THE ASSOCIATION FOR HISTORICAL AND FINE ART PHOTOGRAPHY

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AHFAP JOURNAL

THE ASSOCIATION FOR HISTORICAL & FINE ART PHOTOGRAPHY

Formed in 1985

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From the Chairman

James Stevenson BA FRSA, *Victoria & Albert Museum Photographic Manager*

THE 1999 CONFERENCE at the National Gallery was a great success owing to the excellent quality of speakers. Barbara Bridgers from the Metropolitan gave a fascinating account of the history of her department and William Ingram and Gerard Asnière's self-effacing presentation of their masterful prints was captivating. The open forum on preservation issues was a lively event, one I hope we will continue in the future with other topics. Kodak are to be thanked for their support for this event.

In May of this year the National Railway Museum hosted a third Northern Conference. The highlight of this conference was undoubtedly the illustrated talk by Denis Thorpe, the well-known *Guardian* photographer. Those who stayed to hear him were rewarded by an inspiring talk by one of the great photojournalists of our time. The northern conference has been organised in recent years for those members who often find it difficult to get to London for the annual event. For it to continue it must guarantee the support of regional members. Perhaps more evening or half day social events around an individual speaker would be a more appropriate way of organising these events. I would like to hear from regional members who would host this type of event. It is planned to hold a northern conference at the Museum of Science and Industry in Manchester in May 2001.

It is with sadness that our President, Roy Asser, has been forced to retire from his post due to ill health. Roy served the association well for at least six years and always put a great of energy and effort into supporting the aims of the association. I would like to thank him here publicly for all this hard work. Roy remains a lifetime member and we hope that he will continue to attend association functions when he is able.

The role of President is non-executive but is seen as a post in which the holder represents the ideals of the association and is usually someone who has given service to the profession. A new President will be appointed at the AGM.

The activities of the AHFAP cannot continue without the support of our sponsors. Last year Kodak kindly helped us and this year Fuji have supported both the northern conference and the coming conference at the V&A. The hosts of the events also support the association by giving free or reduced cost support. This is greatly appreciated and without the support of these museums the association would find it difficult to organise such activities. The committee members also give up a large amount of their own time on association business. New committee members are always sought and if there is anyone who would like to become involved then I am only too happy to hear from them.

Before the end of the year it is my intention to get a website of some description built. This will rely on a supply of content from members. It should be a more efficient means of members communicating with each other. Please contact me if you would like to contribute.

The annual conference this year will concentrate entirely on digital image issues. This is a deliberate decision because of the importance this topic features in our working lives. I have recently noticed an increasing trend in some institutions which have formed multimedia departments and given the task of digital image creation. This is regardless of whether they have a photographic studio in-house or not. I find this worrying because image creation should remain the remit of photographers. However, I can see why institutions are being forced to do this, which is that they feel that the technical and managerial issues within the digital environment are not being taken up readily enough by photographers. There is a big learning curve when working in this new way and if photographers do not recognise this change their working destiny will be taken away from them. It with these worries in mind that the current conference will not mention silver halide photography at all. The image maker of the future will need to be one who is both able to 'write with light' in a creative way but will also be able to manage that image from their desktop.

James Stevenson

AT THE MONITOR

THIS IS THE SECOND issue of the Association for Historical and Fine Art Photography's journal to appear in colour and again we are indebted to David Cordery and his team, this time at Max Communications. We are pleased that they still want to be associated with us since they have an impressive list of clients.

This issue's contents, to a greater or lesser extent, carries a warning. Complacency is the luxury of the the rich, the retired and the unemployed. Recently at the Guardian *newspaper's offices some nearly-forgotten photographs of the Easter Rising in 1916 were unearthed in a darkroom. What is significant is not that they were mislaid or, indeed, stored in a darkroom, but that they had to be shifted because the room was no longer needed.*

Again, it was rumoured, not long ago, that the much-trumpeted launch, in the amateur press, at any rate, of the Advanced Photographic System (APS) was a cynical attempt by the major photographic manufacturers to 'launder' acres of potentially useless film stock.

These observations should not cause an outbreak of panic buying but put the message across: the image-hungry world is not sentimental, it abandoned steel-engraving as it embraced photography and took cinema home as its televison set.

The press also recently reported that some churches, in areas where paper money is still appreciated, are to install cash-dispensers. So may the lion lie down with the lamb.

Colin Maitland

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Cover photograph by Michael Kitcat

Articles of Association of the Association for Historical and Fine Art Photography

1. That the Association shall be called the Association for Historical and Fine Art Photography.

2. That it shall exist for the furtherance of photographic and image professionals in the cultural heritage sector.

3. That it shall encourage the interchange of ideas and general support among photographers and image professionals in this sector and promote access to knowledge, thereby increasing opportunities for experience.

4. That the Association shall be defined by membership only. Membership is open to all who work within the disciplines as set out in 2 above.

5. That interested applicants will be invited to submit evidence of eligibility. Membership shall be open to individuals or institutions who meet the criteria as set out in 2 above. The Association reserves the right to refuse membership and renewal of membership, without appeal, to those who bring the Association into disrepute. The committee's decision is final.

6. That the business of the Association shall be conducted by an elected committee, comprising chairman, treasurer, membership secretary, minutes secretary, as officers, and past–future chairman, editor of the journal and up to seven other committee members, with a facility for co-opting other members as required.

7. That this committee be voted to serve for a twenty-four month period for Chairman, Treasurer, Membership Secretary, Minutes Secretary and Journal Editor. That the term of office for the past–future Chairman will be for one year. (Should the Chairman be willing to stand for and be elected to a second term in office the post of past Chairman will be extended accordingly.)

8. That the term of office for committee members will be two years.

9. That the management committee requires a quorum of five members, two of whom shall be officers, to convene a meeting.

10. That the Chairman shall have the casting vote.

11. That the Association shall elect a President. This is a honorary position and members who have given good service to the Association are eligible. The term of office for President will be one year.

12. That a quorate committee shall have the power to dissolve the Association upon notice of one month, with any funds being held distributed to a charity or organisation named within said notice to dissolve.

Approved and passed at the Annuai General Meeting 1999

Postponing the Inevitable

Andrew Renwick, *of the RAF Museum at Hendon, explains how modern and seemingly durable materials are prone to decay*

In July 1998 about 150 photographic conservators and curators from all parts of the world assembled at the University College of Ripon & York St John, York, for the conference on the Care of Photographic, Moving Image & Sound Collections. This was organised by the conservator Suzie Clark on behalf of the Institute of Paper Conservation and the Society of Archivists as part of Photo '98. I was fortunate to be one of those delegates and wish to share with you some of what I discovered.

As its name implies the conference concentrated on the preservation of photographs, primarily twentieth-century plastic negatives such as cellulose, nitrate & acetates, together with cine and magnetic media, including audio and video tape. It even covered the effects of the packaging on the preservation of commercial CDs.

For anyone who has videos, audio cassettes & CDs at home the conference was a real eye-opener. As a photographer, I know the problems associated with the storage of photographs but it quickly became apparent that all plastics share similar problems and that most, sadly, will decay in our own lifetimes unless action is taken.

The conference concentrated on the use of suppressed storage as the only means of preserving plastic materials. By this technique the temperature and humidity are reduced as much as is possible or practical to prolong the life of an object. This can be done in one of two ways; either at the macro level, using large freezers or cold storerooms, or at the micro level, by putting a desiccant into a box with an object in order to maintain low relative humidity (RH). Both methods will help to prolong the life of an object—in our case the photographs we take.

When objects are placed in cold storage access is restricted. The use of digital technology, however, allows researchers access to the image on a screen. At the launch of the *iBase* system *Collage* at the Guildhall Library prints produced by the Fuji Pictrography were shown and it was difficult to tell if an image was created digitally.

The creation of digital images generates its own problems. There is the need for migration of data as file storage-systems become obsolete—how many people still have the hardware to read 5¼" disks, let alone 7" disks? And there is the deterioration of the plastics used in storage media, which we have already discussed. Thankfully the reproduction of a digital image-file does not incur the image-loss traditional methods suffer from and thus can be repeatedly copied, avoiding the need to preserve the media and the equipment to read the data.

In the second part of this article I wish to show a method of analysing the success or otherwise of efforts to preserve photographic materials. It is of value to both the creators of photographs and the conservators. It is a method of measuring the life of an object wherever it may be and projecting the effects of changes in storage.

Many studies have been made to determine the life expectancy of photographic bases; how long a plastic negative will last before it has to copied and how long before decay renders it unprintable. An acetate negative stored in an office at 22°C 50% RH has a life of only 33 years.

These projections are termed the Preservation Index and there is a range for different combinations of temperature and relative humidity. If, for example, the temperature of the office is 17°C the life of the acetate negative would be 66 years—twice as long at a small reduction in temperature.

This only applies if the negative has been stored at the lower temperature from the outset. The Preservation Index does not take this into account and so the Time Weighted Preservation Index was developed.

The Time Weighted Preservation Index (TWPI) is a simple formula, derived from experimentation and experience. For those who are interested it is

$$TWPI_n = \frac{nTWPI_{n-1}PI_n}{PI_n(n-1)+TWPI_{n-1}}$$

where n = total number of time intervals
$TWPI_n$ = TWPI after time interval n-1
and PI_n = PI measured at time interval n

Microsoft Excel or a similar spreadsheet application can be used to record the data and produce a graph. An example (Fig 1) is reproduced overleaf.

In this case each time interval is six hours but the intervals could be of seconds, days or weeks. This is based on real data. It shows that the worsening of conditions after about seven intervals has a greater effect on the overall life of the objects than the improvement at about 22 intervals.

There are a number of ways that this information

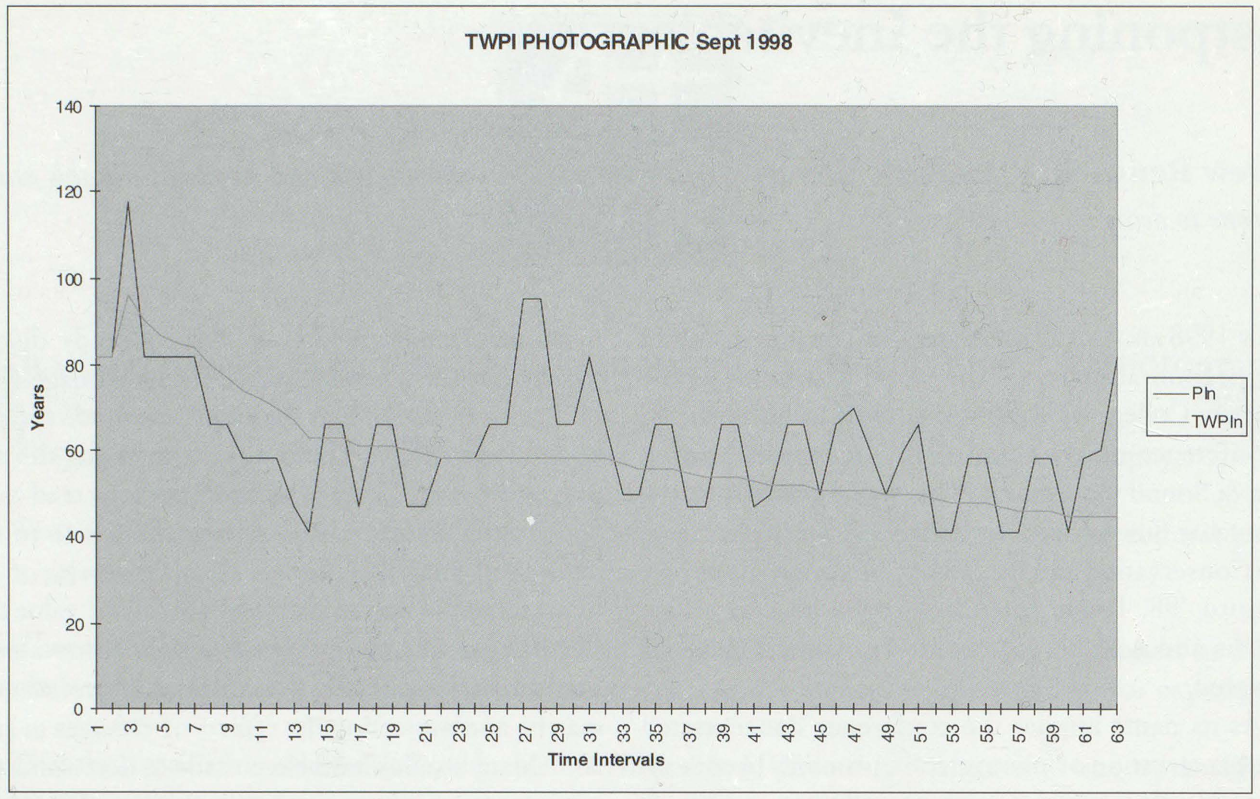


Fig. 1

can help anyone working with photographs. The first is that it allows different storage conditions to be compared. An archive may wish to incorporate cold storage but material used regularly will need to be reconditioned each time, rendering useless any apparent improvement of conditions. Conversely, the use of the TWPI can be used to strengthen the argument for improved storage conditions by quantifying the benefits.

The TWPI can identify material at risk. If a negative has a PI of 30 years and is placed in a deep freeze after 29 it will keep indefinitely, or so it seems. The moment the negative is removed from the freezer, or the power supply fails, that negative is at risk and must be copied immediately. Calculation of the TWPI, therefore, allows us to identify negatives at risk and most in need of copying.

This graph (Fig. 2) demonstrates this. With just one

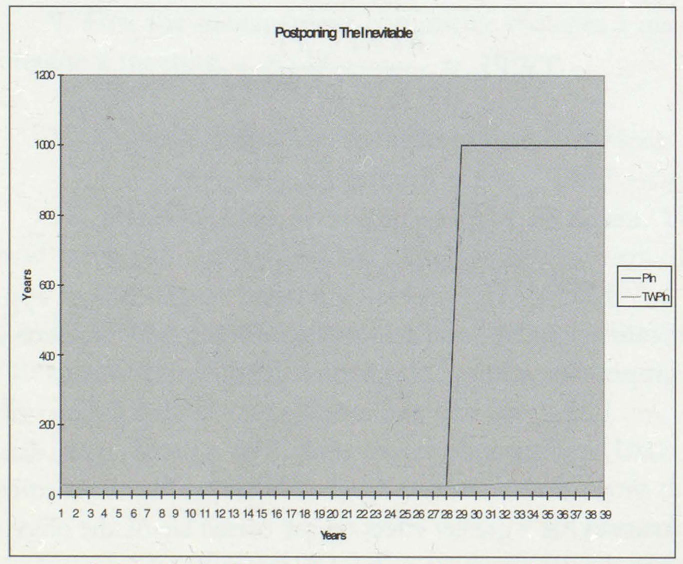


Fig. 2

year of life left the object has been placed in an environment with a PI of 1000, but each year the potential life of the object has been increased by only one year. The object, therefore, will still only survive for one year if removed from storage.

If action is not taken with collections from the 1950s and 1960s they will soon be beyond salvage, although it is impossible to say precisely when the final moment will come. Variations in manufacture, processing, use and storage influence the absolute lifespan of a negative. Thus these are only approximate figures. Sadly, I can confirm they are about right. A collection of material from the 1940s decayed badly at the end of the 1980s, about a 40-year lifespan. Many negatives could not be salvaged but we still have the prints from which they were generated. We were fortunate that the affected collection was mainly of copy-negatives.

All photographers have to deal with plastic-based materials. Careful handling from the beginning can prolong the eventual life of the negative. If care is taken right from the start the ageing of the negative can be reduced, thus easing the problems of curators and conservators in the future. At present only polyester is considered a truly stable base which can be stored for long periods in normal working conditions. All others, including triacetate bases must be considered unstable and in need of extra care and vigilance. AFAP

The Tate Looks Further into the Future

Dave Clarke *reports on the natural consequence of the Tate Gallery's espousal of digital technology—the virtual art gallery*

In the last *Journal* I described the Tate's introduction to new technology, namely digital imaging. We had dipped our toes into the water and scanned 8,000 transparencies onto Photo CD, created JPEGs and constructed web pages accessible to all.

We have now taken a much larger leap to embrace the ubiquitous dot.com culture. This has been made possible by a far-reaching project, the British Art Information Project (BAIP). Closely following the launch of Tate Modern and Tate Britain the project aims to fill all the unrecorded gaps in the gallery's collection of British art and be able to offer images of all works on line by the end of 2001.

Tate Gallery

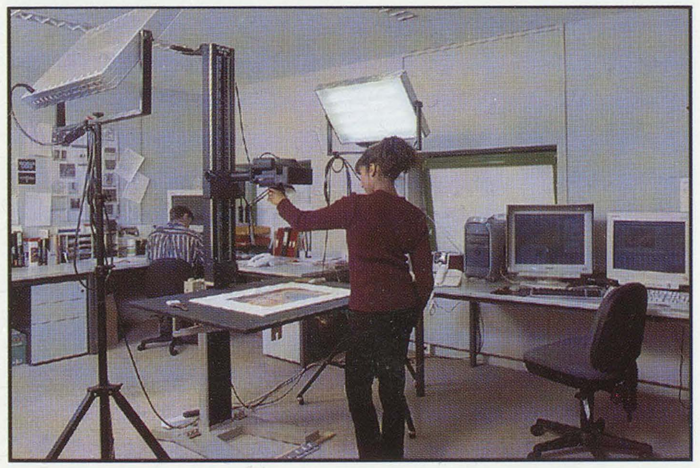
First a project manager was appointed and then, with the help of Tate managers from Imaging Systems, Photography and Registrars, a project team of six was recruited. The team operates independently under the direction of a gallery steering group. The presence of the project manager has been largely responsible for smooth inter-departmental organisation and a distinct lack of the usual protectionism and consequent bruised egos which can occur with this sort of venture.

Two operational sites have been created, one for the project team and the other for permanent gallery photographers. Both sites are connected to an image-management server and possess Mac and PC workstations enabling new digital photography or scanned transparencies to be processed straight to intranet and Internet pages. Image-management is an *iBase* tailor-made system called *inVisage*, which will form part of a new overall collection-management system called *Gallery Systems*, a product currently employed widely in Europe and the USA.

The independent team are using a *Leaf Volare* digital back attached to a Nikon 60mm macro lens to capture all unrecorded works on paper that can be handled by a standard desk-top copy set-up. This three-shot camera produces consistent, accurate, high-quality images. Unhampered by other gallery demands, the aim is to plough through 40,000 works in the next two years. Digital recaptures of Turner sketches and watercolours will form a large part of this total.

The workstations in Photography are connected to, among other devices, an *Imacon Flextight Precision 2* transparency scanner which has proved extremely efficient and user-friendly, producing high-quality images. Dedicated personnel will photograph and scan the remaining unrecorded paintings and sculptures. Although this will accrue to a more modest 2,000 items it represents a substantial organisational challenge. Many of the works will not have been displayed for some time and may need conservation treatment. Access and availability will certainly be a concern in all cases.

It has been decided that the existing 8,000 Photo CD images should be reloaded onto the new system. Although the original scans are essentially good, many of the resulting JPEGs need reassessment with regard to image quality, colour and cropping. This will also be carried out by photographic staff.



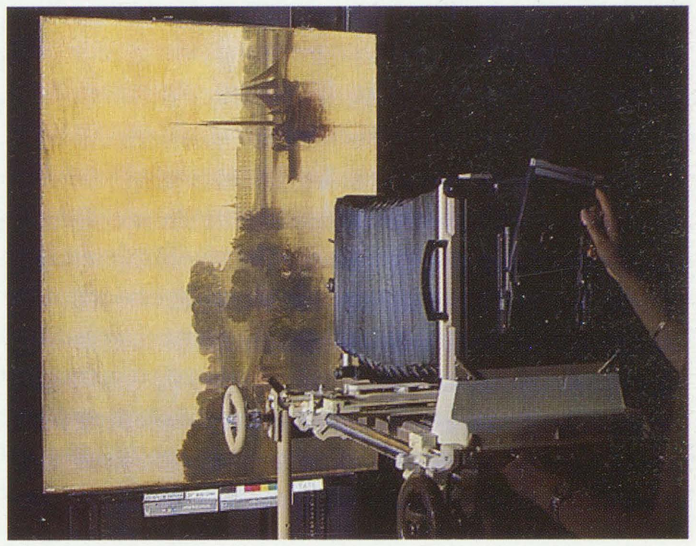
Tate Gallery

Whether produced by *Volare* camera or Flextight scanner, four 24-bit resolutions are produced for Net use, but with only the lower end publicly accessible. Also a 48-bit 35Mb archive image is automatically produced with each image, and stored on CD for future use. All archive CDs will be managed and stored under the Photography umbrella.

The project team has an employment term of about two years but it is becoming rapidly apparent that the work processes being employed are here to stay. The camera–computer–archive logic is very controlled and natural. Even with added complications, such as prints and transparencies, the system is completely secured by the digital archive which is instantly accessible wherever and whenever it is needed. We now have a one-room procedure in place whereby works of art can be recorded, quality assured and be available on the Internet within one working day.

Putting aside technical glitches, of which there are a few at the beginning of any new project, the only really big fly in the ointment is the dreaded C-word, COPYRIGHT! I'm afraid you might sometimes be met by: 'image unavailable due to copyright restrictions', when you open a Tate image on the Internet.

Still...you can't have everything, can you? AFAP



Tate Gallery

High-Speed Imaging at AWE—Then and Now

Philip Rowe, *of the Atomic Weapons Establishment at Aldermaston, describes the development of technology to capture some of the most spectacular sights of the 20th Century. The following is an edited transcript of his lecture at the Northern Conference this year*

THROUGHOUT ITS HISTORY AWE (formerly known as the Atomic Weapons Research Establishment) has had a special relationship with high-speed photography and imaging. In fact, the relationship is reciprocal because AWE has pioneered both the development of high-speed imaging technology and high-speed cinematography. I propose to describe briefly some defining moments and provide an insight into AWE's achievements. But first, with your permission—a short history lesson.

In 1938 German scientists discovered nuclear fission and soon became aware of the potential of this enormous leap forward. After war broke out in 1939, it seemed prudent for the United Kingdom to study the feasibility of atomic weapons.

Ironically, two refugees from Nazi Germany, Otto Frisch and Rudolph Peierls, provided the breakthrough, while working at Birmingham University.

In what is known as the Frisch–Peierls Memorandum, they made two claims—that if the rare isotope, uranium 235, could be separated, the amount needed for an atomic bomb could be measured in kilos rather than tons, and if the fissile component were made in two parts, each less than the critical mass, a bomb could be produced by bringing them rapidly together. British interest led to the formation of the Maud Committee to co-ordinate research into these astounding claims.

In 1940, the Air Ministry Advisor, Henry Tizard, was sent to Washington with the atomic scientist, John Cockcroft. Tizard wanted to attract American interest in the way science was being harnessed to support the war effort and Churchill wanted American help and their contribution to accelerate the atomic bomb development programme.

At this time, information about some considerable British inventions was given to the Americans. This included the cavity magnetron which enabled the development of radar using less than a centimetre bandwidth. The effect was that smaller aerials could be used and resulted in radar being carried on aircraft. A considerable advantage was gained over the Luftwaffe and although it only cost about £200 to develop, the Americans said later that if it had cost £2 million they would still have wanted it. Other products given to the US were details of Whittle's jet engine and the Rolls-Royce Merlin engine, which later replaced the under-powered American engine originally fitted to the Mustang fighter. The Merlin turned the Mustang into one of the most successful fighters of the war. It is not confirmed that copies of the Frisch–Peierls Memorandum were given to the Americans but by late 1940 exchanges of nuclear information were taking place. It must be said that there was some resistance to the passing of British secrets to the Americans but this later bore its fruit. In 1941, Britain began the world's first atomic weapons programme under the codename 'Tube Alloys'. However, the demands of the programme were hampered by the wartime lack of resources. Meanwhile the attack on Pearl Harbour gave American bomb work its own momentum and the British reluctantly concluded that their own work could only continue as part of the American Bomb programme, known as the Manhattan Project. Under the Quebec Agreement of 1943, the British shelved their own project and became a junior partner with America at the Los Alamos laboratory.

The atomic bomb brought the Second World War to an abrupt end. In December 1945, a secret committee under the chairmanship of the prime minister, Clement Attlee, ordered the production of plutonium and a report on the requirement for atomic bombs. The following year, the passing of the McMahon Act by the United States stopped co-operation between Britain and America on nuclear weapons. If anything, this strengthened Britain's resolve to build her own bomb and, in June 1947, work began at Fort Halstead under the leadership of William Penney, who had been on the British Mission at Los Alamos.

A former airfield at Aldermaston became the new home of the British Atomic Weapons Project in April 1950.

By the middle of 1952, preparations for the first British atomic weapon trial were well advanced. The first test took place at 6 seconds before 9.30 am on 3 October 1952 in the Monte Bello Islands, North West Australia.

In July 1954, less than two years after the first test, Britain took the decision to develop the hydrogen bomb, after learning of the success of American tests. But it took more than a year to master the principles. On 15 May 1957, the first test took place following the release of the weapon from a Valiant bomber during Operation Grapple.

The launch of Sputnik by the Russians on 4 October 1957 gave the UK another opportunity for renewed collaboration with the US. Harold MacMillan suggested to President Eisenhower that there might be advantages in pooling effort on weapon development. Eisenhower hinted that the McMahon Act could be amended and British scientists were invited to present some of their work to the Americans, who were impressed with the novelty of their designs. But British scientists continued to work alone and on 8 November 1957, during the Grapple X tests, off the coast of Christmas Island, Britain exploded a powerful hydrogen bomb with a yield of 1.8 megatons.

Operation Antler, a British Atomic Test in Australia in 1957

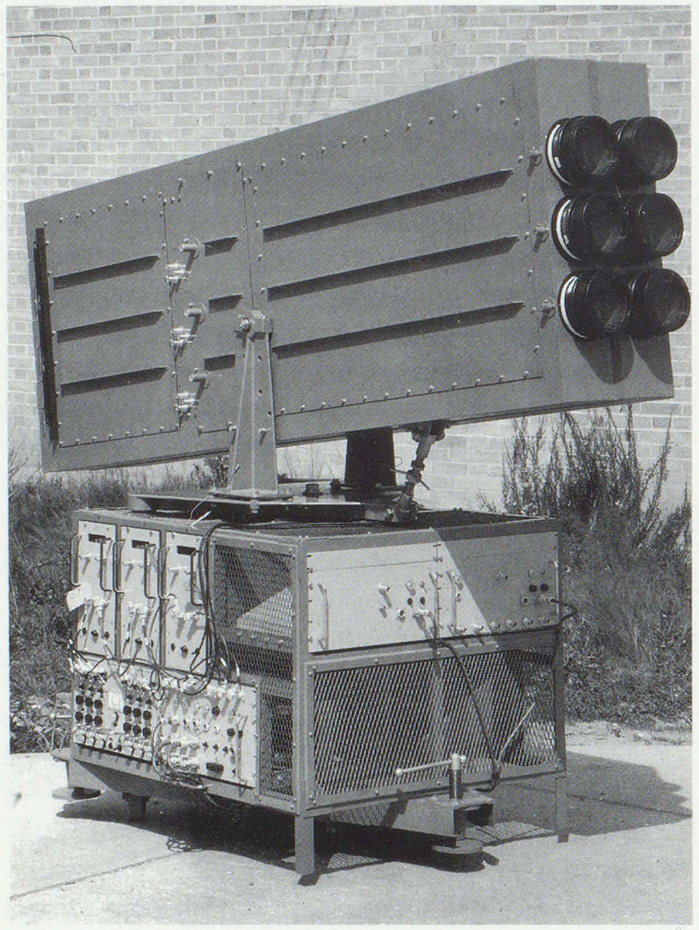
More trials followed, Grapple Y and Grapple Z and more were planned, Grapple M and Grapple O. However in 1958, a moratorium on atmospheric testing focused attention on access to data from fully tested and engineered American devices as a way of avoiding tests. On 2 July 1958, President Eisenhower signed amendments to the McMahon Act which opened the way to a bilateral agreement on nuclear weapon design information. During the negotiations, Eisenhower reminded Congress of the technical developments and help that Britain had given the US in 1940, which had considerably helped the war effort. Hitherto known as 'The 1958 Agreement', it has been a cornerstone for the nuclear weapon community ever since.

The reason for AWE's special interest in high-speed imaging is simple. When the decision was made that Britain would develop a nuclear deterrent and scientists were preparing to test a British atomic bomb, it became clear that photographic evidence would be needed and that this requirement would have two directions. Ultra high-speed cameras would be required to photograph the first few microseconds of the detonation and these images used for further research; more conventional high-speed and normal speed cinematography would be required to record cloud formation and shape, measure height and propagation and to demonstrate to the world that Britain was, indeed, a nuclear power. The problem was that although the latter could be achieved relatively easily, there were no suitable ultra high-speed cameras that could record atomic explosions. These, then, had to be designed and built.

Recording such a rapid event as an atomic explosion requires pictures of very short duration to be taken in order to freeze the movement. Single pictures could not be taken with mechanical shutters because of the requirement for rapid and precise synchronisation. The focus for research was directed towards the exploitation of magneto-optical and electro-optical effects. Michael Faraday discovered in 1845 that in certain materials the application of a magnetic field could cause optical rotation. Consequently, an 'inertialess' shutter could be produced. Faraday predicted that an electrostatic field would also affect light but he was never able to prove this experimentally. However, John Kerr was successful and wrote his work up in papers between 1875 and 1880. The opening sentence of his paper of March 1880 reads, 'In the leisure of my last summer holidays I resumed the inquiry with better means and carried it forward for some weeks with great care.' Thus an achievement that any scientist would be proud of was largely the occupation of the leisure time of a Doctor of Law and mathematical lecturer. The results and conclusions contained in his papers are truly remarkable. He discovered the use of nitrobenzene and described applying voltages that must have been very high—he speaks of ten-inch sparks, implying potentials in hundreds of kilovolts. In his 1879 paper he called his experimental result with nitrobenzol—'a new electro optic effect'. This proved to have great potential as a basis for a high-speed shuttering system. He found that an electric field could induce bi-refringence in certain materials. That is, light could travel at different speeds along different axes in these materials under certain conditions. In this way, placing a Kerr Cell between two polarizers whose axes of polarization are at right angles to each other could provide a high-speed shutter when a suitable current is applied to the Cell. When no voltage was applied, light could pass through the first polarizer (and the cell) but is not transmitted through the second polarizer.

If the correct voltage were applied (typically about 15 kilovolts), the velocities in the cell would differ and a phase difference would occur between the light transmitted on the two axes. If this difference were half a wavelength, the effect would be to rotate the plane of polarization sufficiently for light to be transmitted through the second polarizer. Using Kerr Cells, exposure times could be as short as a few nanoseconds. A nanosecond is 10^{-9} seconds or one thousand millionth of a second.

AWE successfully developed and used Kerr cell cameras on British trials.



A six-channel Kerr Cell camera, with a focal length of 28 ft, which was used to photograph nuclear explosions at distances of several miles. Each channel could take a single photograph with an exposure time of about 0.1 of a microsecond (one tenth of a millionth of a second)

The six-channel camera had a focal length of 28 feet (to photograph nuclear explosions at a distance of several miles) and is six separate cameras mounted on a framework. It utilised three types of shutter, the master mechanical shutter—a relatively slow 'blanking' shutter, the Kerr Cell shutter capable of delivering exposure times of 0.1 of a microsecond when a 16 kv pulse was applied, and a shatter shutter. This shutter consisted of a glass disc sandwiched between two perspex discs. The shutter is closed by firing a detonator placed at the edge of the glass disc which shatters it to a translucent powder.

However, systems based on the Kerr Cell were limited by the rate they could be switched and the other major drawback was that they absorbed a high percentage of the available light. Despite the problems, Kerr Cell shutters were very successful on early trials, because light from the self-illuminating event proved to be advantageous, and they continued to be used for many years afterwards in laboratory experiments. The problem of obtaining colour pictures through Kerr Cells using short exposure times was overcome at Foulness. Here, a really powerful light source, the argon flash bomb was developed. A small amount of explosive is used to shock argon gas contained in a can with a transparent window. Not only is the flash bomb very bright but its duration is measured in microseconds; it produced pictures with a surprisingly good colour balance.

It is interesting to note that the Americans were less interested in the Kerr Cell as a high-speed shutter than the British. They, however, had considerable success using Faraday shutters.

Having reached the limits of speed and the progressively increasing light loss resulting from constantly seeking to shorten the exposure time, new photo-electrical systems began to be developed. Certain metals emit electrons when radiation falls upon them and some are reasonably efficient in response to light. An evacuated tube using a photo-cathode coated with one of these metals at one end and a phosphor, like a TV screen at the other produces an 'image tube'. The image of the event to be recorded is focussed onto the photocathode. Electrons are then emitted from the photocathode in amounts proportional to the amount of light falling upon it. These electrons are accelerated by the anode and focussed by the cone electrode onto a fluorescent screen, where the image is recorded photographically.

An exposure is obtained by deflecting the electron beam across an aperture in the shutter plate, by applying a waveform to the shutter deflector plates. The same exposing waveform is applied to the compensating deflectors in order to obtain stationary images.

It was apparent that in order to gain the most from an experiment, it was important to be able to see what had occurred during the important first few microseconds and to be able to visualise changes during this period. This required more than just single pictures to be produced. Normal cine cameras have an intermittent action—the film moves between exposures and is held stationary while the exposure is being made. These cameras can often run up to about 64 fps and, when projected at normal speeds offer a slow motion view; this can be described as high-speed photography. Specially designed intermittent cameras can run at maximum speeds of about 500 fps using 16mm film.

Beyond the maximum speeds of these cameras, the film cannot survive the stresses involved in continuous high-speed stops and starts. Purpose-built high-speed cine cameras had been available since 1932 when they were first used at the Los Angeles Olympic Games. This was called the Kirby Race Timer Camera after the chairman of the games and was based on the principle of moving the film continuously and compensating for the movement of the image relative to the film. The most popular method employed in the 'image-compensating' camera is to pass the beam of light which forms the image through a rotating prism or glass block; the beam is refracted as it passes through the prism by an amount which varies with the position of the prism.

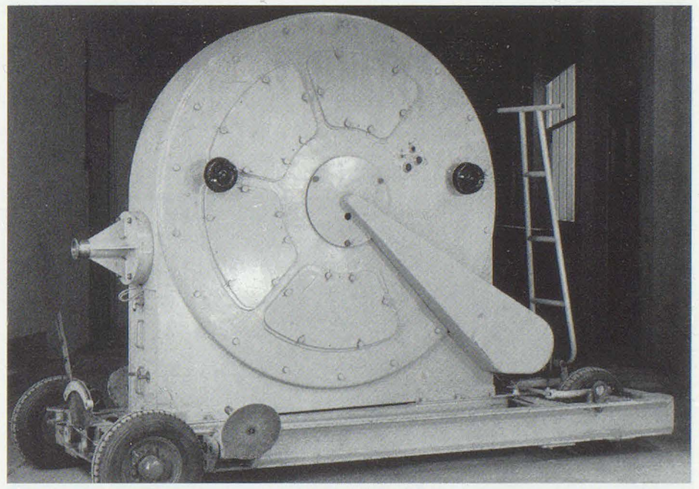
The image moves exactly with the film and the block mount acts as the shutter between exposures.

Typically, modern versions of these cameras use 100-foot or 400-foot magazines of 16mm film and can run at speeds up to about 10,000 frames per second at normal size and twice that at half height. But thought needs to be given to the fact that to achieve running at 10000 frames per second, about half of a 400ft magazine of film is consumed before the recording speed is reached. The maximum speed of rotating prism cameras is limited by the ability to move the film and by the strength of the film itself. Indeed, the latter is critical and Estar-based films are avoided owing to their great strength. Should a problem occur while the camera is running, it is better for the film to break than an expensive camera.

However, at the time of the Hurricane test, commercially available cameras could record only up to about 8,000 pictures a second. This was nowhere near fast enough to photograph the first few microseconds of atomic explosions.

Using film that is stationary and moving the image provided the solution to producing a sequence of pictures taken at extremely short exposure times over the critical period of the event. Although rotating mirror cameras, which scan the light across stationary film, had been used for streak photography since the late 19th century it wasn't until CD Miller's patent in 1940 that the true appreciation of this brilliant idea was realised. However, it was not fully applied until after 1945 when both Los Alamos and Aldermaston developed cameras for nuclear research purposes. The basis of the system is that a real image of the subject is produced at or near the surface of the rotating mirror; each lens of an arc of small lenses above the mirror then produces an image of this onto the film. The speed of these cameras is limited by the strength of the mirror material. At very high speeds the mirror will burst owing to centrifugal force and above about 80% of burst speed the image becomes distorted.

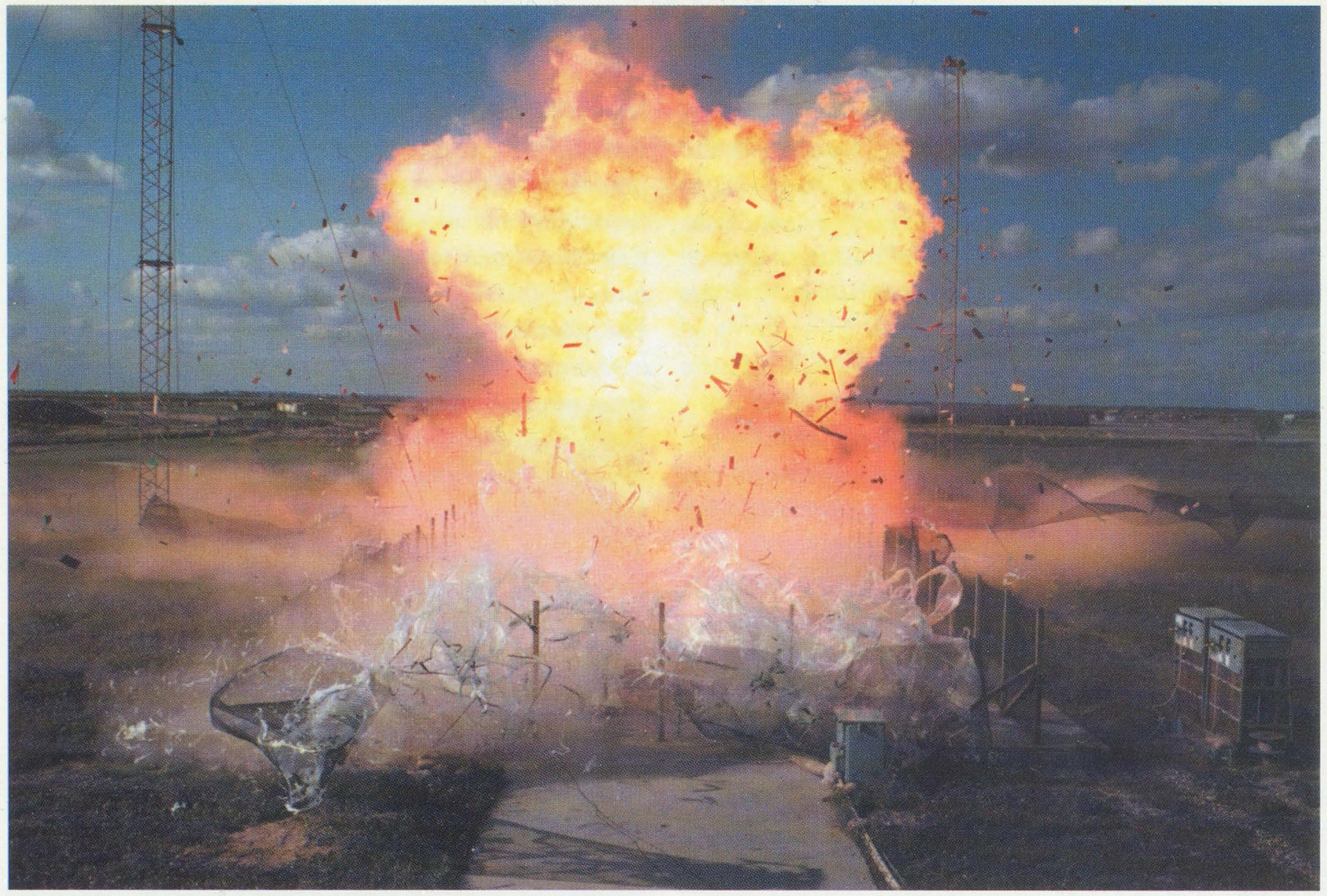
A further development of the Kerr Cell at AWE led to its use as a pulsed shutter, synchronised with a rotating mirror framing camera. A beam-splitter enabled two sets of 40 taking lenses to be used, providing a total of 80 pictures on two conically-shaped film tracks. By means of a carefully synchronised electronic system, capable of supplying pulses to enable repetitive shuttering at the rate of 10 frames each microsecond, the Kerr Cell shutter was made to 'open' for a short period while light was reflected from the mirror through the taking lens and onto the stationary film. The Kerr Cell Cine camera was able to produce equivalent framing rates of 500,000 frames per second, at a rotor speed of 187,000 rpm. The camera was cylindrical, about 5 feet in diameter and weighed about 3,000 pounds. Exposure times were as short as 0.1 microsecond. The use of a Kerr Cell improved the basic camera's resolution because the exposure time is shorter, thus reducing image movement, but its main drawback remained its reduced light output (typical relative aperture—*f*55!). The prototype did not fulfil its original design resolution of 1000 lines over a 2-inch frame, since time considerations resulted in the use of meniscus lenses. The first resolution measured was 700 lines. More serious deterioration occurred when it was run at speed—at 300,000 frames a second resolution fell to 350 lines. It was concluded that this deterioration was due to air turbulence around the mirror but lack of time prevented any further investigation. A mechanical shutter was used at the beginning of the exposure and since this could not be made to operate at sufficient speed to prevent pictures taken at the second cycle of the rotor from being superimposed on the first, a shatter shutter, as described earlier, was incorporated.



The Kerr Cell Cine camera, developed by AWRE, could deliver exposure times as short as 0.1 of a microsecond at framing rates equivalent to 500,000 picures per second

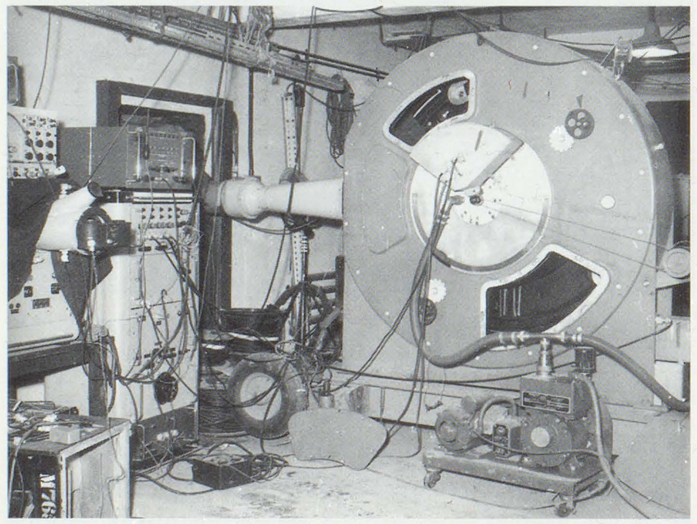
The production model used two types of rotor and mirror assembly—a belt-driven version with a maximum speed of 40,000 rpm and an air-driven model with a maximum speed of 250,000 rpm.

It is interesting to observe this extract from James Tuck's notes, which he produced following his return from Los Alamos as a member of the British Mission. They are dated December 1946. 'For extreme of snapshots photography, a Kerr Cell must be used. (Beams



A recent high explosive trial at Foulness. High-speed rotating prism cameras, capable of recording at 10,000 fps, are used to measure the velocity of shock waves produced by the blast

obtained exposure times of 10^{-8} by such means in his studies of spark phenomena.) A considerable effort was expended at Los Alamos on a really high-class Kerr Cell shutter camera designed to take movie records at exposures of this order. The Kerr Cell was operated from a modified radar pulse generator. It was completed and was found to have too poor a light transmission to be of much practical use and lay derelict in 1946."



The C4 rotating mirror camera, also known as the 200-kilocycle camera, set up for use in a laboratory experiment

A requirement for a 100,000-frames-per-second camera to bridge the gap between the Fastax and the Kerr Cell cine camera for the photography of nuclear explosions resulted in the development of the C4 camera. This camera which could run at 200,000 frames per second (and was also known as the 200-kilocycle camera) was virtually the same as the Kerr Cell cine camera but with the Cell removed. It produced 140 images, had a relative aperture of *f*16 and was produced for British trials in 1956.

The camera had a rotor speed of 43,000 rpm although a maximum of 47,000 was achieved in practice. The lens had 100-inch focal length. Should you have wished to buy one in 1957, it would have cost you £7,000. A later version, the C4a, used a two-lens system to obviate the need for a beam-splitter and to reduce light loss.

The C5 camera, which was later manufactured by Barr and Stroud, was designed for the study of ultra high-speed phenomena, providing 30 pictures at one of three taking rates.

An air rotor, driven by a small compressed air turbine, was able to reach a speed of 400,000 rpm. The rotor housing was fitted with a cylindrical window, so that it was only necessary partially to evacuate the relatively small rotor assembly. This was a considerable advance on the Kerr Cell cine camera and the C4. The camera could operate at 2.5 million, 5 million and 10 million frames a second with picture sizes of 15 mm, 10 mm and 6 mm respectively.

The configuration of the Barr and Stroud CP5 framing camera could be varied to enable a range of pictures and framing rates between 28 pictures at 1.6 million a second to 117 pictures at 7.9 million a second. Event durations at maximum speed were about 14 to 17 microseconds.

The rotating mirror camera could also be used as a streak camera rather than a framing camera. In this mode the relay lenses are omitted and the camera images a slit, past which the event takes place. The mirror rotation moves the image of the slit across the film at right angles to the slit axis. The speed of these cameras is usually given as the distance the slit image moves along the film in a given time (the 'writing' speed).

Of the S series streak cameras, the S4 camera had a writing speed of 20mm a microsecond at a rotor speed of 193,000 rpm. The S4a used a slightly smaller mirror which enabled it to record at 40mm a microsecond at 400,000 rpm rotor speed.

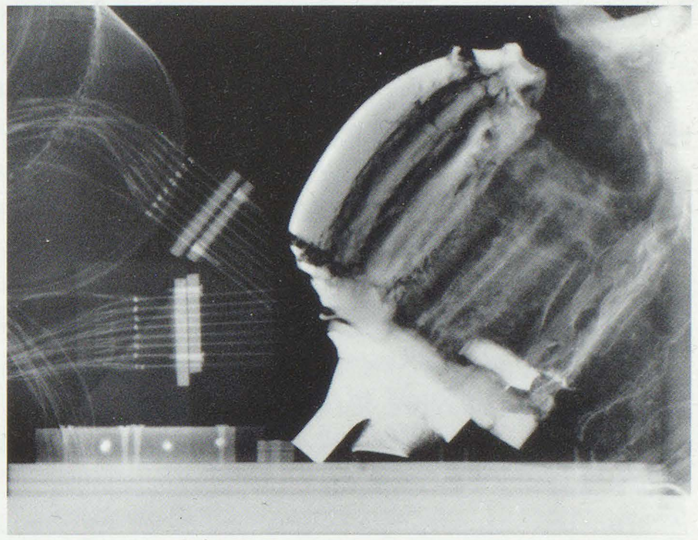
Much effort was put into rotor and mirror design, where bearings, lubrication, speed of rotation and resolution are critical. Hence the major step forward made in design between the Kerr Cell Cine camera and the C5, previously mentioned. Other novel designs were introduced. Alec Huston produced one remarkable design where the mirror was magnetically suspended in a vacuum, thus having no bearings. It could run at any speed up to its strength limit, when it burst owing to centrifugal force, but it proved difficult to use optically.

Today, many other types of high-speed imaging are in use at AWE including high-speed CCD capture, flash x-rays, interferometry and infra-red imaging.

In parallel with the ultra high-speed recording that I have described so far, AWE has always had a requirement for high-speed cinematography to support both trials and other research work. This capability goes right back to the early years. As I mentioned before, the Kirby Race Timer Camera was used at the 1932 Los Angeles Olympics and this later became known as the Electrical Research Products Incorporated Eastman High-Speed Camera–Type 2. It had a maximum framing rate of 2000 frames per second. In 1933 Bell Telephone Laboratories approached Eastman Kodak about making a camera having twice the speed of the Type 2. Since the Depression was still on they were not interested but released the patent to BTL. Their first camera was produced in 1934 and this was the forerunner of the Fastax.

But more development was to take place—in 1942 in Rochester, Eastman produced the Eastman Type 3 High-Speed Camera, later known as the Kodak High-Speed Camera and eventually the Magnafax, when Beckman and Whitley took over its manufacture in 1958.

Operationally, there were similarities between ultra high-speed imaging and high-speed cinematography at AWRE in that it was not just a matter of routine activity. Pioneering work took place in this area, including modifying cameras to suit specific operations. AWRE had its own team of camera engineers and they produced a number of innovative solutions to high-speed cine problems. A modified 400ft Fastax was built with this novel film looping system. The Loop Camera was designed to photograph somewhat unpredictable events. For example, an event might be expected to occur within a time bracket but this bracket might be longer than the recording time of the camera. Normally, 400 feet of film would be expended within two seconds at a framing rate of 8,000 frames a second—thus the event must occur predictably within one second to be sure of a reasonable record. This loop design camera was able to run for about 30 seconds at 5,000 pictures a second and for minutes at 500 pictures a second.



A nanosecond flash x-ray image of a high explosive trial, showing measuring probes and a flash bomb (used to provide illumination for optical rrecording) to the left

The Media and Publishing Group maintains this long tradition (almost 50 years) of providing high-speed cine services both to AWE and outside agencies.

We maintain a considerable capability which is applied to trials and laboratory work and have an extensive inventory of cameras, which are suited to a diverse range of applications and comprehensive capabilities to support instrumentation and other related processes. I'm sure that achievement is what is important.

Philip Rowe, Media and Publishing Group Manager, AWE—May 2000 AHFAP

BOOK REVIEWS

by

Colin Maitland & James Stevenson

BRANDT

The Photography of Bill Brandt

Bill Jay & Nigel Warburton

with a foreword by David Hockney

320 pp., 378 illustrations in duotone

ISBN 0-500-54234-1

Thames & Hudson, 1999 £48

MANY EPITHETS have attached themselves to Bill Brandt over the years, morbid, melancholy, haunted, harsh, ominous, brooding. But enigmatic seems to suit him better. He cannot be neatly pigeonholed. He was variously a Surrealist, he was an assistant at Man Ray's studio in Paris and must have relished the contradiction in terms implied by training as a Surrealist. He was also a Pictorialist, in that the darkroom was his forcing-house, the negative merely a means to an end. And he was a 'documentary' photographer, working for magazines such as *Picture Post*, often uncredited. After its demise he went freelance and concentrated on private work, his *Perspective of Nudes*, until some enlightened picture-editors commissioned portraits of artists and writers for the likes of the *Daily Telegraph Magazine*, *Life* and the artistically committed and fashionable periodicals of the 60s.

And yet, taken in its constituent parts, his work is very much of a piece. His themes are constant, how architecture—he had some training as an architect—defines an age, how different are the lives of the rich and the poor, but how similar are their needs, differently expressed. He fills empty gardens with the intimations of dreams and sometimes succeeds in making the split second of a photograph represent the eternal. His portraits show the sitter's expression in repose so that, as he put it, one may see not only some of the subject's past but also some of the future.

It is reasonable to assume he was not a compromising man: he worked almost exclusively in black and white and insisted, at least in the 60s, on doing his own printing and disowned the softer prints the editors had from their labs. He was an artist first and a photographer only to record his vision.

His influence, at least in the second half of the 20th century, was considerable. Largely eschewing colour, the exciting new medium, he demonstrates the continued value of monochrome and how its apparent limitations reinforce, concentrate and liberate the act of seeing. Mimesis, slavish copying, is only one aspect of image-making. In his experiments with colour, studies of sea-wrack in the 60s, he was not interested in the verisimilitude of the process but in its potential for unusual effects, just as he was not interested in Adams's perfect negative or Cartier-Bresson's rigid precepts. His achievement is as remarkable as theirs is in their way, a function of human creativity.

This description of his temperament is perhaps misleading. He was, for fifty years, a working photographer in great demand not only by the press but also by the government. In 1943 he was commissioned by the National Buildings Record to photograph the buildings and contents of several major cathedrals in

Ascot 1935

what seems a helpless gesture against the Luftwaffe's Baedeker raids, aimed at Britain's historic cities. The following year, for *Picture Post,* he produced a portfolio on *A Year's Work by the National Trust.* Again for *Picture Post*, between 1949 and 1952, he worked on at least a dozen fashion shoots.

BRANDT is a very well produced book. The plates are printed in duotone to a high standard. Following the main plates there is a section of generous thumbnail images showing an example from each of his major projects and an informative note about Bill Brandt's printing methods. The book is short on biographical matter, however, and does not tell us that he was of German extraction, born in 1904 in London and died here in 1983. *CM*

THE JOURNAL OF THE PHOTOGRAPHIC SOCIETY OF LONDON

Containing the Transactions of the Society and a General Record of Photographic Art and Science.

Edited by Arthur Henfrey, F.R.S., F.L.S. ETC.

Volume the First. Taylor & Francis, London 1854

Facsimile edition published by the Royal Photographic Society, 1976 £5

'I HAVE CONTRIVED a very cheap and efficient means of obtaining that perfectly horizontal position and angular direction so essential in depicting architectural subjects and landscapes...having two musket-bullets attached to a silk thread, simply hang them over the camera, and everything required will be attained much quicker by these plumb-lines, and with accuracy equal to...spirit-levels.'

So wrote Mr Wilkinson in the first number of the Photographic Society's *Journal.* It is indicative and typical of the spirit of generosity and curiosity of the early practitioners of photography, a spirit which, I believe, survives to this day. Mr Wilkinson continues that this same silk thread, knotted appropriately, serves also as a measure for stereoscopic photographs and, suspended, produces a pendulum for long exposures. This is an example, surely, of improvisation and ingenuity in the same tradition.

What is now The Royal Photographic Society was founded in 1853 as the Photographic Society of London. Its purpose was to stimulate the new art and foster its science as a conduit for the free flow of information and to redress the 'want of a centre of union'. The *Journal* was established to record the proceedings of the society and disseminate its sum of research to the far-flung membership. It was intended also to 'be open to the correspondence of Photographers, and shall contain, from time to time, a report of the progress of Photography both at home and abroad, with full translations of such papers as may appear especially interesting...'

This delightful facsimile achieves these *desiderata* in full measure. To browse in it is, literally, like turning the pages of history. The immediacy of the reporting of proceedings evokes not only the glare of gaslight and the smell of damp frock coats but the thrill of being present at the revelation of scientific discovery. The high quality of the contributions from members and correspondents marks the *Journal* as a crucible of photographic endeavour—and an object lesson to some publications of today. *CM*

A GUIDE TO COPYRIGHT FOR MUSEUMS AND GALLERIES

Peter Wienand, Anna Booy, Robin Fry

Routledge 154 pp.

ISBN 0-415-21721-0 £19.99

THIS BOOK, which was proposed by the Museums Copyright Group, complements the ABCD of Copyright published by the British Photographers Liaison Committee. It differs from that publication in that it is dedicated to the particular problems faced by museums and galleries and anyone in the cultural heritage sector. It is welcome to see in print examples that recognise issues such as primary and secondary copyright in both the image and the depicted subject, and such subjects as the responsibility of staff members of public institutions.

The publication is written by practising lawyers working in the field of intellectual property rights and this gives confidence that the information it contains will stand up in a court of law, although they are quick to mention where examples are yet to be tested.

What is good about this publication is that it also concentrates on licensing as a consequence of owning copyright. These two are sometimes confused and they clearly explain how you can still license images even though you may not fully own intellectual property rights if the correct procedures are followed. This is really a discussion about contract law and even though the intricacies of this are beyond the scope of this publication the basic principles are sufficient to assist in setting up sound licensing agreements. This is assisted by the inclusion of model licenses and agreements that the authors state are available for any reader to use on a non-exclusive basis. This alone makes this book a worthwhile investment, because agreements such as these can be very expensive to commission.

Perhaps for me the single most telling piece of advice is that a full understanding of intellectual property rights is today an obligatory subject for anyone working in museums and galleries, and that in order for a cultural institution to fulfil its mission of making its collection as widely available as possible then the commercial aspects of licensing cannot be ignored. In fact the current attitude to increased access to the nation's collections makes them beholden to do so. *JS*

Image Metadata and Quality modifiers

Our chairman, **James Stevenson** *of the V&A, describes a useful system of image-classification based on existing stocks and experience of its organic structure*

The management of images in a digital environment demands a different set of disciplines from those that most photographers have used for analogue images. While developing new procedures for cataloguing digital images I realised that the quality variables we take for granted with analogue images needed to be formalised.

The V&A Photographic Studio has always prided itself on producing photographs of fine art subjects to a high standard. Even though fashions in photographic style have changed many times during its history this standard has always been maintained. This history is well illustrated by examples in the V&A image collection.

V&A Category B

These early images illustrate the principles that still apply today: plain background, careful choice of viewpoint, sharp edge and distortion-free high definition. Materials and processes may have changed and can be said to have evolved for the better, but the message of the image remains the same; to illustrate the object to reproduce as closely as possible the experience of seeing the object.

I knew, however, that we have always made other types of images which have not been catalogued and stored in the same way as these descriptive photographs. Many pictures in the museum have been made by non-photographers which have been used for low-level cataloguing purposes, conservation record-keeping, as well as for lecture presentation. These image assets have been neglected for a variety of political reasons.

We have also created images which have been used to illustrate the collection creatively. The publications policy of the V&A has been to match the academic with the popular. To stimulate the latter, a new approach to photography has been undertaken. This is to show the collection, not so much realistically, but in a way whereby the photographer's creative input presents the object within its wider social and stylistic context.

The creation of a whole range of images which do not fit into the accepted view of photographic studio production led me to develop a system of quality classification for V&A images. This system has become useful in the digital environment.

The three types of image made by the museum are classified as

A	Creative Image
B	Descriptive Image
C	Record Image

These classifications, particularly the C category, can be broken down into further sub-categories. As soon as an image has been classified it can be linked to an authority qualifier. Within the digital environment this allows the use of the image to sink, but not to rise.

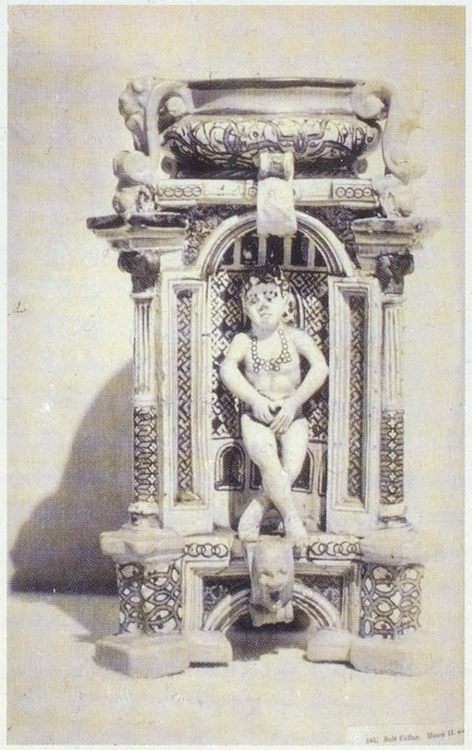
Publicity	High Quality Repro	Academic Reference	Security/ Inventory
A	A	A	A
	B	B	B
		C	C

With this system of classification any image made in the museum can be stored, and managed, in a central image arena. In a database structure this quality classification can be linked to an authority control. Therefore a category A image can be used by any image-user, for any purpose, but category C image use will be limited by its quality. In this way control can be independently exercised on the profile of the museum by its images. For instance, commercial buyers of reproduction will be denied access to category C images.

V&A Category C

How will these quality categories fit into metadata? Image-makers are the people best able to judge these limits and an institution's own policy will dictate its standards.

Metadata is an essential means of managing digital assets. Adding a quality modifier to the metadata structure of digital images allows photographers to limit the use of their images and exercise greater control over potential misuse. The development of metadata for digital images has developed from the IT and bibliographic worlds. Developing standards include such formats as Dublin Core and the Research Libraries Group. Adding a quality modifier helps to bring control of the image back to the image-maker, the photographer.



V&A Category B

The V&A Photographic Studio is the oldest inhouse museum studio in the UK, founded at the same time as the museum in 1856. Since its foundation a black and white print of each photograph made by the Photographic Studio has been archived as a reference source. This record bears witness to continuity in quality. It is clear from this record that photographers have striven to achieve a standard of image-making which replaces as closely as possible the experience of seeing the actual object. Indeed, this was always the original intention for images at the V&A. Photography was a new technology and it was consciously used to allow the public, in its widest sense, to see the collection, even if they could not visit the museum building in person. Prints were made available for sale. Records show that normal bromide prints could be purchased for 1s 9d with platinum prints at 2s 4d. There are also reports, recorded in questions in the House of Commons, which state that the backlog for the production of prints for sale was 16,000 owing to the bad summer that year.

THERE IS A WEALTH of information on the web about digital imaging. Here are a few URLS which you may find useful.

www.tasi.ac.uk TASI is a service funded by the Joint Information Systems Committee (JISC), set up to advise and support the academic community on the digital creation, storage and delivery of image-related

Sara Hodges V&A Category A

information. It is based in the Institute for Learning and Research Technology (ILRT), a national centre of excellence in the development and use of technology-based methods in teaching, learning and research, of the University of Bristol. Its objectives are to share and promote technical expertise and standards within the academic and public sectors and enable the academic community to develop digital archives of good quality image-related materials to support effective teaching and research by providing comprehensive information and advice. This is an extensive text site with a great deal of advice on all aspects of digital imaging, and image management.

www.ukoln.ac.uk The UK Office for Library and Information Networking. UKOLN is the national focus of expertise in digital information management. It provides policy, research and awareness services to the UK library, information and cultural heritage communities. UKOLN is based at the University of Bath.

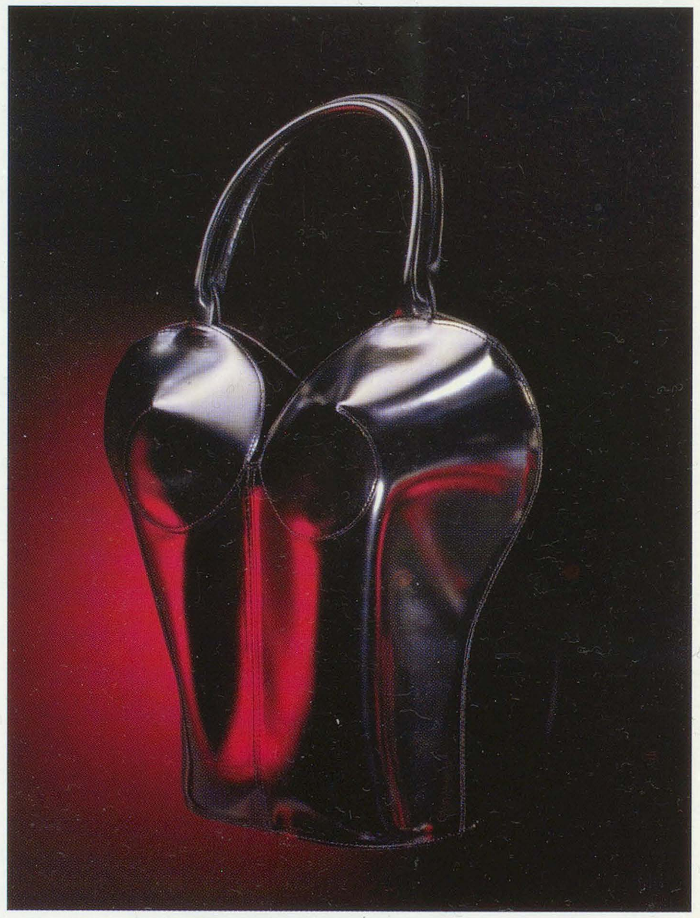
www.bjp.co.uk Online version of the British Journal of Photography. There is a photographic discussion forum on this website

http://purl.or g/DC/about/ This site describes Dublin Core., one of the developing standards for image metadata.

www.pacificstream.com/pr odig/ This is an extremely active discussion group run by the Digital Image Group of the Association of Photographers. It also contains links to many photographers' websites who deal largely in digital imaging.

www.digitalimaging.org/ DIG is a international consortium engaged in the development and introduction of digital imaging standards and technologies. The site contains a very interesting paper on digital imaging.

www.getty.edu/gri/standard/ The Getty Research Institute standards page. This contains information on metadata and links to other Getty tools such as the AAT and other thesauri.
www.digit.org.uk/ The Digital Image Group of the Royal Photographic Society



Sara Hodges V&A Category A

www.pdn-pix.com Photo District News is North America's foremost professional photographic magazine; the American version of the BJP. Published monthly it is available at an overseas rate of $85pa. The website is extensive and is the primary source for information on the business of photography in the US. The pix pages deal exclusively with digital imaging matters. AFAP