THE PHOTOGRAPHIC ALLIANCE OF GREAT BRITAIN

TECHNICAL STANDARDS COMMITTEE

PROJECTED DIGITAL IMAGES
THIRD INTERIM REPORT
APRIL 2006

Disclaimer

Nothing in this Report is to be taken as recommending any particular manufacturer, equipment, service, or supplier in preference to any other.

Acknowledgments

Many people have contributed personally to the work of the Committee is producing this report. Please refer to the Sources list in Annex A.

Version	Date	Description
0.0	19/03/2006	Part-report for rapid comment
1.0	07/04/2006	Complete draft for comment by contributors
1.1	14/04/2006	Contributors' comments included for PAGB Exec

CONTENTS

1. SUMMARY

1.1 Background

The Alliance Executive established a Technical Standards Committee in April 2005, with the remit of reviewing information concerning Projected Digital Images (PDI). The Committee has proceeded by searching a large number of websites, and by corresponding with many individuals with expertise in PDI. Short reports were received by the Executive in October 2005, and again in February 2006. At these times, it was noted that:

- PDI is a new technology for most photographers.
- By corresponding with a sufficient range of experts, it is unlikely that any major issue will have remained unexplored by the Committee.
- By reviewing such a large body of experience, the benefit of the Committee's work is that all other Federations and Clubs need not repeat the same searches.
- By recording and, if approved by the Executive, publishing the results of the Committee's work, the knowledge base of PDI will be widened, and common practice will start to converge.
- Rapid technology change in PDI continues. No single set of recommendations could ever remain current. A statement of some basic principles may be more long-lasting.
- Recommendations by the Executive would not be binding on member Federations or their Clubs.
- The Alliance will need to have its own choice of standards for any future PDI event which it chooses to run.

1.2 Report Format

This is the Third Interim Report, April 2006, to the Alliance Executive. The Executive is requested to receive this report in full, while a short version (Title, Contents and Summary) will also be circulated and available.

The full report is a record, in some technical detail, of the information researched by the Committee. The short form of the report includes the Contents list of the full report and this Summary, which omits technical detail.

1.3 Review of Chapters

Chapter 1 (Summary) is this Chapter.

Chapter 2 (Introduction) describes the establishment of the Technical Standards Committee, its methods of work, and progress to date.

Chapter 3 (Standards) describes the reason for having standards; their scope and use; and why the Alliance could not produce formal standards for PDI which could be binding on member Federations.

Chapter 4 (Principles of Projection) compares and contrasts the principles of slide projection and of PDI. Slide use and projection have become a cultural norm. PDI has important differences from slide projection. In particular, a PDI system imposes a lot of data processing on the image data files submitted by authors, and this processing needs to be understood and minimised.

Chapter 5 (Digital Projectors - Types) describes the market for, and the main types of digital projector. Each has its adherents, and there is no obvious best type. There are many manufacturers and suppliers; and the model ranges change rapidly.

Chapter 6 (Digital Projectors - Common Features) describes features common to all digital projectors, and gives some generic preferences.

Chapter 7 (Computers to Drive Projectors) challenges the idea that a laptop computer is always required to drive a projector. Alternatives are described, with generic preferences for graphics features.

Chapter 8 (Computer/Projector Setup) describes the basic layout requirements, and various methods for colour setup of a projector and its driver computer.

Chapter 9 (Image Display & Event Workflow) lists a variety of display software and of event workflow software. (These lists are incomplete.) A typical slide event workflow can be replicated in digital, although users must realise that this involves increased skill and preparation time. In turn, the chosen event workflow will lead to 'rules', in the sense that authors must cooperate in providing suitable data files.

Chapter 10 (Data Files & Image Preparation) describes the typical data file formats in use, their characteristics, and appropriate ways of preparing image files for submission to PDI events. All images require additional information about the author's images (metadata), whether electronic or simply an entry form.

Annex A (Sources) lists the main sources reviewed to prepare this report. Some additional sources are listed in individual Chapters.

Annex B (Glossary) provides a list of technical terms used in the report, or otherwise relevant to PDI.

1.4 Next Steps

This Third Interim Report is a stage, and not the end of the processes required. As advised to the Executive in February 2006, it is necessary to reach this stage of recording the full range of facts and opinions recovered by, and contributed to the Committee. This is our firm foundation.

Having made this full record, it would be possible to return in the future to any individual section, and see how technology change has affected the content. However, keeping all the information formally updated would detract from what is now required.

Many correspondents have said that typical Clubs and their members are sufficiently confused by PDI that any type of technical report could not help them. They now need some simple guidance, maybe with checklists of actions, and with content which will not be out of date immediately. With our firm foundation, the Executive is now in a strong position to commission and direct such developments.

The Executive is invited to comment, and to instruct the Technical Standards Committee accordingly.

2. INTRODUCTION

2.1 Establishment

Following representations by its member Federations, the Executive of the Photographic Alliance of Great Britain (Executive, PAGB) established a Technical Standards Committee (the Committee) in April 2005.

2.2 Terms of Reference

The Terms of Reference of the Committee are to review any information concerning Projected Digital Images (PDI) and to make recommendations to the Executive.

2.3 Membership

The Chairman of the Committee is Mark Buckley-Sharp LRPS CPAGB (CACC), and the other members are Roger Force FRPS DPAGB APAGB (KCPA) and Ian Lyons LIPF (NIPA).

2.4 Methods

The Committee has proceeded by a widespread search of websites including those of the PAGB Federations and their Clubs; other national and international photographic organisations; commercial manufacturers and service suppliers; and by correspondence with individuals.

Material gathered by these methods has been lodged on a website announced to the Executive, and to which all contributors have access to enable feedback and as a small reward for their contributions.

See http://myweb.tiscali.co.uk/markbuckleysharp

2.5 Purpose

PDI is a new technology for most photographers, and PDI technology is rapidly changing. Hence the desire for some central initiative in collating and sharing information.

There has been a twofold purpose in adopting the Committee's methods of working

- Where a reasonable number of skilled people have been canvassed for their opinion then it is unlikely that any major topic will remain undiscovered.
- Where there is diversity of practice, then merely widening the knowledge base of that diversity is enough to start convergence, with or without the formal creation of standards.

2.6 Progress

Short reports were presented to the Executive meetings of October 2005 (First Interim Report) and February 2006 (Second Interim Report). And now this longer report is presented to the Executive meeting of April 2006 (Third Interim Report).

2.7 Next Steps

The Executive will determine how to proceed following discussion of this report.

3. STANDARDS - (Purpose)

This Chapter explains the reason for having standards and why they are useful; and it identifies the scope for the Alliance in creating recommendations for its members.

3.1 Why are there Standards

Standards develop to establish order and control, and to save time. Standards may be developed from a theoretical basis eg, the SI units of measurement, but often are developed by suppliers of goods and services. Standards allow purchasers to understand products, and so increase confidence and the overall market.

3.2 The Scope of Standards

Standards may be published by national or international organisations (BSI, ISO), and may have legislative force (CE marking). Standards then become commonly accepted when quoted as a manufacturing standard for products. There may also be informal standards, which merely represent current good practice.

3.3 Accreditation

Where suppliers claim to use standards, there may still be a need for audit. This is provided by accreditation bodies that check adherence to standards, so providing confidence in the supplier.

3.4 Standards as Culture

Standards may become commonplace and are assumed as part of cultural background. Cultural norms are rarely re-examined, and may become a barrier to further progress. In this context, standards for slide projection are reviewed as a comparison alongside those for Projected Digital Images (PDI).

3.5 The Alliance and Standards

This Report follows from requests by member Federations for the Alliance to create standards for PDI. Placing these requests in context, it is clear that the Alliance and its Executive are neither skilled nor resourced to create formal standards. Nor would the Alliance be able to recommend any particular supplier of PDI goods or services.

3.6 The Role of the Alliance

What the Alliance can do is collate information, and comment on current practice, which otherwise would have to be done by every member Federation and their Clubs. Such comments will change as the products and practice develop. But, the Alliance will not be the prime source of most practical experience, which will most likely arise from a pool of expert practitioners. Comments or recommendations by the Alliance may be influential, but constitutionally cannot be binding on member Federations or their Clubs. However, the Alliance will need to have its own code of practice to support any PDI event of its own, and to accredit PDI events via its patronage service.

4. PRINCIPLES OF PROJECTION - Slides & Digital

This Chapter compares and contrasts the principles of slide and digital projection. This is done to give a clearer understanding of the differences and their implications for setting up Projected Digital Image (PDI) systems.

4.1 Slides

Buying a slide film, using and processing it, and viewing the result is commonplace for the serious amateur photographer. It is easy to forget the enormous technological challenges, which have been overcome to produce the end result with such consistent quality.

The film base is coated to tight tolerances with multiple layers including those sensitive to blue, green and red light. As if creating the materials with those separate sensitivities was not enough, all three must match in their absolute speed and their contrast curves. During processing, dyes with specific spectral absorbance must be deposited accurately in relation to the original exposure. By their choice of materials, including the final dyes, manufacturers must try to attract purchasers. Film offerings include those reputed to be very accurate, or to have higher contrast, or to be especially vivid in their colours. (Slide users may recognise their preferences.)

Apart from some specialist uses, Club events only accept 35mm film slides in 50mm (2") square mounts. This is of course a standard, and it has had to be learned and incorporated into our culture. There are also standards for spotting slides for projection, and for marking slides for AV sequences.

The key point of the slide is that it is the finished coloured image. While the author has made choices of film type, subject, composition, focus, exposure, etc., the author has no other input to the production process, which is highly controlled on behalf of all authors. Then, whether viewed on a light box, held up to the daylight, or projected, the viewer's eye and brain will accommodate to variations in viewing conditions and judge the finished image directly. (It is incidental to this Report that a slide is also an extremely robust and high-density storage medium quite likely to outlast most digital storage.)

4.2 Slide Projectors

Today there are relatively few slide projector types and models. The prospective user can choose between straight (Leica) racks and round (Carousel) racks, between a 150W bulb and a 250W bulb, and not much else. As a result, selecting a slide projector is quite easy. For domestic use, straight racks are cheaper and 150W is adequate. For Club and commercial use, 250W is required. Extras like remote control do not affect the projected image, although the choice of lens will affect the quality and brightness.

While the choice is simple, slide projectors are so robust that purchasing is uncommon. And, amongst Club members, real skill in using a slide projector of any type is quite rare. These are factors which now contribute to the widely realised difficulty of specifying, purchasing and using a digital projector.

As the slide is the finished image, the slide projector neither creates nor manipulates the image. In particular, it is inherent in the system design that collections of slides from many authors, such as in a competition or exhibition, are treated identically by

the slide projector. If one author has chosen a vivid film and one has not, then the projector will not modify either image, and the authors' intentions remain visible on screen.

The need to retain identity of treatment, which in practice implies the minimising of any processing of the author's image, is an important requirement which needs to be carried over into digital projection.

4.3 Digital Images

Like a slide, a digital image prepared for projection is the end result of many processes. Unlike a slide, many of these are not subject to tight manufacturing and processing quality assurance. By devolving power to our desktops, we can now all get it wrong quite easily. It is worth noting that the explosion of image taking brought about by digital has in no way diminished the general public need for processing 'labs' who will take the work out of making prints. Most images are not processed by the author, while those serious amateurs who have embraced digital face a steep learning curve on their image processing software, whether for prints or projection. Before digital images get anywhere near a projector, it is clear we have a training backlog in image preparation.

The key feature of a digital image is that it does not exist visibly except when rendered (qv Glossary) by a display, printer or projector. Far more than for film, the intermediate processing of a digital image has to be conditioned by the intended end use. Images for the web, print or projection, all require quite different handling and file output.

4.4 Digital Projectors

Unlike slide projectors, there are innumerable makes and models of digital projector. Not only is the range extremely confusing, but most models are in the market for only a few months before being replaced. Suppliers habitually manipulate availability so as to sell models at their preference. Chapter 5 considers projector types in more detail.

Unlike slide projectors, it is a key feature of digital projection that the image file is substantially processed, and these processing steps may significantly alter the author's intention: even more so if the author did not know how to prepare the image properly. The supplied image data must pass through some or all processes such as

- Profile management from the supplied colour space into the device colour space.
- Digital to analog conversion.
- Low-pass filtering and cable losses including crosstalk between channels.
- Analog to digital conversion using projector channel gain settings.
- Scaling of image size (interpolation).

Many of these processes are hidden from the user or difficult to find and review. If settings are changed inadvertently, then neither the change nor the method of rectification may be obvious or easy.

4.5 Overall Comparison

Slides are simple to use because manufacturers have standardised production to a high degree. A slide is a static image which is not manipulated selectively by the slide projector. Slide projectors are available in only a very few variations making selection easy.

By contrast, digital images must be prepared depending on the specific intended use. At present, authors cannot be assumed to have sufficient skill in preparation of data files for high fidelity projection. The digital projection system imposes significant processing of its own on all images, and some settings on projectors will cause differential adjustment of each . Digital projectors are available in a bewildering variety.

5. DIGITAL PROJECTORS - Types

This Chapter explains the main types of digital projector. Opinions are collated from many sources, and these sources are not always consistent.

5.1 The Market for Digital Projectors

The market for digital projectors is dominated in quantity by the requirements of commercial and educational presentation. This market requires easy use, limited or no blackout with rare use of black in the image, adequate brightness, moderate colour precision, and reasonable resolution. Projectors may be fixed in many educational settings, but highly portable models are desirable for mobile commercial use. This market is highly competitive. Prices are being driven down, and new models are constantly being released by many manufacturers.

A smaller market, but one which may well grow, is home cinema. Units are likely to be static, but they must handle video with good colour and contrast fidelity.

Commercial cinema installations are increasing, using high-powered projectors. These are likely to be 3-panel DLP type (qv Glossary and 5.3).

It should be clear that the photographic market is not directly addressed by available models. Broadly we require - easy use; proper blackout with blacks in the image rendered well; adequate brightness on larger screens; good and reproducible colour precision; good resolution; portability (similar weight to a slide projector); and long life. These features resemble those for the commercial/educational market, provided that some care is taken to eliminate unsuitable models.

5.2 LCD Projectors

LCD projectors (qv Glossary) are available from many manufacturers (Table below). They have relatively low contrast - typically 200:1 to 400:1 (see 5.5), which means blacks will not be particularly well rendered. They are reputed to have a realistic look to the image, with good colour saturation.

Due to manufacturing tolerances, some individual units may show varying density (bars) on the screen, and this should be checked before acceptance.

Another feature of LCD projectors is ‘chicken-wire’ on the image. This is because the light switches cannot be perfectly adjacent, due to the need to run electrical connections between them on the LCD panel.

A worry is the life of the LCD panels. If these fade, and especially if they fade differentially eg, by individual colour or within the area of a single panel, then colour fidelity will deteriorate and the unit will become unusable for photographic images. Detractors of LCD projectors claim that this may happen within the life of the original bulb ie, 2,000-3,000 hours. However, the realistic use of a Club projector may not exceed 100 hours per year.

5.3 DLP Projectors

DLP projectors (qv Glossary) are also available from many manufacturers (Table below), although the imaging panels are all made (patent) by Texas Instruments. They have relatively high contrast - typically 1000:1 or more (see 5.5), which means image blacks will be well rendered in a good environmental blackout. They are reputed to

have a less realistic image appearance than LCD. DLP projectors do not show image bars, and 'chicken wire' is less obvious giving a smoother image.

Except for very high power models, DLP uses a single image control panel, and forms colour using a synchronised spinning colour wheel. The basic wheel has R, G and B segments. Normally, the rapidly changing colours merge for the observer, but this can fail giving a distracting rainbow effect for some people, especially if the eyes are moved rapidly across the display. The disadvantages, albeit limited, of the basic 3-colour wheel have led to improvements.

The first level of DLP improvement comes from spinning the wheel faster. Another improvement comes from increasing to more segments on the wheel with the RGB colour order permuted. By comparison, digital camera detectors commonly have a matrix of 2 green to 1 each of red and blue detectors, while broadcast TV uses green as luminance and red/blue alternate chroma lines. The same balancing tricks can be applied to DLP.

A further improvement to colour fidelity comes from adding more colours to the wheel. By comparison, Fuji Reala film has an extra colour layer, and some digital arrays are now made with an 'emerald' detector replacing a green to improve the ultimate RGB signal characteristics. The latest colour printers are using up to 10 inks even though they are still driven by only the three RGB data channels. These are all attempts to improve colour rendering (qv Glossary), and DLP has more capacity to improve in this way than LCD. Unfortunately, excellent colour reproduction is not a major selling point in the typical DLP market (see 5.1). Manufacturers may make some of these improvements in colour wheel use but, unlike the number of inks in a printer, details and effects can be very hard to find in technical specifications. Help may be available in the home cinema market where DLP projectors are more often featured for their colour fidelity.

5.4 LCOS Projectors

LCOS projectors (see Glossary) have very limited availability. Models by Hitachi are mostly withdrawn, and only Canon is in the market. The SX50 has a higher resolution (SXGA+) than the usual, and LCOS technology does not show the 'chicken wire' effect of LCD. Being in a very limited market, there is no driver to lower price, although the Canon model range is currently being extended. Although image quality is said to be excellent, it is difficult to know whether there is enough added value for the much higher price.

5.5 Contrast Ratios

There are three different ways of considering contrast ratios. Although they are inter-convertible, there may be some confusion.

- The arithmetic ratio eg, 400:1; usually quoted for digital projectors. This corresponds to the relative luminance on a linear scale. However, neither the eye nor film is linear.
- The absorbance; sometimes quoted for film scanners. This is a logarithmic ratio in powers of ten ie, 1.0A means an attenuation to one tenth of the original. On this scale, 400:1 is 2.6A, which would be considered quite poor.
- Stops. Familiar to photographers, this is a logarithmic scale in powers of 2 ie, one stop means an attenuation to one half of the original. On this scale, 400:1 is about 8.5 stops.

The example of 400:1 in this section is a typical contrast ratio for an LCD projector, explaining why LCD projectors fail to reproduce deep blacks very well. The good colour saturation for which LCDs are reputed may merely be an expression of limited gamut. DLP projectors have much better contrast ratios, although this is easily negated by a poor blackout.

5.6 Projector Suppliers

The Table is of those reviewed while preparing this Report. It is not necessarily comprehensive, and no opinion is expressed on the suitability of any particular manufacturer's products for photographic display use.

Maker	LCD	DLP	LCOS
3M	Y		
Acer		Y	
BenQ		Y	
Canon	Y		Y
Dell		Y	
Epson	Y		
Hewlett Packard		Y	
InFocus		Y	
NEC	Y	Y	
Optoma		Y	
Panasonic	Y		
Sanyo	Y		
Sony	Y		

5.7 Additional Resources

Websites with more information about projector types include
www.projectorcentral.com
www.ivojo.co.uk
www.dlp.com

6. DIGITAL PROJECTORS - Common Features

This Chapter describes features common to all digital projectors, and includes some suggestions for feature selection.

6.1 Resolution

Cheaper digital projectors use SVGA resolution (see Glossary). While suitable for lectures, these should no longer be considered for competition or exhibition use.

Currently, the resolution most often used for competitions and exhibitions is XGA (see Glossary), with 1024 x 768 pixels. There are projectors entering the market at the next step up in resolution ie, SXGA (see Glossary, and note that SXGA covers several resolutions). At present SXGA is a minority market with little drive to lower price, so that it is debatable whether SXGA offers a value for money improvement over XGA at present.

Given the typical mix of portrait with landscape images used in photography, native widescreen projectors should be avoided. Likewise, projectors made solely for home cinema, as opposed to hybrid models, have their resolution expressed only in video formats and are not suitable.

Even at a given resolution, different projectors may use smaller or larger image panels. It may be desirable to choose a larger size if all other requirements are met.

6.2 Size / Weight

Ultra portable projectors are now available at surprisingly low size and weight. While these may be satisfactory, especially for travelling lecturers, Club use may require a more robust construction involving more weight. Before assuming that anything up to the weight of a good slide projector is suitable, also consider the weight of other necessary equipment such as a computer to drive the projector.

6.3 Lens, Throw and Image Size on Screen

There are digital projectors designed for long throw in theatres, but these are expensive models with interchangeable lenses. The bulk of digital projectors for commercial/educational use are fitted with short focal length lenses giving a much larger image for the throw distance than Clubs will be used to with slide projectors. Lenses usually have some limited zoom, but this is only intended for fine adjustment.

Another feature of digital projectors, differing from slide projectors, is that the lens is normally shifted vertically to give an asymmetric image. With the projector right-way up, the top of the image is much higher above the projector than the bottom of the image is below. Unlike a slide projector, it is not intended that the digital projector be raised vertically to align with the middle of the screen. This feature also allows the digital projector to be turned over and mounted from the ceiling while being kept reasonably level.

Given the wide-angle throw, and that the distance to the top edge is much more than the distance to the bottom edge, it would be thought that constant illumination across the image would be problematic. But, this seems to be quite well controlled with typical projectors.

Projectors usually include digital keystone correction (qv Glossary), which may be automatic and based on an inbuilt level sensor. As digital keystone correction introduces another tier of image processing, good practice for competitions and exhibitions should be to turn off keystone correction, and either align the projector height properly or tilt the screen. Motorised lens shift adjustment is available on some more expensive models.

Digital projectors always run in 'landscape' format. Because Clubs may be familiar with setting up a square screen to allow both landscape and portrait slides, there is a tendency to describe screens by width. Projector specifications more commonly refer to size by the image diagonal. Then, remember that the typical aspect ratio will be 4:3 so that Diagonal = [Width x 5/4], and not [Width x √2]. Example: A 6' wide screen will have a 7.5' image diagonal, and not 8.5'.

As each make and model of projector has its own throw for size of image, evaluation for purchase must include calculation against the intended screen size and vertical position, with preparation of a site plan. Many manufacturers include a calculation utility with the projector specification on their websites. Clubs may also find they need a new projector stand.

6.4 Lamp

Lamps in slide projectors are relatively simple halogen lamps. Like all incandescent lamps, brightness reduces with time due to a build up of tungsten deposits on the envelope. Most slide projector users ignore the decreasing brightness, and run lamps to destruction while carrying a spare. Spares are relatively cheap. Changing a lamp may take 10 minutes. Professional projectors may carry a spare in a quick-change mount, and the changeover can even be automated.

The most obvious difference in the lamps for digital projectors is their cost. £300 is not unusual. Unlike slide projectors, these lamps are meant to be actively managed. Any lamp can fail soon after installation, and digital projector lamps often carry a short-term warranty. Otherwise, the lamp has a design life at the end of which it is expected to reach half brightness, but not to fail. The projector will warn at the end of the lamp life giving ample time for a planned change. The lamp is fitted in a precision assembly, and changing the lamp is complex. While changing the lamp from cold might take 15 minutes, changing a failed lamp from hot is more likely to take an hour meaning that an entire event may have to be abandoned.

The typical usage of a Club projector (maybe 100 hours per year), set against the design life of the lamp (2000 hours or more), is such that a lamp change will be very unusual. Holding a spare lamp for a digital projector may not be worth the investment.

6.5 Luminance

Digital projectors are rated in Lumens (qv Glossary), without any clear idea of what is required for a particular use. A recommendation may be given as audience size, which is a proxy for screen and image size, hence m^2 of image, hence Lumen/m^2. Confusingly, LCD displays are rated in candela/m^2: 250-500 being typical. None of which is informative to compare with the typical brightness of a slide projector.

Given lamp ageing (above), the brightness of a projector may be as rated new, or down to half that value, or another value altogether as many digital projectors have an economy mode with reduced lamp brightness.

If a digital projector is to be used with different audience and screen sizes eg, Club/group and then Federation/Open event, then a base rating of at least 2000 Lumen may be preferred. Others may be able to refine this suggestion.

6.6 Connectivity (Image)

Up until recently, it would have been universal to expect a projector to have one or two VGA input connectors (qv Glossary), and to drive the projector from a graphic card with VGA output of RGB analog signals. A projector may also have a slave output VGA socket.

That position is changing rapidly. It is becoming common to see projectors fitted with a DVI socket able to accept direct digital input. The DVI socket may or may not be able to accept analog RGB as well (DVI-I standard, see Glossary). The specific advantages of digital input are discussed below, and in the Chapter on computers. Meanwhile, current advice would be to specify DVI inclusive of analog RGB input as this gives maximum compatibility with all computer sources.

6.6.1 Digital (DVI) v Analog (VGA)

Previously, most displays were analog CRT devices. In 2004, increasing production of LCD displays passed decreasing production of CRT displays, and the trend is likely to continue.

A CRT display requires an analog voltage signal per colour channel. The computer's graphic processor reads off the digital pixel data, and converts this with its RAMDAC (qv Glossary) to an analog signal for the display raster line, delivering the signal on its VGA connector. The bandwidth of the analog signal is increased by sharp changes in the pixel data. Regulatory requirements limit the permitted bandwidth, while the attenuation and crosstalk in any cable (such as that connecting to the display/projector) are greater at higher frequencies. Therefore, there is a limit to the resolution of sharp image edges using analog data transmission.

The situation is worse when analog data feeds a digital display. The display must digitise the analog data for its own pixels. Besides the rounding errors in converting the original digital data into and out of analog format, there is no exact alignment between the display/projector pixels and the original image pixels.

So, for a digital display, it is a disadvantage to have analog data, if the original digital data could be sent. With the rapid increase of LCD display production, including their use in broadcast televisions, the DVI connector is becoming the preferred standard for computer displays and projectors. In turn, this is driving a change of the typical video connector on computer graphics systems.

[For a good discussion of these issues see the Dell website section on visual displays.]

6.7 Connectivity (Other Options)

A projector may be fitted with component video (separate phono sockets coded red, green, blue), and/or composite video (phono socket coded yellow), and/or S-video (small DIN socket). These are intended more for video sources including camcorders and DVD players, and may be ignored.

A projector may have a USB connector intended for connection to a computer as a remote keyboard/mouse. Then, a presentation can be controlled on the computer via

the projector remote control. But, equally, a computer can be controlled directly by a wireless (Bluetooth) keyboard/mouse.

Most projectors have some sort of inbuilt speaker system for sound. This will typically be monaural and low power. It will certainly not be suitable for AV presentations, and sound features in projectors may be ignored.

A projector may have a network connector, when both control and image data can be sent from a computer without using a video cable at all. This is useful in multiple or remote projector installations. The extra cost is unlikely to be justified for Club use.

A projector may be able to take image data from a memory card such as USB, Compact Flash, etc.. The reader may be built in or provided by an optional accessory. This allows presentations without a computer to drive the projector, which has obvious advantages in a commercial environment. Software to create the presentation before storing it on the memory card will be provided with projector models having this feature. The disadvantage for Club use may be the inability to manage colour precision accurately (see 9.1).

These options are mentioned really to suggest that any added cost to include them may not be justified for Club photographic use.

6.8 Menus

Each projector manufacturer has their own menuing system to run the projector. Some menu items may only be available on the remote control, which should not be mislaid. Only a few menu items are mentioned here as being important for photographic use.

Users should be reasonably familiar with computer display settings including Brightness, Contrast, Colour Temperature, and the gain for Red/Green/Blue channels. These are replicated on projectors.

Brightness is used to set the lowest observable increase at the shadow end of a step wedge. Contrast is used to set to maximum white level. Colour Temperature usually has some preset values. A custom setting allows individual choice of the Red/Green/Blue channels gains. The Colour Temperature setting is not absolute as the display/projector optics and image control change with time. However, choosing a standard value (typically 6500K) gives a starting point for proper profiling (qv Glossary).

Projectors often have selectable colour processing modes. These may provide settings for video, or particular projection environments like a blackboard, and may also dynamically alter the image processing depending on the image content. For photographic use, a projector should have a least one static setting, which manages all images identically, regardless of content. This may be listed eg, as sRBG mode, and a static mode should always be used.

To permit back projection, a digital projector may have a menu setting to laterally reverse the image. This may be useful for exhibitions.

For ceiling mounting, the projector is usually inverted to allow access to its control panel. Then, there will be a setting to rotate the image by 180 degrees.

7. COMPUTERS TO DRIVE PROJECTORS

7.1 PC Chassis Types

PCs come in various package types - Tower, Minitower, Desktop, Smallform, Ultra-smallform, Laptop, Notebook, Tablet, etc. Within each type there is a fair degree of standardisation, although there remains much scope for customisation if required.

It is commonly supposed that a Laptop computer is required to drive a projector. This is incorrect, and any type of PC can be used. There may be reasons, such as transportability, why a particular type is preferred. But, laptops are more expensive, less configurable and typically slower. The following examples illustrate two alternatives.

7.1.1 Laptop configuration

In a typical laptop configuration, the laptop is tethered to the projector by the image data cable. A variety of cable lengths are available, but this is some limit on the operator location. Depending on the projector model, an additional connection to the laptop may allow the projector remote control to act as a mouse to control the computer.

7.1.2 Smallform configuration

Just to illustrate an alternative to the laptop, a smallform PC is not much larger than a projector, and could be set up as a base underneath it. The operator can use a wireless (Bluetooth) keyboard and mouse to control the computer directly at a distance. Note that the operator does not necessarily need a display in addition to the projected image.

7.2 PC Graphic Cards

Cheaper PCs, and most laptops use ‘integrated graphics’. This means the graphic processor is on the main motherboard, and video memory is shared with main memory. This works adequately for many purposes, and the performance required of the graphic system for static images is quite modest.

If the chosen chassis type has no expansion capability, which usually applies to laptops, it will not be possible to upgrade the graphics eg, to provide a DVI socket if one was not fitted originally. A suitable (non-integrated) card may cost no more than £40. The merits of DVI connection are described in Chapter 6. PC designs are evolving to provide a DVI connection more often, but this is not universal.

7.3 PC Graphics Resolutions

Digital projectors and the flat screen displays used with most current computers, and obviously in laptops, all have a native resolution (qv Glossary). For best display quality, it is important to set the graphic card to drive the display at its native resolution, but this requirement now poses a real problem.

While projector resolutions are mostly XGA, laptop and flat screen displays are rapidly changing, especially to widescreen format (qv Glossary). Even a year ago, it was easy to assume that a 14” display was SVGA and a 15” display was XGA. Therefore, a 15” display laptop would suit an XGA projector with both internal and

external displays driven optimally. Now it is nearly impossible to buy a laptop with XGA as its native screen resolution.

There are options to resolve this problem, which must be considered within the specification and purchase process for any system:

- Use a computer where the projector is the only display, and set the graphics card to XGA. Hence the suggestion to consider a smallform PC rather than a laptop.
- Set the graphics card to XGA and tolerate lower quality on the local display in return for best quality on the projector.
- Use dual graphic cards, set to different resolutions. There is support within Windows XP for dual monitors either as replicate displays or as extended desktop.

7.4 PC Sound

All types of PC will usually have a sound card included. This will include microphone and headphone sockets, and an output for stereo speakers. While there are complex sound cards available eg, for cinema and surround sound, the basic setup is more than adequate for AV presentations.

The universality of sound with PCs has created a mass market for compact but highly effective speaker systems. Either 2-speaker or 3-speaker systems are readily available at low cost, and may be bundled with the computer purchase. These speaker systems are directly mains powered, and accept the low power signal feed from the computer.

7.5 Macintosh Computer Types

PCs predominate at work and at home. But, Macintosh computers predominate specifically in the graphic, photographic and print industries; and in university courses for these disciplines. Therefore, use of Macintosh computers in serious amateur photography may be expected to be higher than in the general population. This may or may not affect the choice of a computer to drive a projector. But, in any case, cross-platform compatibility does have to be considered when data files are exchanged.

Macintosh computers (since 1999) are fitted with DVI-I connectors to feed either digital or analog signals eg, to a projector. Using Plug-and-play, the projector resolution sets the graphic card resolution automatically. Recent Macintosh models have dual/mirror display capability so that a local display and a projector can both be driven simultaneously at their own native resolution, and each with their own calibrated colour profile. Max OSX fully supports on-the-fly resolution and profile switching.

8. COMPUTER / PROJECTOR SETUP

Simply purchasing a computer and projector is not enough. As explained at 4.4, the image data file is manipulated by settings in the computer graphics driver, and by the projector. To provide an adequately faithful reproduction of the author's subject (assuming that the author has prepared the image file correctly), the equipment must be set up correctly, regularly checked and maintained.

8.1 Basic Layout

As explained at 6.3, the image from a digital projector is vertically asymmetric, and the projector should ideally be level. Switching off keystone correction removes one manipulation stage from the rendering process.

The screen is considered part of the overall system of projection. All common plain white screens are considered suitable. Beaded and silvered screens are too directional. Grey screens are sometimes used to control the brightness of a presentation image in ordinary room lighting, but should not be considered for photographic purposes.

8.2 Projector Calibration

Calibration is the process of fixing some settings on the projector menu, and other settings for the computer graphics driver. Overall, calibration affects both these items of equipment, and not just one of them. In particular, a projector is not calibrated in isolation, in the sense that it can then be used with any computer or in any environment.

The range of menu settings for the projector should be reviewed, and a list of exact settings should be recorded. This list will include those for brightness, contrast and colour mode eg, sRGB. An economy mode for reduced lamp power may be useful for smaller screen sizes, and then accurate calibration may be needed for both normal and economy settings.

Note that the calibration can be affected by the room environment. The projected image reflects onto the walls and audience. Light spill, possibly with a colour cast, can then fall back on the screen, especially in small rooms with pale coloured walls. This also reduces the effective contrast ratio of the images.

Calibration should be repeated from time to time. Keeping a record of any calibration drift may be helpful.

There are several approaches to calibration which represent different degrees of complexity and cost. The 80:20 rule probably applies.

8.2.1 No Calibration

It is perfectly feasible to do no calibration at all. The colours may not be quite as expected, but the viewer's brain can make significant adaptation especially in a darkened room. Where events have shown slides and digital consecutively, it is a common perception that the slides appear dim and yellow, and compare poorly with even an uncalibrated projector. Yet Clubs have been happy with their slide projection.

While no calibration may be acceptable for personal use, for training and lectures, and perhaps for non-critical Club use, it cannot be recommended as a deliberate policy.

8.2.2 Simple Utility Program

Any user of Photoshop/Elements will have the Adobe Gamma utility, which is commonly used for monitor calibration. Adobe Gamma is simple to use, and it represents a big improvement over no calibration, at no cost.

8.2.3 Standard Images

Standard images may be in various forms.

- Synthetic step wedges in grey and/or colour are easily prepared as image files, or may be purchased. The wedge should have a fair number of steps: up to 21 steps are used by some. When viewed, all the steps should be individually distinct.
- Colour charts, like those from GretagMacbeth, may be held in matching physical and electronic form so that the projected image can be compared with the printed chart.
- Realistic photographic image sets may be shown before each event. Assuming that at least the basic computer/projector setup is done anyway, these image sets are more about calibrating the viewer than the equipment. But, they may have a place even with a fully calibrated system. Image sets are used by the Royal Photographic Society within their distinction assessments for all media to demonstrate the artistic standard, and for projected digital images additionally to demonstrate the equipment standard.

8.2.4 Calibration Equipment

Equipment has been available for some time as fairly cheap kits to calibrate monitors. More expensive kits, of which the cheapest may be the ColorVision Spyder2Pro Studio, are required to calibrate the image reflected from a screen. By following the kit instructions, a software profile is created and stored for the computer graphics driver.
These types of equipment are reputed to give good results, and might be a shared purchase by a number of Clubs. Calibration is not required for every use, especially if the environment remains much the same. Calibration immediately before use in a major event may be both desirable, and also educational for the participants.

Such equipment is also used to improve the calibration of authors' monitors. This will minimise differences between each author's perception of their submitted image and the end result of digital projection.

8.3 Additional Resources

Websites with more information about colour profiling etc
www.normankoren.com
www.computer-darkroom.com
www.drycreekphoto.com
www.smugmug.com
www.imageplace.co.uk
www.scs-imaging.co.uk
www.colourcollective.co.uk
www.nativedigital.co.uk

9. IMAGE DISPLAY & EVENT WORKFLOW

When setting up a facility for projected digital images, the purchase of a computer and projector may seem like the principal problem. Certainly, questions about purchase are common from those beginning in this field. But, purchasing is done once, and users will quickly realise that the real investment has to be in skills and time to make effective use of the equipment by assembling and managing image sets for events.

9.1 Display Software

The need to file and manage large numbers of images from digital cameras has produced a wide range of album and browser programs. The list discussed below is by no means comprehensive and is not a set of recommendations. This section should be read in conjunction with 9.2 and Chapter 10.

Key decisions when choosing a display program include:

- Colour-awareness. This feature means that the program can read and act upon a colour profile embedded in the image data file. Only with this feature can a colour-managed workflow be retained. Depending on the exact use, there may be an overriding reason not to require this feature, but it would be expected for serious exhibition use.
- How much effort needs to be put into learning and using the software, and how much support it may give for the required use. Programs which support specific event workflow may have some advantage.

9.1.2 MS-Explorer

Microsoft Explorer is quite capable of displaying a slide show either in filmstrip or full-screen. JPG data files are supported, and the data is scaled on the fly to fit the display window. The PC version is not colour aware (qv Glossary) ie, it will not act on any colour profile embedded in the data file. The Macintosh version can be made colour aware.

9.1.3 MS-PowerPoint

Microsoft PowerPoint is the standard for presentations, and can be used to assemble a slide show. Data files need not be pre-scaled before importing. PowerPoint was used as the demonstrator for the Executive's previous experiments considering a permanent collection.

9.1.4 Pictures2Exe

This program is extensively used by AV workers, and has been used for static image events.

9.1.5 Irfan Viewer

This is a general-purpose file viewer with a slideshow feature. It is freeware, and is recommended for salon use by the Photographic Society of Southern Africa. Irfan Viewer may not have a very good scaling algorithm, so images should be prescaled by the author.

9.1.6 ACDSee

This is a viewer and editor program used by The Royal Photographic Society for its distinctions. There are several versions with different ranges of supported file types. Only the Full version when configured with the 'ImagePro' add-on is colour aware.

9.1.7 ProShow Gold

This program has many good reviews, and has been used by The Royal Photographic Society to issue exhibition catalogues. The resulting files cannot be read on a Macintosh computer.

9.1.8 Adobe Acrobat Reader

This freeware program can display any content packed into a PDF file, including pages of images. There are free/cheap programs available to write PDF files.

9.1.9 CompupicPro

This is a browser and viewer program used by the Rushden Open event. There are several versions with different ranges of supported file types.

9.1.10 iView MediaPro

This is a viewer program used by Cambridge CC. It scales images, and is colour aware. The program uses data file embedded metadata to assist in workflow.

9.1.11 PhotoCompViewer / DigiCompViewer

This is a competition workflow program by Philip Stapleton of Marlow CC. It scales images and supports both authors and organisers for the collating, scoring and reporting processes.

9.1.12 ImageComp Pro

This is a competition workflow program by Roy Moore of Maidstone CC and used by the Kent County Photographic Association for its events. It manages the images and supports the scoring process.

9.1.13 Digital Competition Presenter

This is a competition workflow program by Hien Quan of Farnborough CC.

9.1.14 Others

Other display and workflow systems include one written for their own use, and their open exhibition, by Evesham Vale PS. Doubtless there are more.

9.2 Event Workflow

When Clubs invest in digital projection, a key driver is their response to the increase of primary digital capture coupled with the decrease of slides. Clubs will therefore be thinking of digital projection as the logical replacement to slide projection. Chapter 4 compares and contrasts digital and slide projection, and concludes that the two are not directly equivalent, and that new features must be considered.

Even so, the workflow for slide events is sufficiently well understood that Clubs and Federations will be looking to replicate that workflow in digital if possible. Features of slide workflow include some or all of those activities shown in the Table, where some comparative comments about digital workflow are included.

Slide workflow	Digital equivalent
Selection of work and delivery by authors.	Similar, but authors must comply with file format requirements. See Chapter 10.
Intermediate level selection eg, by a Club for a regional/national event.	Club must use digital workflow, and enforce file format requirements. See Chapter 10.
Receipt by the organiser of labelled slides; cataloguing; and sorting into show order.	Handling media and files; use of metadata. See Chapter 10.
Showing the images, recording scores, holding back some items for review.	Use of workflow management software.
Reshowing items for review, recording scores and awards.	Use of workflow management software.
Reporting the results; producing a catalogue.	May be independent of, or included within workflow management software.
Returning work	May only require secure destruction of data files and any supplied media.

9.2.1 Using Simple Viewers

Simple viewers (see 9.1.1 thru 9.1.9) are usable for projected digital events. Scoring can be recorded on paper as would be typical for slide events.

The simplest viewers may lack any means of holding back images for scoring later. But, many album programs allow images to be tagged, where this may be described as a numbered level, or as a star rating, or as a favourite. Then, tagged images can be selected as a subset for reshowing.

Another approach (Swansea CC) is to project from one computer, and have a second operator on another computer with a copy of the image files. Images on the second computer are then moved into folders by score. At the end of the first pass, the folder with the unscored images is copied to the display computer and those items shown again.

9.2.2 'Match-a-Slide' ?

While there is obvious enthusiasm for digital projection, it is worth noting that the cheap and cheerful match-a-slide Club event could be endangered. A fun event with three light boxes, and three domestic-grade projectors becomes a different ball-game when the equipment cost rockets, and the light box has to be managed electronically as well.

9.2.3 Full Workflow Support

Several systems are available with more extensive workflow support. Examples are shown at 9.1.10 thru 9.1.14, but others are known to be in development.

Committing to use one of these programs should be a serious decision involving close study of the facilities, and good training. Working in a blackout during an event is not the time to forget which button to press.

While support during the event presentation itself is expected, some systems go much further and can support the process of submission of work and its collation; and then the process of cataloguing the results and publishing to authors eg, by e-mail. The more extensive the support for interaction with authors, the more important it is that authors comply with the system requirements. That is discussed in Chapter 10.

9.3 Event 'Rules'

The choice of projector, and the choice of event workflow system (whether simple or comprehensive) will dictate the technical limits within which authors must submit their images for projection. These then constitute the event Rules.

It is not possible to make specific recommendations about what Rules should apply for all events. But, it should clearly be the responsibility of event organisers to understand the consequences of their choices of equipment and setup, so that authors can be given an unambiguous set of instructions to follow when preparing their images for the event.

It is unlikely that one set of 'Rules' should apply at all levels of event. At local/Club level, the need is to involve authors whatever their level of skill and equipment. It would be appropriate to retain maximum flexibility in the way work is submitted and managed. At the other extreme of the international exhibition, authors can be expected to be skilled, or not to take part. Organisers should be very specific about their requirements so that the author's work is processed as little as possible (see Chapter 10).

Organisers will lose credibility if their instructions are obviously wrong. For example, many sites searched while preparing this report specify pixels/inch ('ppi') resolution (qv Glossary) for digital projected image files, when 'ppi' is irrelevant.

10. DATA FILES & IMAGE PREPARATION

With slide events, the author does all the preparation of the image, and the event organiser shows the slides as they are provided. Images from all authors are treated the same.

With digital events, the projection equipment always undertakes some processing of the supplied data file, although this can be minimised (eg, avoiding keystoning correction), and must be controlled. But, authors should not fall into the trap of thinking that they need do no special preparation of the image file if they want their work to show to best effect.

This Chapter is about the choices and requirements applicable to image file preparation. When read in conjunction with other Chapters, and especially Chapter 9, this means that event organisers must publish their requirements (see 9.3), and authors must prepare their submissions to match. Basically, it is in the author's own interest to perform as large a share as possible of the image processing.

In general, it has become apparent from several sources that authors need increased awareness of how to prepare their image files. Just as files are prepared for print specifically depending on the intended size and paper finish, so authors should be able and willing to prepare their image files specifically for each projected event. Good practice would be to keep an original image file in whatever format may be desired, and then produce a copy image file to meet the requirements of each event.

10.1 File Formats

Of the innumerable data file formats, only some are for graphics files, and only a few need concern photographers.

10.1.1 PSD Format

This is the Adobe Photoshop native format. It allows layers and an embedded colour profile. Many serious amateur photographers will be manipulating their images and storing in this format. MS-Explorer supports PSD for thumbnail display but not for preview or filmstrip display. PSD may be kept as the master file, from which copies are prepared for individual uses.

10.1.2 TIF Format

This file format may contain layers, and can contain an embedded colour profile. It is possible to apply lossless compression to TIF files, but support may not be provided, and compression is best avoided. TIF may be preferred because there is no loss of data when saving. A TIF file should always be flattened to one layer before submission, and an XGA size image, with embedded profile, then occupies about 2.5MB. A few viewing programs eg, Pictures2Exe do not support TIF. The Royal Photographic Society requires TIF for distinction applications.

10.1.3 JPG Format

This is a compressed file format, which cannot contain layers, but can contain an embedded colour profile. The degree of data compression, and hence data loss, can be chosen when saving. JPG files should not be saved and resaved as data losses accumulate. JPG is the standard for photographic images on the web. The web is not colour-aware so JPG files for this purpose should be converted to sRGB and the

colour profile omitted from the file. JPG is the most commonly specified and supported image file format. Event organisers reviewed for this report often specify a maximum file size (note, not image dimensions) for e-mail submission. An XGA size image, which occupies 2.5MBin TIF format (see 10.1.2) may easily be compressed below 500KB in JPG with little obvious loss of visual quality.

10.1.4 Other Formats

Other file formats such as BMP, PCX should not be used. PNG is not fully supported. For completeness, note that digital camera raw formats, like CRW and NEF, are only input data for the author, and not formats for image submission to events.

10.2 Layers

Authors using image layers will normally retain these in their saved master image file. As when printing, the image will be flattened as part of the preparation of the copy file for submission to an event.

10.3 Sizing

As most events are using XGA equipment, these comments refer to XGA sized images. However, part of the published rules of an event must state the native resolution of the equipment, and authors should size their images accordingly.

Many display and workflow management programs used by event organisers will resize images from that supplied by the author into the native resolution of the equipment. While this may cope with the work of authors who have not sized their images correctly, resizing is a complex processing step not then under the control of the author, and often not much under the control of the event organiser either. As far as possible, authors should control the final appearance of their own images, and proper sizing is part of that control. Event organisers will need to state whether they insist on correct sizing or whether they are prepared to resize, either manually or automatically, at the author's risk.

The XGA format is 1024 pixels wide x 768 pixels high. It is improbable that these dimensions and aspect ratio will exactly fit an individual image. When the image is sized by the author to fit one dimension, the other will be smaller than its limit. The most obvious example is the portrait format image, maybe 512 pixels wide x 768 high. Reports from events relate that authors have difficulty following the instructions on sizing images, especially portraits.

Portrait shaped images get far less image space on screen than landscape shaped images. Several approaches have been used:

- Ignore the difference. Portraits must be 768 high by whatever their width. Landscapes must be 1024 wide by whatever their height. Void space is filled with black by the display program.
- Constrain the landscapes slightly to some width between 768 and 1024 by whatever their resulting height.
- Constrain the width to 768 as well as the height (reported from some Canadian events). Images have 768 on their longer side, and the shorter side is as required. There may be objection to this as a large part of the projector capacity is being discarded, but all images do use a similar screen area.

A specific advantage of using a 768x768 square area for the permitted image is that the projector can then be moved back to enlarge all images on the typically square screen. Although not using the full resolution, a landscape image at say 768x512 pixels is no worse off that a portrait image which anyway had to be 512x768 pixels before. Whether or not this is considered a good idea for competitive events, it is a very good choice for a lecture presentation when the individual images are not so closely examined.

None of the reviewed events seems to have carried their instructions to the logical conclusion, which is to specify that the author must always submit an image of a black background exactly 1024 pixels wide x 768 high upon which the author may place a photographic image using as much of that space as desired. The square image variant of such instructions would merely require the background to be 768x768 pixels. The photographic image could also be any shape - not just rectangular.

In summary, organisers need to reconsider their image dimension requirement, and how much effort they will put into enforcement. Authors must learn to size their images for each event as specifically required. At Club level, open participation by less experienced photographers may require the event secretary to enable automatic resizing. At Federation through to international level, the event organiser may be better placed to disqualify incorrectly sized images.

10.4 Colour Profile

A colour profile (qv Glossary) is a device-dependent specification converting as best as possible between the characteristics of the device, and an independent standard. Nothing in the profile actually changes the colour capability of the device beyond its design specification.

Consumer cameras, most monitors, many display programs, and the web are either colour-unaware (they do not manage colour specifically) or are assumed similar to the device specification called sRGB. Running a workflow amongst these devices without any colour profile management is often adequate for the purpose.

More knowledgeable photographers are likely to capture in the wider gamut of AdobeRGB, and have cameras to do so. Those who capture in raw format will have their own means of pre-processing, also likely to end up in AdobeRGB. This profile will be embedded in the image data file for use by colour-aware software such as Photoshop.

A fully colour-aware workflow requires colour management from the point of capture to the point of ultimate presentation. This divides neatly into two parts - that managed by the author, and that managed by the event organiser. The participants interface via the submitted image data file, whose preparation is part of the author's responsibility. If colour management is omitted at any point, then the only option is for the following stages either to remain unmanaged, or to assume a default such as sRGB.

The colour-unmanaged author is one who either doesn't have the equipment or the knowledge, or who omits colour management at some stage up to and including embedding a correct colour profile in the image data file.

The colour-unmanaged organiser is one whose procedures or computer systems fail to make proper use of any colour profile in the image data files.

The Table shows four scenarios for which effects can be described.

	Colour-unmanaged author	**Colour-managed author**
Colour-unmanaged organiser	Unmanaged workflow throughout, where everything probably approximates to sRGB. Results may be adequate.	Either avoid the event, or, convert files to sRGB before submission. This will approximate to the organiser's unmanaged workflow and may be adequate.
Colour-managed organiser	Files received without a profile should have sRGB assigned at author's risk. Results may be adequate.	Best option. Author embeds the profile with the data file. Organiser can use the submitted profile to best effect.

Although having both colour-managed authors and colour-managed organisers is the best option, note that this still involves the organiser applying some processing to the received images as they are converted to the gamut of the projector. The conversion is lossy for out of gamut colours, and is affected by settings of the rendering intent (qv Glossary). However, authors are still likely to get a better result from a colour-managed organiser than otherwise.

10.5 Metadata

Metadata (qv Glossary) is the information accompanying the image file and which acts as communication between the author and the event organiser to allow the image to be correctly assigned and managed. Even the entry form is a type of metadata.

The following Sections describe some available options. Just as with sizing and profiles, reports from events show that authors find difficulty in understanding and hence in complying with requirements. Success with any of these methods will depend on some training, some practice, and on some operational assistance, so that it becomes harder for the author to provide the data incorrectly.

The most complex data need not be the most difficult to collect, as it may be easier to automate. Equally, just using the filename correctly (10.6.1) defeats some authors.

10.6.1 Filename

The most basic metadata usage is the image file's name, and several formats have been proposed:

- Recognising the old DOS 8+3 naming convention, FIAP has proposed using a country code of 2 characters, a shortened author name of 5 characters, and a sequence number within the author's entry. The short author's name would be confirmed on the entry form.
- A more common suggestion, used by ImageCompPro (see 9.1.12) and many others, is to allow the current file naming style and use a format of "<imagetitle> by <authorname>.jpg", where 'by' is a keyword separating the two name elements. The fields would probably be confirmed on an entry form.

Use of only the filename is simple, but has a limitation, especially in larger groups of authors, where two authors may share the same name.

10.6.2 EXIF / XMP

More extensive metadata than just the filename can be embedded within the file. EXIF (qv Glossary) is a format for data recorded by a digital camera. XMP (qv Glossary) is a more generic standard, and other acronyms may apply. Cambridge CC use this metadata with iView MediaPro (see 9.1.10) to manage their workflow. While users may be aware that files have lists of such fields, commonly reviewed via a File-Properties function, few are familiar with using it consistently.

10.6.3 XML

The ultimate flexibility is available using XML, a mark-up style language suited to defining any fields of the designers choice. XML is used to bind the data elements in PhotoCompViewer (see 9.1.11). Data collection for PhotoCompViewer is assisted by an author-side utility, but could be done via a web page for submissions.

10.6 Media / Submission

There are many media available for submission of files, including e-mail, although the floppy disk is effectively obsolete. The event organiser will need to consider and be equipped for whatever media are proposed for use.

10.5.1 e-mail

Even the best-equipped event organiser may baulk at receiving several hundred uncompressed TIF files by e-mail. e-mail submission usually specifies JPG files, and organisers often state a maximum data file size. To avoid misunderstanding or disappointment, it is advisable for the organiser to confirm receipt of all files. Afterwards, e-mail avoids the need to return any material to the author.

10.5.2 CD

The amount of data likely to be submitted will fill only a tiny part of a CD. CD-R disks are so cheap that they can be considered disposable and organisers can publish a policy of destroying them rather than postal return. Because of this, use of CD-RW or DVD formats merely increases the cost with no benefit.

10.5.3 Memory cards/sticks

There are many types, from USB memory to Compact Flash and the other types of card used in digital cameras. These are valuable media, and are likely to be used only amongst small closed groups eg a Club.

A. SOURCES

As e-mail and website names are subject to change, they are not given here. Readers should search to obtain current details.

A.1 Federations and Clubs

Federations were reviewed via their websites, and Club websites via Federations. Many Clubs refer to digital equipment and competitions, but only those with significant technical descriptions are included here. Also included are links with individuals who have corresponded with the Committee.

Federation	Club	Contact/Content
CACC	Federation site	Policy documents
	Amersham	Steve Brabner
	Marlow	Philip Stapleton
EAF	Cambridge	Tony Sweet
KCPA	Ashford Quest	Alan Crotty
	Deal	John Bowsher
	Maidstone	Roy Moore
L&CPU	Federation site	Digital event rules
	Southport	Keith Suddaby
	Wigan10	Ed Roper
MCPF	Bromsgrove	Peter Young
	Northampton	-
	Rushden	John Tisbury
	Vale of Evesham	Simon Walden
N&EMPF	-	-
NCPF	Tees Digital	-
NIPA	-	-
NWPA	-	-
SPF	-	-
SF	Federation	Policy documents in development
	Isle of Wight	-
	Newbury	-
	Southampton	-
SPA	Farnborough (also SF)	Terry Redman
	Ludshott	David Huntingford
	S.London Federation	Steve Wilbur
	Tandridge	Marcus Scott-Taggart
WCPF	Backwell	Denzil Ellis
WPF	Swansea	Philip Davies
	Gwynfa	Leigh Woolford
YPU	-	-

A.2 Other Organisations

Organisations reviewed where there are recommendations for digital projection.

- Royal Photographic Society (RPS). Contact - Barry Senior.
    - Including, the RPS Digital Group and the RPS AV Group with their regional subgroups. Contacts - Maureen Albright, Ian Bateman
- *Federation Internationale de l'Art Photographique* (FIAP).
- The Photographic Society of America (PSA). This Society has a large Electronic Imaging Division with much useful guidance.
- The Photographic Society of Southern Africa (PSSA). This Society has a very comprehensive set of recommendations for digital exhibition procedures - available on their website.

A.3 Other Individuals

- Tony Riley (ImagePlace)
- Rob Griffith (The Colour Collective)

B. GLOSSARY

This Chapter contains a list of technical terms used in, or relevant to, the Report.

Term	Description
AdobeRGB	A colour gamut more limited than the theoretical maximum, but larger than sRGB. Because of the wider gamut, AdobeRGB is commonly used by serious photographers for capture and processing of images.
Analog	In relation to video signals, where the signal intensity is recorded by a variable voltage.
Analog display	Eg, a CRT display where the image is formed by scanning a beam across the screen with the intensity modified by an analog input signal.
Aspect Ratio	The ratio of width to height of an image or of a display defined in landscape orientation. 35mm film, and some professional digital cameras are 3:2. Standard TV, many consumer digital cameras and most digital projectors are 4:3. Widescreen is 16:9. and other ratios may be used. An image may be masked or matted to fit a particular display. Slide projectors will commonly cover 40x40mm (1:1 aspect ratio, superslide) allowing portrait images to be shown full size. This does not apply to digital projectors.
Calibration	The process of defining and applying a device Profile (qv)
Colour Aware	Refers to display/print software which uses both the profile (qv) of the source data and the profile of the output device to adjust the image for optimal rendering (qv). Software which is not colour aware ignores profiles, and may not maintain the intended image quality. Note that the web is not colour aware. All image work for colour unaware workflow should be in sRGB, as this is closest to most displays.
CRT	Cathode Ray Tube. The traditional type of television and monitor screen. Being largely replaced by LCD displays.
Digital	In relation to video signals, where the signal intensity is recorded by a variable integer number usually in the range 0-255 (8 bits) per channel.
Digital display	Eg, an LCD display where the image is formed by discrete pixels, each individually controlled.
DLP	A type of digital projector where the pixels comprise a reflective grid of movable mirrors which are front illuminated. The image is constructed by rapid switching of the filters. Small DLP projectors use a single panel with successive colours provided by a spinning colour wheel. High-powered and cinema DLP projectors use three panels with spectrum splitting (RGB) and recombination.

DVI	Digital Video Interface. A type of connector on graphics cards and to connect to a display/projector. Colour : white. Two subtypes 1) DVI-D. 24 pins in 8x3 layout, using only digital signals. 2) DVI-I. 24pins as above, but with an additional 5 pins for an analog signal. Assuming the graphic card drives these extra pins, a DVI-I to VGA adapter can be used to connect a VGA cable and analog display.
EXIF	A standard for metadata (qv) recording information about settings of a digital camera when capturing an image.
GIF	Graphic Interchange Format. An image file format, commonly used for logos and other limited gamut images in e-mail/web applications. A GIF file can have up to 256 colours, with the palette embedded in the file. Several GIF images can be packed into one file to provide a cyclical display ('Animated GIF').
Graphic Card	Hardware in a computer, often with its own memory and processor, to drive a display or projector. Will be set to a particular pixel count (horizontal and vertical) which may match one of the common types (SVGA, XGA, WXGA etc), or may use other intermediate values.
JPG *(jay-peg)*	Joint Photographic Expert Group. An image file format, commonly used for continuous tone images in e-mail/web applications. A JPG file is always compressed using a lossy method, where the degree of compression/loss can be stated when saving. When a JPG file is opened it will never contain all the original data. A JPG file may contain an embedded colour profile.
Keystoning	A trapezoidal image on screen due to tilting a projector. May be rectified by: Altering the projector height (hence tilt): first preference. Tilting the screen: second preference. Projector lens shift: only available on some models. By digital adjustment: considered undesirable for image quality.
Lab	Standard device-independent colour space defined by (L)ightness and by two (ab) chroma channels.
LCD	Liquid Crystal Display. A type of digital display where the pixels comprise a transmissive grid of on/off light switches which are trans-illuminated. The image is constructed by rapid switching of the filters. A flat panel display also includes static coloured filters. A projector uses three LCD panels with spectrum splitting (RGB) and recombination.
LCOS	Liquid Crystal on Silicon. A type of LCD digital display where the pixels comprise a transmissive grid but placed on a front-illuminated mirrored chip, so that the light passes twice through the switches.

Lumen	A unit of directional light intensity (flux), derived from the international standard Candela. [The amount of light received on that part of the surface of a sphere subtended by one steradian, from a source of 1 Candela at its centre (4π Lumen = 1 Candela)]. Where used for a projector, this should be the light output through the lens, and hence available to spread on the screen. The audience will experience light from the screen (depending on the screen reflectance efficiency) measured as Lumen/m^2 ie, a larger image on the screen will have fewer Lumen/m^2
Metadata	(lit.) Data about Data. Refers to information additional to the main data in a file, which describes additional properties of the data eg, the author, date, etc.. (qv XML)
Native Resolution	For a digital display or projector, this is the physical pixels of the device. May be expressed eg, as XGA (1024 x 768 pixels). If the pixel dimensions of the supplied image differ from the native resolution, then the device must interpolate the pixels. This is considered poor practice when the aim is to maintain image quality.
Pixel	The smallest square element of an image which can be individually controlled for tone/colour according to the bit depth of the signal. Not strictly applicable to film or analog displays but still used where the image has been processed digitally.
Pixels/inch Pixels/cm	Only required when placing image pixels on a physical medium such as a print. Given the pixel dimensions of the image, this exactly determines the size of the print. Not relevant for display/projection.
PNG	Portable Network Graphic. An image file format designed to allow more colours than the GIF image format, and avoiding the data losses of the JPG format. Rather similar in effect to a compressed TIF file.
Profiling	Establishing the tonal and colour responses of a particular device, and recording these in a standard way so that Rendering (qv) will be optimal. Note that for printers, the paper type is part of the device. Note that for projectors, the screen is part of the device. Profiling may need to assume particular viewing conditions.
RAMDAC	Hardware on a graphic card to convert digital image data to analog format (see VGA connector). Required for analog displays, but not required where a display can accept direct digital data (see DVI connector).
Rendering	Processing an image which may be in one colour space (gamut) and presenting it on a particular device (display / projector / printer) which may have a different gamut. Rendering must manage the combination of all colours, both in and out of gamut for the device, such that the observer sees a fair representation of the original. The method chosen to manage the rendering is called the 'rendering intent'.

Resolution	In relation to displays, the numbers of pixels displayed (horizontal x vertical). Commonly abbreviated, such as VGA, SVGA, XGA. SXGA; also WXGA; also several modes describing television and high-definition television standards not discussed in this Report. See also - Native Resolution.
Rounding Error	Where arithmetic is performed on digital data, the result must be rounded to the nearest number for storage. Image data with only 256 values per channel will be subject to rounding errors on repeated processing such as by image manipulation. The effect appears as blank columns punched out of the histogram, and posterisation levels in the finished image. For example, rounding error is a reason for recommending that multiple manipulation is done by adjustment layers in Photoshop so that all calculation is postponed to a single step in the final flattening for output.
sRGB	A colour gamut more limited than the theoretical maximum, and equating roughly to the capability of a display or projector. Effectively, sRGB is the default gamut for web applications which are not colour aware (qv) and which are expected to be viewed on an uncalibrated display.
SVGA	A screen resolution of 800 x 640 pixels
SXGA	A screen resolution larger than XGA, with a maximum of 1400 x 1050 pixels which may be described as SVGA+. Submaximal values eg, 1280 x 960, or 1280 x 1024 (which is 5:4 aspect ratio), may also be described as SXGA.
TIF	Tagged Image File. An image file format. Usually a TIF file is uncompressed, although it may be made smaller using a lossless compression method. A TIF file may include an embedded colour profile.
VGA	1) A screen resolution of 640 x 480 pixels 2) A type of connector on graphics cards and to connect to a display/projector. 15 pins in 5x3 condensed layout. Colour : dark blue. Uses analog signals for RGB.
Widescreen	Use of a 16:9 aspect ratio for an image instead of the usual 4:3 aspect ratio. Hence, screen resolutions such as WXGA. Widescreen may be emulated on a normal display by leaving black bars top and bottom.
WXGA	A widescreen format resolution of 1366x768 pixels ie, the same height as XGA but wider. May also be minor variations around these values.
XGA	A screen resolution of 1024 x 768 pixels

XML	Extensible Mark-up Language. A language using mark-up tags in a syntax similar to HTML (Hypertext Mark-up Language), but where the tags may be anything conveniently agreed, and are not restricted to a standard lexicon. Particularly useful for describing a database schema, and hence allowing parties to exchange data instances without ambiguity. Use of mark-up syntax distinguishes XML from other systems of data description and messaging, where data exchange is defined by position using field and subfield separators in agreed message segment types. (Examples, but not relevant to this Report, are ASTM, EDIFACT and HL7.)
XMP	Extensible Metadata Platform. A standard for metadata (qv) which, unlike XML, is held within the data file. Includes EXIF data from digital cameras.