

Institute *of* **Physics**

Printing, Packaging and Papermaking Group

NEWSLETTER

August 2001

Editorial

Well it's been a year since the last newsletter and a lot has happened. Notably the group has organised its first 2 day conference in collaboration with the London College of Printing and the Camberwell College of Art, The London Institute. The meeting was called "Preservation and Conservation Issues Related to Digital Printing". This was mainly due to the sterling efforts of Bob Thomson who was the main organiser. Thanks Bob for a great effort. The conference was a success in many ways and it highlighted one of the great things about being a physicist or scientist in an applied area such as Printing, Packaging and Papermaking. What became clear at the conference was that today's technology and knowledge are not meeting the users expectations. This leads to a clear opportunity for an improvement to meet these expectations. When I was at University my tutor told me that one of the great things about being a Physicist was you could have a job you enjoyed doing. When you work in Applied Physics not only do you get to do job you enjoy but you get to do a job which pleases others who get to use the fruits of your work and see a clear improvement. For me there is nothing more satisfying than finding a problem, understanding it and implementing a solution to fix the problem. You will find details of the abstracts later in the newsletter.

Unfortunately it has not been all good news and the decreasing attendance rate at the half-day meetings meant that the AGM did not meet quorum and the yearly outing had to be cancelled. This has prompted the committee to send out the questionnaire we all received in May. The responses have given us food for thought as we consider what to do for the best future of the group. There is a detailed summary of the responses in the newsletter. A couple of people responded that they would like to join the committee in the questionnaire. Could those concerned either contact myself or the secretary, details below.

On the last letter I requested that people write to me with a short description of who they are and what they are working on. Thanks to all those who did contact me. It was a real pleasure. If anyone feels they would still like to email or write to me then I would love to here from them.

Thanks

Martin

Contact Details:

Editor

Martin Gouch
16 Edenhall Close
Hemel Hempstead
Herts
HP2 4ND
Email: martingouch@hotmail.com

Secretary

Dr. Nigel Sherman
Videojet,
10 Viking Way
Barr Hill
Cambridge CB3 8EL
tel: 01954 782848
fax: 01954 7817743
Email: sherman_nigel@videojet.com

Reports on Meetings

Abstracts from Conference on Preservation and Conservation Issues Related to Digital Printing

Date: 26th and 27th October

Location: Rutherford Conference Centre, London

Preservation and Conservation Issues Related to Digital Printing – the Publisher’s Perspective

John Peacock

Production Director, Macmillan Publishers. Eccleston Place, London SW1

ABSTRACT: Digital printing techniques entered the publishing industry in the early 1990s. Usage seems certain to increase substantially in the years ahead, bringing into the domain of digital printing many of the lower-run publications presently serviced by litho. The challenges for the conservator of printed materials will be (a) to identify and deal with the physical properties of such publications. (b) to solve the bibliographical issues which print on demand especially will throw up, and (c) to assess whether physical or digital storage is the more appropriate medium in many cases.

Digital Print In Library And Information Services

Poul Steen Larsen.

The Royal School of Library and Information Science. Denmark

ABSTRACT: Within a few years most printed documents we wish to keep for posterity in libraries and archives will be print-outs. expectedly on non-descript paper qualities and in toner powder or inks still in libraries and archives regarded as less permanent than traditional offset inks bonded to quality paper. In the future such public document repositories need to consider more closely the life expectancy of documents in their custody. This paper focuses on the requirements and presents some existing and forthcoming International Standards relevant to the long-term keeping of digital print.

Developments in Ink Jet and Electrographic Printing Processes

Nigel Sherman

Marconi Data Systems, Cambridge.

ABSTRACT: The development of both ink jet and electrographic printing technologies continues apace. Although it is not clear that one or the other will dominate the future, the level of research and development activity suggests that these technologies will seriously challenge traditional methods. The advance of desktop drop on demand heads towards photo-quality prints is described by reference to the Canon Microfine technology and the Xaarjet XJ1000s. For the case of continuous ink jet, the use of finite element analysis along with computational fluid dynamical modeling and their impact on the understanding of jet breakup mechanisms is reviewed. In particular, the potential this provides for faster, higher resolution machines, and hence more applications, is discussed. Laser printers are also making progress. Work at Hatachi using diode laser arrays and optical fibres is reviewed. Finally toner-based development is explored, in the form of toner direct electrostatic printing. The conclusion is drawn that the conservator of the future will be faced with material produced by a number of source technologies.

Paper factors which may affect the physical stability of digital printings

M R Chamberlain

Pira International, Randalls Road, Leatherhead, Surrey, KT22 7RU

ABSTRACT: This paper briefly reviews the current and future applications of digital printing covering the text, communication, fine art, and display markets, from a papermaking development perspective. The differences between conventional and digital printing at the paper-ink interface will be considered as they affect the life of the printed work. These differences will be illustrated by reference to literature and examples taken from work done at Pira.

The development of fine art ink-jet printing papers

Richard Shearwood-Porter

Technical Manager, Inveresk PLC, St. Cuthberts Paper Mill

ABSTRACT: When St Cuthberts Mill discovered that part of its product range had been adopted in the US for ink-jet printing of fine art. This prompted development of the paper to fine-tune it for the purpose. This paper describes how the mill defined performance criteria for the new grade & translated these into measurable properties for manufacturing. As the mill gained market experience the paper and process were developed further. The presentation finishes by discussing coated papers and the importance of selecting the optimum ink choice for long display life.

Paper Coatings for Digital Imaging

Aidan Lavery

Felix Schoeller Imaging Ltd. Glory Mill, England

ABSTRACT: The rapid development of the computing and software industries has led to the requirement for better printing systems capable of producing high quality digital images. Ink jet printing has tended to dominate the digital photo, proofing, digital art, wide format and textile market segments. For some of these applications the images need to be stable for many years either for archiving purposes, or for the preservation of the image exposed to light over a prolonged period. The surface coating on the media has a significant influence on the image quality.

Colorants for Non-Impact Printing – An Overview

Peter Gregory and Philip Double

Avecia, Hexagon House, Blackley, Manchester M9 8ZS

ABSTRACT: Non-impact printing has grown at a remarkable pace in the last decade and now dominates many printing markets. Three technologies. electrophotography. thermal transfer and ink jet are vying for market position with ink jet likely to be the eventual winner in many applications. The colorants used in these three technologies, namely pigments for laser printers/copiers. solvent soluble dyes for thermal transfer and water soluble dyes for ink jet. are discussed.

Factors affecting the stability of dyes and pigments for “Preservation and Conservation of Issues Related to Digital Printing”

Peter Gregory

Avecia, Manchester M9 8ZS

ABSTRACT: A story should begin at the beginning and end at the end. This presentation begins, literally, at the very beginning with the Big Bang formation of the universe, and, although it can't continue to the very end (as this is some several billion years away), continues to our present state of knowledge on the factors affecting the stability of colorants.

Famous works of art. such as paintings by Cima and Van Gogh. are used to illustrate types of colorants and the major causes of instability and fading. The effect of light. water. both in liquid and gaseous form, and heat on the properties of both natural and man-made inorganic pigments, organic pigments and dyes, is explored. Particular emphasis is given to dyes for ink jet printing since the technology is becoming ubiquitous and is the fastest growing area for modern colorants.

Lightfastness and mechanical resistance of electrophotographic printings

Dr Wolfgang Rauh, Stephan Dietzel, Alexander Schiller

FOGRA. München

ABSTRACT: The aim of our investigation was to test the quality of electrophotographic prints. Based on tests which are commonly used to assess the quality of prints in conventional. offset printing. electrophotographic prints were evaluated. It was shown that the quality standard of offset prints could not be achieved in all areas. Significant differences in the prints of the investigated digital printing machines could be observed. Therefore aspects of calibration and standardisation are becoming more and more important. Further research work is required in the area of varnishing and lamination of digital prints, in order to achieve better durability.

Toward a methodology for the identification of digital formats

Martin Jurgans

Department of Art, Queen's University, Kingston, Ontario K7L3J4

ABSTRACT: The identification methodology presented attempts the distinction of digital prints from other digital prints and from analogue prints by non-destructive, purely visual examination with the naked eye and by magnification. It functions firstly on two levels of examination: that of the physical and circumstantial evidence of the print, and that of specific image characteristics, and secondly on comparison of this data with knowns. The condensed information presented here is based on the Identification Guide and Digital Printing Process Database on the internet.

Light stability of computer-generated printing

Martine Gillet, Herman Maes, Chantal Garnier, Bertrand Lavedrine

Centre de Recherches sur la Conservation des Documents Graphiques UMR 8573 36
rue Geoffroy Saint Hilaire. 75005 Paris France

ABSTRACT: This research estimates the light stability of Iris inkjet prints: a study to which much research has been devoted in recent years. The stability of Iris inkjet prints was compared to two Fuji color processes and the influence of the support and the dye combinations were considered. Light fading tests were performed using metal halide and daylight fluorescent lighting and different ageing conditions were performed to estimate the effect of spectral distribution and light intensity on the image. The effects of continuous exposure versus intermittent exposure were investigated and densitometric readings were performed to measure ink degradation.

The effect of relative humidity on ink jet prints

Andrew Robb

Conservation Division. LMG-38. Library of Congress. Washington DC 20540-4530.
USA

Thermal stability of ink jet prints

Anthony W Smith and Zoitsa Gkinni

Camberwell College of Arts. Wilson Road. London SE5 SLU

ABSTRACT: The dark (thermal) ageing of ink jet prints has not received as much attention as their light stability. This paper describes an accelerated ageing procedure intended to determine their thermal stability. Arrhenius-testing and the conditions recommended for the thermal ageing of ink jet prints are discussed. A range of substrate-ink combinations was subjected to heat ageing at 80°C and 59% RH for a total of 14 days. The most significant change observed was the yellowing of the paper-based substrates. The inks themselves were not significantly affected by this treatment, with no obvious fading taking place. However, the yellowing of the substrates did affect the colour of the printed areas and needs further investigation.

If you want a copy of the Conference Proceedings then contact

Dr Robert Thompson

School of Printing and Publishing London College of Printing

tel 0171 514 6708

fax 0171 514 6756

email r.thompson@lcpdt.linst.ac.uk

Winding and Web Handling

Date: 14 February 2001
Venue: IoP Headquarters, 76 Portland Place
Report: Dilwyn Jones

8 members and 5 non-members attended this afternoon meeting. Unfortunately, one of the pre-arranged speakers could not attend owing to business commitments, so the author stepped in to give a talk. It may be possible for Dr Hamad of International Paper, New Jersey, to give the missing talk, "Novel Measurement Techniques for In-Roll Stresses," at some time in the future.

Traction in Web Handling: Dilwyn Jones, Consultant

This talk, not on the original programme, reviewed the phenomenon of traction between a moving web and machine components, especially rollers. Traction falls dramatically with speed. This is due to air being dragged between the web and roller surfaces then remaining in the gap at slightly elevated pressure, reducing the true contact force between the two surfaces and hence the maximum friction force. Increasing the surface roughness of web and roller can increase the traction.

Full numerical modelling of air flow and web deformation over a roller has been successfully carried out by groups in the US. For design and troubleshooting purposes, a "coefficient of traction" can be used in the same way as coefficient of friction, and predicted from surface roughness, roller radius, speed and tension. Simple analytical models can predict the behaviour of real machines, for example, the steady running of an idler roller below the web speed, and the tension profile through a set of driven rollers, some of which are slipping. It is important to avoid situations intermediate between "stick" (speed matching) and floating, as significant slip leads to scratching and lateral web movement.

Traction also provides force perpendicular to the direction of web travel. If the vector sum of lateral force and tension change is greater than the available friction force, undesirable sideways web movement will occur. Also, lateral traction and slip are important in determining wrinkling and scratching on a roller.

Deviations from elastic web behaviour, such as thermal expansion, shrinkage from heat or drying, and viscoelasticity, reduce available traction. The areas of speed matching no longer have constant tension, and extra zones of slip may appear. As an example, a model of a thermal vapour deposition on a film on a cooled drum was described. The heat load causes thermal expansion, which tends to reduce tension in the machine direction and generate lateral compression. If the tension is too low, wrinkles form, and are set in as the material lifts off the drum and rapidly heats up.

There are of course devices for high traction, such as nip rollers, vacuum pull rollers, and assist by electrostatics or air jets. Traction from rollers can be improved by roughening or grooving the surface, increasing wrap and using more rollers. Sometimes, low traction is required, and air flotation devices may be employed. There is still scope for improved modelling of traction, especially to specify the desirable peak size and spacing on rough surfaces.

Wavelets and Web Tension: Tim Clarke, Department of Electronics, University of York

This current project, entitled “Measurement and Characterisation of Web Tension Lateral Profiles” is being carried out as a Faraday Partnership Program with the Packaging Industry. The industrial partners include Alcan Roll Products, Kodak Ltd and Spooner Industries.

In the manufacture and processing of many web products, the lateral distribution of tension is not controlled, but uneven distribution frequently leads to complications such as creasing, fold-back and tearing. Subsequent damage to machinery, plant downtime and feedstock wastage mean this is a significant production issue.

A measuring system has been built and tested which shines a narrow line onto the web, which has been displaced normal to its plane by an air nozzle. The deformation is recorded by line scan cameras at 25 frames/s and processed to give the profile of machine direction tension across the width. The instrument has been developed to cope with shiny, diffuse, striped, and transparent materials: further issues include flutter, fluting and embossed webs, which affect the signal.

The tension profile varies in time. The wavelet transform technique has been applied to extract signal from noise, and show the dominant spatial and temporal features in the web. The project is now moving on to consider aspects of control, and develop actuators to minimise lateral variations of tension. The idea is to spot the growing disturbance before it is large enough to damage the web, and act to correct it using predictive control methods.

The project is at an exciting stage of development, and the team are seeking more industrial applications.

Web Handling in the Real World: Ian Mitchell, Ilford Imaging Systems

Solving web handling problems in production is often regarded as a black art, with practical experience and a trial and error approach the main tools. This can often be wasteful, and may not prevent problems recurring in the future. At Ilford, many photo film production lines run in the dark, making visual diagnosis difficult!

Over the last 25 years, web handling science has developed and can be applied to these problems in a systematic way. The talk described four case studies, where a problem affected or even prevented production, and solutions were developed using a quantitative approach. Simple calculations were performed by hand, but now software is available for this purpose (TopWeb).

The first example was a persistent diagonal crease. Analysis showed that the rollers had to be aligned to 150 microns, which could not be achieved with tape measures, and confirmed that the expense and time for optical alignment was necessary. This achieved the required accuracy and the crease disappeared.

The second problem was persistent wrinkling across the whole web. This was solved by reducing tension and wrap angle, but creases developed elsewhere. The final solution was to change the roller surfaces to low friction material, allowing tension to be raised again whilst wrinkles and creases can still spread out.

The final problem was persistent dishing of wound rolls. Again, optically aligning the rollers gave some improvement, but acceptable winding was only achieved by increasing winding tension near the start of the wound roll, after experiments showed that slippage was occurring between turns near the core.

Report on 6th International Conference on Web Handling Stillwater, Oklahoma, USA. 10 - 14 June 2001

Author: Dilwyn P Jones, Consultant, Emral Ltd, Greenabella, Bentley Wynd, Yarm, Cleveland, TS15 9BS, UK

“There’s a bright golden haze on the meadow” was certainly true every beautiful mornin’ in rural Oklahoma. But by 8 a.m. each day, delegates were able to escape from the blistering heat into the air-conditioned cool of the lecture theatres of Oklahoma State University for the sixth conference in the series on Web Handling, hosted by the Web Handling Research Centre at OSU. As ever, the conference covered the behaviour of web materials such as paper, film and foil in process machinery, but excluded web processing itself (such as extrusion, coating, drying, and plasma treatment).

The conference attracted an audience of 109 listed delegates, with 74 coming from the US. In addition, there were 12 OSU staff members and many students not listed. There was American dominance of the conference content also, with 18 out of 32 papers submitted; in addition, there were several contributions from Finland and Germany. The sessions had a reasonable mix of experiment and theory. However, theories tended to be tested with only one or two example materials: there is still much to be done to establish the general validity of the science being developed.

In the first keynote speech, Dr Joe Howard, Vice-President, Technology, of AET Films, gave his personal outlook on “Films Business Trends and their Technology Implications”. His conclusions, based on the oriented polypropylene business, have implications for all web material producers and converters. He energized the conference by explaining how models for many web handling processes can add value for manufacturers. This can be accomplished by improving product quality and consistency, reducing costs through faster changeovers and reducing the time for new products to be established, and increasing flexibility with add-on processing and larger ranges of thickness and materials. Companies can get early access to the

science and models developed by sponsoring university research work (such as OSU), but usually have to nominate a web handling specialist or team to fully exploit them. In discussion, Technology Transfer was seen as key. It still seems very difficult for the average small to medium sized company to take advantage of the science – very often there is no web handling specialist, or he or she has insufficient time or skills to take in and apply the equations. There is definitely room for tools to help them, such as software.

In the second keynote speech, Dr Dilwyn Jones, a consultant from the UK, gave a review of “Traction in Web Handling”, the friction between webs and machine elements such as rollers, especially reduction by air entrainment at high speed. There was a related practical paper by J N Dobbs (3M) on the increased traction produced by a Vacuum Pull Roller.

The final keynote speech by Dr Ron Swanson of 3M, reviewed “Web Handling Technologies, Past Present and Future”. This was done by considering the topics of the Web Handling Conferences through the whole series, starting in 1991, assessing the current state of knowledge and giving future direction for the work. However, the advances made by individual companies in machine size, speed, web material design and process capability better represent the current technology. There are very few examples of companies sharing their knowledge of this forefront technology. In addition, their business perspective is inevitably absent from this meeting of practitioners. This was reflected in the content of the formal discussion sessions, which tended to focus on the technical content and the challenges in modelling, not technology development.

The submitted papers generally increased the subject knowledge and understanding in winding, tension and position control, bagginess effects and reduction, nip mechanics, and cutting, with two contributions worthy of special mention. Dr Emil Wolf (Ruhr-Universität, Bochum, Germany) presented an instrument for recording slit edge quality, and grading different types of edge defects. It would be good for this type of objective grading to become an industry standard in the future, replacing operator-dependent assessment and the plethora of terms in use in different companies, industry sectors and locations. Dr Ron Markum (Oklahoma State University, US) described results validating a theory for web spreading by profiled diameter rollers, and so could be useful for design purposes.

In the evenings, we were fed barbeque-style, and entertained by country music, Indian dancing and an open-air performance of Oklahoma!, complete with guns, horses and carriages. We came away from the conference clutching our shoulder bags and collection of papers, eagerly awaiting the bound proceedings and the next conference in 2003.

Questionnaire Summary

Everyone received a questionnaire through the post in May and here is a summary of the responses as of 1st August.

Institute of Physics Printing, Packaging and Papermaking Group

Analysis of Membership Questionnaire,
2001

	No. of replies	% of replies	% membership
Current group membership	111		
Number of questionnaire forms returned	44		40%
1 Which part of the group's scope is most interesting to you?			
Papermaking	14	32%	
Printing	29	66%	
Packaging	12	27%	
None of these	1	2%	
2 In which field do you work?			
Industry	26	59%	
Education	1	2%	
Retired	13	30%	
Consultancy	3	7%	
Govt. Lab	2	5%	
Student	1	2%	
3 Have you ever attended a 3P's Group meeting?			
Yes	23	52%	
No	21	48%	
4 What are the reasons why you do not attend more meetings?			
Meeting topic of no interest	11	25%	
Cannot justify time away from work	18	41%	
Cannot afford travel costs	8	18%	
Other commitments	16	36%	
5 Would you attend more meeting if they were held closer to where you live or work?			
No	28	64%	
Yes	12	27%	
6 Did you join the Institute of Physics to become a Group member, or were you already a member of the Institute before you joined the Group?			
Joined IoP to be Group member	7	16%	
Already in IoP	37	84%	

7	Are you a member of other Groups of IoP (NB Groups only listed if they received more than 1 reply)		
	Optics	8	18%
	Consultancy	6	14%
	Polymer	3	7%
	History of Physics	3	7%
	Electronics	2	5%
	Education	2	5%
	Static electrification	2	5%
	TQM	2	5%
	Primary affiliation (NB Groups only listed if they received more than 1 reply)		
	3P's	5	11%
	Optics	2	5%
	Professional institutions (NB Institutions only listed if they received more than 1 reply)		
	Institute of Printing	4	9%
	Paper Industry Tech Assoc.	3	7%
	Institute of Packaging	3	7%
	SPIE	2	5%
	Institute of Rheology	2	5%
	IEEE	2	5%
8	Which sub-division best describes your main interest?		
	Paper manufacture	16	36%
	Coating	10	23%
	Board manufacture	10	23%
	Board packaging	7	16%
	Plastic film manufacture	6	14%
	Plastic film packaging	6	14%
	Printing pre-press	16	36%
	Offset printing	15	34%
	Flexo printing	13	30%
	Gravure printing	11	25%
	Digital printing	24	55%
	Plastic film converting	7	16%
	Optical properties	2	5%
	Security printing and paper	2	5%
9	Does your work involve you in any of the following?		
	Print, packaging, paper processes	24	55%
	Supply of machinery	7	16%
	Supply of materials	10	23%
10	Would you be willing to:		
	join the Group Committee	2	5%
	present a talk at a Group Meeting	8	18%
	neither	29	66%

- 11 Please suggest one or more topics, which would interest you.

Paper in filtration
Computer to plate technologies
Control and automation in PPP
Access to digitally published material for the visually handicapped
Future needs for industrial digital printing
Plastic film: manufacture, printing, properties, packaging
Bulk plastic packaging
Comparison of card and plastic packaging
Packaging for pharmaceuticals
Current research from students
Physics in digital printing
Quality control
Effects of leaks through seals and seal performance testing
Paper physics (structure, characterisation)
Corrugated packaging
Digital printing
Large format image printing
Colour
Ink/paper interface
Visits to Pira, NPL and Science Museum
Physics teaching at GCSE/Adv level
Cold badging – laser etching printing onto a ceramic substrate
Fluid mechanics – suspensions, coating colours and applications
Magnetic stripe ticket manufacture
Use of screw threads in packaging

- 12** Do you think there are opportunities for joint meetings with other IoP Groups or Institutions?
Magnetism

Total Quality
Institute of Printing
British Computer Society
Paper Science, UMIST
Static Electrification
Polymer Physics
Tribology
PITTA
Colour Group
Plastics
Optical
Rheology
IEE
Engineering Physics

- 13** Would you like to see the scope of the Group widen to include:

Internet	13	30%
WWW publishing	10	23%
Security	12	27%

- 14** The Group recently organised a meeting to visit Marconi Data Systems. Unfortunately, this event had to be cancelled due to low level of interest from 3P' Group membership. Which of the following best describes why you did not wish to attend?

Subject not relevant	7	16%
Could not spare the time	16	36%
Clash with other event	6	14%
Location not convenient	14	32%
Lack of information on event	2	5%

If the event had been held out of work hours, would you have been more likely to attend?

Yes	10	23%
No	21	48%

Future Meetings

Currently we have no meetings planned but I am certain this will change soon. In the mean time here is some information on an event which might be of interest to you.

Short Course on Coating, Drying And Web Handling

Multicoat Ltd. is organising a 2½ day residential course aimed at web coating practitioners in Leeds on 10-12 September 2001. Delegates will be introduced to up-to-date scientific know-how in each area, and work through case studies in PC workshops. No previous knowledge of coating theory is needed, just basic computer skills.

For more details, contact Bruce Ikin at Multicoat Ltd, 21 Turnfield Road, Cheadle, Cheshire SK8 1JQ. Tel 0161 282 7058, e-mail bruce.ikin@ukgateway.net.