Ben Sturgeon Award 2002 presented to Dr Steve Elston

The Ben Sturgeon Award is offered annually by the UK & Ireland Chapter of SID, for outstanding work by a young scientist in a field related to liquid-crystal display technology. Ben (short for Bennett) was for many years the research director of BDH Ltd, both before and after the company became part of the E. Merck Group. Among many achievements, he was the driving force behind commercialisation of the cyanobiphenyl liquid crystals, then newly discovered by Professor George Gray and his colleagues in collaboration with the displays group at Malvern. His energy, focus and judgement were an inspiration to the younger scientists who worked with him and are commemorated by the award.

It has sometimes proved difficult in past years to find suitable candidates who can demonstrate a high level of achievement and innovation while meeting the criterion of relative youthfulness. This year, however, Dr Steve Elston of the University of Oxford was put forward for the award and it was quickly realised that he was an outstandingly suitable recipient. Steve's work has been internationally recognised for its quality in combining rigorous theoretical modelling with skilful experimental investigations. The outcome has been an understanding of the switching mechanisms and processes in ferroelectric and antiferroelectric liquid-crystal devices to an unprecedented level of detail.

Presented with the award at the 2002 AGM meeting of the Chapter, Steve was characteristically modest about his work, commenting that he expected little of it to be of practical value. However, ferroelectric and antiferroelectric displays remain a hot topic of R&D, because of their fast response and wide viewing angle. Both in passive matrix-addressed devices and on silicon active backplanes, they offer tremendous promise for projection systems, miniature displays, optical processing and 3D display systems. Even without this background, Steve's work would stand out as exceptional science. Our congratulations got to Steve on his award, for the rest of us, we will watch his ongoing work with anticipation

Alfred Woodhead Best Paper Awards

The Best Paper Award for the first meeting of 2002, held on 23 January at the Sharp Laboratories of Europe was won by Guy Bryan-Brown of ZBD Displays for his paper entitled, 'ZBD - the low power choice for mobile displays'

David Coates receiving the Best Paper Award certificate from John Raines at the CRL Opto meeting

Photo: Ruppel Joshi, CRL Opto

At the two-day meeting following the AGM on 10 and 11 April, the award went to David Coates of CRL Opto for his paper, 'Dyed liquid crystal on silicon devices' on the first day and to Adrian Travis of Cam3D, on the second day, who presented a paper, 'Large-area, flat-panel displays - the wedge'.

The third meeting of 2002 was held on 12 September at QinetiQ, Malvern and on that occasion, Ian Underwood of Microemissive Displays won with his paper entitled, 'Through the eye of a needle (one man's experience of exploiting novel display technologies)'. CRL Opto was the venue for the final meeting of the year where David Parker of Philips Research Laboratories was the winner with his paper, 'Direct View LCD TV'.

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SOCIETY FOR INFORMATION DISPLAY
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A WORD FROM THE CHAIRMAN

John Raines

When working with your PC either in the workplace or at home are you still peering at a CRT? If so you must be one of a steadily diminishing band. I have been more than surprised by the spread of flat-panel displays over the past year. Even to the extent that ex-corporate user's L.C. panels are appearing on the surplus market for about £100 or so. Not that I would want to buy one, they are generally well beyond their useful life, looking rather dull and lifeless when compared with a new panel. And the new ones are now so affordable with 15 inch panels selling at £200 or less. Another sign of the times is the flood of 17 inch second user CRT monitors, many in excellent condition selling for anywhere between £40 and £60. The march into the marketplace of the desktop LCD now seems to be relentless, albeit a lot later than those of us who've been in the game for many years expected.

Further evidence arrived a week ago when I saw a demo of one of the latest PC video driver cards. Made by Matrox, and given the name Parhelia, why? Well there is a bit of Latin and Greek there, referring to a mock sun or bright spot in a solar halo. (Yes I did have to look it up). The card is in fact designed to drive **three** desktop monitors, and when I asked why, the prime users are expected to be games addicts and simulator users. And you don't want three CRTs on the desk do you? Further evidence of the rapid spread into the consumer market appeared when I made a rare visit to the Motor Show at the NEC.

Touch screen interactive LC panels on all the stands, lots of large plasma panels, and most significant of all many TFT LCD panels built into car dashboards, and not necessarily the very expensive up-market models. Satellite navigation and rear view cameras for parking are here to stay and no doubt will soon become standard equipment.

So it looks as though we are in for a year or two of market consolidation with the large TFT panel manufacturers at last getting a return on the massive investments they have made over the past years. At the local level this means that we are finding it more difficult to find both topics and speakers to meet our commitment of providing members with the very latest news on new developments at our technical meetings. At the moment, we are just managing to meet our obligations to you the members. If you are aware of a hot topic which we haven't covered please let us know and we shall do our best to find a speaker.

On behalf of your hard working committee, may I wish you all the season's greetings and thank you for your membership over the past year. We are still doing better than the average SID chapter with our membership still growing, so many thanks for your support.

As always, your views on Chapter activities are always welcome, send me your thoughts by e-mail. Or contact any committee member.

John Raines jrsid@nildram.co.uk

Chapter AGM and Two-day meeting

Knebworth House, Stevenage
2 and 3 April 2003

One-day meeting

Sharp Laboratories of Europe, Oxford
25 June 2003

Details to follow

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DISPLAY TECHNOLOGIES FOR CONSUMER TELEVISION

One-day technical meeting at CRL Opto, Hayes

Report by Alan Mosley

The aim of this meeting was to discuss the range of technologies that is now emerging to compete with the cathode ray tube in the market for consumer television. It was appropriate for the meeting to be held at CRL Opto because the Central Research Laboratories of EMI, out of which CRL Opto has evolved, were early pioneers in the market of consumer television. Attendees of the meeting had the opportunity to see the EMI exhibit of very early direct view televisions and a rudimentary projection television.

The original programme included a presentation by SIM2, Italy on rear projection television based on the digital micromirror light engine provided by Texas Instruments, which is commonly known as the DLP chip. Unfortunately, due to last-minute problems SIM2 had to withdraw their presentation. Fortunately, Trevor Whittley was able to step in at very short notice to replace SIM2's presentation with one on rear projection television based on a ferroelectric liquid crystal on silicon (LCOS) microdisplay.

The preceding change to the programme meant there was not a presentation on the DLP technology, however, all was not lost. Due to problems with the in-house projector, a second projector was required. This was provided by David Monk of Texas Instruments and was, of course, a DLP projector that was compact, bright and compatible with the laptops used by all of the speakers.

A review of the status of plasma panel and CRT technology was provided by Roger Pieri of Thomson Research and Innovation, France (contact pierir@thmulti.com). Mr Pieri confirmed that the CRT would continue to dominate the market for consumer television, having a market share of 65% by value in 2006. He proposed that the recent advances in CRT technology were driven by styling, i.e. a flat faceplate, and size, i.e. reduction in depth.

Although the performance of plasma panel displays continues to improve; peak luminances of 450 cd/m^2, contrast ratios of over 150:1 under ambient lighting, and luminous efficacies of 1.8 lm/W are now achievable, there are still areas that require improvement. Achieving 8 bits of greyscale with a linear gamma value, an improved resolution of 1920 x 1050, and no motion artefacts are all targets that still need to be achieved. Dr Pieri also pointed out that meeting electro-magnetic interference requirements adds $200 to the price of a plasma panel. Regarding price, it was predicted that the price of a 42 inch plasma display module from OEMs would be $700 by 2005. However, the biggest problem that appears to be facing plasma displays is their relatively short lifetime, which leads to adverse effects such as image burn-in. Notwithstanding these problems, it was generally agreed that plasma displays would achieve the 25-fold growth predicted in Table 1.

	2002			2007		
Technology	**Value ($B)**	**Volume (M)**	**Average Price ($)**	**Value ($B)**	**Volume (M)**	**Average Price ($)**
CRT	48.2	157.7	305	64.6	182	354
Direct View LCD	2.6	1.5	1733	7.1	8.2	866
Plasma Panel	1.4	0.2	7000	11.7	4.9	2388
Projection	5.7	2.6	2192	8.4	4.0	2100
Totals	57.9	162	N/A	91.8	199	N/A

Table 1: Worldwide value and volumes for the consumer TV market by technology in 2002 and 2007 (Data: iSuppli)

The first speaker, Andrew Murray of iSuppli/Stanford Resources, UK (contact amurray@isuppli.com) gave an overview of the technologies that are starting to compete with the cathode ray tube (CRT) and ended his talk with some very useful marketing information. Mr Murray pointed out that the CRT for consumer television was in reality limited to a 36 inch diagonal screen size. It was technically possible to manufacture larger CRTs, but their large bulk and weight meant they were unacceptable for use in conventional homes. Today, the best established competitors to the CRT are plasma panel displays and DLP projectors, but the newly released direct view LCDs are starting to gain market share. The figures given in Table 1 were provided by Mr Murray. It is interesting to note that in five years time the CRT is still the dominant technology. It was equally interesting and somewhat reassuring that the data provided by other speakers were broadly in line with Mr Murray's numbers.

The next paper, which was entitled "Single Panel LCOS Optical Engine Architectures for Rear Projection TV", was presented by Dr Steve McCLain of Philips Creative Display Solutions, The Netherlands (contact steve.mcclain@philips.com). Because the manufacturing cost of LCOS microdisplays is higher than originally envisaged, it has become necessary to develop single (LCOS) light engine projectors. The conventional approach to providing colour in these systems is to use a colour wheel having red, green and blue segments separated by small opaque regions. Dr McClain pointed out that this approach normally discards two-thirds of the light since the red, green and blue sub-fields are display singly. This obviously greatly reduces the light output of the projector. To reduce this problem, Philips has developed several optical elements that produce rectangular bands of red, green and blue light that move across the face of the microdisplay.

The following designs were reported:

- An architecture based on three scrolling prisms
- The combination of a reflective polariser, RGB colour spiral and a mirrored cylinder
- A rotating drum having pairs of red, green and blue filters

The efficiency of each approach was determined. It was found that the first approach, which it was stated is shortly to be introduced into the market-place, was the most efficient, i.e. it provided the brightest image.

The first paper of the afternoon session was presented by David Parker of Philips Research Laboratories, Redhill, UK (contact david.parker@philips.com). Mr Parker gave a detailed description of the performance and present limitations of direct-view LCD televisions. The efficiency of these displays is quite acceptable because they employ highly efficient (70 lm/W) cold cathode fluorescent lamps. The displays have a transmission of ~5% giving a luminous efficacy of ~3.5 lm/W. The main limitation of LCD TVs is their slow response time, which is dependent on the following parameters

- The properties, e.g. viscosity and dielectric anisotropy, of the liquid crystal material.
- The liquid crystal effect, e.g. twisted nematic, in-plane switching, multidomain vertical alignment
- The cell spacing, response time can vary as the square of the cell spacing
- The change in voltage used to switch the liquid crystal layer: a large change in voltage leads to a short switching time. This effect is a problem when applying small changes in voltage to switch between closely spaced grey levels.

By addressing these issues, companies such as Philips have been able to achieve response times of 12ms. Today, 42 inch diagonal LCD TVs are able to provide 8 bit colour, contrast ratios of 500:1, luminance levels of 500 cd/m^2 and power consumptions of less than 200W. As many readers will be aware LCD TVs are now available in sizes ranging from 15 to 42 inches. The prices of these displays are thousands of pounds, thus making them approximately 10 times the price of CRT displays. Even by 2007 the price of LCD TVs will be twice that of CRTs. But LCD TVs are predicted to be the lowest price alternative to CRTs, see Table 1.

During the lunch break, the UK distributor, Displaze Ltd, demonstrated a 42" LCD TV manufactured by Sanyo, which had impressive brightness and contrast ratio, and an acceptable response time. The author has since learnt that this product is also available from Inelco Ltd, who is the UK distributor for Sanyo.

A different approach to large area televisions, namely tiling was presented by Dr Min Huang of Screen Technology Ltd, Cambridge, UK (contact MHuang@screentech.co.uk), who was a late replacement for Paul Bayley of the same company. Screen Technology is a start-up company that intends to license its technology to manufacturing companies. Dr Huang began his talk by pointing out that the manufacturing cost per m^2 of display area for a non-tiled display increases rapidly as the size of the display increases, but that the cost per m^2 of an idealised tiled display is constant as a function of the display area. Therefore, tiling offers a lower cost solution for large area displays.

The key issue for tiled displays is that the joins must not be visible. There must be no change in the pixel pitch or the interpixel gap across the join between two displays. Furthermore, there must not be a change in the luminance of the display across the join, particular as a function of viewing angle. Dr Huang pointed out that to demonstrate infinite tiling it is only necessary to produce a 3 x 3 matrix of displays since this configuration includes a central display that is bounded on all 4 sides.

In order to minimise the cost of their tiled display panels, they intend to use standard off the shelf displays. The demonstrator recently completed by Screen Technology was, at the time of this meeting, being shown at the International Display Workshop conference in Japan, so Dr Huang was only able to show photographs to demonstrate his company's technology. A photograph of the first and very recently assembled 52" SVGA tiled display formed from a 4 x 3 matrix of 12" active matrix LCDs was shown. It was possible to see joins. It was reported that the luminance of the display was 1000 cd/m^2. In spite of the visible joins, Dr Huang was pleased with this first attempt and was confident that this problem could be eliminated in future displays.

The final speaker was Dr Trevor Whittley of CRL Opto Ltd, Hayes, UK (contact twhittley@crlopto.com), who described the development and performance of a rear projection TV system based on a single ferroelectric LCOS device. Ferroelectric liquid crystals (FLCs) are very fast switching having typical response times of less than 100 microseconds. This enables devices based on FLCs to be used in colour sequential systems having sub-frames of red, green and blue images. Because ferroelectric LCDs only switch between two states, greyscale must be achieved by temporal dither, which leads to a linear gamma. Dr Whittley explained that in addition to developing the ferroelectric LCD technology his company had also designed an SXGA silicon backplane and an ASIC to act as the interface to the SXGA display. In addition, CRL Opto's sister company MicroVue has sourced the silicon wafers for the SXGA design and was able to supply (totally within its control) SXGA microdisplays which are able to provide 24 bit colour and contrast ratios in excess of 500:1. These SXGA ferroelectric LCOS devices are now in production and are already being used in head mounted display systems. More recently, they have been incorporated into prototype rear projection TVs. With regard to the latter, Dr Whittley pointed out that in developing a rear projection TV, it is essential to select carefully the projection screen.

Overall this meeting provided a good combination of technical developments and market information. The general message was that size matters; the two dominant technologies, i.e. LCDs and CRTs, of today will continue to dominate for the foreseeable future.

Thanks to our Host Companies

We should like to acknowledge the generous support of the companies who give us the use of their premises, free of charge for our one-day meetings. Without this, not only would the meetings cost far more to attend, they would not have the friendly, informal atmosphere which helps contribute to their success. Meetings this year have been hosted by Sharp Laboratories of Europe, QinetiQ and CRL Opto.