


Issue 1 • June 2006

 **B•K•S•T•S The Moving Image Society**

# TDP

## TRAINING FOR DIGITAL PROJECTION

A REFERENCE GUIDE  
TO DIGITAL CINEMA

**CELEBRATING  
75 YEARS**



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**A supplement to Cinema Technology**  
**The leading specialist publication for cinema industry professionals**

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The Society exists to encourage, sustain, educate, train and provide a focus for all those who are creatively or technologically involved in the business of providing moving images and associated sound in any form and through any media. The BKSTS works to maintain standards and to encourage the pursuit of excellence in all aspects of moving image and associated sound technology, in the UK and throughout the world. The Society is independent of all governments and commercial organisations.



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#### On the cover:

*A Barco DP100 Digital Cinema projector with a complete  
Dolby Digital Cinema installation, at the Odeon Cinema,  
Wimbledon. The equipment includes Disney Digital Cinema  
3-D facilities, and was installed by Bell Theatre Systems.*



# TDP... Training for Digital Projection Welcome!

Welcome to the first edition of a brand new publication aimed squarely at projectionists, and in particular at those projectionists who are shortly going to find themselves involved in the digital revolution that is just starting to spread throughout the cinema industry.

BKSTS - The Moving Image Society has a long history in the training of people within the film industry, and, amongst many other activities, organises seminars and training courses for cinema projectionists. BKSTS member companies are playing a significant part in the determination of the emerging standards within the digital cinema business, working with the European Digital Cinema Forum, the US (DCI) Digital Cinema Initiative, and with the manufacturers of digital equipment, and the Society recognises the new awareness of the ground-breaking effects that the introduction of Digital Cinema is currently having on the industry, as reflected in the various initiatives being introduced by government and the UK Film Council.

Rapid change in the industry is imminent - now that the long-discussed international standards are virtually finalised the roll-out of digital cinema is likely to be extremely rapid, not only in the form of the cinemas which are being created as a result of the UK Film Council's Digital Screen Network, and which are discussed in detail later in this issue, but as the large commercial cinema chains realise that they must not be left behind, and recognise the significant commercial advantages that Digital Cinema can bring to them.

The cinema exhibition industry will soon be faced with a situation where virtually all of its current technical staff will require re-training to accommodate digital cinema. There is also a need within the management structure for re-training so that the full cinema team can benefit and work together to create a greater enjoyment for the viewing public.

To support the ongoing re-training of cinema staff which will follow the current installation programme in the UK to ensure that the whole 'change' process goes smoothly and makes the optimum use of the considerable amounts of other funding being directed towards Digital Cinema, the BKSTS is introducing this new quarterly magazine, containing technical information including articles written by experts, dealing with digital technology and techniques as they affect the cinema exhibition industry. The issues of TDP will form a series of part-works which will eventually form a complete digital cinema reference work for projectionists and cinema management teams. Although very different in its layout, it is expected that this new manual will take its place in every cinema, as a technical reference book on Digital Cinema, alongside the long established Projectionists Manual, which the BKSTS produced with the Cinema Exhibitors Association, and which, being recognised for its unique content and its technical excellence, is to be found in most projection boxes in this country and many throughout the world.

TDP won't always be easy reading, that isn't its primary aim, but the various parts will build into a technical reference guide to Digital Cinema, and it is hoped that TDP will form part of a nationwide training scheme to include specialist courses for cinema projectionists utilising venues such as the European Digital Test Bed at NFT3 on the South Bank and our special links with other organisations such as the European Digital Cinema Forum, the DCMS/DTI Digital Cinema group, the Cinema Exhibitors Association and the Film Distributor's Association. We

hope to carry information about the structured training course which accompanies the UK Film Council's digital cinema installations.

The aim is to establish an accurate and well-respected information database on Digital Cinema. The contents will be provided by the experts who form the BKSTS Cinema Technology Committee, which includes senior managers from small and large cinema chains and from companies who provide equipment to cinemas, many of whom are currently playing ground-breaking roles in the development of Digital Cinema.

The BKSTS believes that the introduction of this completely new magazine aimed squarely at the training of all those involved with Digital Projection will go a long way to support the UK Film Council's role of stimulating a competitive, successful and vibrant British Film Industry and culture throughout the nations and regions of the UK. Other European countries are extremely interested in how the UK Film Council is establishing the Digital Screen Network, and the new magazine could help the UK's reputation as a leader with great expertise in this fast-expanding field. The BKSTS is at the forefront of showing that the UK film industry is a leading force in film capture, creation and display and recognises the need for skills training which will show the overseas market that their product will be handled professionally, encouraging overseas productions to invest in the UK market, satisfying the criteria set by the Film Publications Fund.

We are grateful to the UK Film Council Publications Fund for its support.

*Jim Slater*



## The Digital Cinema Experience So Far

The 'Digital Brains Trust' at the UK Cinema Conference 2006 allowed speakers with practical experience of the UK Film Council's Digital Screen Network to tell other operators about their findings, for better and (rarely!) for worse.

The afternoon of the UK Cinemas Conference 2006, Sponsored by Christie and Sound Associates, had the overall title 'The Digital Brains Trust', and this ultra-topical session brought together a number of speakers with direct practical experience of the digital cinema world, to share the lessons that they have learned with the wider conference audience.

*David Monk*, well known to BKSTS Members as an authority in the Digital Cinema business, having worked in the area for 15 years, chaired the sessions, beginning with a summary of the challenges described during the morning. He said that Digital Cinema promises to answer many of the questions that were raised, and it was puzzling that it seemed to have taken a lifetime to get off the ground, when it can show films as they really should be seen. The afternoon session would focus on the opportunities that DC was bringing to the UK, which is very well positioned, with the Digital Test Bed and the film Council's Digital Screen Network, which is using DC to make the independent cinema sector even more successful. The industry must cope with whatever changes come along, but above all we must keep the cinema experience special.

Steve Perrin has the grand title of Deputy Head of Distribution & Exhibition, UK Film Council, but is known to most of us simply as the guy who has made a once risky-looking government project work on time and to

budget, a rare achievement in government circles these days. In the first of his two slots during the afternoon, Steve gave the background to the setting up of the Digital Screen Network, and explained its objectives as basically non-technical, but aiming to widen and strengthen the market for specialised films, to provide more flexible models between distribution and exhibition, and to increase the market by 40%. The building blocks of the DSN are the new high-spec Digital Cinema projection systems, the 240 new digital screens that are being set up around the UK, the specialised films, and the growing audiences for such films. It was good to hear him announce that phase one of the DSN rollout is now complete, with 50 screens installed in the West End, in the North West, and in Yorkshire. He praised the distributors for the high level of



support that they had given to the project, and said that the next phase of installations would begin in April, to be completed by Spring 2007.

### Eat Cinema

Steve wasn't the only speaker to comment on the benefits that the new 'EAT Cinema' channel (on Sky 199), backed by AIM, the All Industry Marketing for Cinema Committee, is already bringing to the industry. The channel is dedicated to publicising the big screen cinema-going experience, broadcasting movie news seven days a week, helping viewers to decide which films they might like to go and see, providing news of forthcom-



*Dave Monk*



*Steve Perrin*

ing releases, behind-the-scenes and red-carpet coverage and competitions as well as offers and interviews with the stars. The new channel's website [www.eatcinema.com](http://www.eatcinema.com) provides a one-stop information service to find out what's on the big screen.

#### The Future for the DSN

In rather tentative mode, Steve then looked at possible ideas for the future of the DSN. The key to that future obviously relies on more funding being made available, but if such funding can be found, Steve obviously has no lack of ideas. He would be interested in seeing an extended commercial rollout of the DSN, and in changing booking and distribution practices to suit the new world of digital distribution and exhibition, with the major aim being to increase and widen audiences for specialised films. He would like to get the industry to a position where far more or most films are delivered to cinemas as digital masters, and, somewhat tongue in cheek, suggested that something else for the future would be even more conferences on digital cinema!

#### Explaining the Technology

Another of the Digital Screen Network pioneers, the Director of Digital Cinema for Arts Alliance Media, Fiona Deans, first introduced AAM and then went on to explain the background to their Film Council bid. She showed how they had taken the UKFC requirements and come up with a proposal to use the latest and best technologies to satisfy these and also to offer a path to the future, with built-in upgradeability. She explained the choice of two different 2K DLP Cinema projectors for different venues, of the server and multimedia switcher, and stressed the importance of ensuring that the equipment must interoperable - i.e. it must be able to work with the existing automation and safety systems in cinemas. Upgradeability to whatever newer standards might come along, especially the DCI requirements, was vital to the long term success of the project,



Fiona Deans

#### 2K DLP Cinema™ Projector



OR



#### QuVIS Cinema Player



External storage for  
5 films



Alternative content  
switcher



and all the equipment, especially the servers, was chosen with that in mind.

#### Keeping it working

Fiona explained the comprehensive service and support arrangements that have been put into place.

- Preventative Maintenance Visits include the replacement of filters, image calibration and performing any necessary upgrades.
  - A 24 hour support line allows the projection team to report faults, to get help with operational issues, and to ensure that any problems are rapidly escalated to trained engineers where necessary.
  - Remote diagnostics enable potential issues such as overheating to be identified before they cause payout problems, and can enable corrective action to be taken.
- A maintenance centre can contact any of the network's projectors via an ADSL line to checkout any machine.

• On site call outs  
If all else fails, a trained engineer will attend on site to sort out any problems.

- Six- year Warranty - speaks for itself, and contradicts those who say that any digital equipment will be obsolete in no time!

#### The Importance of Training

Fiona stressed the important part that training plays in the Arts Alliance digital cinema network, and she described the various steps in their carefully thought out training programme.

- Projectionist Training  
Projectionists must attend a two-day training course at AADC premises - this training

is free for up to two projectionists per digital screen. The course covers the basics of loading programme content into the equipment and building up shows. The operation of the projection and storage equipment is explained and demonstrated, and since the training is at Arts Alliance, projectionists are encouraged to get 'hands-on' experience of using the kit before they return to their own cinemas.

The projectionists are taught basic troubleshooting techniques and tasks like changing lamps.

The second phase of the projectionists' training takes place on site, whilst the equipment is being installed at their cinemas. The installed equipment is carefully explained to the projectionists, and they are taken through each part of the equipment, reviewing the points that they had initially learned during the off-site training course.

- Technician Training

A one day course is available for cinema technicians and chief projectionists, free of charge for one staff member per digital screen. This course goes deeper into the operation and advanced set up of the projector, and provides troubleshooting assistance and basic maintenance training.

- Manager Training

Realising that digital installations may allow and require different working methods in cinemas, Arts Alliance have set up a half-day course aimed at cinema managers, and again this is free of charge for one staff member per digital screen. This course explains the basics of digital cinema, and help

managers to understand how the changes involved may impact on the wider, non-technical operations of the cinema.

Experience and feedback gained from the early months had highlighted a number of other training issues which were currently being addressed. These included the need to communicate the overall purpose of DSN, to provide further information about the Quvis equipment, and, interestingly, to provide a degree of reassurance to projectionists about the effect that the introduction of digital technology is likely to have on their job prospects. The decision to do the initial training in a classroom setting had been vindicated, since on-site training tended to be subject to all sorts of interruptions, but it might eventually be possible to pack the information currently provided on the two-day course into a single day, which would have financial benefits for those who currently have to arrange to stay overnight in London.

### Good Progress

Fiona was obviously delighted to be able to confirm to the audience that all the 50 sites in phase one of the DSN project had been installed, just ahead of schedule! So far 100 projectionists have been through the training courses and more than 20 digital films have been shown. Two of the DSN sites had been used to provide 3D digital screening of the Disney 'Chicken Little'.

A DSN web booking system has been launched. Fiona announced that they had already put on what was the first commercial screening of a movie using the JPEG2000 and MXF packaging features that the Digital Cinema Initiatives specification requires, and she gave details of the expected timings of the upgrades towards DCI compliance that would be carried out on the DSN equipment in the coming months. The introduction of JPEG 2000, MXK packaging and the required modifications to Security Keys were imminent (March/April 2006). Other features necessary for DCI compliance would be introduced during 2007, including FIPS140 certification, which concerns the physical security of the delivery of movies and the equipment, upgrading the encrypted link between the server and projector to the Cinelink 2 standard, and Watermarking.

### Hands on stuff - installing the kit

After the management overview from Arts Alliance Media, it was interesting for technical types to hear directly from the Managing Director of one of the country's premier cinema equipment installation companies, Graham Lodge of Sound Associates. He took the audience through the whole pro-



*Clockwise: Graham Lodge; a challenging installation; the Z-filter; ventilation solutions*

cess of installing the Digital Screen Network equipment in a typical cinema, although as he explained, and showed a fascinating range of slides taken during installation, every cinema is different, and probably none can be regarded as typical. The complete process takes place in three stages: A pre-site survey, the delivery and installation of the equipment, and then commissioning the equipment and training the staff.

The vital pre-site survey includes the completion of a detailed form containing full details of every aspect of the cinema, including equipment access routes, available doors, corridor widths, parking arrangements etc. which is invaluable to enable the third party equipment delivery contractors to carry out their part of the work before Sound Associates engineers do the technical installation and commissioning.

Photographs are taken and a summary of the work required is prepared, and again it was interesting to see how detailed this was, with one example showing:

- 3 phase power - no extra work needed in this case, but often an extra supply is required.
- single phase power - extra 16 amp socket required
- Porthole - new porthole required
- Heat Extraction - Additional ventilation required. Graham said that providing increased ventilation is often one of the biggest problems for a cinema.
- 35mm kit - 35mm equipment will need relocating

- Telephone - a dedicated ADSL line is required
- Audio - audio upgrade needed
- Fire Alarm - connection required
- Other works - none required

### Careful Planning

Plans of the layout of the projection area are carefully drawn, and if a new port is required, plans are drawn up for the builders. The whole DSN project is obviously designed to be as future-proof as possible, and I was interested to learn that the requirement to provide for digital 3D is now part of the pre-installation survey, one reason being that the Z-filter that modulates the polarisation of the 3D beam takes up some space in front of the projection lens, so the installation has to ensure that there is sufficient space between the end of the lens and the porthole for the Z-filter (left of photo above) to be properly positioned.

### Everything Ready

Before the Sound Associates team come to the cinema to carry out the installation they have to be assured that everything is ready, all the requirements that were highlighted on the pre-installation survey have been carried out, that all building and electrical work is complete, and that the projection staff have been on the Arts Alliance training course. SA have to be guaranteed access to the appropriate screen and its box for two days - this is not negotiable, Graham said, and the SA team need to be able to complete the job in one go, with no need to return the cinema

to finish anything off at a later stage. This is vital when a tight installation programme covering geographically separate and remote parts of the country must be made to work on schedule.

Once everything is wired up and the equipment aligned optically and electrically adjusted, the on-site training of the operational staff can start. They are taught how to take incoming programme material and load it onto a local drive or server, and then shown how to build a show and operate the new projection equipment. Once the system is running to everyone's satisfaction, a Cinema Acceptance Certificate is issued, and the SA team moves on to the next installation.

Graham told some interesting tales about the various installations that SA have carried out, and showed some slides that proved conclusively that the multiplexes aren't always the easy option when it comes to having to get equipment up stairs and around corners into difficult projection boxes.

#### Learning from experience

Graham also highlighted a number of operational issues that have become apparent now that many cinemas have installed digital equipment. Since most are still running 35mm projection kit, parallel operation is likely to continue for a long time ahead, and at the moment it is the norm to run the ads and trailers from 35mm, even when the feature film is digital. Ads and trailers might actually be sitting in the middle of a platter when required. Interfacing the equipment with the existing automation equipment has proved difficult in some instances, but much has now been learned about this. Another aspect that has given rise to some initial difficulties is the availability of 'unlock' codes for certain shows. These are sent to the server via ADSL, and it has been found to be very important to check that the codes are actually in place before the show begins.

#### Lessons for the future -

##### **MORE of everything**

Having installed large numbers of digital projection systems, Graham said that they had learned several lessons that should be taken on board by cinema architects and those designing new cinemas. Any new cinemas should be designed so that they have

- more space in the projection room
- more ventilation
- more portholes
- more power
- better access via both internal and external doors

Graham said that he had come across cases of multiplexes where projection equipment had been fork-lifted in before the building was complete, and the wall then later



Rob Kenny

bricked up. It didn't make life easy when new projection equipment has to be installed! The message was that a little more thought at the design stage will make cinemas of the future much easier to change, whether for regular equipment changes, or to go digital.

#### **The Impact on Exhibition...**

was the title of the presentation from Rob Kenny, General manager of The Curzon Soho, in which he promised to give the view of an independent about the effects on the business of a move to digital projection. The Curzon Soho has three screens, Screen 1 has 249 seats, with digital projection; Screen 2 has 120 seats; and Screen 3 has 133 seats with digital projection.

#### **Reality v Expectation**

Rob said that he had expected the introduction of digital projection to have a very small impact, whereas in reality it has been much bigger. The coming of the DSN equipment was welcome, but they had previously hired in digital projection equipment, so knew what to expect. Image quality wasn't better than from film, as is so often claimed, purely because the Curzons already received first-run show prints. He appreciated that regional cinemas are not always so fortunate with their prints. No customer had noticed a change in image quality or commented on it, which Rob said he felt was good.

#### **Practical issues**

Rob said that they had experienced no major issues with the DSN equipment, but a number of minor ones. Most of the problems had been easily sorted out off-site via the ADSL diagnostic system, which works well. No shows had been lost, but they had experienced a last-minute panic leading to a few minutes delay with one show. The biggest problem initially was that the projectionists found it less than straightforward to write the scripts with which to build the shows. This has now been overcome by further training, and no

longer presents a problem.

#### **The Effect on Programming**

Rob said that the programming at The Curzons had always been very flexible, and since the digital installation in July a third of the total output had been shown digitally. The shows had been backed up with 35mm film initially in case the digital kit broke, but this had proved totally unnecessary. Rob listed some of the interesting movies that had been screened digitally, including King's game, Saraband, Breakfast on Pluto, Cock and Bull Story, Good Night and Good Luck, Crossing the bridge, and the unexpected South African success story Tsotsi. There had been some interesting experiments, including the showing of The Road to Guantanamo on the day after it had been 'premiered' on Channel Four TV, and similar experiments would help to increase our understanding of the effect that TV showings might have on cinema attendance. He hoped that the coming of digital would be accompanied by more flexibility from the distributors, allowing them to continue to run some films for longer, even though the shows wouldn't necessarily be full.

#### **More Digital Projectors, Please!**

Rob raised the question that was to be echoed later by other small cinema operators - if a digital print attracts good audiences to the 300 seat Screen One for a fortnight, how can you manage to move it to Screen 3 to continue showing it to smaller audiences? At the moment the only answer is to order up a 35mm print, which is expensive for all concerned. If digital cinema is to make the most of its much-vaunted flexibility, then cinemas like The Curzon will need a digital projector for each screen.

#### **Non Film Council use of the equipment**

Rob said that they had successfully shown a number of non-feature films, and highlighted Tibet - A Buddhist Trilogy as one that had run for three weeks, saying that it was good to see that a number of smaller films are being funded to produce 'HD' copies that can be played out on the top class Digital Cinema projectors. They had also carried a Latin American Film Festival, hosted a Joe Strummer season, a Halloween Film Festival, a Football Film Festival, and numerous other events and cinema hirings. As far as he was concerned the DSN equipment was already achieving one of its aims, to make a wider range of movies easily available to more people. He felt that the next phase should be for this to lead to an increase in the total cinemagoing audience, and said that all those involved in the cinema business would need to work together to achieve this.

#### **A View from the Lake District**

Derek Hook then addressed the same topics



Derek Hook and Zeffirellis

as Rob Kenny had done, but from a viewpoint centred some 300 miles to the North of the metropolis, in Cumbria's beautiful Ambleside. Derek is Managing Director of Zeffirellis, which consists of a two screen cinema and an excellent restaurant/cafe/bar on one site and a further two screens a little down the road. Cinema seats can be pre-booked as part of their 'Movie Deal' which gives a two-course meal in the restaurant and a reserved cinema seat. Derek was enormously enthusiastic about the DSN project and addressing his Reality v Expectation brief he started by saying that Independents aren't used to receiving gifts, so he could hardly believe his luck when this beautiful new projector was offered, and he admitted to wondering what the snags might be, and whether the new projector might prove to be something of a Trojan horse! In reality, the only complaint he had was 'too much paperwork', and he was delighted with the DSN kit. The images and sound are stunning, the installation by Sound Associates went extremely well, and the new Christie CP 2000 2K Digital Cinema projector has been fitted in its own space.

### Practical issues

The only problems they had experienced

with the equipment were minor ones, and they had never lost a show. Derek instanced a snag when they tried to show the movie Hidden, when the screen just went red, but said that the Arts Alliance telephone support team were absolutely brilliant and did a fantastic job with their remote diagnostics kit in getting everything working quickly.

### The Effect on Programming

They had shown Nania for four weeks, Saraband, March of The Penguins and a digital Brief Encounter and had hit the problem of having to get an additional 35mm print for Penguins, so as to be able to move it to another screen. The need to move a print to another auditorium and its subsequent relationship with booking other films is a topic that Derek said is important if the flexibility in programming that digital presentation can offer is to be maintained. He had found that film distributors are now warming to digital and being helpful in providing more movies as digital prints, which had enabled Zeffirellis to bring forward some movies in their planning schedule.

### Non Film Council use

Derek said that they had successfully shown a number of programmes from DVD, with excellent results and had an evening celebrating Bob Dylan's Hard Rain book. He was sure that the digital technology represented the way forward for cinema.

Derek finished his very positive presentation with two comments that must delight all those involved with the Digital screen Network project:


- The whole cinema industry should go digital as soon as possible.
- Thank you from a genuine independent to the Film Council and everyone involved.



Hamish McAlpine

### Is Digital Helping Distributors?

Tartan Films distributes specialist films, art house films and Asian Cinema products for cinema exhibition and DVD, and its Chairman, Hamish McAlpine, took a look at how the coming of digital cinema has affected specialist distributors. With the help of some remarkably candid statistical information he showed that in financial terms digital distribution wins hands down, with a typical foreign language film making a saving of £7,700 over eight 35mm prints, and break even occurring after just three prints. For English language titles, where the film prints are cheaper, there are still savings, with break even occurring at the 6 print point, and reductions in digitisation costs making this likely to fall to 4 prints by the end of 2006. For those distributing 100 prints, the financial figures are even more startling, with savings of £58,000 being possible when using digital distribution. Tartan Films certainly wants more and more digital distribution as soon as possible!



### Financial Issues of a digital release

#### English language film analysis 100 prints

- **35mm release on 100 prints release vs a digital release**
- **Digital release:**
- \*Encoding, encryption and encoding of 5.1 surround sound - £2,037.50 per title hour x 1.75 (a film 98mins long – rounded up to nearest 15mins) + £100 for encoding of cert and distributor logo.
- E.g. For film = 1.75 hours @ £2,037.50 ph + £100 = £3,666.00
- 100 x Digital copies @ £78 each = £7,800.00
- Total £11,466.00**
- **Analogue Release**
- 100 x prints @ £700 each = £70,000.00
- Saving for a digital release = £58,534.00
- It should be pointed out that there is a cost of £78 per site for additional venue changes post release.

### Technical / Practical issues

Hamish underlined the problems over 'holdovers' that the other speakers had raised, saying that after the first two or three weeks of a digital release a 35mm print is needed as well, adding to the on-costs. A digital print is only good for one booking, whereas a 35mm print can be played throughout an entire theatrical run. He said, with a smile, that he hoped that Steve Perrin had been paying attention - more digital projectors are definitely needed out there!

There are real problems with the current availability of material in digital form, with much good film material not available digitally. New contracts need to insist that films are produced with an HD version as well. Another disadvantage of digital is that distributors still have to physically ship digital prints to sites - electronic distribution still seems a long way away. There is also an occasional problem that a Director is reluctant to have his film shown digitally.

There are, however, numerous advantages to the digital distribution route. Apart from the tremendous cost advantages already detailed, digital distribution means that the quality of image and sound can be far more carefully controlled throughout a film's release, since digital copies are not subject to the inevitable degradation that occurs on a film print. Hamish said that they have found that the digital prints are far more robust than film prints and less prone to being damaged by human error or a projection malfunction.

### The Effect on 35mm releases.

The move to digital offers a world of new possibilities. Small distributors like Tartan can now afford to compete with the majors on a more equal footing by being able to afford to release a far wider range of films on 'day and date', since the cost of providing extra digital prints is much smaller than for 35mm. Not having to spend so much on materials also allows a distributor the option of spending more money on advertising the launch.

Digital distribution enables distributors to be far more flexible with their release plans, since extra digital copies can be produced at very short notice. It also enables distributors to go wider on the second weekend of release if the film has been a success, without the financial worry of having expensive under-used prints in the event that the film then underperforms in weeks three and four.

Smaller films that were shot digitally have historically been denied a theatre release because of the cost of creating a 35mm blow-up; digital distribution allows these to be shown in a far wider range of cinemas.



This will enormously encourage cultural diversity, not only by making more films available, but also by encouraging audiences to explore far wider options in their viewing habits than have previously been possible. This advantage will extend to local filmmakers, who will find that it is financially viable to show their films on a purely regional basis within their own community.

Saying that the coming of digital represents **The Democratisation of Cinema** Hamish said that more and more films being made in HD would lead to increased diversity of programming, increased diversity of audiences, and increased attendances overall. Tartan's early experiences with digital suggest that all these things are happening. He presented a very interesting case study of the digital release of the Ingmar Bergman film *Saraband*. Tartan had released this entirely in digital format, and had made and distributed six digital prints.

The Box Office take to date had been to £40,000, which led, after all expenses, to the movie roughly breaking even for the distributor. But the entire cost of the six digital copies had been only £1000, because Svenska Filminstitutet had digital materials available which enabled Arts Alliance to offer special rates. The key comparison was that if Tartan had released the film on analogue prints this would have incurred extra costs of at least £10,000, which would have made the release totally uneconomic.

Hamish ended his presentation by repeating previous requests to the UK Film Council to provide digital projectors for second screens, and provided three very positive conclusions about digital cinema:

- Digital Distribution offers smaller films the chance to achieve a far

wider release than economically viable with 35mm.

- Larger films now have the ability to earn far greater returns for the producers than was previously possible.
- UK Film Council and Arts Alliance are to be applauded and encouraged to continue to roll out the digital network as quickly as possible in order to make the UK a digital nation.

As though on cue to acknowledge the many plaudits of the other speakers and their repeated requests for more digital cinema projectors (on the same favourable terms as before, of course) Steve Perrin returned to the lectern to talk about the future and explain the Film Council's Audience Development Strategy. With a budget of £3 million over three years, the aims of the project are fourfold:

- Encourage greater experimentation in film viewing habits
- Increase awareness and opportunity to see a wider range of films
- Provide a national programme, but with local delivery
- Achieve a greater appreciation of film as both cultural and educational as well as for entertainment.

The three main target audiences of the project are:

- General cinemagoers who have an interest in seeing a wider range of films
- Young adults who visit the cinema regularly but who could be encouraged to widen their viewing
- Film 'buffs' who will be provided with greater access to a wider range of films as a result of the DSN initiative.

Steve said that their strategy to achieve these aims was to increase communication via mainstream and electronic media, to provide greater awareness of what is on and where, to provide more background information about film, and to encourage press and TV to provide greater coverage





*The afternoon panel*

of specialised films, rather than restricting themselves to the blockbusters as they tend to do today.

An open tender approach looking for a consortium having all the relevant skills produced 11 tenders, and after reducing these to a short list of three, discussions were now going on with one consortium, although no award has yet been made - an announcement will be made once the selection process is complete.

#### **The Afternoon Panel Session**

All the speakers were kept on their mettle, as Chairman David Monk steered the questions to the most appropriate panel member. Mark Cosgrove from Bristol's Watershed cinema pointed out that several speakers had already commented on the need for more than one digital projector in order to maximise the business case for digital cinema. Several panel members agreed with the case, and although Steve Perrin was obviously pleased by how well the DSN project was going, he wasn't in a position to tell people that any more funding would be provided after the first tranche of some 240 projectors had been installed. Steve did answer a question from a small cinema operator who asked if a 1.5K projector would be good enough for a 50 seat auditorium, saying that the DSN had had to go down the 2K route in order to be sure that they would be able to obtain the widest range of films from all the distributors, but that if any particular cinema and their distributor were comfortable with showing lower resolution images, he had no objections. David Monk felt that this wasn't the right way forward, explaining how Hollywood had started from a 4K requirement and that there is a need to be careful of dropping below the 2K threshold. The better way forward would be to do everything possible to bring down the cost of 2K equipment, and he noted that a 2K 'domestic' projector is now on the market for £6000. He noted that some speakers had used the language of 'HD', and said that it would be much better to talk about a

D-Cinema release, since these should have higher production values than an HDTV programme. An audience member pointed out that it won't be possible to connect 'low-res' digital projectors to D-Cinema servers, and Fiona Deans explained that such restrictions are necessary to protect the content, and that security is vital to the continuing success of the digital cinema business.

David Pope of DTS pointed out that although the successful Film Council project had been entitled the Digital Screen Network, the programme material is not being distributed by a network, and he asked whether there is any prospect of being able to send the pre-show advertising to cinemas via their ADSL link. Fiona Deans said that digital ads would need to be the same quality as the features, and one of their cinemas did manage totally digital shows with a digital pre-show. It was pointed out that, given the size of the current digital cinema files, perhaps around 250 Gbytes, network delivery isn't yet practicable, either technically or financially, since a typical movie might take many hours when downloaded over a satellite. US operators think that distribution would need to take place to perhaps 6,000 cinemas before it becomes economically sensible.

Vincent Jervis of City Screen said that the speakers had shown that distributors were getting savings - how is the UKFC going to assist exhibitors to get better terms? Steve Perrin said that that isn't part of the Film Council's role. The real benefit of the project is that any cost savings should be put into the wider distribution of a wider range of films, and already this is showing that such films can be more widely distributed than if 35mm prints had to be provided. Hamish McAlpine pointed out that Tartan lose money on 9 out of 10 films that they release. The DSN will give exhibitors more product and a greater diversity of films, which will in turn increase their revenues. Max Livingstone-Learmonth from PWC Strategy asked whether digital cinema

would help or hinder piracy. Fiona Deans said that digital would help to guard against piracy, noting that the encryption systems in cinema are similar to those used by the banks. Watermarking was also likely to help. Graham Lodge explained that film data can be locked before and after showing, so that it is not possible to gain access to it. Watermarking shows which server, which showing, and which print a pirated copy was made from. Much pirated material has been shown to come from the studios. Hard drive disk packs weigh less than a reel of film. Jason Power of Dolby congratulated all involved in the successful installation of the first 50 digital screens. He asked about the use of the equipment for non Film Council material, noting that relatively low-quality DVD sources are sometimes used, and asked what flexibility a cinema has in connecting up other sources. Steve Perrin said that as long as a cinema carries out its UKFC commitments they can do what they like with the equipment. Rob Kenny said that operators need to think more creatively about the use of down time. Sports events can be popular, and the quality from a DVD in a cinema can be fine - it will be the best that any home DVD viewer has ever seen. Derek Hook said that he is still experimenting with alternative content, and Zeffirellis will be trying the effect of showing SkyHD on the big screen, as well as hosting daytime business conferences. Tony Williams asked Graham Lodge about the range of costs that a typical cinema might incur when becoming involved with the DSN project. Graham said that anything from zero to £10,000 was possible, and quoted Amblesdie as having to pay around £8,000. Steve Perrin pointed out that UKFC has a special fund to assist small cinemas, and said that the average exhibitor spend was about £4,000 per screen. Anthony then asked if there might be a danger that mixing different types of input signal, DVD, video etc. might degrade the high quality image of digital cinema. Derek Hook said that they always make it clear when they are using DVDs, and other panel members agreed that it was important to be honest with the customers. Steve Perrin said that, practically, most customers would be seeing better quality results from the digital cinema projectors than from any other source.

David Monk drew the formal proceedings to a close, but animated discussions on the vast range of topics that had been raised during the day continued for a long time afterwards, helped by the excellent drinks reception hosted by Sound Associates.

*Jim Slater*

# Compression and Packing

Wolfgang Ruppel of T-Systems and Benoit Michel of XDC provide an introduction as to how digital content can reach cinemas



T-Systems



When we examine the delivery of content to cinemas, three major technical areas have to be considered: first, the compression formats for the image and audio essences (including uncompressed audio), secondly the packaging format which serves as a container for the compressed essence streams and associated metadata, and, as the third area, the applied encryption scheme. Here we discuss compression and packaging formats for cinema use.

## Image Compression

Digital Cinema distribution includes the process of transmitting motion pictures to movie theatres and their subsequent projection. Compression is thus needed to reduce the cost and time of transmission and storage of the movies. For day to day use, compression ratios are expected to be higher than for the archive by permitting lossy but visually lossless compression. Visually lossless is understood to mean that the reconstructed moving picture after decompression shall not be distinguishable from its original by a human observer when exposed to typical viewing conditions in a theatre.

Digital Cinema has been generating much work in industries involved in high quality video coding, as well as in university labs and standardization bodies. The ideal requirements for Digital Cinema may be summarised as follows:

- High resolution: minimum resolution of 1920/2048 x1080 pixels (a.k.a. 2K) or, even better, four times that size (4K)
- Frame rates up to 150Hz/120Hz,
- Color coded with 10 or 12 bits per component, log or linear, with pre-correction for linear
- Compression ratios that support fast transfers of Digital Cinema programs - typically around 10:1 to 20:1, according to the compression method and the complexity of the image content;

notice that for TV and HDTV distribution, these ratios are around 60:1 to 200:1

- Support for various resolutions, frame rates, quality levels
- Low cost and small size implementation for embedding in projector systems
- Visually lossless coding for distribution when the size of transferred files is important.
- Completely lossless coding for archive applications when top quality is required and the file size seen as less important.

The standardization bodies SMPTE and MPEG have set up study groups on Digital Cinema aimed at defining a standard for digital cinema video compression, considering two main applications, archiving and distribution. Major actors in these activities included industry and universities. The proposed solutions were competing to be the baseline for potential future Digital Cinema compression standards. MPEG finally decided to stop this activity because of a lack of cooperation of the industries involved (probably due to intellectual property issues). More recently, joint efforts led DCI to recommend a technological solution for distribution which is based on a development of JPEG2000.

The compression schemes belong to two main classes: intra-frame and inter-frame coding. The 'intra' class is composed of compression methods addressing a movie frame by frame in an independent way. Each image is compressed, stored or transmitted, then the next one is compressed, etc. These methods have several advantages, such as a easy access to any image in a movie and simple schemes to 'splice' or assemble several sequences together.

The 'inter' class of compression methods use the redundant information between consecutive frames to further reduce the transmit-

ted amount of information. The gigabytes saved because of this advantage are used to gather more detailed information within each frame, leading to a similar quality for less space or to a better quality for the same space as compared to the results from the first class. The price to pay for this advantage is complication within the compression algorithms and the need to decode several images before being able to display a single one. A typical example of intra-frame compression is JPEG2000, while a typical example of inter-frame compression is MPEG-2.

Another way to classify compression methods is by their internal algorithms. Here again, two main classes exist: direct cosine transform methods (DCT) and wavelet methods. DCT deals with the picture by dividing it into small, usually square regions, while wavelet transforms work on the picture as a whole. The practical difference for the viewer is in the way compression errors are visible in the restored image after compression and decompression: with DCT methods, errors are small and confined to the sub-region being dealt with, typically an 8x8 pixel square; with wavelet methods, errors are more global and are often located at high contrast frontiers between objects. It is worth noting that in both cases, at the digital cinema compression rates, those errors are so small that you need trained 'golden eyes' to pinpoint them. MPEG-2 is a DCT compression method while JPEG2000 is a wavelet one.

## Image Compression in the future

As we have seen, the two main existing compression schemes belong to different classifications, with defined criteria.

As the following table shows, the ideal combinations of advantages seem to be in the inter-frame line and in the wavelet column of the table. In the distant future, there could be opportunities to create a new compression scheme taking the best parts of both existing worlds, and some research teams are already working on that.

Compression class	DCT algorithm	Wavelet algorithm
Inter-frame	MPEG-2 (long gop variant)	
Intra-frame	MPEG-2 (I-only variant)	JPEG2000

Another way to classify the available compression methods is to compare their main characteristics. The table shows the main features of both compression methods and that advantages and disadvantages clearly exist with both methods. MPEG-2 gives the best economy in today's applications, while JPEG2000 offers potentially better quality but at a higher price.

The MPEG group is defining a new coding scheme called "MPEG-21 part 13", also known as "Scalable Video Coding" or SVC. This new standard, to be issued at the end of 2006, aims at providing an efficient and seamless scalable video coding solution. The Post-Production industry will be strongly interested by this new standard, since scalability allows proxies to be edited with less powerful computers or over lower bandwidth networks. In case of non-adoption of JPEG2000 compatibility in MPEG SVC, another strategy will be to promote the introduction of inter-frame coding over JPEG2000 within the JPEG group. This solution would potentially have the support of numerous industries that have already invested in JPEG2000. However interesting those solutions could be, they remain long-term goals and don't interfere with the everyday reality we are facing now.

**Image Compression Choices**

As of today, basically two compression formats have been deployed, if we forget to mention the Microsoft Windows Media9 format used in a few demonstrations. For Level 1 and Level 2, almost all implementations use MPEG-2 Main Profile at High Level for the image essence, with a usual picture format depending on the

aspect ratio but inscribed inside a 2048 by 1080 pixels frame. In addition, a proprietary wavelet compression scheme has been deployed by one vendor. Although this looks like guaranteeing some level of interoperability between theatre equipment of different vendors, this is not the case. The reasons are the differences between packaging formats, between the ways metadata is handled and between differences in encryption schemes.

Windows Media9 Compression has also been implemented by some vendors, allowing for the presentation of HDTV at an ever higher compression rate.

The major studios do accept MPEG-2 as a current practice technology, although they insist on JPEG2000 as mid-term codec. Windows Media9 is not accepted by the studios for Level 1, but has its applications for pre-show and arthouse content where quality constraints are more relaxed.

**Packaging Choices**

As of today, due to the absence of standards in the past, the theatre system manufacturers have deployed different packaging formats, mainly concerning the way metadata is wrapped into the distributed packages and the multiplexing scheme. Examples of current practices are MPEG-2 transport stream and MPEG-2 video elementary stream. These data streams are encapsulated within GXF or MXF files: GXF (Generic eXchange Format) is currently used, but expected to be replaced by MXF (Media eXchange Format), the emerging standard. The variety in existing schemes has led to inefficiency on the distribution side from the studios because of the need to cre-

ate different distribution packages of a movie to cover the whole installed base. Almost all theatre equipment vendors are making efforts to overcome this situation by agreeing upon an interoperable file interchange scheme based on MPEG-2 compression and SMPTE/DCI-compliant MXF based packaging and encryption. This scheme has been specified by the MPEG Interoperability Initiative, an industry forum open to all server manufacturers. It is very likely that the MPEG Interop Scheme will be adopted by all major vendors for Level 1 and Level 2 theatre systems and will lead to one single packaging format for almost all theatre systems. It will be possible to upgrade the already deployed systems to the MPEG Interop format, leading to a commonly agreed packaging format which will ease the production of digital products and lower the barrier for the content providers to go digital.

**Roadmap for Level 1 D-Cinema**

The MPEG Interop format is the first step towards fully DCI/SMPTE compliant systems. This format already offers image, sound and security keys packaging. The security keys are distributed in a small encrypted message called a KDM or Key Delivery Message.

The second step will be the shift from MPEG-2 towards JPEG2000 based compression for the mainstream distribution business. With the first step, DCI/SMPTE compliant packaging will be deployed as well as DCI/SMPTE compliant security mechanisms and key delivery although the compression format will - at least for a transition period - still be MPEG-2. With the second step, MPEG-2 compression will be replaced by JPEG2000 compression which allows not only even better picture quality but also a more straightforward access to every frame inside a movie.

*Thanks to the European Digital Cinema Forum for permission to reprint this article from their Guide for Early Adopters.*



Compression method	Compression ratio	Color resolution	Spatial resolution	Random access to any image	Maximal throughput
MPEG-2	Typ. 20:1	8 bits /component	1920x1080 std 2048x1080 non-std	Difficult	Guaranteed
JPEG2000	Typ. 10:1	8 or 10 bits + /component XZY space	1920x1080 2048x1080 +4K	Easy	Not Guaranteed

# Flexibility - a long term solution to DCI compliance

Keith Morris, Marketing and Sales Manager of intoPIX, but perhaps better known to BKSTS Members from his previous work on Digital Cinema with Barco, explains how the move to the all-important 'DCI Compliance' is going to affect all of us in the digital cinema business.



Scratch the polished surface of Digital Cinema these days and behind the stunning presentations, declarations of ever increasing numbers of Digital screen installations and raft of new product introductions that is now ShoWest and you quickly discover another reality - 'DCI' and the language of 'Interoperability' and 'Compliance'.

Since long before its publication in July 2005 the Digital Cinema Initiative (DCI) recommendations document <sup>(1)</sup> - the tablet of stone that now defines 'Digital Cinema' - has been exhaustively combed by equipment manufacturers for its deeper meaning, and potential cost implications.

..... Just how will server and projector manufacturers interpret FIPS security certification <sup>(2)</sup>

..... meet the JPEG2000 compression standard <sup>(3)</sup>, and

..... what indeed will constitute acceptable Watermarking?

In this context is the so called 'Media Block' a realist proposition and if so, by when? How is it defined, and is it better located in the Digital Projector or the Server?

These may be mature considerations but, if the feedback from ShoWest'06 is any measure, these issues now have to be dealt with urgently to achieve the Hollywood's desire to implement the JPEG 2000 compression standard this year, ahead of the deployment of significant quantities of digital screens in 2007, and to fully enable the (only slightly) longer term promise of 4K, 3D and, who knows, even 4K 3D display!

How *will* manufactures meet the multiple objectives of :

- ensuring that they are quickly and fully DCI compliant, while
- attaining true Interoperability, while
- ensuring that they are sufficiently

prepared for the variable cocktail of D & E cinema, digital broadcast and advertising display that is the future?

All of which raises intriguing questions regarding today's technology ...

Can it deliver the necessary processing power to meet even more demanding future applications ...or the flexibility to provide an affordable, and manageable, migration path?

And questions of functionality. In the context of 153 pages of DCI specifications encompassing such matters as DCDM (Digital Systems Digital Mastering), Security, Packaging, Compression, Digital Certificate, Extra-Theater Messages (ETM), and Key Delivery Messages (KDM) requirements, what are the priorities. Just where do we start?

## Today's technologies

Behind the discussion about whether a Texas Instruments (2K resolution) or Sony (4K) 'Digital Eye' is most desirable, there is another - about the 'Digital Brain', its form, function, and for some, even the location of the core intelligence that drives the D-Eye.

Three processing technologies exist today to provide this processing intelligence - ASIC, DSP and FPGA.

Of these, ASIC is the most well established and is the processing intelligence incorporated in the majority of today's Digital Cinema servers. [Application Specific Integrated Circuits, i.e. ICs designed for a particular application, as opposed to ICs such as those for RAM in a PC, are built by connecting circuit 'building blocks' together. The blocks already exist in a library, so it is easier to produce a new ASIC than to design a new chip from scratch.]

However an ASIC is essentially a dedicated device with a fixed functionality and insufficient inherent processing power to meet the needs of an increasingly complex Digital Cinema requirement. Even today a minimum

of three ASIC chips are needed to process at 2K resolution and, depending on the architecture, fifteen or more, *plus* an FPGA controller [Field Programmable Gate Array], will be required for 4K use.

Secondly the use of DSP (Digital Signal Processor) architecture provides an interesting possibility considering its software based reprogrammability and the resulting greater flexibility. It too though has its limits, specifically in its ability to efficiently meet the precise, real time, requirements of entropy decoding - the most critical of all of the many image compression blocks. [Entropy encoders compress data by assigning codes to symbols so as to match code lengths with the probabilities of the symbols - the most common symbols use the shortest codes.]

The third technology uses FPGA, a field-programmable gate array; a semiconductor containing both remotely programmable logic components and standard interfaces.

## Power and Flexibility

At a first glance FPGA appears a strong option. It has the processing power needed for future display applications, its re-programmability containing the promise of cost effective new product development, and its ability to be reprogrammed on-site easing the (potentially considerable) burden of bug fixing first generation display networks.

Additionally FPGA also incorporates both a DSP block for the benefits of its arithmetic computation and benefits from the software flexibility of an on-board CPU. It is then an ideal host for a full Media Block, and furthermore, one that can be equipped with reprogrammable Ethernet, SATA and HD-SDI output links.

Even more compelling still however is the FPGA's high level process integration and its compact physical size, both of which provide significant processing and physical security advantages.

**What Comes First?**

DCI compliance is indeed a daunting prospect for most equipment providers.

Just how and when will manufacturers achieve full DCI compliance when, for example, the FIPS [Federal Information processing Standards] and Watermarking security requirements are still being debated, and DCI compliance procedures have not yet been defined, is still an open question.

While the industry holds its breath on these and many other detailed issues however, the one certain, immediate and realizable reality is the DCI adoption of the JPEG 2000 compression format in place of the MPEG system currently incorporated into most Digital Cinema servers. Since its publication in Y2K the Wavelet based JPEG 2000 compression algorithm has been noted for its extreme flexibility – but regarding Digital Cinema applications particularly – it provides the benefits of frame-by-frame multi-level access (e.g. for single frame editing), and also allows users to address specific ‘regions of interest’ and define up to lossless output quality. And so, assisted by Hollywood Studio demands that providers move quickly, the race for JPEG 2000 compliance is on!

**Meeting the challenge**

‘Cue’ Belgium to take its place on the leading edge of the Digital Cinema discussion again!

In another of a succession of the country’s Digital Cinema innovations the management of one of Belgium’s leading technology universities, the Université Catholique de Louvain (UCL), recognized the technology challenge in 2001 and made the visionary decision to investigate the suitability of JPEG 2000 compression for Digital Cinema, in the context of its internationally recognized expertise in the relatively new field of FPGA technology.

Pre-empting the DCI decision on compres-

sion standards by a full four years, UCL consolidated the JPEG development programs of three of its laboratories, and set about a mission to develop secure handling tools for high quality, high throughput and high value data streams. And now, in another timely decision, UCL is launching the resulting IPs [Intellectual Properties] through intoPIX, a Belgian technology company, to market a range of FPGA based solutions that meet the DCI specifications but, wisely it transpires, are also capable of much more.

Building on over 15 man-years management experience UCL and intoPIX associates have in fact been making significant contributions to the JPEG 2000 and Digital Cinema standardization committees since 2001 – most recently through UCL’s involvement as a repository for the JPEG committee’s Digital Cinema Interoperability Test Plan.

Currently UCL and intoPIX associates are also project managing the EU ‘EDCine’ program; a project commencing in June involving a consortium of 16 European organizations (including the Fraunhofer Institute appointed by DCI to define its Compliance Test Procedures) who will look even further into the Digital Cinema crystal ball.

By thinking beyond DCI and pushing the limits of SMPTE specifications the EDCine project aims to still further enhance the Digital Cinema experience by investigating quality optimization issues, robustness to transmission errors, content security tools, stereoscopic imaging, interactive access, forensic marking and metadata for indexing and retrieval.

**The intoPIX solution:**

It’s against this background then that intoPIX has defined three strategic objectives in developing its own, highly integrated, and flexible media-block solution:

- First, and most important, that it should meet &, wherever possible, exceed DCI compliancy requirements.

- Secondly that it should be expert in FIPS Levels 3 and 4 certification requirements.

- And third that it provide a flexible solution; one based on a family of IP’s that are both inherently flexible and also be ‘mixed and matched’ to fit the differing requirements of individual users.

And it is in recognition of the importance of this final key objective in particular (to provide a flexible and therefore future-proof solution) that has ultimately decided the company to develop its IPs on the FPGA platform.

**IPX-JP2K decoder module**

Currently intoPIX is proposing two key FPGA based IP cores, one for the JPEG 2000 decoder (the IPX-JP2K) and an AES encryption/decryption (the IPX-AES) module.

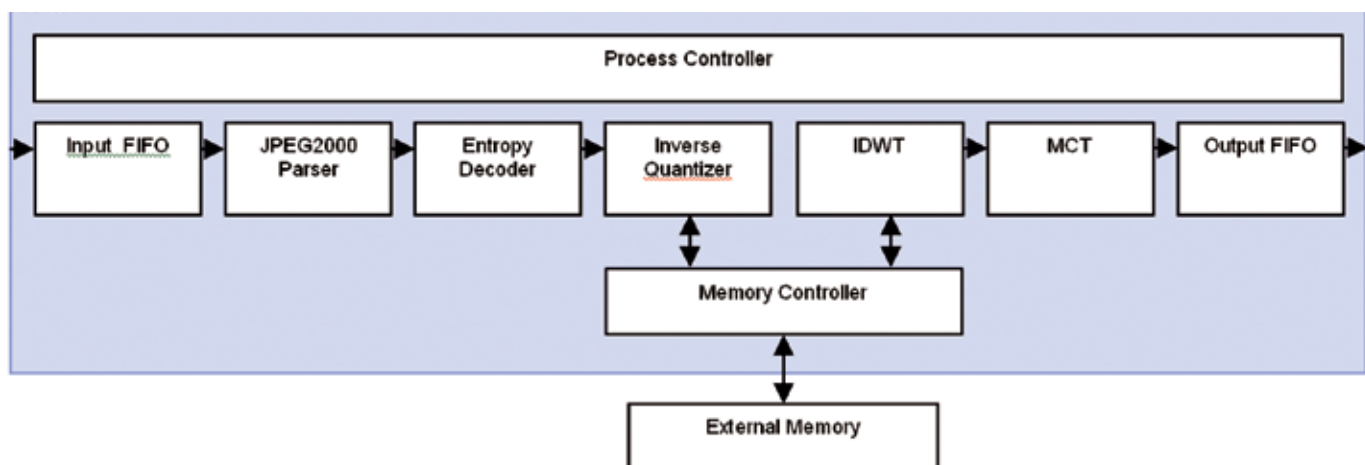
The first of these, the IPX-JP2K JPEG 2000 decoder module, is based on the Xilinx Virtex-4 FPGA and specifically intended to meet the needs of a Digital Cinema playback system. In achieving the objective of providing a flexible family of IPs, the IPX-JP2K compression core is entirely compatible with other core IPs such as the company’s own AES security core.

Just as important for the Digital Cinema system operator however is the IP’s efficient combination of on-chip hardware and software operations and optimal co-design repartition of the decoding blocks (illustrated below) that provide the IPX-JP2K a unique post-deployment renewability for field upgrade and update.

**The IPX-JP2K core**

*JPEG 2000 parser*

The JPEG 2000 parser analyses the main and tile-part headers of the JPEG 2000 codestream, checks the syntax, reports images properties and sends the compressed bit-stream to the entropy decoder. The parser is developed in software running on



a microblaze.

#### Entropy decoder

The reconstruction of each wavelet subband divided into several code-blocks is achieved by two blocks: the *Context Modeller* and the *Arithmetic Decoder*. The Context Modeller successively decodes each bit-plane of the code-block by sending information describing the neighborhood of each bit to the Arithmetic Decoder. With this information, the Arithmetic Decoder decodes each bit from the bit-stream.

#### Inverse Quantizer

The coefficients of the wavelet subbands are inverse quantized. The quantization steps are defined in the main header of the JPEG 2000 file and can be different for each subband. The inverse quantizer uses up to date Xilinx Virtex-4 features (such as DSP blocks).

#### External memory

A double frame memory buffer is used at the Inverse Quantizer output and enables an efficient IDWT processing. This buffer, containing two DDR-SDRAM external memories, always keeps at least one valid frame that could be repeated when convenient. The required DDR-SDRAM type is a 512 Mbit memory (32 Meg x 16; 133 MHz for 2K and 48 fps). The frame buffer is able to store 4 frames at maximum.

#### Inverse Discrete Wavelet Transform (IDWT)

A bi-dimensional wavelet recomposition of the sub-bands is achieved. Two filter banks,

with a 18-bit fixed point precision, may be used: either the Le Gall (5/3) filter bank prescribed for lossless encoding or either the more complex Daubechies (9/7) filter bank for lossy encoding. In DC application only a 9/7 filter is required.

#### Multiple component transformation (MCT)

In order to improve the JPEG 2000 compression efficiency, multiple component transformations can be used. The reversible transform (RCT) is used with the 5/3 filter, and the irreversible transform (ICT) with the 9/7 filter. Both transformations are implemented with a 18-bit fixed point precision.

#### Error Handling

The decoder is designed to detect errors in the input data. This detection is achieved at two levels:

##### - JPEG 2000 header

Codestream characteristics such as image size and bits per components are checked. The coherence of the J2K headers with the specifications given by the decoder controller is analyzed.

##### - JPEG 2000 packet headers and compressed bit-stream

Packet headers are analyzed to verify the coherence of tag trees, number of bit-planes and code-block compressed bitstream length.

When an error is detected, specific error codes are sent to the device managing the decoder. In the case of a corrupted frame codestream, the decoder will decode the

next frame and repeat it until a correct frame is encountered. If no frame can be decoded during the elapsed time determined by the frame rate, the previous correctly decoded frame is sent to the output to avoid any unpleasant display artifacts.

#### Process Control

Taking advantage of the JPEG 2000 intra-frame coding, the decoder controller can manage the stream at the frame accuracy. When there is no data to decode at its input, the decoder can loop on the latest decoded frame, output a black frame or stop processing. And by controlling the input stream and the output options, the decoder controller manages *Pause*, *step by step*, *slow-motion*, *fast forward* and *rewind*, and *random access*.

#### Interfaces

The input receives data by 32-bit bursts of in Little-Endian representation. A burst of two pixels (RGB, XYZ or YUV) is output. The output clock depends on the sequence frame rate and picture size.

#### DCI plus

In attempting to achieve the first of its key objectives intoPIX has, from the beginning, set itself the challenge of beating the current DCI requirements wherever possible and, in this respect also too, the IPX-JP2K IP appears to succeed.

As demonstrated in the chart below comparing today's DCI requirements with the performance intoPIX has anticipated, a considerable technology evolution in the key

Specifications	DCI requirements	IPX-JP2K features
Image Coding Format	JPEG 2000 : ISO/IEC 15444-1	JPEG 2000 : ISO/IEC 15444-1
Wavelet Transform Filter	9/7 filters 16-bit fixed point precision	5/3 and 9/7 filters 18-bit fixed point precision
Tiles	Single tiles	Single or multiple tiles
Quality Layer	Single quality layer	Single quality layer (Multiple quality layers optional)
Resolutions	Up to 6 resolutions	Up to 7 resolutions
Code Block size	32x32 pixels	32x32 pixels
Code Block coding style	Standard JPEG 2000 options	Standard JPEG 2000 options (Parallel Mode optional)
Input data-rate	Up to 250 Mbit/s	Up to 500 Mbit/s
Image size	Up to 2048 x 1080 pixels (for 2K content)	Up to 2048 x 1080 pixels (JP2K)
Frame-rate	Up to 48 FPS	Up to 96 FPS
Output throughput	Up to 3,8 Gbit/s	Up to 7,6 Gbit/s
Component transform	ICT 16-bit fixed point precision	RCT and ICT 18-bit fixed point precision
Color output format	XYZ	RGB, XYZ and YUV
Color Depth	Up to 12 bits per component	Up to 14 bits per component
Recommended FPGA	No recommended solution	Virtex-4 SX35

areas of input and output bit rates, frame rates and colour depth; while also allowing for a considerable variety of screen sizes up to 2048 x 1080, and RGB, YUV or XYZ output types.

The major advantage of IPX-JP2K is indeed its ability to manage with higher input and output bit-rates.

While current DCI input bit rate is 250 Mbps for all compressed content (2K @ 24/48 and 4K @ 24 frames per second) the IPX-JP2K provides output rates of up to 500 Mbps making the IP ready well in advance of the possibility of higher frame rate 4K requirements. This future IP will be called the IPX-JP4K and be available soon in Virtex-4 FX60 technology.

Again, anticipating 3D display requirements, the JP2K operates at up to 96 fps

Also, in another example of its forward thinking, the intoPIX decoder exceeds the DCI 12 bits color depth requirement to deliver an ample 14 bits per component.

And last but not least, recognizing the special needs of several other potential IP user groups the intoPIX decoder provides the opportunity to manage multiple quality layers allowing archivists for instance to create a unique 2K file, 48 fps, 500 Mbps, or to allow one decoder to decompress the 250 Mbps layer only, while a second decoder decompresses all other layers representing, in total, 500 Mbps.

#### The end game – Compliance

It seems only yesterday that the Cinema industry was vociferously concerned about being driven (unnecessarily) by technologists. Today however there's no doubt that market forces are back in the driving seat.

To quote John Fithian, President of NATO in his keynote address at the Digital Cinema summit at NAB this year "2006 is the big year for Digital Cinema; the DCI standards, quality and business models are there. Digital Cinema is on the bell curve ... 2007 will be huge"

It's no surprise then that, with digital installations forecast to grow from 1000 to over 2000 by the end of the year, there is pressure from Hollywood for immediate action to meet as many of the DCI requirements as quickly as possible.

The work of developers has taken on a new sense of urgency and, obliged to act ahead of the publication of Compliance procedures, Digital Cinema equipment providers are, once again, required to apply the Wisdom of Solomon.

However the industry-wide scrutiny of the DCI protracted specification process does provide some clues. Informed anticipation and more than a shake of inspiration has ensured an elegant solution to at least the 'known quantity' of JPEG2000 compression.

And if this can be made available in a 'host' processor that also eases the development path for manufacturers, assists Hollywood's security concerns, provides logistical benefits to Network operators and supports the 4k and 3D future of Exhibitors then surely so-much-the-better.

#### References:

- [1] Digital Cinema Initiatives, LLC, "Digital Cinema System Specification V1.0", July 20, 2005.
- [2] Federal Information Processing Standards, "FIPS 140-2 Security Requirements for Cryptographic Modules", May 2001.
- [3] ISO/IEC 15444-1: Information Technology-JPEG 2000 image coding system-Part 1: Core coding system, 2000.
- [4] Society of Motion Picture and Television Engineers, DC28 Digital Cinema Technology Committee. Authors: Gael Rouvroy CTO / Keith Morris, Marketing Manager intoPIX s.a.

For further information on the IPX-JP2K and IPX-AES IP modules and intoPIX scientific publications visit: [www.intopix.com](http://www.intopix.com)



## About intoPIX

intoPIX is an independent image technology company with a mission to develop and market secure handling tools for high quality, high throughput and intrinsically high value data streams.

#### EXPERTISE

Working closely with the Université Catholique de Louvain in Belgium intoPIX benefits from the knowledge and facilities of the University's advanced Compression, Cryptographic and Micro-electronics laboratories. Bringing together world-class expertise, intoPIX works on the leading edge of JPEG2000 image management and its implementation in the latest generation FPGA chips.

#### MARKETS

Building on over 15 man-years management experience, intoPIX associates have made significant contributions to the JPEG2000 and Digital Cinema standardization committees since 2001, and now also lead the way with cost effective solutions for Digital Acquisition, Post Production, Distribution and Archiving.

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B-1348 Louvain-la Neuve

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## TDP - Ideal for the Digital Cinema Advertiser

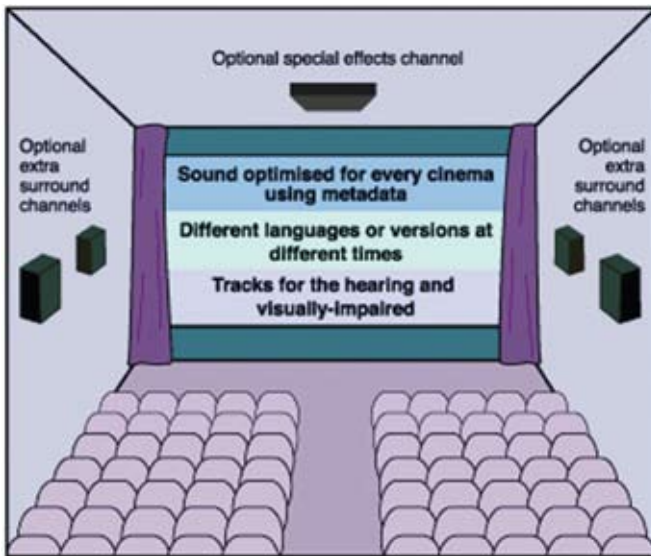
Training for Digital projection is published four times a year alongside Cinema Technology, the Leading Specialist Publication for Cinema Industry Professionals. It is distributed to all UK cinema multiples and independents and many throughout Europe and the rest of the world - some 55 Countries worldwide. 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](mailto:visionplus@onetel.com)

Tel+44 (0) 1380 724357





# Great Picture - What About the Sound?

Jason Power of Dolby explains  
the sound advantages that  
digital cinema can bring



A movie tells a story. It entertains people. And the story is told by the use of both pictures and sound. Delivering this story to the audience in the best possible way has always been a high priority for filmmakers, film distributors, and exhibitors. Digital cinema offers the potential to deliver superb quality cinema experiences more consistently than ever before, with enhanced soundtrack options as well as pristine digital pictures.

In many discussions of digital cinema, the emphasis is on picture rather than sound. This is perhaps not too surprising as film sound has already had its digital conversion - digital sound was introduced into cinemas in 1992 and the audience experience was totally revolutionised. High-quality multichannel sound is now delivered to over 32,000 cinemas worldwide and audiences already expect nothing less than premium-quality sound.

The superb sound experience already on offer in the cinema is the result not just of high quality technology for delivering the audio, but also of an advanced production, post production and distribution chain. In particular, standards and methodologies in the post production - distribution chain have evolved over a long period of time, to the point where directors can be sure that the soundtrack they hear in the studio will be reproduced accurately for the audience in the cinema. As this chain changes with the introduction of new digital cinema distribution technologies, care must be taken to ensure that the original artistic intentions of the creative team are preserved, whether the audience watches film or digital.

## Creating the soundtrack

Even with the latest sound processing technology in today's film mixing studios, there

are certain limitations - it is simply not possible to create good sound out of bad. Just as in the world of film, location sound recording must be of the highest quality, with distortion-free dialogue, minimal set noise and high-quality effects and ambience recording. The music for the movie should be mixed with the cinema in mind, in a multi-channel format with balanced monitoring conditions as regular stereo mixes do not translate well in the cinema.

Over the last 30 years, the film industry has worked to establish a standardisation of monitoring conditions between film mixing studios and the cinemas where the mixes will be replayed. Cinemas and studios use the same types of specialised loudspeaker and sound processors calibrated to exactly the same conditions, enabling a complex surround soundtrack to be created in the studio and then be reproduced faithfully in each and every aligned cinema. For digital cinema to yield better soundtracks than film, or even match the quality of film, it will be essential that these standards for mixing studios and cinemas are upheld for all releases in the future.

One of the potential opportunities of new digital technology is the possibility to exhibit alternative kinds of content in the cinema - sports events and live concerts, for example. It should be noted that, whilst it is already technically straightforward to deliver 5.1 soundtracks into cinemas via live digital telecoms links, soundtracks that have been created primarily for the home environment do not necessarily perform well artistically in a cinema environment. Soundtracks prepared for the home are listened to using sound systems very unlike those used in the cinema, in rooms that are not calibrated to cinema conditions, and therefore it is impossible to

predict how these soundtracks will sound when replayed in a cinema. Several alternative content projects have already trialled production of a cinema compatible soundtrack under the same conditions to those used for movies, with successful results.

## Future Possibilities

The cinema sound system of the future will contribute to an even more realistic, immersive movie-going experience. Digital Cinema will also give far greater flexibility in the way that movie soundtracks can be presented. The capacity for additional audio channels for each release might enable cinemas to play different language versions, or to offer dedicated tracks for hearing- or visually-impaired customers. Some filmmakers have even expressed interest in using additional auditorium channels such as roof-mounted speakers for special effects.

But the future won't be about just more and more channels. Perhaps the most important development in the coming years will be the introduction of metadata - information about the soundtrack which is carried with the release. This will enable the presentation of a soundtrack to be optimised for each and every cinema to suit the specific equipment and environment.

This may sound a little far fetched, but in fact it already happens to an extent in home DVD players - the audio is optimised for replay on different types of home system from big home cinemas to small TVs using metadata in the Dolby Digital soundtrack. If the same idea can be adapted for cinema sound, it could be possible to reproduce the director's intentions even more accurately, and make sure the cinema continues to be the most dramatic, most exciting and most involving place to experience a movie.

Jason Power

# Hands-on with **CHRISTIE** digital projectors

Film projectionists have had many years of experience with the multiple tasks that their day to day work involves. What differences will the change to digital projection make for them? Film projectors consist essentially of a light source and power supply, a film head, and an optical system, and when you get behind the casings you find that many digital projectors use basically the same elements, with the film head being replaced by a digital imaging system. In the first of a hands-on practical series from Christie, TDP shows what is involved for projectionists in changing a xenon lamp on the Christie CP2000 2K projector.

**Cinema Technology is a professional magazine for professionals, and so we won't go into detail about the need for all the usual safety precautions and protective clothing when lamp-changing - the safety techniques that served you well for film projectors should also be applied when you are dealing with digital projectors. The safety-related things that you have learned over the years, like being sure to replace a lamp when it reaches its warranted lifetime, and certainly before it gets to 20% above this, were taught you for good reasons - old lamps become increasingly fragile and the risk of explosion increases.**

One of the advantages that digital projectors like the CP2000 bring is that you can easily check the age of the existing lamp to help you to decide whether a replacement is needed. To do this go the touch panel

controller and call up the 'Status' menu. You can find out how many hours the lamp has been in service under both 'Environment: Lamp' and in the password-protected 'Advanced Lamp' menu and Advanced Lamp 'History' menus. (Figure 1)

If the lamp needs to be replaced ensure that you have a Christie Xenon CDXL lamp of the correct wattage available - never install a lamp intended for a different model or projector. Since the high pressure inside the lamp increases with temperature, it is vital to allow the lamp to cool prior to handling - failure to do this could cause the lamp to explode, causing injury and damage. The lamp must be turned off at least ten minutes before turning the projector off, so as to provide sufficient time for the internal lamp cooling fans to properly cool the lamp. The lamp is controlled from the touch screen menu. (Figure 2)



Figure 3

At the breaker panel on the projector, set the 3-phase MAIN AC circuit breaker to OFF. After running the fans for at least 10 minutes for cooling, turn off the remaining INTERNAL and PROJECTOR circuit breakers located on the breaker panel of the projector. (Figure 3) Then unplug the projector from the AC supply - never attempt to conduct maintenance on a live projector.

Figure 1

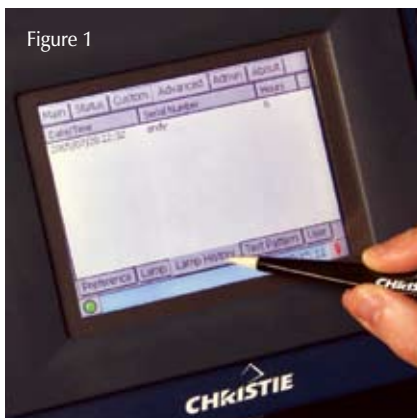


Figure 2



Figure 4



Figure 5



Figure 7



Figure 10



Wearing your protective clothing and face shield, as always whenever the door to a lamp housing is open or when handling lamps, unlock the lamp housing door and open it. If desired you may release the latch mechanism to remove the door entirely. Turn the knob to open the inner lamp cooling compartment and reveal the cathode end of the lamp. (Figures 4, 5)

Loosen the set screws from the negative/cathode (rear, 7/64") and the positive/anode (front, 3/16") lamp connectors. Make sure to apply minimal torque and do not stress the quartz tube. Carefully slip the positive anode connector off the front of the lamp.

Handling it by the cathode end only, unscrew the lamp from the rear connector and carefully remove it from the projector. Immediately replace the used lamp inside the protective lamp cover (saved from the previous installation) and then seal it in a heavy carton on the floor where it cannot fall or be bumped. Handle the box with extreme caution – the lamp is hazardous even when packaged. Dispose of the lamp in accordance with safety regulations for your area.

With the lamp removed, visually inspect the reflector for dust and clean if necessary. Brush most of the dust off with a camel-hair brush and/or blow dust away with compressed air.

If some dust remains, just leave as is – air circulating at the lamp is unfiltered, so some dust is inevitable. Avoid unnecessary cleaning. (Figure 6)

Now take the new lamp, remove the tape, knurled nut and locking star washer (if present) that secures the lamp within its protective cover. Handling at the ends only, extract the lamp from the cover. Set aside the protective cover for re-use in your next lamp disposal or for warranty return of an expired lamp. (Figure 7)

Insert the threaded cathode (-) end of the lamp into the negative lamp connector nut located in the rear of the lamp compartment

and screw in fully – though hand-tighten only. (Figures 8, 9)

When inserting the new lamp handle by the cathode and anode end shafts only, never the glass. **Do not over-tighten. Do not stress the glass.**

Rest the anode (+) end of the lamp on the lamp cradle and slip the positive lamp connector over the bulb end. (Picture 10)

Note that the lamp cradle is an adjustable stand, designed for placement within the lamp housing to accommodate different sizes of lamp. It is unlikely that the lamp cradle will require adjustment unless the projectors is being moved to support a different screen / screen size.

Hand-tighten set screws in both negative and positive lamp connectors, ensuring proper electrical contact. Proper electrical contact prevents resistance in lamp connectors.

Make sure that the anode (+) lead between lamp and igniter is well away from any projector metal such as the reflector firewall.

Leads too close to metal parts will cause arcing during the lamp starting pulse. This is a safety hazard and also the lamp may not ignite.

Close the lamp-housing door, as the projector will not operate unless the louvered door is locked shut.

Reattach the projector pedestal to the mains and at the projector's breaker panel, turn all breakers to ON.

If your new lamp is larger or smaller than the old lamp, you will need to record the new lamp type (2.0,3.0,4.5 or 6.0kW) in the Touch Panel Controller's menu before igniting the new lamp. This setting establishes the proper range of power available for the newly installed lamp, ensuring it is neither under-powered or over-driven.

**Turn the lamp on** by pressing and holding the lamp button on the Touch Panel Controller's (TPC) Main Menu. Continuing to use the TPC to adjust

Figure 6



Figure 8



Figure 9

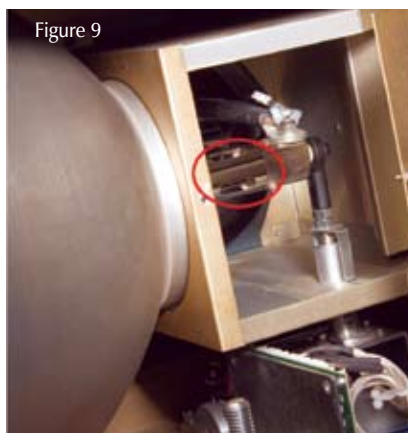




Figure 11



Figure 12

the lamp position within the projector. This is to ensure maximum performance, with the lamp well-centred with the reflector and distanced correctly from the rest of the illumination system. (Figure 11)

#### Now record the lamp's serial number.

From the Advanced Lamp menu, select "New Lamp" and in the Lamp History sub-menu, enter the serial number in the text box. Save to record the serial number and to reset the lamp timer. The timer will now begin to log time for the new lamp. (Figure 12)

**And Finally....**Remember - Whenever the lamp module is changed, replace the air filter. This is vital for the continuing reliable operation of the projector..

**Thanks to Christie for their help in the preparation of this article. Do note that the article is intended purely to give those projectionists who haven't yet had the chance to get 'hands-on' experience of digital cinema projectors a broad idea of what the new technologies are likely to involve them in - in no way should this article be regarded as a substitute for using Christie's official operating and maintenance manuals.**

*The Christie website  
www.christiedigital.com  
contains a treasure trove of  
technical information about  
their digital cinema equipment,  
and is well worth a visit by any  
projectionist wanting to know  
more about any aspect of digital  
projection.*

# DSN - first fifty are in service

As reported earlier in TDP, Arts Alliance Media successfully completed phase one of the UK Film Council's Digital Screen Network, by installing 50 digital screens on schedule, in the locations shown below. Christie CP2000 DLP Cinema projectors are used in 45 of the screens, with NEC IS8 2K projectors being used in five screens, generally where projection box size was restricted.



#### CHRISTIE CP2000 DLP™ CINEMA PROJECTORS INSTALLED

Cineworld Ashton under Lyne  
Cineworld Bolton  
Cineworld Bradford  
Cineworld Castleford  
Cineworld Didsbury  
Cineworld Haymarket  
Cineworld Hull  
Cineworld Shaftsbury Avenue (2)  
Cineworld Wandsworth  
Cineworld Liverpool  
Cineworld Runcorn  
Cineworld St Helens  
Cineworld Sheffield (2)  
Cineworld Wakefield  
City Screen, York (2)  
The Duke's, Lancaster  
Curzon Mayfair  
Curzon Soho (2)  
Kino Hawkhurst  
National Film Theatre  
Odeon Covent Garden (3)  
Odeon Printworks Manchester  
Picturehouse at FACT Liverpool (2)  
Rheged Cinema, Penrith  
Showroom Cinema, Sheffield (2)  
Vue Blackburn,  
Vue Bury  
Vue Cheshire Oaks  
Vue Doncaster  
Vue Leeds Kirkstall  
Vue Leeds Light  
Vue West End (2)  
Vue Preston  
Vue Scunthorpe  
Vue Southport  
Zeffirelli's, Ambleside



#### THOSE USING THE NEC IS8 2K (SHOWN BELOW) INCLUDE:

Brewery Arts Centre, Kendal  
Cornerhouse Manchester (2)  
The Palace Cinema, Malton  
Odeon, Panton Street, London





# DSN - Forward to Phase 2



Darren Briggs, Field Service Manager, Arts Alliance Media talks TDP readers through the phase 2 rollout of the DSN, and explains what cinemas should expect.

Phase 1 of the UK Film Council's Digital Screen Network (DSN) was completed just before the end of February, several weeks ahead of schedule. Approval from the UKFC board for Phase 2 of the rollout was received in March and the rollout itself is now well underway.

## New for phase 2

During March and April, we revisited the 50 installations from phase 1 and we upgraded all of the servers with hardware and software to enable them to support "JPEG2000 Interop" format. This is an interim format in use by a number of Hollywood Studios prior to the full DCI format being decided on.

The new equipment installed in phase 2 will all support JPEG2000 Interop from the outset. We expect to do several further upgrades over the next year or so as elements of the DCI specification are locked down.

## Timing

Phase 2 of the deployment is divided into 5 mini geographical rollouts (see map).

Our engineers will be coming to each region in turn to perform site surveys. The site surveys enable us to identify which equipment the cinema requires and to tell cinemas the alterations they need to perform in order to accommodate the digital cinema equipment. These typically involve putting in suitable power and venting and installing and ADSL line so that we can remotely monitor and fix any faults in the equipment and deliver

security keys to unlock encrypted films. Our engineers will return to the area after the cinemas have performed their alterations in order to carry out the installation itself. The approximate installation survey and installation dates are shown in the table. We will provide more detailed timing information for your region nearer the time.

We've now completed the site surveys for the Midlands area and have sent cinemas details of the alterations documents. The next stage is to agree an installation date with AAM and to schedule your projectionists on the training course at our brand new warehouse and training facility in West Byfleet. (more about AAM's training on page 22).

## Preparing for installations

All your alterations must be complete prior to installation, including power, venting, ADSL, portholes and any movement of equipment.

We will let you know when the equipment will be dropped off and you should make sure someone is available to show the delivery company where the equipment will be installed. They will carry the equipment into the projection room and put it into place. This will normally happen on the installation date itself, or a few days before.

The engineer will then attend site to install and commission the equipment. To do this, he needs a good amount of screen time, so you must cancel all shows in that screen until

6pm. After he has finished installation, he will demonstrate to your technical representative that all aspects of the equipment are working and he will also provide some more training to your projectionists.

## Dos and don'ts for your installation

### Do

- Complete your alterations well ahead of time and keep us informed on your progress
- Make sure key personnel are onsite during the installation and to check the final set up
- Cancel shows to give our engineer the necessary screen time to set up the equipment correctly

### Don't

- Hope alterations can be finished after installation – they can't!
- Assume commissioning can take place in between shows – we need several hours of continuous screen time.

Arts Alliance Media look forward to working with you as we roll out phase two of the groundbreaking DSN network.



## Regional Installation Schedule

Area	Site Survey Dates	Approx Installation Dates
Midlands	April - May 06	July - September 06
Central London	May - June 06	September - October 06
South East	July - August 06	November - December 06
Northern England & Scotland	August - September 06	February - March 07
South West	September - October 06	March-April 07

# So you want to be a Digital Projectionist

Fiona Deans, Director, Digital Cinema, of Arts Alliance Media, explains just what it is that film projectionists wanting to extend their skills into the digital arena will need to learn, and she describes the contents of the courses that AAM has developed so successfully to meet the needs of the Film Council's Digital Screen Network, with over 100 projectionists trained so far



Digital cinema is a new technology requiring projectionists to learn new skills and procedures. As well as the new equipment they must operate, there are new ways of working, for example, digital films are encrypted so require security keys to unlock them - a cinema may have a copy of a film but not be able to play it.

Training projectionists to learn how to use the new equipment and to familiarise themselves with its operation is a crucial part of ensuring that a digital cinema network works efficiently. It's extremely important that projectionists are comfortable with the equipment and confident using it in all situations. As a result, AAM places enormous emphasis on the role of training in the UK Film Council's Digital Screen Network (DSN).

There are four different training courses that are available to cinemas in the DSN:

#### Offsite projectionist training:

Projectionists attend a course at AAM's premises prior to installation in order to learn all the key skills required to operate the equipment with confidence. The classroom-based course combines presentations with discussions and hand-on practice.

#### Onsite projectionist training:

While our engineers are on site installing the equipment, projectionists are provided with refresher training to remind them of key aspects of equipment operation.

#### Technician training:

Following projectionist training and several months of using the equipment chief projectionists and cinema technicians will be invited to an advanced course which covers more advanced set up and troubleshooting skills.

#### Manager training:

Managers need to understand how digital

cinema changes the way their cinema operates, for example the role of content security keys. We offer a half day course to cover the basics and answer any questions.

The cornerstone of the training course is the offsite projectionist training. To date we have trained over 100 projectionists in the use of the DSN. The course covers all of the skills required to operate the server and the projector, load and delete content and security keys and troubleshoot. It also covers the reasons why the DSN has been created and how digital technology can improve access to specialised films.

The objectives of this course are:

#### The Digital Cinema Network

- gain a basic understanding of key digital cinema technologies, including familiarity with key terms
- understand the objectives of the DSN
- understand the business benefits of the DSN
- understand the function of the different entities within the DSN
- be able to describe the basic architecture and operations of the network
- understand the different levels of support and how to access them
- understand the role and function of remote management

#### Projector operation

- be able to power up, log on to and power down the projector
- understand, at a basic level, the local system architecture
- know how to operate the touch panel, including selecting presets and viewing the projector status as well as navigating through menus
- be able to switch from different

sources

- know how to change a bulb and reset the alignment
- know how to check and to change the air filter
- be able to check and add coolant as necessary
- be aware of common problems and how to solve them

#### Server operation

- be able to power up, log on and power down the server
- understand the function of transport drives and how to handle them
- understand the menu structure and interface
- know how to load content from the transport drives onto the server
- know how to load content within the system, build a show and operate the basic transport controls
- be able to insert cues for automated events
- be able to delete and rename content
- know how to load decryption keys
- be aware of common problems and how to solve them
- be able to access and interpret the error log

#### General

- know how to recover from a power failure
- be able to check for audio failure

***You may also attend our training courses if you are not part of the DSN. If you are interested, please contact us for details.***  
**[www.artsalliancemediacom/](http://www.artsalliancemediacom/)**

# Digital cinema glossary

Like many new technologies, digital cinema can sometimes seem to have a language all of its own. This short guide from Dolby explains some of the key new terms used to describe the operation, performance, and features of digital cinema equipment.

## 1.3K/2K/4K Resolution

These are proposed resolutions for digital cinema projectors - one of several factors that influence quality on screen. The figures (quoted roughly in thousands) refer to the number of pixels (dots) across the horizontal axis of the image, so 2K is approximately 2000 pixels across the screen.

## Alternative Content

Entertainment media in addition to movies that can be played in a digital cinema environment. Proposals include sports, live events, and theatre productions. Alternative sources are usually connected via the second input of a digital cinema projector and a suitable cinema audio adapter.

## Colour Space

The complete range of colours that can be represented by a given device. Can be reprogrammed on some devices including digital cinema projectors to enable different looks for different content. During replay in cinemas, the same colour space should be selected on the projector as was used during original mastering.

## Compression

A way of processing digital images or sound so that they take up less space on a disk or less time to transfer. Image compression is used in digital cinema so file sizes remain manageable and can therefore be mastered, distributed, loaded and projected. The image needs to be decoded again before it may be displayed.

## Data

Digital information. Digital data has the advantage that it can be copied or transmitted over a digital network any number of times without affecting quality. In digital cinema, instead of storing the movie images and sound on celluloid, they are stored as digital data, usually on a hard disk.

## Guide to Playing a Digital Show

Step One: Load Content

Step Two: Build the Show. Drag and drop on the computer screen to assemble Ads, Trailers, Movies, and Cues. Load movie. Load license

Step Three: Play the Show. Press Play to start show manually or schedule an automated show using the digital cinema system or existing automation

## Delivery

Method of transferring digital cinema file packages to cinema installations. This can be via physical delivery of digital media such as

removable hard drives, or by cable or satellite. File encryption is used to secure the files during transfer.

## DC28

A technology committee of the SMPTE (Society of Motion Picture and Television Engineers) to provide an industry forum for digital cinema. DC28 consists of working groups to provide standards and recommendations to ensure interoperability, compatibility, and performance.

## DCI

Digital Cinema Initiatives, LLC. A company formed as a joint venture between Disney, Fox, MGM, Paramount, Sony Pictures Entertainment, Universal, and Warner Bros. Studios. DCI's purpose is to establish voluntary specifications and an open architecture for digital cinema.

## Digital Cinema Playback System

Often referred to as a server, the playback system performs several functions, including storage and replay of the digital movie data, security decryption, and image decoding. Not to be confused with simple broadcast or PC-based video servers that do not offer the security and image decoding features required by DCI. Advanced systems may also provide a control panel for the projectionist, scheduling features, and comprehensive automation interfacing.

## Digital Cinema Projector

A very high performance device designed specifically for cinematic display of movie content. Projects the digital image from the digital cinema playback system on to the screen. Digital cinema projectors today use the DLP Cinema™ technology from Texas Instruments, although other suppliers including Sony are also developing their own solutions.

## Digital Projector

Any projector that uses digital technology to create the image. Performance levels vary from table top designs for offices, large 'rental and staging' projectors, right through to digital cinema projectors. Smaller units are sometimes used in cinemas for slide-style advertising and to project subtitles with 35 mm film.

## EDCF

European Digital Cinema Forum. A group with representatives from public bodies and the cinema industry formed with the intention of encouraging co-operation in European digital and electronic cinema projects and to

provide input into worldwide standards.

## Encryption

The general name for techniques used to protect digital data so that it can be accessed only by legitimate users. Encrypted data is meaningless to anyone who obtains it until it is decrypted using a mathematical 'key'. In digital cinema, encryption is used at several points along the electronic chain to prevent the valuable digital movie data from being stolen by pirates. In parts of the system where encryption cannot be used (for example, during image decoding), physical security is required so that valuable data cannot be accessed.

## Ethernet

A standard way of interconnecting pieces of digital equipment on a network, used in digital cinema systems to interconnect equipment within a screen or between multiple screens. Different kinds are used depending on the application - slower 10BaseT or 100BaseT is used for transferring simple information such as control instructions, whilst Gigabit Ethernet (1000BaseT) can be used for large amounts of data, such as movie files.

## Hard Drive

Also known as a hard disk, this device is used to store large quantities of digital data. Used in RAID arrays in digital cinema playback systems to store the digital movie file packages ready for playback. Removable hard drives can also be used to transfer movies to cinemas.

## File Encryption

Used to secure the movie file package during distribution and whilst in the cinema. The file package is encrypted before distribution to cinemas. For maximum security, the file stays encrypted when it is loaded on to the playback system and is only decrypted whilst the movie is being played back. A valid security license is required to decrypt the movie.

## File Package

The digital cinema equivalent of a film print, so sometimes referred to as a digital print. A collection of the various image, audio, subtitle, and playlist data files for a specific piece of content. The file package can be stored on disk or transferred over electronic networks.

*Thanks to Dolby Digital Cinema for providing this glossary - to be continued.*





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