory, with over 772 D-screens at the end of the first half 2006 (a growth rate of 690 per cent from a year earlier) and over 1,000 in place as at October 2006. The UK had 75 D-screens at end June 2006, a growth rate of 650 per cent during the one year period.

Screen Digest forecasts 17,800 high-end digital cinema screens globally by the end of 2010, with US leading the way as one quarter will have converted by that date.

This work is carried out by the Screen Digest Cinema Intelligence team, and fuller details of their research in this area can be obtained from sales@screendigest.com or Tel: +44 20 7424 2820
The Transition to “DCI Compliance”

Jason Power, Marketing Development Manager of Dolby looks at some of the technical issues involved in bringing operational standardisation to Digital Cinema.

Back in July 2005 DCI, the organisation formed by the major Hollywood film studios to discuss requirements for digital cinema, finally published its specification for digital cinema systems. This specification outlines the key features that the studios believe are essential for digital cinema systems to have, and includes details of a standard digital movie format that should be playable on all compatible systems. So what practical impact does this specification have on operations in the projection booth? And why is it said that no system is “DCI-Compliant” today?

Encryption
Perhaps the most significant impact of the DCI spec on projection booth operations is that movie content is generally encrypted. This means that is has been specially encoded so that it cannot be played back without an additional piece of information, referred to as a playback license or key delivery message (KDM). Therefore to play a digital movie in a cinema, you need both the digital movie file and a valid KDM. Each KDM is coded for playback on a specific unit, so distributors need to ensure that they generate KDMs for each of the screens where the movie will be played. Often KDMs will be generated automatically for all digital screens at a given site so that there is flexibility to move the movie as necessary, but this is not always the case. Finally, each KDM is usually valid only for a specified time window, usually of a week or longer but sometimes as short as one day for special advance screenings like premieres. For digital projectionists, this means that it is essential to check that the right KDMs have been delivered and loaded for all screens where the movie will play, and to make a note of when they will expire so that new ones can be obtained if necessary.

Compression
Another well publicised feature of the DCI specification is the requirement for the JPEG2000 image format. This is a new format for storing the digital images which has been optimised specifically for digital cinema. This requires new versions of digital cinema servers which can play the format, and of course new encoders for creating the digital movie files to send out to cinemas. These new versions are gradually becoming available, and although during 2006 there have been some compatibility problems as the new format becomes established, these are gradually being resolved so that we are now much closer to the goal of having one file that can be played on all DCI-specification servers. Although the JPEG2000 encoders available to date have been quite slow and expensive, faster and scalable solutions are now becoming available that should ease the production of movies in the JPEG2000 format.

The transition to JPEG has a key operational benefit for projectionists. Anyone with experience of MPEG digital cinema content will know that MPEG content can be prepared in different ways - for example, with slightly different picture sizes or slightly different colour spaces - requiring adjustment of the digital projector, or selection of a different preset at the very least. The good news about JPEG is that a single image size has been picked for each of flat and scope, and there is only one colour space available. Hopefully this will mean that the only adjustment needed is selection of the flat or scope preset, either manually or by the automation system.

There is so much more...
So, if JPEG systems are already being introduced to cinemas, why is it said that no systems are “DCI-compliant” today? The main reason is that the DCI spec contains requirements about much more than just the image format – of the 176 pages, only four actually refer to JPEG2000. The rest outlines other features, some of which – like FIPS security certification – are difficult and time consuming for manufacturers to implement (the FIPS certification process is a military-grade analysis of security integrity by a specialist outside agency and takes many months).

Others require coordinated efforts between encoder and server suppliers, and sometimes between competing suppliers themselves, in order to introduce a new feature in a controlled way to all systems in the field at similar times to ensure compatibility. The other reason is simply that, at the time of writing, no formal procedure exists to test whether a digital cinema server or projector meets the DCI specification.

Standardised Testing Techniques
Fortunately, DCI has recruited the Fraunhofer Institute to create such a test process, and it looks promising that various agencies might be in a position to use it to test in future and therefore clearly indicate which products are DCI-compliant. For now, cinema owners need to trust that their equipment provider will deliver whatever upgrades are needed in future to bring them to full “DCI-compliance” once the testing programme is underway.

Perhaps the most significant impact of the DCI spec on projection booth operations is that movie content is generally encrypted.'
Digital Cinema Projection Screen Considerations

Andrew Robinson, MD of Harkness Screens, shows how using the correct screen technology can optimise Digital Cinema presentations

With the roll-out of D-Cinema digital projectors accelerating worldwide, this paper reviews screen issues that should be considered. In existing theatres, in most cases, it may not be necessary to change screens, but there may be economic and performance benefits in doing so.

Screen luminance levels
SMPT standards for screen luminance in cinema auditoria for 35mm film projectors call for 16 fL (55 cd/m²) in the centre of the screen. For digital projectors, these minimum luminance standards are reduced to 14 fL, recognising that digital projectors do not have the light loss associated with the shutter movement in 35mm projection. Screen luminance levels depend on the amount of light falling on the screen, which originated from the projector (incident light), and the amount of light that is then reflected back (reflected light).

The incident light depends critically on:
• Factors associated with the lamp source – power, lamp type, lamp age.
• How the projector is set up to correlate the aspect ratio of the screen and that of the film content being shown. This can result in significant loss of available light.
• Other light losses (e.g. via port glass, etc).

The reflected light depends on the reflectance factor of the screen – essentially the “gain” of the screen.

Lamps for digital projectors
The Barco, Christie and NEC 2K projectors can use a variety of lamp sizes from 1.6 kW up to 6 kW. These lamps can be the standard xenon lamps that are used in 35mm projector lamp houses or the new xenon lamps developed specially for use with digital projectors in order to maximise brightness. (This extra brightness is achieved by a combination of using shorter arcs, higher gas pressure and treatment of the anode and cathode to enhance the overall efficiency of the lamp). These special lamps generate 15-20% more light but have shorter lives and cost considerably more than their standard xenon equivalents.

Film aspect ratios
The native aspect ratio of the Texas Instruments “DLP chip” used in these 2K projectors is approximately 1.9:1. (The DMD has an array of 2048 x 1080 elements). This aspect ratio is very close to the 1:1.85 “widescreen” film format but significantly different from the 1:2.35 “cinemascope” film format normally used in blockbusters.

Cinemas have to be able to show both cinemascope and widescreen formats interchangeably (and sometimes other formats). There are two ways to achieve this when using digital projectors. One is a wholly electronic approach, and the other makes use of an anamorphic lens. Both result in light losses but to a varying extent. If the screen in the cinema is sized as a cinemascope screen then the projector can be set to fill the full width of the screen when projecting...
a movie in cinemascope format. This will use the full width of the DMD. The excess height of the DMD is cropped electronically, which loses approximately 20% of the available light.

When a movie in widescreen (1.85:1) is shown, then the sides of the DMD can be cropped. This loses even more light but the screen is correspondingly smaller, so the light per unit area is the same in both formats. This technique is known as “letter-boxing”.

Alternatively, the projector can be set to fill the cinemascope screen height using all the DMD. An anamorphic lens is then used to stretch the image to fill the screen width. This maximises the available light compared with the letter-boxing approach. Some light is, however, lost through the lens. The disadvantage of using an anamorphic lens is that the lenses are very expensive (around £10,000). Also, changing between film formats means moving a lens in and out as opposed to just an electronic change, which can be easily automated.

With very big cinemascope screens using an anamorphic lens may be the only option, in order to get the required amount of screen luminance.

When the aspect ratio of the screen is 1.85:1, then the adjustment between film formats can be done entirely electronically. For a widescreen movie, the screen width is filled, which uses almost all of the DMD array as the native aspect ratio of the DMD is 1.9:1. The height of the DMD array is cropped to achieve the cinemascope picture (2.35:1) aspect ratio. This reduces the amount of light available for the cinemascope picture, but since the cinemascope screen picture is correspondingly smaller than the 1.85 screen picture, the same amount of light is available per unit of screen area in both film formats.

(Note: With 35mm projection when a 1.85 screen is reduced in size to create 2.35, there is a lot more light available for the cinemascope picture (a consequence of the larger gate size in a 35mm projector for cinemascope movies) and there is not the same natural balance between the available light and different aspect ratios. As “constant width” screen set-ups are increasingly popular in stadium theatres, particularly in the US, digital projection offers a benefit over 35mm projection in this respect).

Screen reflectance

Cinema screens typically come in three reflectance (gain) levels:

- **Matt White**
  - 1.0 gain such as Harkness Matt Plus
  - 1.4 such as Harkness Perlux 140
  - 1.8 such as Harkness Perlux 180

Silver screens used for 3D typically have even higher gains (c. 2.5).

Gain is measured against a reference standard. All Harkness screens are measured according to the British Standard BS 5550. Essentially, the gain level indicates the relative light reflectance on axis (strictly at 5º off axis), so a 1.8 gain screen will reflect 80% more light than a 1.0 gain screen on axis.

Using gain screens therefore provides an alternative to brighter lamps (all other things being equal) to achieve screen luminance. Generally, the bigger the screen the more attractive it is to use a screen with a higher gain level. With really large screens, a high gain screen may be the only practical choice.

Curving a gain screen minimises the luminance fall off effect. It is

<table>
<thead>
<tr>
<th>SCREEN GAIN</th>
<th>SCREEN WIDTH / CINEMASCOPE FORMAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>40' (12.2m) 9500</td>
</tr>
<tr>
<td>1.4</td>
<td>6600</td>
</tr>
<tr>
<td>1.8</td>
<td>5600</td>
</tr>
</tbody>
</table>

Lumens required to achieve 14 fl.

output light requirement may be significantly more than the incident light requirement. This also ignores the possible effect of the ‘throw’ (distance from projector to screen).

Viewing angles

To achieve an enhanced gain level a screen has to be more directive, and reflect more light, than a matt white screen. The luminance of any screen is lightest when viewed on axis and the luminance reduces as the angle to the axis increases (so called viewing angle).

The fall off in luminance is normally acceptable with higher gain screens up to a viewing angle of 20-25 degrees. For most cinemas, this fall off in luminance with the increasing viewing angle is not a problem, as the majority of seats are within an angle of 25 degrees.

Curving a gain screen minimises the luminance fall off effect. It is
therefore recommended that all screens with a gain level of 1.4 or higher should be curved. The recommended curve is 5%.

Digital projectors have an inherently more even light distribution than 35mm projectors, so the luminance reduction at the screen sides is less noticeable.

**Economic factors**

Gain screens can allow lamps with lower power ratings. This can be a big financial benefit with digital projectors where the lamps can be expensive. With a gain screen, it may be possible to use a standard lamp instead of a higher power special lamp, or it may just be possible to use a lower power lamp.

As lower power lamps also have a longer life and use less electricity, there can be multiple cost benefits from using gain screens. This can lead to a payback in one year of the cost of the gain screen.

**Pixilation/moiré fringes**

Interference between the pixel size on the screen and the perforation pattern of the screen can cause bands to be seen upon the screen (known as “moiré fringes”). This is less likely to occur with the perforation pattern/size used on most cinema screens with 2K projectors. It is possible with smaller screens used in small cinemas and screening rooms. If this occurs, it is recommended to use a different perforation pattern with smaller holes. This is probably necessary anyway to avoid seeing the holes when close viewing.

**Measuring gain in the theatre**

When installing a digital cinema projector in an existing theatre, it is quite useful to be able to measure the screen gain. Even if it is already known from the original screen, the gain level may have reduced, due to contamination over time.

Harkness Screens can advise on a method of doing this, which gives a good approximation to the British Standard method. SMPTE also have a method but this method is likely to overestimate the gain of most screens quite significantly.

**Does the screen need to be changed when installing a digital projector?**

In many cases, in existing theatres, it is not necessary to change screens but this should be considered in the following circumstances:

- if there is not a gain screen installed – there may be significant long-term economic benefits in changing the screen for a gain screen
- if the existing screen is more than 5 years old – the screen will have deteriorated in reflectance; a big investment is being made in installing the digital projection; it is a relatively low additional cost to change the screen and this will certainly give the optimum performance
- if there are interference patterns, it will almost certainly be necessary to change the screen
- if the screen has any visible imperfections

**References**

- SMPTE Standard 196M – 2003 Screen Luminance
- British Standard for Gain Measurement BS 5550
- Measurement of Gain in Auditoria (Harkness data sheet DS-073)

Andrew Robinson is Managing Director of Harkness Screens, Unit A, Norton Road, Stevenage, Herts SG1 2BB.

www.harkness-screens.com    e-mail: sales@harkness-screens.com

Harkness Screens have manufacturing facilities in the UK, Europe and USA and their screens are the world’s most widely used cinema screens.

The installation of a brand new Harkness ‘digital screen’ (note the screen curve) and two far east cinemas with digital projection using Harkness screens.
IBC made a very wise decision some years ago when it decided to bring Digital Cinema within its ambit, and this year’s extensive sessions took place from Sunday through to Tuesday, with workshops, screenings, a major conference, and an open meeting of the European Digital Cinema Forum which discussed current issues for D-Cinema deployment. It was interesting, and perhaps a bit worrying for those who regard Sony as primarily a consumer electronics company, to see that when Sony Chief Naomi Climer was asked on the IBC TV channel what she thought would be the next big thing, she quickly replied ‘D-Cinema’. The Digital Cinema conference theme day is covered in detail elsewhere, but for TDP readers I just want to provide a little information about what I personally found to be the most useful and the most informative of all the many D-Cinema sessions at IBC, the EDCF Post Production Workshop, organised by BKSTS Council Member John Graham.

BKSTS Council Member David Monk chaired what turned out to be a great afternoon session with more audience interaction than any chairman could possibly have hoped for. It was above all a tremendously practical session, with speakers from the post-houses, service providers and manufacturers who have actually been working to create what was described the “DCI environment”. Howard Lukk, Executive Director of Production Technology at Walt Disney Studios (pictured right), is responsible for incorporating new technologies into the workflow of the studio, and he set the ball rolling with a discussion of an interesting if somewhat arcane topic.

It was a surprise to many in the audience that Disney had found that when they scanned film using standard Digital Intermediate techniques and size specifications, the images produced for film projection were fine, but when a DCDM (Digital Cinema Distribution Master - the set of uncompressed and unencrypted files that represent moving image content optimized for the electronic playback in cinemas) was produced from the same scan, the digital cinema images turned out to be a different size - the projected image area for digital cinema encompasses more of the original captured image frame than the projected image for 35mm. We learned that for all the movies that Disney has shown digitally they have gone along the DI route for film output, and then re-sized the images for use in D-Cinemas. This is obviously not ideal, and the extra expense could affect smaller producers, so Howard put forward some proposals to overcome the problem. One idea was to modify DCI scan requirements such that ‘academy’ width scans could use the full 2048 pixels, with the DCDM ‘safe area’ width changing to 2000 pixels. This would provide an ‘overfill’ of 48 pixels, to account for any edge distortions, key-stone effects etc. Knock-on effects of such a proposal would include the need to provide extra area markings on camera ground-glass screens, but many DoP’s felt that they already have more than enough of these safe area markings to cope with when shooting. The speaker’s exuberant presentation of his proposal led several in the audience to believe that he (or was it Disney?) was putting forward the idea as a sort of ‘fait accompli’, which raised a few European hackles, but after sensing the tone of the meeting Howard said that his intention was only to raise the problem and to get the debate going. There
was general agreement that this subject was important and would be considered further by the EDCF, which satisfied most of the audience. I am hoping to get Howard to provide a fuller explanation for a future issue of TDP. Our own Peter Swinson asked what DCI’s suggested pixel numbers were when using the 1.66:1 format, often used for art-house movies, especially in Europe? There was a general muttering that no-one uses this ratio any more, but Peter remained unconvinced.

Rick Hunt of Ascent Media, and not the advertised Gavin Schultz, who had left Ascent Media only days before as part of a senior management reorganisation, gave a good explanation of many of the practical issues that post-production companies face when working to make Digital Cinema material, reflecting on what the company has learned in the last couple of years. He spoke of DCI and of the work that SMPTE is doing with the DCI specifications, saying that DCI Compliant is not the same as DCI Compatible, and that the differences between ‘passing’ and ‘failing’ can be extremely thin. Amongst other problems that they had encountered were difficulties with audio files and with X’Y’Z’ conversions. Storage and network bandwidths had also proved important, and including the vital security definitely slows down the data. He said that one of the main current operational challenges was maintaining the relationship between DSM and DCDM, and that new tools are required to pre-check the content before a package is made.

As well as the masses of yet unanswered technical problems that Digital Cinema is bringing, there are many new business pressures arising, with more equipment (and more expensive equipment) being needed, and highly skilled staff being required to carry out what had come to be straightforward routine tasks in the non-digital film business. DCDM and DCP work is often difficult to fit in with the other work of a post-production house. Rick gave many examples of places in the workflow process where detailed industry agreements will be necessary to ensure interoperability, and he stressed that the process is certainly not trouble free today. I was left with the feeling that this was a very useful contribution, packed with detail from his real-life experiences, and that the EDCF will be an excellent forum to hammer out some of the remaining problems.

Rick’s very practical words were received with great interest, and numerous questions, and he pointed out that many terabytes of data needed to be stored in order to keep all the different versions of a movie as it passes through post-production. Any move to 4K would require a whole new infrastructure, and would require a lot of business justification.

Gwendal Auffret from Éclair Laboratories, France talked about the business of mastering and delivery of movies in the DCI environment, and spoke from hard practical experience, having just created a 4K master for ‘Paris, je t’aime’. Éclair had recently taken delivery of a Doremi DMS-2000-4K, the 4K-capable version of Doremi’s Digital Cinema mastering system that uses DCI JPEG 2000 compression encoding. The 35mm film ‘Paris, je t’aime’ was scanned-in at 6K and mastered in a 4K DI operation at Éclair. Encoding the images for the DCM took around 24 hours per reel including monitoring acceptance, and the film was completed in a week. The realization of a complete 4K production and delivery path is an important step towards the Digital Age for European feature films. Gwendal stressed the importance of integrating the different parts of the process, and said that he had learned some vital lessons:

- Visually lossless encoding is a reality
- Transcoding to X’Y’Z’ is relatively easy but time consuming
- Compression is impressive
- Packaging takes 5 times real-time

Smiling at the possibility of DCI compliance occurring in Europe any time soon, he pointed out that there was just one JPEG 2000 server in the whole of France in September 2006. He felt also that there is a need for lower cost Digital Intermediate processes - if you want digital films to reach the screen then you must be able to create digital masters in an affordable way. Interoperability between servers is not yet perfect, and the only way forward will be to develop ways of carrying out quality control on the target servers. He welcomed the initiative to get the Fraunhofer institute to come up with certification methods, and made a plea for a certification method that works reliably. Digital cinema can only work if we have a common means of distribution for movies and for the encryption keys, and the industry must get itself into a situation where the mastering and distribution processes are as reliable and affordable as those for 35mm film.

Richard Welsh, DC Mastering Manager of Dolby, whose digital cinema presentations have appeared in Cinema Technology on numerous occasions (I noted that he had become ‘Rich’ Welsh on his IBC Powerpoint presentation, which is either an indication of trendiness or a reflection of how well the company pays!) described his experiences both in working the DCI way and using alternatives. He gave an excellent presentation, clearly delivered, and from a number of the practical problems and difficulties he had encountered in his daily work, it certainly seems that we are currently still in an experimental phase as far as mastering ‘DCI Compliant’ material is concerned. My notes said ‘ask him if we can use his paper in CT’ - which has to be a good recommendation! (See page 19 of this issue of TDP).

The audience willingly took up Chairman Dave Monk’s invitation to ask the speakers the ‘tough questions’ that need answering at this stage of the DCI implementation, and the workshop continued with discussion and argument until the time came to clear the room. A really superb afternoon, clearly demonstrating the strengths of the EDCF, which can call upon expert speakers from around the world, and which isn’t afraid to let a little controversy get in the way of reasoned technical argument.
There is something remarkable happening in the Digital Cinema business, including the fact that our most ‘dyed in the wool’ film person, Dion Hanson, has been convinced that he just had to tell us how Digital Projection played a major part in Venice.

Digital Cinema at the Venice Film Festival

I have written many articles for Cinema Technology throughout the years but this must be a first - An almost unbiased report on Digital Cinema!

It was about a year ago that plans for this year’s Venice Film Festival were starting to be hatched. Angelo D’Alessio, International director of the SMPTE, met up with Joel Schiffman of Quvis at a Digital Cinema symposium in Northern Italy. Both wanted to see more digital films screened at the festival, since the previous year’s electronic screenings had been far from perfect, ranging from good to terrible.

The original plan was to master the content in Rome before being sent on to Venice for screening. However, as everyone in the cinema industry knows nothing is ready until a few days before the premier. Consequently it was quickly realised that the mastering would have to be in Venice, during or just before the festival opened.

Every August/September for the last twenty years I have been responsible for the film sound at the festival and this year was no exception. One change was that the empty office next to ours had a new sign fixed on the door stating that it was the ‘Quvis Mastering Suite’. A quick coat of paint followed just before boxes of equipment and digital techs started arriving.

Digital projectors then also started to arrive. The first from Cinemeccanica for the two largest screens, the Sala Grande and the Pala Lido. Unfortunately it was quickly realised that the projector would not go up the tight staircase into the Pala Lido projection room. Consequently the second one was installed in the Sala Perla. SONY came to the rescue with their 4K projector but apparently there was a problem and it was quickly put in its flight case to be replaced by a BARCO. The BARCO was then found not to be able to offer D-Cinema quality and was subsequently replaced by an NEC. Busy days.

In the end four auditoria were equipped, the Sala Grande and Perla with Cinemeccanica, the Lido with NEC and the smaller Volpi with a BARCO. All four had Quvis servers supplied by Impianti Televisvi of Italy and installed by Gabriele Berto.

It was at this point that I became involved in that Quvis asked how we were going to decode Dolby E and the digital AES/EBU signal. The answer basically was ‘we can’t’! Meetings ensued and solutions sought. Realising that this was a week-end in the middle of August when Italy is on holiday, it was not an easy quest. The two Dolby CP650s in the Perla and Volpi were capable of decoding the AES/EBU tracks but it was the two CP200s in the main screens that required a separate decoder. The Dolby DMA8 was the obvious answer but it was almost impossible to find any. Many phone calls followed and eventually three were found, as Quvis also wanted one for monitoring purposes.

Once all the equipment had arrived and been installed Joel and his team could begin mastering and testing, this was four days later than they wanted to start. As masters started arriving for loading onto the hard drives it was quickly realised that although standards exist, content was starting to arrive in various formats. Anything from HD CAM and DIGI BETA down to very low quality systems - many filmmakers were shooting on very low budgets as it was probably their first film.

Transfers were done in real time and continuously monitored before being transferred onto removable hard drives for distribution to the screening venues. Scripts had also to be written to ensure continuous shows since much of the material was on separate cassettes and so operator intervention could be cut to minimum. As you can imagine this involved Joel and Curtis working long hours, often way into the night, to make up for lost time.

On top of all this Angelo had organised a
one-day SMPTE seminar on digital cinema with particular attention to Digital 3D. One system requiring the infamous silver screen to be installed in the Sala Grande. Because movie makers screening films at the festival did not want their films to be projected on a silver screen a smaller one had to be fitted on the day and flown out when not required. There were two systems shown, Real D which requires a silver screen and conventional glasses plus a polarising shutter on the projector. This was followed by a system using active glasses by NuVision. Here a conventional screen is used and projected images for left and right eye switched on and off in synchronisation with the glasses. This requires an increased frame rate to eliminate flicker and IR transmitters to switch the glasses.

The final complication arrived when Mike Denner turned up for a screening of The Magic Flute using the Dolby server. The complication being that Quvis and Dolby are competitors in the Digital Cinema market and I was in the middle acting as the ‘unbiased’ festival projection engineer. Me the diplomat! Although there were only two screenings in the Sala Grande of The Magic Flute there were also public screenings in the Fenice Theatre in the centre of Venice. The projectors for this event were supplied by NEC and operated by their technician Stefano Tura.

All in all I believe that everyone was happy with the results obtained at this year’s festival, certainly it was a steep learning curve for all those involved. There were nearly 40 films, features and shorts, with over 100 screenings in total. One thing that was a first was that the Golden Lion went to the Chinese director Jia Zhang-Ke’s “Still Life” presented digitally. Also the award for best documentary went to “When the Levees Broke: A Requiem in Four Acts” by Spike Lee, another digital screening. One thing I did learn about digital cinema is that if you have the wrong film loaded on the server you cannot just change over to the correct one. Still I suppose if we had been running film on a platter the same would have applied. Finally a ‘tip for techs’. If all else fails when trying to run digital audio you can always take an analogue feed off the Quvis head phone socket and play it into the non-synch input of a CP200, it keeps the world’s press happy. In all I suppose a successful event, I certainly now know more about digital cinema.

Long live sprockets and holes.

Dion Hanson
Arts Alliance Digital Cinema, who are currently supplying, integrating and installing the Digital Cinema Equipment for Phase 2 of the UK Film Council’s Digital Screen Network, tells TDP that it has 145 Screens installed as we go to press and that it is well on its way to completing the total of 240, which will all be installed and operating by Spring 2007.

You can always find up to date information on the numbers of DSN installations from www.ukdsn.com/DSN/about/?section=Installations

145 and growing - Arts Alliance make good progress with DSN

Recent Installations

During the autumn, installations have been carried out in many different areas in a wide variety of cinemas, and the technical teams have now built up considerable experience and become well used to dealing with situations where the nature of a particular cinema means that special planning is required beforehand to ensure that all goes well.

One example of a very non-standard installation was at the National Film Theatre in London. As many Cinema Technology readers will know, NFT1 has limited space in the regular projection room, and this constraint meant that the Arts Alliance engineers had to install the DSN projector in another smaller room below the regular projection room.

But to enable the projectionists to control the DSN system fully, all the rest of the D-Cinema equipment is located upstairs in the regular projection room.

To overcome this, cables were run between the Christie CP2000 projector and the projection room’s video equipment rack. Cinema engineer Ed Mauger installed the correct cables as specified by AADC and made space in the video equipment rack for the QuVIS D-Cinema server, along with the RAID storage device used by AADC in the DSN system - picture centre right.

The CP2000 projector Touch Panel Controller was also moved upstairs to the main projection room. This allows the projectionists to run Digital shows from the main projection room, whilst the CP2000 is located in a completely different room. The Christie CineIPM-2K (the digital cinema processing module (above) that enables the projector to take in various forms of ‘alternative content’) was left in the projector’s equipment rack, as patch leads from the main room feed signals downstairs to the unit. The CineIPM-2K remote control cable was extended to the upstairs projection room to allow full control of the unit.

Projectionist Training

AADC also provide training and ongoing service and support to the DSN cinemas, and it was interesting to pay a short visit to their London Headquarters, in a beautifully converted old chapel close to Olympia, where...
I met a number of the key staff and saw some of the digital mastering operations. Numerous projectionists have visited the chapel for their initial training on Digital Cinema systems, and it was interesting to see the well-equipped preview theatre and its associated projection room, fitted with an NEC digital projector, which was used for the first fifty projectionist training courses, as well as for the critical assessment of programme material that plays such an important part in the life of the company.

**A Multi-media business**

Arts Alliance are involved in far more than digital cinema, of course, and distribute entertainment content to the consumer and to the industry. AAM is the single largest shareholder in LOVEFILM, a leader in online DVD rental and the first company in Europe to launch a Download-to-Own service, in partnership with Universal Pictures. This allows you to download material and to make your own copy from this, with strong safeguards to prevent further copying and piracy, the digital content storage and delivery facilities being fully FACT approved for security and copyright protection. LOVEFILM’s Download-to-Own service sends you the film on DVD, and two download versions - one for a PC and one for a portable device. AOL’s web-based film download service is also powered by AAM and LOVEFILM.

I spoke with Daniel Payne, who is the Digital Content Mastering Manager, and was surprised to learn just how much digital content is now being supplied and sold to customers via the web. Evidently you can rent a film online from our banks or utility companies, it was interesting to see the well-equipped preview theatre and its associated projection room, fitted with an NEC digital projector, which was used for the first fifty projectionist training courses, as well as for the critical assessment of programme material that plays such an important part in the life of the company.

**Remote Monitoring**

Interestingly, the control and monitoring centre for the DSN network is in the London HQ, and it was amazing to see just how much data they have incoming about every aspect of digital shows at the DSN cinemas. Monitoring is carried out on a pro-active basis, so that potential equipment faults can be anticipated and dealt with before they can cause problems.

As an example, if sensors in part of the projection system in a remote cinema send back signals to the control centre showing that something is running too hot, an automatically generated email can be sent to the on-site projection team to warn them to investigate immediately. The remote monitoring system has enabled AAM to gather vast quantities of data about all aspects of their digital cinema network, and they use this data to work out how best to prevent faults occurring, as well as how to respond to problems that do arise.

Ian stressed the importance that they give to the projectionist training - the company realises that providing projectionists with the best information and experience gives them the confidence and the ability to make the best use of the new equipment, and this plays a major part in the prevention of faults and the rapid solution of any problems that may arise. In these days when we all get frustrated at hanging on the phone awaiting ‘service’ from our banks or utility companies, it was also good to hear how AAM realises that the training of its DSN ‘call centre’ staff is vital - so many DSN projectionists have told me how good these people are at at helping them to solve problems over the telephone that might otherwise have needed a visit from an engineer or delayed a digital showing. Only a handful of these well trained staff provide a ‘round the clock’ diagnostic and service advice for all the DSN projection teams around the country.

**Cinema Film Mastering**

Cinema film mastering operations are always interesting - and it was good to see the masses of digital processing equipment from lots of different manufacturers and the vast amount of digital storage locked away in ‘Bank of England’ style security vaults. Rich Phillips, Head of Technical Operations, took me through the process of how the finished digital output from the studio, usually delivered on tape, is encoded, compressed, quality-controlled and packaged into a form that the projectionist can use - invariably on a rugged hard disk these days. Rich has vast experience of the cinema business, and it was good to learn that he has agreed to join the BKSTS Cinema Technology Committee and to contribute his practical knowledge of digital cinema matters - he will be a valuable addition to the CTC team.

**New Management System for Small Cinemas**

Gemma Richardson, Sales Director, and Marketing Executive Kate Pidgeon were very keen to talk about the latest AAM offering - NEWMAN. Newman is an online cinema management service which is aimed at providing independent cinemas with many
Remote Control can help in difficult locations

AADC have designed and built a special remote control unit, which is available at extra cost, to enable Cinemas to remote control the starting of a show without having to have the operator stand in front of the DSN system. It is an ideal extra that will appeal to many non-automated cinemas. The equipment consists of the DSN Server Remote Control box and a remote start/stop and play status unit. The unit is linked to the unique DSN Wall box system that was designed by AADC for the UKFC roll-out.

![DSN wall box and optional extra, server remote unit.](image)

Below – close up of the remote front panel

When the show is stopped or in Pause mode ready for the start of the show, the red LED above the large red stop key is flashing. When the Play key is pressed, and once the unit is playing, the Green LED will illuminate.

Everything isn’t always perfect first time

I know that projectionists are often the most cynical of people, and it has worried me for some time that much that I write about Digital Cinema is suffused with that rosy glow that comes from reading too many manufacturers’ glossy booklets! Everything can’t work perfectly every time, as we know well, but getting sensible information about the faults that occur with digital projection systems has so far been quite difficult. The chances of getting a manufacturer to tell you what the problems are with his kit are fairly slim, and so for some time I have been talking with digital projection people and asking ‘what goes wrong?’ Invariably I can get the gossip from the operator, but if I then try to get a management take on the story everything dries up - ‘don’t want the competition to know what is going on, do we?’

I think that the Digital Cinema business is now in a sufficiently strong state that we ‘techies’ can do as engineers have always done, and share our knowledge for the common good of the business. ‘A problem shared is a problem halved’, as the old ‘agony aunts’ used to say!

During my visit to the Arts Alliance HQ I put my usual request for information about technical problems that occur to their Operations Manager, Ian Strang, but honestly didn’t really expect much of a response, based on past experience. I was therefore delighted when, just as I was completing this section about Arts Alliance, an email came in from Ian, containing just the sort of information that I had been looking for and that I know many of you will be interested to learn about.

Common problems with digital projection

- Our most common fault is when the server is booted up before the RAID array is ready. This means that the server can’t always see all the films available to play. If your QCP (Quvis Cinema Player) says it can’t find an asset, reboot the QCP but leave everything else on; this will make sure the QuVis can see the RAID properly.
- Expired or missing keys are also a common problem. If your QCP tells you that a license is not found, check the content sheet that comes with each print for the dates when your keys should be valid. If the key should be valid, give us a call. If the key has expired, call your film bookers and request they order a replacement. Always hang on to these content sheets as a reference.
- If your picture looks green or pink, then you might be in the wrong preset. If the film is a QPE (Quality Priority Encoding) film, you should be in an HD preset; if it’s a JPEG2000 film, you should be in a DCI preset.
- Sometimes wallboxes get switched off at the mains. If this happens, your projector will refuse to switch the lamp as it will see this as an open fire alarm (auxiliary) interlock.
- Always start and end your script with black header and footer. Just like 35mm, the QCP needs to be playing material to trigger pulses and automation events.
- When building scripts on the QuVis with both HD and JPEG2000 material, it is important to get the correct black leader at the start/end to match the content that it is joined to within the script. This stops the system having to re-sync to the new frame rate/resolution and saves you having to douse the projector to cover up these on-screen disturbances that would occur during a re-sync.
- Arts Alliance have made a useful start with this list of common problems. It is now up to the rest of you digital projection people out there - let other projectionists share your digital ‘hints and tips’, and we will all become much wiser. Should you have problems in getting them past the ‘management filter’ then we can always use the ‘anonymous projector’ label, but how much better if management can be convinced that it is a sign of strength in an organisation when it can willingly open up its workings for the benefits of the whole industry. See what you can do!
Projectionist Training at AAM

In the June issue of TDP Fiona Deans, Director of Digital Cinema for Arts Alliance Media gave a rundown of the offsite training course for projectionists, which is one of the key links in ensuring the reliability of the DSN.

So far more than 200 people have been on the courses, which cover all the skills required to operate the server and the projector, load and delete content, deal with security keys, and perform basic troubleshooting.

Topics covered include:

- Powering up/powering down
- Turning on Projector (1)
- Touch Panel Controller, Cine-IPM (2)
- The CP2000 Manual
  - Overview of equipment
  - Touch Panel Controller (TPC)

Explanation of menus and settings, and details of how to change image settings and identify faults.

- Lamp
  - Step by step instructions on how to install and remove the lamp, as well as instructions on cleaning the lamp, mirror and filters (3).
  - Troubleshooting guide
  - Qvis Manual (4)
    - Overview of Cinema Player
    - Basic Operation
    - How to play clips
    - Assembling and playing scripts:

- Assembling and playing scripts:
  - Loading content onto the server from removable drives
  - How to play content from an alternative source using the Cine-IPM unit

Maintenance
- Instructions on cleaning & maintaining equipment.
- Glossary of terms used in the manual.

And purely by coincidence....

Just as the preceding Arts Alliance article had been put together, the Editor received the following very relevant letter from an experienced projection engineer. Comments from other readers are always welcome.

Hi Jim

You may remember me from the article that you featured in ‘Cinema Technology’ a few years ago, following my involvement in the Boeing Digital Cinema system installation at the Ritzy Cinema in Brixton, then part of the Oasis group.

I’m now Head of Technical Operations at City Screen (Picturehouse Cinemas), who coincidentally now operate the Ritzy! I was in there again a couple of weeks ago installing 2 Christie CP2000’s with Arts Alliance. How things go around!

City Screen & Arts Alliance are in fact sister companies - much of the research carried out by Arts Alliance prior to the successful UKFC bid was carried out on City Screen sites. As such, I tend to ‘crossover’ between the 2 companies, seeing both sides of the coin as it were. I have just spent a month working solidly with Arts Alliance, including installations, service & upgrades and projectionist training.

My point is that there doesn’t appear to be much publicity about the positive side of Arts Alliance. Yes, they decided to proceed (very successfully) with phase 2 of the rollout without the involvement of certain sub-contractors, but what is never mentioned is that during the first 50 installations, Arts Alliance were developing their own team of dedicated Digital Cinema Engineers, which is now in place. This team includes trained people based at their warehouse carrying out pre-builds, configuration & testing, support line personnel, field-based installation & service engineers. This is all backed up by a superb IT system that allows any engineer to access the live Cinema systems remotely, identifying & addressing problems via an ADSL line, which all Cinema systems are connected to.

At their Byfleet location, Arts Alliance have set up a dedicated training room, specifically to train projectionists in the new technology and giving them real ‘hands-on’ experience of using the kit that they will have installed in their cinemas. The training room is fully equipped with a full-size screen, 5.1 channel audio system, Christie CP2000 projector, Quvis player, Raid array, Cine IPM unit etc. The room is laid out with desks & chairs in a horseshoe formation & includes a smaller pull-down screen for powerpoint presentations. The course lasts for 2 days - each attendee is given a copy of the very comprehensive training manual written by Arts Alliance, which they take away for reference.

This manual isn’t just copies from manufacturer’s originals – it is an original, created in-house, with loads of pictures, diagrams & helpful tips. Attendees have to sit a written test at the end of the course and those that pass are issued with a certificate.

I am one of the instructors that regularly takes this course and feel that it is superb. In my opinion this is the best ‘Training for Digital Projection’ that there is. We have had many positive comments from attendees, who are delighted to be shown just what they need to use their new technology and be given as much technical information as they need. Incidentally, the course does cover the operation of the Cine-IPM unit!!! (although not over 2 days). Unlike other training venues, which are often simply a Cinema auditorium and projection room with cancelled shows, this is a training room that is used for no other purpose. I would highly recommend that you come along & take a look - even sit in on a course. [This is currently being arranged with AAM -Ed.]

Best regards,
Rob Younger
Head of Technical Operations
City Screen Limited
The Digital Cinema Difference

Patrick Zucchetta of Doremi Labs, famous for their range of video servers and disk recorders and for their growing expertise in Digital Cinema mastering, discusses the advantages that a move to Digital Cinema can bring.

The significance of change
As with many technical developments coming under the banner of ‘digitalization’ the full significance of the change only starts to become apparent as the industry reaches the point of large-scale installation. The first objective is always to gain acceptance by at least equalling the performance of the existing technology. The next phase then, hopefully, introduces a raft of new features and possibilities that go far beyond those of the traditional. Digital Cinema is now at that stage.

Digital Cinema is here
The discussions about digital ‘film’ quality against celluloid were largely laid to rest by the Digital Cinema Initiatives (DCI) setting industry standards. Among the many parameters this defines are image sizes of 2K and 4K as well as colour space (XYZ), bit depth and compression coding using JPEG 2000. It is widely accepted that the quality of 2K digital cinema images matches that expected from the photochemical release prints – especially when using a Digital Intermediate path, as increasingly is the case. Sound has been less of an issue as high quality digital audio has already been used in cinemas for some time.

Release print cost
Installing a DCI-compliant digital projector and player is not the leap of faith it was two years ago. By the end of 2006 Doremi Cinema alone will have installed nearly 2000 cinema players that follow DCI 1.0 recommendations. The whole workflow of Digital Cinema is different and offers huge cost savings. It means that the movie arrives at cinemas as data rather than celluloid. This movie data is easily duplicated in large numbers and distributed on disks. The process is far cheaper than the $1500 (USA) to $2000 (Europe) or more cost of making a movie release print and, in many cases the cinemas are paid virtual release print fees to help fund their digital equipment.

Of course the customers benefit too. Whereas film will have degraded significantly after 100 replays and may need replacing, the digital movie is still pristine – no scratches, weave, dirt or ‘re-join’ edits. For the first time every Digital Cinema goer will see pictures at the same quality as the makers saw it – ‘film’ as never before seen by the public.

Security
It is this ease of copying that has also alarmed the content owners, the studios, causing them to insist on stringent security measures to be enshrined in the DCI standard. There are a number of safeguard levels. The digital movie received by the cinema is encrypted as a part of the mastering process. The exhibiting cinema has to be given a digital key to enable their movie to be decrypted. As the key is time-dependent the studios can define when the replays can occur – an even greater level of control than they had with celluloid. In addition the cinema images are always encrypted when outside the equipment so another strong AES-128 encryption, such as CineLink II, is used on the line between the player and the projector.

And to achieve maximum security, the cinema player box is tightly secured with FIPS 140 Level 3 compliance to guarantee that no content or key can be accessed at any time in “clear” in the box.

This still leaves the content as open as ever to the bootlegger’s camcorder pointed at the screen. The inclusion of Philips forensic watermarking or Thomson’s NexGuard watermarking means that any recording can be traced to the cinema and the time – even though the quality of the bootlegged footage is way down on that of the original. The upshot of these measures is that the studios are likely to refuse to supply cinemas who do not have these security measures that give them more control and tighter security than ever before.

Further Advantages
There are more benefits. As the movies are cheap to copy and so well protected they can be delivered without the secure and expensive methods necessary for film. The inclusion of digital subtitling in DCI cinema players allows subtitles to be added into the pictures as they are run at the theatre. Fast, low cost copying and live subtitling mean that it is quite possible to have a worldwide release rather than opening country-by-country – and so effectively undermining a major part of the piracy market.

JPEG 2000 and MPEG
Two forms of digital coding are used for the pictures. Most movies are encoded using JPEG 2000 that is recommended by DCI. Unlike the widely used JPEG (.jpg) encoding generally used in digital cameras and computer applications that works on 8 x 8 pixel blocks, JPEG 2000 uses...
There is scope also for wider automation that is useful in multi-screen locations. It has taken a monumental effort for digital technology to better the experience of 100 years of film in the cinema. Now it has done so, and the technology is continuing to evolve to enable a wider, more engaging cinema experience.

The DCP-2000 from Doremi Cinema is a technologically advanced digital cinema server, which was first to market and is by far the most installed cinema server capable of playing JPEG2000 digital movies. Doremi continues to add advanced features to keep the DCP-2000 ahead of the competition. Some of these features include 3D playback, CineLink II strong link encryption, and Thomson’s NexGuard and Philips’ CineFence forensic watermarking, making the DCP-2000 the most secure server on the market. Each DCP-2000 server includes the CineLister software utility that provides effortless scheduling and playlist.

Patrick Zucchetta is Manager, EMEA Digital Cinema Business Development for Doremi.

TDP - Ideal for the Digital Cinema Advertiser

Training for Digital projection is published four times a year alongside Cinema Technology, the Leading Specialist Publication for Cinema Industry Professionals. It is distributed to all UK cinema multiples and independents and many throughout Europe and the rest of the world - some 55 Countries worldwide. TDP is designed as a reference guide to digital cinema, intended to be filed and kept, and so is an ideal, precisely-targetted advertising medium for companies involved with all aspects of Digital Cinema.

We also welcome editorial contributions on technical and training aspects of Digital Cinema.

Contact Bob Cavanagh e-mail: visionplus@onetel.com Tel +44 (0) 1380 724357
Looking back to the EDCF workshop on “mastering and delivery of movies in the DCI specification environment” held at the recent IBC conference, there was a common theme amongst all the speakers about the difficulties faced in preparing content for digital cinema. The DCI specification is a well defined document; however, standard workflows for creation digital releases are yet to evolve. Those coming fresh to digital cinema delivery often are unaware of subtle problems in content creation that lead to much bigger problems in content preparation. The following is based on a presentation at the EDCF workshop which addressed some of the challenges seen in two years of digital cinema mastering at Dolby UK, how those challenges were faced and how workflow is much improved when content source formats are close to the DCI specification.

Content Flow
In the DCI specification, movie content is delivered to cinemas as a Digital Cinema Package (DCP). The content preparation facility creates the DCP from the Digital Cinema Distribution Master (DCDM). The DCDM is provided by the content creation facility, who conform the Digital Source Master (DSM) to the DCDM standard. These three elements form the fundamental basis of the workflow model for digital cinema content distribution.

The DSM consists of the audio, image, subtitle and ancillary elements of the movie. These can be in any of the diverse formats available for handling these elements in digital form. However, the DCDM is strictly defined, and this definition acts to distil the DSM down to a single delivery for the DCDM. This is invaluable to the content prep facility, since the process of producing the distribution master from the source is fraught with technical pitfalls and a job that also requires creative sign off.

The DCP is created from the DCDM and the major difference here is that the image will be compressed in the DCP using JPEG2000. The audio remains uncompressed, while subtitle/caption and ancillary data files are small and have little effect on the size of the DCP. Any of these assets can be encrypted in the DCP to protect the content from piracy, making them playable only by those given the appropriate decryption key. The DCP can now be distributed to cinemas via satellite, fibre or physically on hard disks. Hard disk remains the most popular method in the early stages of digital cinema while numbers of delivery sites are relatively small.

All nice and easy so far: a simple and efficient workflow. Not quite...

Diversity is our friend at the creative stage of making a movie, and gives many different ways of working and getting the desired result. However that same diversity can quickly become an enemy at the content preparation stage. The formats available for each element of a movie include:

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And so on – the DSM can consist of any of these formats and a myriad of others not mentioned. So these elements need to be conformed into the DCDM. The ancillary data, which is already in the right format, requires little or no conversion. The Subtitles may need a file format conversion, but timing information should not change. Audio needs to be converted to Broadcast Wave files and may require some sample rate and bit depth conversion to meet the DCDM specification. Picture presents the biggest challenge, and the DSM potentially requires a number of colour, size, and bit depth conversions to create the 16bit X'Y'Z' TIFF files specified. These processes differ significantly between formats and projects, and colour management in particular is one of the most difficult challenges faced, particularly as most projects are simultaneously working towards a 35mm and D-Cinema release.

Transporting the Data
Once a conformed DCDM is made, there is still the small matter of transporting it. The DCDM for a 4k movie could easily be seven terabytes of data, and this obviously represents a large amount of data to move, even in today’s high bandwidth world. If the content preparation facility is geographically separated from the post production facility...
providing the DCDM, which is often the case, this becomes even more of a problem. Even though there are portable drives of 2TB or more capacity available, the load speed to and from the drives is limited to the interface (FireWire or USB).

This is the case at Dolby’s UK mastering facility, 2 hours west from Soho along the M4. Our solution has been to use multiple small hard disks, rather than a few very large disks. By receiving the DCDM split into reels, or even sub reels, it is possible to simultaneously ingest a large number of drives into our central storage system through the render farm, and this currently gives 4Gbps aggregate ingest speed across the drives.

However, in the real world it’s extremely unusual to receive a full conformed DCDM, prepared according to the DCI specifications and ready for assembly into the content package. In fact, usually at least one element is still at the DSM stage and needs conversion into the appropriate format for the DCDM. For example, here is the process to produce a JPEG2000 DCP from an HD-D5 image source (which does not comply with the DCDM specifications):

Conversely, when a full DCDM is supplied with all elements in the appropriate format, creating the DCP is a much simplified process:

There is the small issue of JPEG2000 encoding, (which was mentioned more than once in the EDCF workshop) and this again can be very time consuming. However, utilising a render farm approach to JPEG encoding can give much faster results. Using the new Dolby SCC2000 Secure Content Creator in conjunction with a render farm, Dolby can currently encode full container 2K movies into JPEG2000 faster than real time, and 4K movies in 2 x real time. To go even faster, it’s simply a question of adding to the render farm (the central storage system, a DVS SAN, [Storage Area Network] will sustain reading a 4K and two 2K uncompressed data streams simultaneously).

It’s the Only Way to Go

So working in the DCI specification environment is a “no-brainer” from the workflow point of view. But the reality is that there is going to be a long transition from the current DSM delivery reality to the DCDM delivery future. Enabling film makers new to digital cinema, and with the DSM to DCDM workflow yet to be standard working practice, inevitably means helping them get their content on screen by accepting DSM and dealing with it on their behalf.

As much as anything, the answer lies in education, and making the tools available to simplify workflow. For instance, if DCDM and DCP creation are physically separated, then JPEG2000 encoding at the post production facility makes a lot of sense, but this still represents an expensive proposition, especially for smaller post houses.

As digital cinema grows, we see a lot of combined effort across the industry to move towards a better defined and understood workflow at the content creation and preparation stage, and despite the challenges we all face, the future looks bright!

Richard Welsh, Digital Cinema Mastering Manager, Dolby UK
www.dolby.com
Joost Hunningher, Chair of CILECT - Centre International de Liaison des Ecoles de Cinéma et de Télévision - the association of the world’s major film and television schools, provides a few digital snapshots from the exhibition-related part of a major Digital Conference held at the NFT.

Exploring D-CINEMA 2

Digital Snap Shot – Setting New Boundaries and New Ways of Working
Paul Trijbits from the New Cinema Fund talked about ‘Setting New Boundaries’. The digital world gives you more opportunities to show your work than if you were on 35mm film. One film that he had produced, This is Not a Love Song, was placed on the internet and had ‘175 thousand requests for a download in one hour!’ He introduced filmmakers Carol Morley and Richard Jobson. Both showed digital films they had made in one day.

Richard Jobson took the position that he liked the aesthetic of HD and wasn’t interested in making it look like film. He felt traditional film-making was finished. He concluded with, ‘I defy anyone to say that film will be around in the film industry in two years. It is over. It’s completely over.’

Carol Morley took the opposite view: ‘I think film is just gorgeous’. Her main criticism of the digital film making process was that it was always associated with speed. She concluded by saying, ‘My main interest as a film-maker has more to do with the thought process and the ideas than with the medium itself.’

Paul summed up the session: ‘If your work isn’t getting into cinemas – either as 35mm or as a Digital Release – and you want an audience, there are plenty of new opportunities for new film-makers to think about.’ The film-maker Olaf Wendt showed us some examples of a new and very effective form of digital back projection in a train carriage that he designed for the film Derailed (Michael Håfström). It illustrated possibilities for digital techniques during production which allowed for control over lighting which, if using blue or green screen techniques, would have been very difficult to achieve. He also showed his own film Running Man which creatively merged film, digital and back projection techniques.

Digital Snap Shot – Digital Projectors and 3D
We put on glasses and saw a 3D demonstration of Star Wars and Chicken Little. Joel Schiffman from QuVis and David Monk gave a primer on 3D and explained that a big extra on digital projectors is that 3D presentations are possible. They explained that it isn’t really 3D (otherwise you could touch it) but a stereoscopic effect. It is a trick of the brain where, by wearing glasses that can turn each lens off and on separately, the projected, nearly-identical-images give the illusion of depth. The rate for such projection is 96 frames per second, so for 3D movies you are essentially shooting twice at much as for a normal movie. Apparently all
the Hollywood Studios are working on 3D presentations. Will audiences flock to see 3D movies? Could one big 3D hit be a killer blow to conventional 35mm projection?

Digital Snap Shot
– Digital Screen Network
Steve Perrin of the UK Film Council, Rob Kenny of Curzon Cinemas and Richard Boyd of the NFT talked about the success of UK Digital Screen Network and reported that it had been reliable and had given most theatres more variety and a better standard of projection. They felt that audiences were interested in the films and not how they were projected.

Richard Boyd had used questionnaires to discover that 94% of the audience ‘liked the digital presentation and enjoyed the film’. Throughout the conference Richard organised for us to see digitally re-mastered clips of film classics including Casablanca, Robin Hood, The Searchers, Singing in the Rain and Black Narcissus. Seeing is believing and these carefully prepared clips illustrated that ‘cinema quality Digital Projectors’ can make a massive contribution to our discovery and appreciation of film history.

Digital Snap Shot – The Challenge and Take-up of D-Cinema

Thomas Höegh, filmmaker and Chief Executive of Arts Alliance Media, gave the keynote address. His company is preparing the UK Digital Screen Network and have already had 10,000 screenings at their 50 digital screens and in 2007 will install a further 150 digital screens in the UK. Thomas said that he saw local digital cinemas developing into social centres offering a variety of films or, on some occasions, international sporting events. He concluded that cinemas should be ‘temples of moving culture imagery that reflect the community.’

Summing up – D-Cinema is coming
David Monk summed up a panel discussion about the future of D-Cinema with Peter Swinton, Jon Thompson, Jonathan Smiles, Patrick Von Sychowski and others by saying, ‘Going to a cinema where the image is always focused and always has the right colours and contrast would be a great improvement.’

The effect of electronic projection has to be similar to the best film projection: digital projectors need to show film natively at a speed of 24 frames per second and have colours and details as good as you would get in the best film print. The quality of the film has to be the same in every cinema wherever you show it. These were David’s ‘guiding goals’ to developing D-Cinema. He said things were moving very quickly. One morning soon we’ll wake up and the film reel will be gone.

Exploring D-cinema 2 concluded with a reception in ‘The Great Hall’, 309 Regent Street, London. Here, 110 years ago, the first UK public screening of film was held. Fifty-four people paid one shilling each to attend the Lumière film programme shown on a cinématographe. A review in the Polytechnic Magazine said, ‘The effect is really most wonderful.’

D-Cinema is coming. We, film lovers in industry, education and life, must prepare ourselves and the next generations for the future and past of cinema. We must make sure it continues to be an effect that is ‘really most wonderful’.

Joost Hunningher
Chair CILECT Exploring D-Cinema 2

(Note: DIGITAL SNAPSHOTS, a DVD by Julie Lambden and Ronald Gow about Exploring D-Cinema 2, is now available. Check www.dcinema.org.uk for availability.)
Digital 3D Projection Developments

3D Cinema has had a long history of coming into fashion and then disappearing again, following the whims of the marketplace. Providing 3D images from film requires a lot of skill in the projection box, normally requiring two film projectors which must be precisely aligned and adjusted, usually 'by eye', in order to ensure that the two images on screen fit precisely on top of each other. The slightest mis-alignment, especially vertically, can cause considerable discomfort for the audience, and many people can't bear to watch 3D images for long periods of time. Nevertheless, 3D has always had its devotees, and audiences are still enthralled by the magnificent images from the one system that has continued through the years to offer 3D on a regular basis - IMAX®.

The coming of digital cinema has brought with it new technologies that make the creation of 3D programming achievable without the traditional expensive and difficult process of shooting with two cameras, increasing widely the range of potential 3D programme material. At the same time the introduction of 3D Digital Cinema projectors means that a single digital projector can be rapidly switched to show left-eye and right-eye images in sequence, eliminating projector alignment problems, at least mechanically. Various systems are used, and one example uses the so-called 'triple-flash' mode, where the frame rate is an incredible 144Hz using the complex sequence LRRLLR to feed the correct images to each eye. Other systems use 96Hz, but it goes without saying that the digital server carrying the movie needs to be able to provide data to the projector at a much faster rate than normal.

One system uses 'active eyewear', fairly complex glasses with built-in switchable LCD shutters that are synchronised by infra-red signals from the projection room to ensure that the appropriate images reach each eye. The system works extremely well, providing good images on normal cinema screens, but such glasses are fairly expensive, and commit the cinema to having to collect and clean the glasses between performances.

Another popular system passes the light beam from the projector, which contains the rapidly switched left and right images, through a 'polarisation modulator' mounted on a bracket in front of the projector. This is a liquid crystal shutter that phase shifts the light from the projector, which has first been linearly polarised. The output from the polarisation modulator is effectively a beam that switches between left and right-hand circularly polarised light at the frame rate, and the inexpensive passive polarised glasses (cheap enough to give away after the performance) ensure that the viewer sees the appropriate images in each eye. The only real problem with this system is that, as 3D people have known for years, the reflected light from a standard white cinema screen cannot maintain the phase of the polarised signals, so the only way for such a polarisation-based system to work is for the cinema to install a 'silver screen', which does maintain the polarisation discrimination. Installing a new screen for 3D performances is expensive and inconvenient for theatre management, of course, especially as silver screens have different gain characteristics than the normal Perlux types, and can mean that 2D images from the silver screen can be less than ideal in some parts of the auditorium.

So what has really been needed for some time is a method of showing 3D movies that doesn't require a silver screen and doesn't need active glasses. Those of us who keep an eye on new technologies have known that there were various laboratory techniques that might be able to achieve this holy grail, but the first hint that something practical might be possible came in a Dolby press release, which TDP reported its last issue, saying that they are going to offer a 3D digital projection system that will work with existing screens and inexpensive glasses.

The company is, understandably, reluctant to reveal much about its plans before it is ready to bring the system to market next year, but we do know that they have been working closely with German research company INFITEC (acronym for interferenz filter technik) which has developed a new technique to display stereoscopic images.

To try to understand the basics of what the system does, we need to go back to one of the earliest stereoscopic techniques, commonly known as Anaglyph, in which the 3D effect comes from a pair of stereoscopic images that are printed in two different colours, usually red for the left image and blue-green (cyan) for the right. When viewed with special glasses having the corresponding lens colours, the 2D anaglyph image appears in 3D. This occurs because the red lens, through which the left eye views, allows only colour and detail from the red image to pass through into the left eye; anything blueish just appears black. The same thing happens on the right side, where the eye sees only bluish-green colours and nothing from the red end of the spectrum. A properly balanced anaglyph system can give 'perfect' results with black and white film, and although the 3D effect does also work with colour film, the very nature of anaglyph 3D system means that it can’t possibly reproduce many colours accurately, and there are real problems with reds and the various shades of red. It is probably not unfair to describe the standard red and blue-green filters as ‘cheap and cheerful’ in that they can only ‘roughly’ filter out the ranges of colours (wavelengths of light).

Infitec, however, have developed a far more precise system of colour filtering, where the image information for each eye is transmitted in different wavelength triplets of the visible spectrum of light. The spectra of the left and right eye images in the INFITEC system are carefully tailored and precisely complementary to each other. Precise colour filtering allows two different spectra, each containing a narrow band of Red, Green and Blue components, to be fed to each eye. Since the human visual system can build up good colour pictures from even fairly narrow band red, green and blue stimuli, the Infitec system allows good 3D colour images to be seen when using passive glasses and a standard white cinema screen. Ref: http://www.dambratec.com/resources/infitec_english.pdf

We expect to carry a detailed article from Dolby about how the techniques developed by Infitec will be used as part of the Dolby Digital Cinema System in a future issue of Cinema Technology.
It’s About Choice

If you are considering D-Cinema for your theatre and haven’t spoken to Christie yet, ask yourself this:

• Does my provider hold its own DLP Cinema™ license and look to meet DCI compliancy?
• Is my provider truly independent of OEM ties and in full control of the support they offer?
• Does my provider develop its own systems for Film cinema, E-Cinema and D-Cinema?
• Has my provider got real-world experience of a large-scale deployment of D-Cinema?
• Has my provider got real-world experience of a large-scale deployment of D-Cinema?
• Is my provider the digital projection supplier for the UK Film Council’s DSN?
• Has my provider been responsible for more than 80% of UK Digital Cinema installs to date?
• Does my provider have a proven NOC to deliver remote monitoring and on-site response?
• Has my provider got more than 75 years experience designing systems for public cinema?

Don’t make a rash decision. Please give Christie a call, we offer FREE consultation - without obligation.

It’s About Choice - be confident you made the right one.

Visit the Christie Digital website for full Digital Cinema Projector details:
www.christiedigital.co.uk/portfolios/cinema/index.asp

ViewPoint
200 Ashville Way
Wokingham
Berkshire, U.K.
RG41 2PL

Ph: +44 (0) 118 977 8000
Fx: +44 (0) 118 977 8100
sales-europe@christiedigital.com