



Knowledge Transfer Networks Accelerating business innovation; a Technology Strategy Board programme

UKDL Newsletter



LED dress created by Couture
Clubbing modeled at the UKDL event:
Future Lighting Debate in 2008

Winter 2008/2009

UKDL Newsletter

Issue 5

January 2009

Contents

A view from the director... by <i>Chris Williams</i>	3
Display and lighting news from around the UK	5
<ul style="list-style-type: none"> Paul Friedlander shows "Maquinas & Almas" in Madrid Julian Beaver's sidewalk chalk paintings astound Inition introduces Organic Motion Stage Pufferfish supports UK National Oceanography Centre North-East England set to become leader Merck expands research facility in the UK Pro-Lite introduces TrueMURA analysis software Brunel Research focused on recycling mobile phones Loop.pH creates biomimetic architecture Queen Mary College wins awards for functional polymers Europe launches AEVIOM white OLED project Plastic Logic previews electronic-reading device CDT and Silvaco develop a new universal organic TFT PHOSFOS project aims at exploiting flexible photonic skins OLLA project reaches final milestone Nanoco appoints KISCO as exclusive Asian distributor UK and Russian researchers build an LCD with graphene Zytronic touch sensors enable table-top exhibition Mindstorm shows off interactive surface solutions Culloden Battlefield Visitor Centre uses imaginative AV Luminvision projection systems offers interactive effects Clear Channel Outdoor unveils spectacular banner site UK pumps £15 million into photonics projects E/T/C Paris creates 40-megapixel video projection 	<ul style="list-style-type: none"> Simworx announces 4D effects theatre for Drayton London could get HD Freeview in 2009 Mi3 project advances active-pixel sensing See3D and Oncomorph Analysis to develop 3D Sky moves towards 3D broadcasts Inition add another dimension to Keane's new video Pro-Lite releases new version of ProSource software MFLEX announces agreement to acquire Pelikon CDT and Semprius announce agreement for OLEDs PolyPhotonix to build production line in County Durham Merck acquires the entire IP portfolio of OLED-T Peratech to make RFID for contactless access control University of Strathclyde develops novel bistable LCDs Shoothill shows off Charles Darwin in Silverlight OLED 100.eu development project to succeed OLLA University of Manchester develops EL yarn Chris O'Shea and Cinimod Studio shows off "Beacon" Haque Design creates "Primal Source" Santa Monica Wasp develops capacitive switching system Black Cat provides "twin-headed" touch-screen kiosks Clear Channel Outdoor introduces new billboard lighting SmartGlobe brings out Internet-updateable globe SISA stores going digital with ZBD electronic shelf labels
Brief Report on Lighting – January 2009 by <i>Gareth Jones</i>	28
The search goes on! by <i>Myrddin Jones</i>	30
An interview with Bob Raikes from Meko	31
Interview with Aimin Song from Nano ePrint	34
Touch-screen & Interactive Display Technologies Seminar	37
Report from IDTechEx Printed Electronics USA	41
Plastic electronics: analysis of competence matrices for UK and Germany	47
Governance of the UK Displays and Lighting KTN	57
Contacting UKDL	58
UKDL Events	59

The **UKDL Newsletter** is focused on bringing news and commentary about plastic electronics, displays, and lighting-related happenings in the UK. The **UKDL Newsletter** is published quarterly for the UKDL by Veritas et Visus. UK Display & Lighting KTN 2009

A view from the director...

by Chris Williams

Happy New Year to all of our UKDL Members at home and overseas!

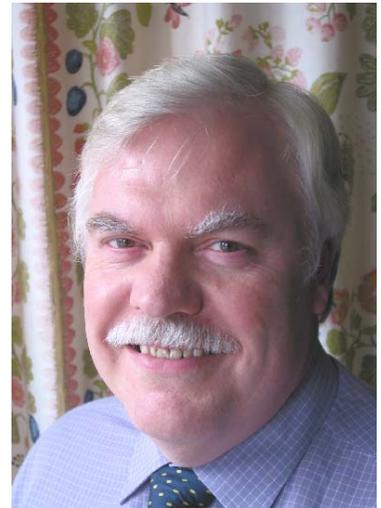
Welcome to this Winter 08/09 edition of the UK Displays & Lighting Newsletter. Those of you with a keen sense of timing may think that this issue is a month or so late in coming. You would be right in thinking so as we have delayed the issue to allow us to bring you news “hot off the press”.

During 2009 there will be developments that radically change the Knowledge Transfer Networks that address the electronics and photonics sectors in the UK. UK Displays & Lighting is one of five KTNs in the sector; the others are Electronics, Photonics, Sensors & Instrumentation and Integrated Product Manufacture.

The Technology Strategy Board, (TSB), after receiving an external review of the whole of its 25-strong KTN network, has decided that our sector would be best served by a single unitary KTN. Put simply, the decision has been taken to merge the five KTNs into one.

This process will take place in two stages; Stage 1, due by September this year will require UKDL to merge with Photonics KTN, and Electronics to merge with Integrated Product Manufacture KTN. Sensors and Instrumentation will remain unchanged. Stage 1 will be for the very limited period up to July 2010, and during this period each of the “themes” will be expected to operate on a 15% reduction in grant level from that currently received. Stage 2 of the process, due in July 2010, will require the three “themes” to come together under a common unitary body to create a single sector KTN. At this point, the unified body will be expected to operate at a lower grant level than that currently received.

The decision to merge has not met with unanimous support from the Governance Boards of the KTNs, but the TSB are committed to make this happen and are driving the process forwards accordingly. The directors of the five KTNs are now working together to determine how this can be implemented.



There are significant challenges. The events and activities, and the delivery mechanisms, are totally different – for example electronics is a very mature industry serviced by multiple trade associations and professional institutions; plastic electronics, a primary activity of UKDL, is a nascent industry with most still pre-revenue, and with no trade association in existence in the UK.

The needs of the companies in plastic electronics, photonics and (conventional) electronics are vastly different. The five directors of the existing KTNs will work together to achieve the unification, but will fight hard to protect the specific needs and wants of “their” members.

In tough financial times everybody has to make savings and we are fighting to avoid any serious cut in the level of activities and services offered to members. The alternative is to raise revenues from other sources to allow us to continue in the manner that our membership demands. TSB are quite happy for us to supplement grant income with revenue from other bodies – indeed, they expect us to raise a sum equivalent to 20% of the grant from our members, through membership fees or event fees. During the next few weeks and months we will be presenting various ideas for future fund raising to our Advisory Board and Steering Committee for discussion that fall within the “allowable” activities defined by the TSB.

Our responsibility at UKDL is to limit the downside and maximize the upside benefits for our members during this period of change, particularly as it occurs at a time of unprecedented global financial instability. To achieve this, we have made a couple of operational changes. All UKDL activities, home and overseas, will be planned and delivered by Ric and Cathy, while I negotiate the terms of the deal for UKDL as we

move towards the 5-into-1 merger. This has already resulted in a significant reduction of overseas activity for UKDL in the first half of 2009.

As the programme of the 5-into-1 merger develops, we will keep you fully informed of progress, both through the newsletter and by direct e-mail.

One positive change for members! During the next few weeks we will be implementing secure payment by credit card at our website www.ukdisplaylighting.net for delegates wishing to attend any of our chargeable events. We hope this change will simplify the process for members who prefer this method of payment.

At the time of writing we are seeing a frozen financial marketplace in the UK, albeit there are indications that the UK government will introduce an 80% loan guarantee scheme to break the current impasse in the availability of business loans to companies.

Innovative steps like this will be a major help to get industry in our sector working again, but it must be supplemented by direct action from the other funding agencies – Carbon Trust, RDAs and TSB for example. We will certainly be engaging with, lobbying, pestering, hectoring – call it what you will – with the TSB to try and secure specific funding under the collaborative R&D programme for the key activities of plastic electronics and ultra-efficient lighting.

We at UKDL are expected to act as the “voice of Industry” back to the TSB on behalf of all of our members, but our voice will be strengthened if it is supported by your evidence – and your written comments to us that can be passed on to TSB about any of the points I have made above, or anything else that affects you and is within our remit to help, will be most welcome. You can e-mail, fax or write in – all methods will reach me, and your comments will be passed to the TSB.

With best wishes for a prosperous '09!

Chris Williams



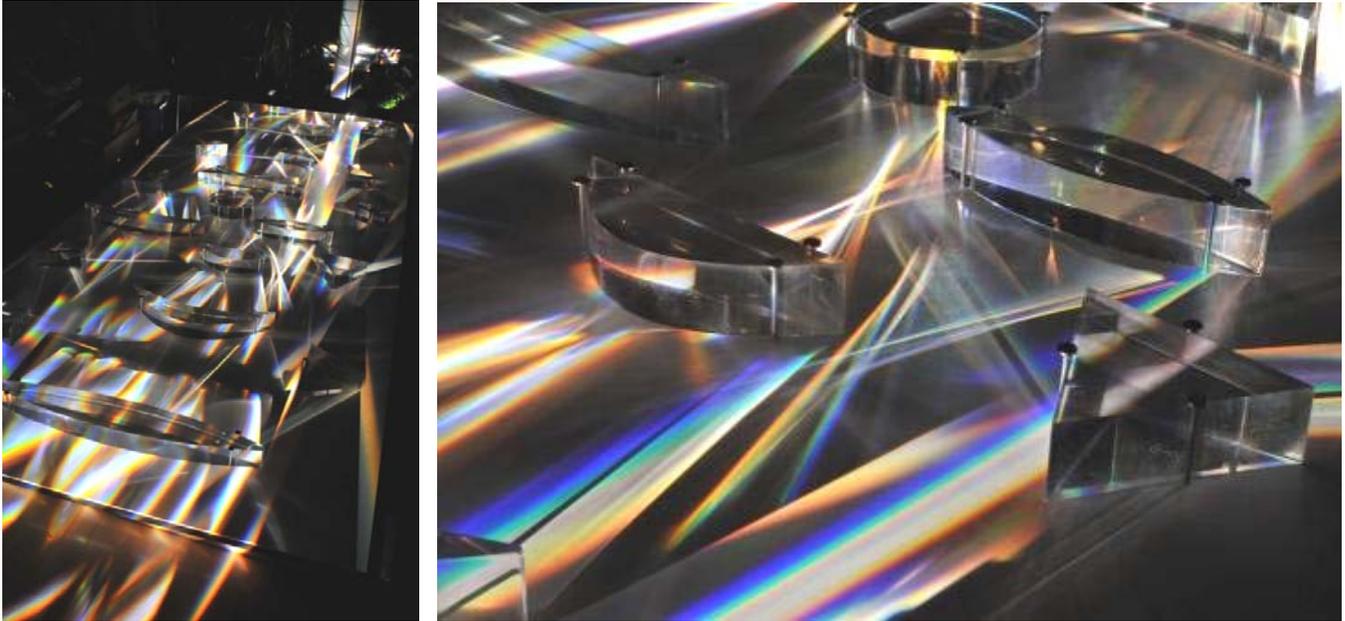
Ric Allott welcomes delegates to the two-day seminar, the 5th Annual Meeting on Metallisation held by UKDL at the Radisson SAS Hotel, London Stansted Airport in mid-January. With 17 speakers from industry and academia from across Europe it was a unique opportunity to examine the latest developments in metallisation materials, technologies for additive metallisation, vapour deposition technologies and transparent conductors.

Display and lighting news from around the UK

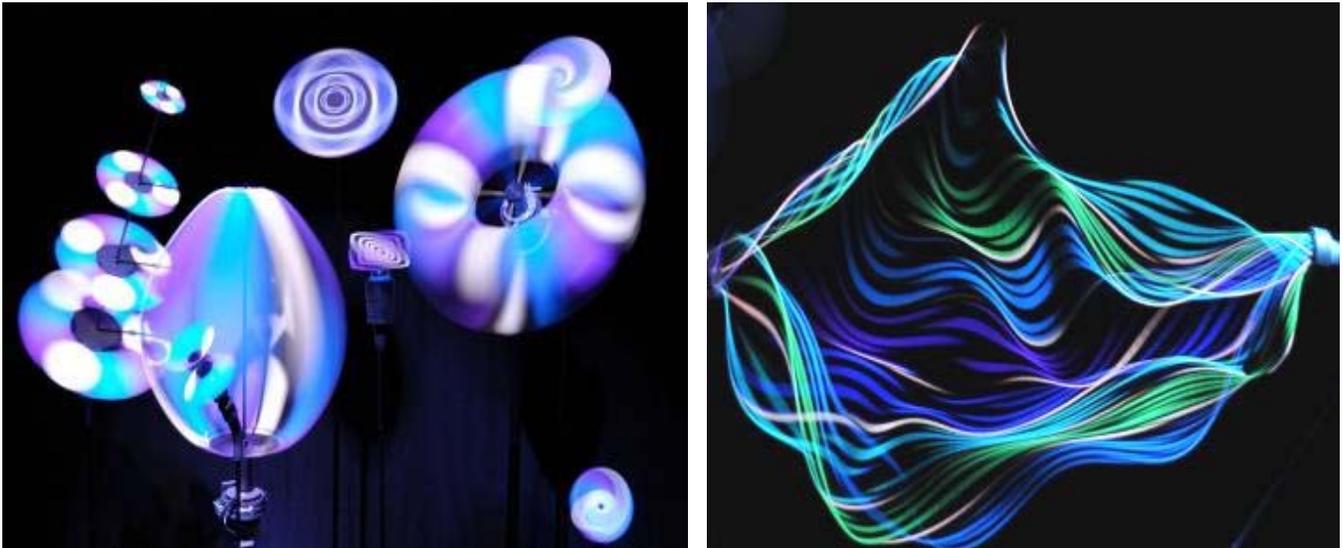
excerpted from Veritas et Visus newsletters

Paul Friedlander shows “Maquinas & Almas” in Madrid

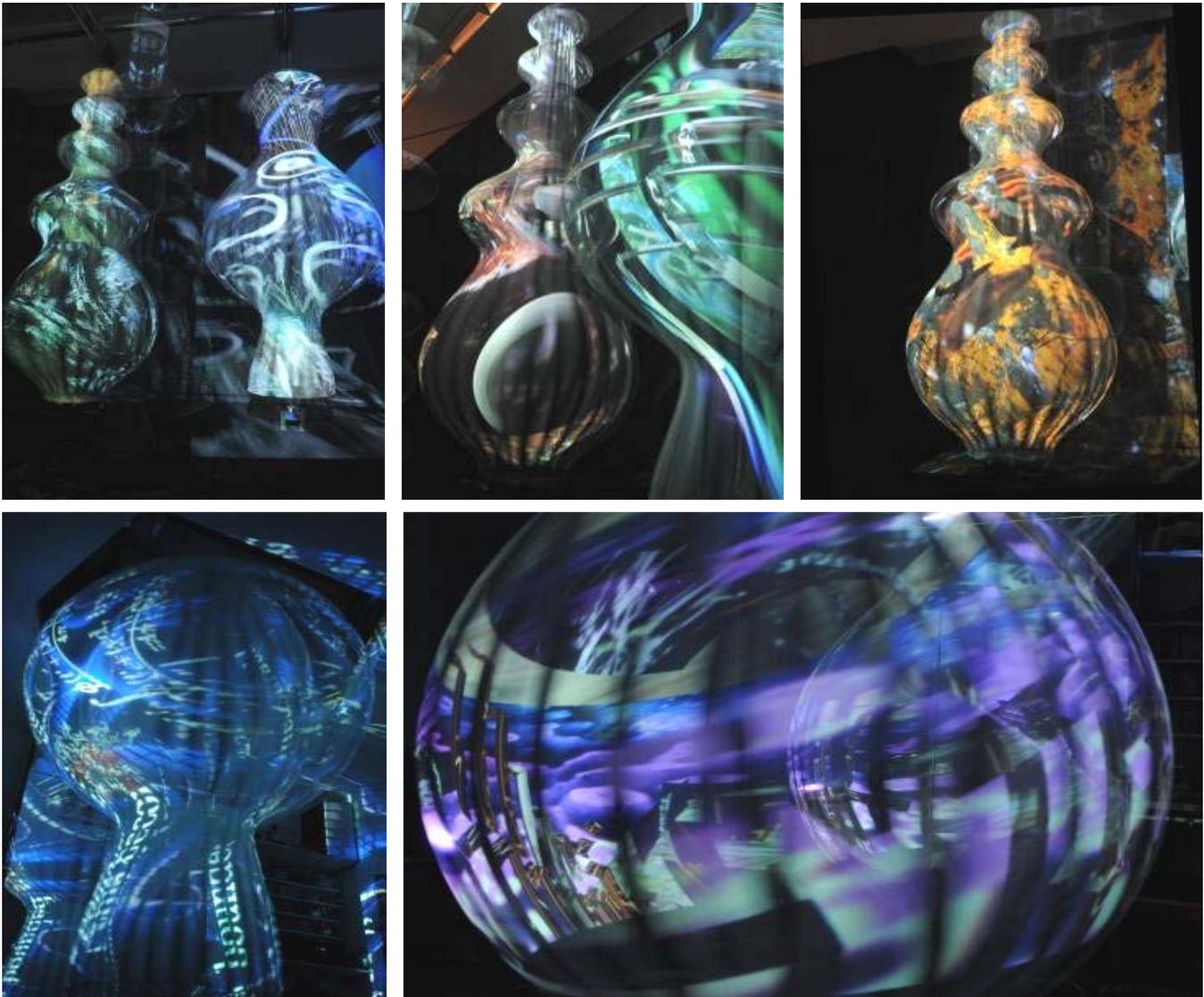
The light-based computer-enhanced sculpture artistry of England-based Paul Friedlander was showcased at the Reina Sofia Museum in Madrid recently in a show entitled “Maquinas & Almas”. The sculptures combine a stunning use of light played in three dimensions. <http://www.paulfriedlander.com>



In the “Enigma of Light”, Friedlander worked with light and its transformation as it passes through transparent media. The piece is made from acrylic forms and chromatic light, 2.4x1.2x0.2 meters.



The image on the left shows off the work “Spinors” a series of three-dimensional moving light projections. The Spinors are illuminated with chromastrobic light, light that changes colour faster than the eye can see. Their appearance is a result of the interaction between their form and the light illuminating them. A spinor has the peculiar property that if you rotate it through 360 degrees, it returns not to where it started but becomes the negative of itself. Continuing to rotate it through another 360 degrees will restore it to itself. The piece measures 1.5x1.5x0.75 meters. The image on the right is entitled “Wave Function”, a hand held light sculpture that is a vibrating waveform. The piece measures 0.75x0.75x0.75 meters.



The final piece in Friedlander's exhibition, "Abstract Cosmology", is "a hybrid bringing together my interest in cosmology, computer programming and kinetics", according to the artist. He explains: "I believe causality in certain circumstances operates from future to past. The future, the present and the past are tied together in a subtle interdependence. The effects of the future on the past are mostly elusive and hard to detect. But at the moment of creation, in the absence of any other influence and with nothing preceding it, retro-causality predominates. This remains for now an abstract idea. It needs careful study. I hope I will inspire mathematicians and physicists to reflect. We need radical thinking, a fresh direction, and a willingness to consider what might otherwise be thought impossible. Only then will cosmology throw a clear light on our origin, the nature of time and just possibly, on how the mind operates." A group of three individual pieces, using five video projectors, measures 6x6x6 meters.

Simworx announces 4D effects theatre for Drayton Manor Park

Due to open at the beginning of the 2009 season, the new, 152-seat theatre will be housed in an existing building which Drayton Manor will adapt for the purpose. Simworx will provide a full turnkey project, which will include a Christie high definition projection system to present the 3D imagery, along with special effects lighting and the company's Dimensions 4D effects seats. In addition to the familiar seat movements, numerous special effects will be incorporated into the attraction including water spray, air blast, leg ticklers, aroma, low smoke and bubbles, while among the films due to be shown will be the Simworx distributed, Red Star Studios produced, "Curse of Skull Rock", winner of the Best Children's Animated Film award at the prestigious Stuttgart Film Festival. Installation of the new theatre is scheduled to start at the beginning of 2009. <http://www.simworx.co.uk>

Julian Beaver's sidewalk chalk paintings continue to astound

In past editions of the *3rd Dimension*, we've shown images of Julian Beaver's amazing chalk paintings, which so clearly show us the importance of perspective. In the below images, the lines in the sidewalk serve to remind us that these really are 2D paintings. <http://users.skynet.be/J.Beever>



London could get HD Freeview in 2009

Freeview viewers in London and other major metropolitan areas could get high-definition TV next year under spectrum juggling plans being considered by regulators. The BBC has applied to Ofcom to temporarily use so-called "program making and special events" frequencies for high definition broadcasts until the national switch off of analogue transmitters is complete in 2012. If approved, the 2010 football World Cup would be available in better picture quality to millions, if they buy new receivers. Freeview high-definition broadcasts will be encoded in MPEG 4 and transmitted using the as-yet incomplete DVB-T2 standard. The new channels will occupy multiplex B, a data stream operated by the BBC. Granada viewers will get high-definition Freeview signals first, late next year. Ofcom is now considering letting the BBC broadcast the channels in big cities, on a case-by-case basis, over other frequencies until analogue systems are switched off nationally.

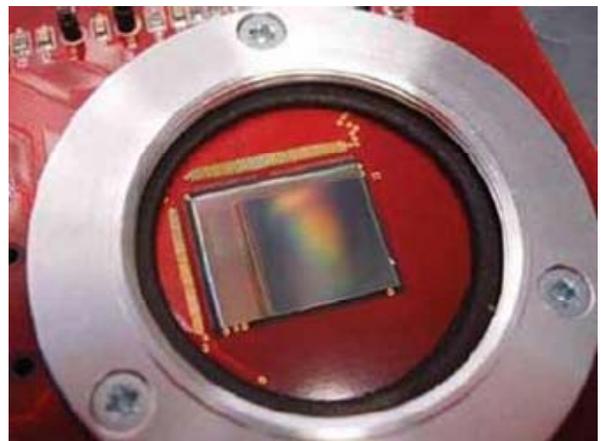
Inition introduces Organic Motion Stage for markerless motion capture

Organic Motion Stage from Inition in the UK is the world's first commercially available markerless motion capture system, allowing you to enter a world where it's easy to track human motion; where set up, calibration, and highly accurate tracking is complete in seconds, not hours; where the actor, the patient, the athlete or the child wears no artificial tracking markers of any kind. Whereas current systems rely on tracking of precisely defined items (passive reflective markers, active LEDs, inertial sensors), the organic motion team use software to analyze the performers actual silhouette. The core technology is in the software recognition. Stage radically redefines motion capture for the animation and entertainment industries for game developers, 3D animators and special effects studios. Stage can eliminate time and money from the production process, while empowering more creative results for animators. Stage streams clean 3D motion data directly into Autodesk MotionBuilder and also generate 3D mesh and surface textures frame by frame. <http://www.inition.co.uk>



Mi3 project advances active-pixel sensing

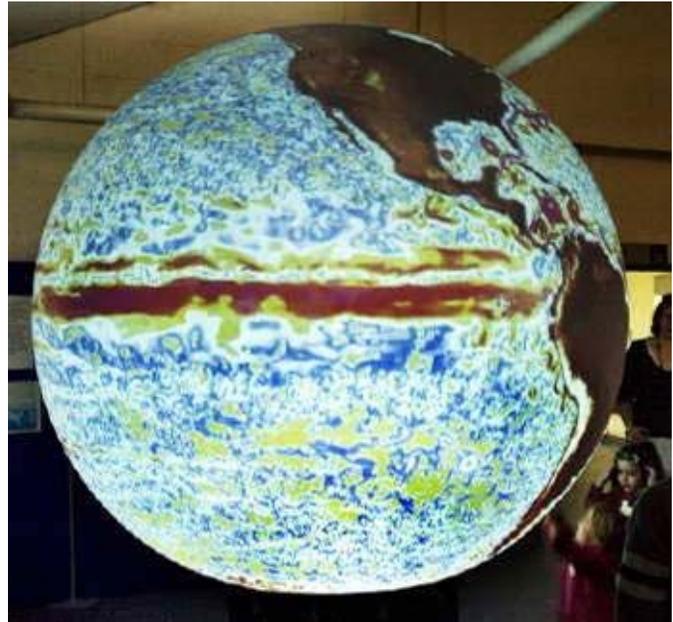
A major UK collaboration, the Multidimensional Integrated Intelligent Imaging Project (Mi3) pooled the talents from 11 research centres (see below) to advance the performance and applications of active-pixel-sensor (APS) technology. Medical applications, including mammography and portal imaging, are at the forefront of those that have benefited from the project. Started in June 2004, Mi3 ran until June 2008 supported by the UK Research Councils through a Basic Technology Programme grant of £4.4 million (approximately \$9 million). Advances in APS have been driven by the capability of mainstream CMOS technology – APS allows the cheaper and more flexible CMOS detectors to compete with their CCD counterparts. The team set out to extend the effective spectral response of APS from the visible, across the range from high-energy gamma radiation and ionising particles, to the infrared, including the increasingly important soft X-ray and extreme-UV regions. In addition, developing on-chip intelligence down to the pixel level was seen as a key enabler in scientific applications. The group has had considerable success in designing and fabricating sensors and supporting instrumentation. A test structure, OPIC (On Pixel Intelligent CMOS), is designed for in-pixel intelligence, including sparse readout, analogue-to-digital conversion, storage in each pixel, and setting thresholds. Two other test structures include developments for reducing fixed-pattern noise and increasing the dynamic range (HDR) in APS. Vanilla (also known as PEAPS; see figure) is a multipurpose APS with digital and analogue modes and the ability to process a “region of interest”. Operating at 100 frames/s, this sensor is a 520x520-pixel chip, using 25µm pixels and with a total active area of 13x13mm². Standard CMOS detectors have good efficiency up to low-energy X-rays. Vanilla uses 150µm-thick thallium-doped caesium iodide (Tl:CsI) as a scintillator, allowing operation with higher-energy X-rays. It has been back-thinned to increase sensitivity and is available on a ceramic header board for use in ultra high-vacuum systems. Vanilla is two-side-buttable. Putting units together allows a novel stitched sensor architecture that is especially useful in medical imaging. Designs include the LAS (Large Area Sensor) released in spring and the eLeNA, a test structure that develops a range of low-noise pixels.



The Mi3 project's Vanilla sensor (here, bonded to printed-circuit board) is a multipurpose active-pixel sensor developed by the Mi3 consortium in the UK

Pufferfish spherical viewing system supports UK National Oceanography Centre

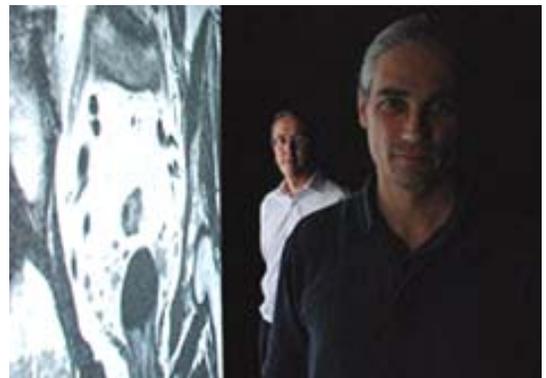
Pufferfish's flagship inflatable display system, the PufferSphere, offers a compelling 360° spherical viewing window for the high-impact display of digital content in a wide range of environments. Inescapably conspicuous and impressively adaptable, the PufferSphere not only delivers content, but attracts audiences. Pufferfish recently used their PufferSphere technology to highlight activities of the National Oceanography Centre in Southampton, England. The NOC's annual Ocean and Earth Day offers the public a chance to meet those at the forefront of oceanographic research, explore the various technology involved in gathering oceanographic data and, most importantly, develop their understanding of how the changes ongoing in the world's ocean affect us all on dry land. The PufferSphere was used to display the complex datasets of Earth's oceans in an engaging and easily understood manner. Allowing visitors and researchers alike to see the models played out around a glowing 2-meter digital globe, the tactile PufferSphere brings the data to life in such a way that young and old, experts and novices, can better grasp the processes at work in the oceans. <http://www.pufferfishdisplays.co.uk>



On the left is a photo of James Sears' Orb which utilizes thousands of LEDs; on the right is the Pufferfish spherical viewing solution which project images onto the inside of a spherical object.

See3D and Oncomorph Analysis to develop 3D prostate cancer detection solution

Visualization specialists See3D are working with Oncomorph Analysis Ltd. to develop sophisticated computer-generated models that will help doctors to improve the diagnosis and treatment of prostate cancer. See3D's visualization project, commissioned by medical imaging software company Oncomorph Analysis Limited, established by the University of Aberystwyth and Exomedica Ltd., will over the next two years, identify smaller cancerous regions of the prostate that are currently undetectable to doctors by the rapid processing of numerical data. Doctors can then use this information to aid diagnosis and subsequently treatment. Dr. Reyer Zwiggelaar, senior lecturer in computer science at the University of Aberystwyth and chief scientific officer of Oncomorph Analysis – who is leading the project with the See3D team, said: "Once developed, this software application will be unique in the world. From our collaborative work with hospitals in Norwich and Swansea we know that our software analysis and visualization program will make a real difference to the important work of doctors in combating cancer by enabling them to diagnose cases earlier and improve patients' chances of recovery." <http://www.see3d.co.uk>



North-East England set to become leader in innovation as centre nears completion

Building work at the state-of-the-art Printable Electronics Technology Centre (PETEC) has been completed, establishing the North East as a global leader in innovation for the plastic electronics industry. Based at NETPark, Sedgefield, a national development and prototyping centre for the development and commercialisation of printed electronics spans 3,000 square meters, providing high-tech cleanrooms, laboratory space, offices and seminar rooms, which are set to house an impressive range of equipment and highly skilled industry experts.

With the aim of de-risking industrial research and development in printed electronics, PETEC, creates a clear route between an innovative idea and a marketable product. The facility is designed to be an ideal



platform for both start-ups and larger manufacturing companies to get prototype and pilot-scale production up and running. Customers of the centre will be able to test design concepts and novel materials for a variety of next-generation products, processes, and services for use in a wide range of markets. Potential innovative products to be developed at the centre include: real-time newspapers, smart packaging, flexible printed lighting and point-of-care medical diagnostic products. Throughout the remainder of the year equipment, including roll-to-roll processing facilities will be installed ahead of the formal opening early in 2009. <http://www.ukPETEC.com>

Sky moves towards 3D broadcasts

Sky TV in the UK says it has made a significant step towards bringing 3D television to British viewers. The satellite broadcaster says it has successfully tested the delivery of 3D programming to a domestic television, via a high-definition set-top box. Such broadcasts would require the use of 3D televisions, not yet available in UK stores, and viewers would need to wear 3D polarizing glasses. Earlier this year BBC engineers broadcast a Six Nations rugby union international in 3D to an audience at a theatre in London. Sky says it has gone further by showing that 3D could be delivered into homes, straight to its Sky+HD set-top box, without much difficulty.



Sky has filmed several sporting events using the new technology

At a demonstration at its West London headquarters, the company showed clips from program it had filmed in 3D, including a Ricky Hatton boxing match, a rugby union international and an episode of Gladiators. The move to 3D would not be anything like as expensive as the investment the industry had made in high-definition television, Sky says.

Merck expands research facility in the UK

Merck KGaA of Darmstadt, Germany, announced that it is expanding its facilities at the Chilworth Technical Centre in Southampton, England. Merck is investing approximately €3 million to construct an extension that will house state-of-the-art research facilities for the further development of two segments within its liquid crystals division. The new laboratories equipped with the latest technology for researching and developing organic photovoltaic products and materials for flexible displays as well as modern offices and meeting rooms will be built on a surface area of 400m². The new facilities are to be completed by June 2009. <http://www.merck.de>

Inition add another dimension to Keane’s new music video “Spiralling”

Inition provided rock band Keane with depth information of front man Tom Chaplin singing to add a new dimension to their new music video, “Spiralling”. Inition was approached by Andras Ketzler, the video’s director, with a request to record a singing head, and to provide 3D data giving him the ability to manipulate the head in a 3D modelling program. The brief was to record the lead singer’s head, and extract Z-depth and colour information. Inition provided 3D data as a sequence of greyscale height map images (z-depth), rather than as a point cloud. This gave the director the ability to render his animated head from any angle. Keane’s lead singer Tom Chaplin was filmed using the firm’s 2K stereoscopic filming system (3DVidRig-SI), with a pattern projected on the singer to help with the depth-extraction algorithms. They used Inition’s 3D conversion facility, to generate a Z-depth image at 25fps. <http://www.inition.co.uk>

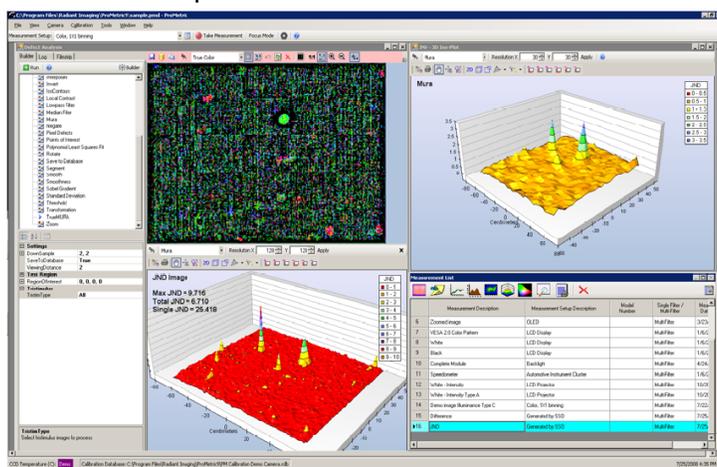


With the colour data mapped onto the 3D geometry, and a number of lighting effects added, the final shots were created

Pro-Lite’s TrueMURA analysis software for improved LCD display image quality

Pro-Lite Technology announced the release of the TrueMURA software module for users of its ProMetric CCD imaging photometers from Radiant Imaging. TrueMURA adds advanced functionality to ProMetric 9.1 software to enable the identification and classification of flat panel display mura which are correlated with human perception in terms of Just Noticeable Differences (JND). The TrueMURA Analysis Module for ProMetric 9.1 provides automated defect detection analysis for flat panel display (FPD) systems that is

precisely correlated to human judgment of brightness, colour and blemishes. When used in conjunction with a ProMetric CCD imaging photometer or colorimeter it provides a complete characterization and testing system for FPDs – especially LCD panels and displays – in both R&D and production. TrueMURA is based upon a model of human perception which allows a grading of LCD Mura in a way designed to match human observers, ignoring Mura that cannot be seen by humans and ranking different Murals which are distinguished by humans into categories matching those assigned by human observers. Radiant Imaging’s TrueMURA Analysis Module is the first commercial system available to provide



TrueMURA’s software appearance on screen

advanced image analysis algorithms for computing JND. This augments the defect analysis functions already available in ProMetric 9.1. The JND detection algorithm incorporated in TrueMURA is based upon a patent-pending “Standard Spatial Observer” technology licensed by Radiant Imaging from the US National Aeronautics and Space Administration (NASA). <http://www.pro-lite.co.uk>

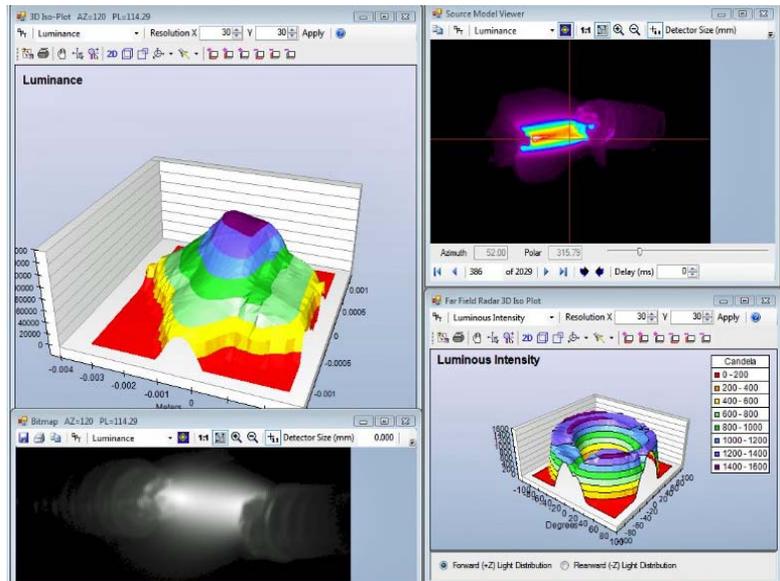
Pro-Lite releases new version of ProSource software for light source modelling

Pro-Lite Technology of Cranfield announced the release of ProSource 8.0 software from Radiant Imaging. The light source modelling software now delivers an improved user interface and expanded functionality for Radiant Source Model analysis and ray generation. ProSource is used widely for near field light source modelling and ray generation. ProSource 8.0 provides simpler, more intuitive programme navigation, enhanced graphics and improved ray generation from Radiant Source Model data files, including full colour ray set generation. ProSource 8.0 is intended for use by light source and lighting system designers and developers, and can be used with all types of light sources including emerging LED-based solid state lighting.

ProSource 8.0 includes improvements to nearly all areas of the software. First, ProSource 8.0 provides an intuitive interface to allow the user to view, manipulate, and process Radiant Source Model (RSM) data files more simply and more quickly than in previous versions.

RSM data files are industry-standard representations of the near-field output of light sources comprised of thousands of detailed images of a light source. RSMs are generated by measuring a light source on source imaging goniophotometric systems such as Radiant Imaging's SIG-300 and SIG-400. In addition, window docking and tabbing enable much easier organisation of the different data representations and operations that result during a typical ProSource session.

Second, ProSource 8.0 generates ray data that accurately represents the output of the light source and which can be exported for use with all popular optical and illumination system design software packages, including ASAP, LightTools, TracePro, and ZEMAX. Users can control the number of rays generated, the angular extent of the rays, the total luminous flux of the ray set as well as the ray origin location. In addition, colour RSM models can be directly analysed in ProSource and the programme has the ability to generate full colour ray set data for export, providing significant advantages to optical designers in accurate modelling of lighting systems. Colour models are especially important for emerging LED lighting and display applications. <http://www.pro-lite.co.uk>



Brunel University research makes it easier to recycle mobile phones

A new approach to creating the fastenings and tabs for mobile devices based on the shape-memory effect in plastics could mean that disassembling such devices at end of life could be automated. The approach would allow valuable components and metals to be recovered more efficiently from the millions of devices discarded every year, according to research published in the *International Journal of Product Development*. Researchers at Brunel University, England, say that Europe's WEEE regulations, the Waste Electrical and Electronic Equipment directive, are aimed at tackling the growing stream of waste electrical and electronic goods in order to reduce landfill usage and waste that is incinerated. The regulations mean that there are now incentives to design equipment that is more recyclable. They have investigated the possibility of Active Disassembly using Smart Materials (ADSM). ADSM uses materials that can act as fasteners within a product, which at product end of life, can be undone simply by direct heating. This releases the fasteners causing the device case to fall apart without screws having to be undone or stiff clasps opened manually. Their concept relies on the so-called shape memory effect in engineering plastics, or polymers. Plastics can be fabricated in one shape - the unfastened state - and then moulded a second time into a new shape - the fastened state. When the fastened state version is heated, the plastic will revert to its original, unfastened state, as it retains a molecular memory of the form in which it was originally produced. <http://www.brunel.ac.uk>

MFLEX announces agreement to acquire Pelikon

Multi-Fineline Electronix (MFLEX), a provider of flexible printed circuit and component assembly solutions to the electronics industry, announced that it has agreed to acquire Pelikon Limited, a privately-held technology company focused on the development of printed segmented electroluminescent (pSEL) displays and keypads. Consideration for the transaction includes a purchase price of approximately \$10.7 million, payable by two-year promissory notes, plus contingent consideration which may be earned based upon unit sales in future periods. Pelikon, founded in 2000, is headquartered in London and currently has 22 full time employees. Pelikon's proprietary flexible display technology is used to create reconfigurable, or "morphing", keypads that provide tactile feedback to the user of products such as smart mobile devices, home appliances and control panels, among others. With mobile phone applications, for example, the visible keypad will reconfigure itself depending upon whether the user is texting, calling, listening to music, or taking a picture. Users only view the controls relevant to the task in which they are engaged, making complex devices easy to use and multiple features easy to access. <http://www.mflex.com>

Loop.pH creates biomimetic architecture – Metabolic Media for Nobel Textiles

Loop.pH is a London based design and research studio that aims to bridge the gap between design and the natural sciences. They specialize in the conception, construction and fabrication of environmentally responsive textiles for the built environment. A recent project was showcased at the London Design Festival in September at Saint James Park under the heading: Metabolic Media for Nobel Textiles. The Nobel Textiles project is a collaboration between five Nobel-winning scientists and five designers to create textiles inspired by the discoveries of the Nobel Laureates. Loop.pH was paired with Sir John E. Walker who was awarded a Nobel Prize in 1997 for his work describing how enzymes make ATP (adenosine triphosphate). Loop.pH created adaptive flexible architecture based on molecular biology, coupled with energy harvesting canopies and membranes inspired by photosynthesis.



The studio's woven and modular architectural structures provide a lightweight solution for growing food plants in small spaces without soil. The urban ecosystem, Metabolic Media, comprises of geo-textile structures and solar cells designed to charge the batteries of a fuelling pump system that feeds and monitors the network of plants by misting the roots with nutrient rich solution.

One of the exciting developments of this project has been the outcome of a collaboration with Risø DTU, the National Laboratory for Sustainable Energy in Denmark. Loop.pH has been working with printed, organic solar cells based on the work by Dr. Frederik Krebs, senior researcher and Torben Damgaard Nielsen, innovation pilot. Large tensile surfaces and building façades could be used to harness the sun's energy and turn it into electrical energy using flexible printed photovoltaics (solar cells). More information on the organic solar cells can be found here: <http://www.risoe.dk/solarcells>. Images from the organic solar cell project are on the next page. <http://loop.ph/>



A modular photovoltaic membrane was prototyped for the installation that can be clad to synthetic textile architecture to provide both shelter and shade from the sun during the day and once evening falls light is cast into the darkness using low-power micro LEDs with printed circuitry. Loop.pH will be developing this over the next 12 months as a low cost, high volume source of light for emergency shelter relief – in places where light and electricity are not provided.

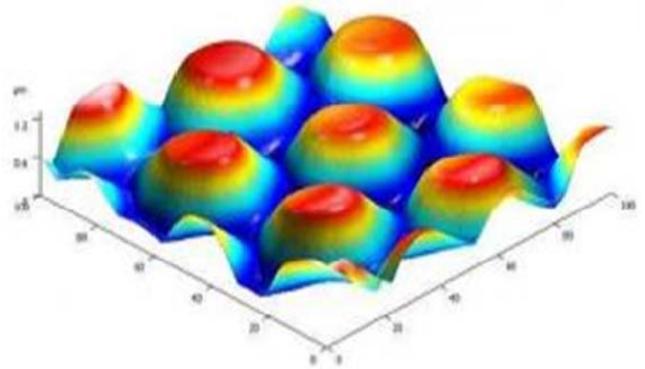
CDT and Semprius announce agreement to develop new OLED backplane technology

Semprius announced that it has entered a joint development agreement with Cambridge Display Technology (CDT) to develop new technology for the manufacture of OLED backplanes for flat panel displays. The goal of the two-year collaboration is to apply Semprius' patented semiconductor printing technology to improve performance of backplanes, which hold the electronic components that drive display screens for computers, televisions and a host of other devices. CDT, a wholly-owned subsidiary of Sumitomo Chemical, is a leader in the research and commercialisation of polymer OLEDs and their application in displays. Semprius' micro-transfer printing process allows transfer printing of high-performance semiconductors onto virtually any surface, including glass, flexible and rigid plastic, metal and other semiconductor materials. Semprius will focus on using its patented process to transfer single crystal silicon semiconductors onto the backplane, thereby increasing overall display performance.

<http://www.cdtttd.co.uk> <http://www.semprius.com>

Queen Mary College wins more awards for research in functional polymers

For Queen Mary College, London, 2009 will see, besides the start of the Doctoral Training Centre in Plastic Electronics, the start of another four projects in the area of functional polymers. The four awarded projects are funded through the Dutch Polymer Institute (DPI) and represent a total value of around £800K. Two projects involve the development of new multifunctional nanocomposites including high-strength conductive polymer composites based on graphene nanofillers. The other two other awarded projects are on the development of novel smart polymer fibbers with surface patterning through photo-embossing and the development of functional polymers for use in organic electronic applications. <http://www.qmul.ac.uk>



Surface patterning through photo-embossing

UK OLED lighting start-up PolyPhotonix to build production line in County Durham

UK start-up company PolyPhotonix recently announced plans to build polymer OLEDs in north east England. "We are looking to generate revenue through sales within a three-year business plan," CEO Richard Kirk advised. "We are not a research company. We are going to demonstrate how to make three million units at high yield, high performance and high efficiency." The production line is to be installed in the clean room of the Printable Electronics Technology Centre (PETEC) in Sedgefield. It will produce lighting panels using OLED intellectual property licensed from CDT in Cambridge. The firm secured some funding through the Government's Technology Strategy Board through a project called Manufacturing Emissive Nanotechnology Devices in Polymers (MENDIPs). Other partners in the MENDIPs consortium are Japanese car interior maker Sanko Gosei and the County Durham-based Centre for Process Innovation (CPI), which owns PETEC. PolyPhotonix' intended main markets are automotive and architectural lighting, but Kirk also expects some interest from makers of general lighting products. The production line will initially make its OLED emitters on 200x200mm glass substrates. "We are taking the best materials as they are today," said Kirk. Flexible plastic substrates are also on the cards once glass-based emitters are in production. <http://www.polyphotonix.com>

Europe launches AEVIOM white OLED project

White OLEDs are potentially highly-efficient large-area light sources. The ICT-STREP project AEVIOM (Advanced Experimentally Validated OLED model) is a collaboration between leading academic and industrial groups in Europe. The project aims at enabling a breakthrough in white OLED efficiency and lifetime by the development and application of an integrated "second-generation" OLED model. The model will be the basis for efficient numerical methods that properly include the entire chain of electrical and optical effects inside the disordered organic semiconductor material, as well as the optical out coupling. The AEVIOM project is a "small or medium-scale focused research project", funded by the Information and Communication (ICT) program of the European Commission's 7th Framework. The aim of the AEVIOM project is to develop a powerful numerical simulation tool for achieving breakthroughs in white OLED technology. The AEVIOM consortium consists of nine partners: five university groups, two large industrial laboratories and two small/medium enterprises, from four European countries. They are Philips Electronics, Technische Universität Dresden, Sim4tec, University of Cambridge, Zurich University of Applied Sciences, FLUXiM, University of Groningen, Eindhoven University of Technology, and Philips Forschungslabor. <http://www.aeviom.eu>



Merck acquires the entire IP portfolio of OLED-T

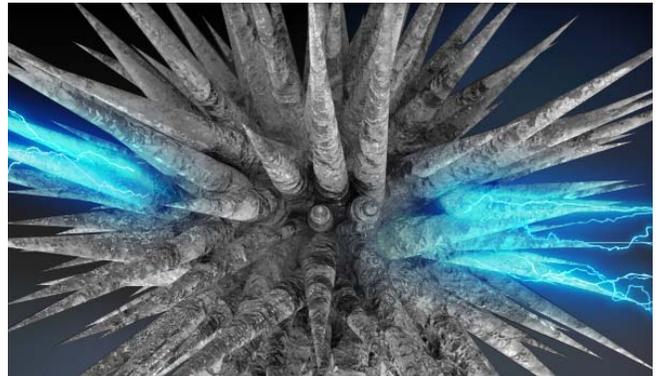
Merck KGaA announced the completion of an agreement to acquire the entire IP portfolio of the company OLED-T with immediate effect. OLED-T has an extensive IP portfolio in the field of electron transport and phosphorescent-emitting materials for OLED applications. Merck KGaA will combine the acquired IP with its own extensive IP portfolio and expertise to further expand its position as a market leader in the development and commercialization of new innovative OLED materials. <http://www.subscribe.merck.de>

Plastic Logic previews electronic-reading device with plastic electronics display

Plastic Logic previews a game-changing new device that brings a panoply of business information to your fingertips with powerful tools to make people more productive and simplify their work lives. Differentiated by a form factor of 8.5x11-inch paper), the Plastic Logic reader features a big readable display. Yet it's thinner than a pad of paper, lighter than many business periodicals and offers a high-quality reading experience. The Plastic Logic reader supports a full range of business document formats, such as Microsoft Word, Excel and PowerPoint, and Adobe PDFs, as well as newspapers, periodicals and books. It has an easy gesture-based user interface and powerful software tools that will help business users to organize and manage their information. Users can connect to their information either wired or wirelessly and store thousands of documents on the device. The reader incorporates E Ink technology for great readability and features low power consumption and long battery life. The Plastic Logic reader is scheduled to ship in the first half of 2009. Plastic Logic's display technology, first developed at Cambridge University, uses high-resolution transistor arrays on flexible plastic substrates, manufactured at a low temperature. The company also passed another significant milestone in commercialising its product with the opening of its new manufacturing facility in Dresden, Germany on September 17, 2008. The factory is the world's first commercial-scale plastic electronics manufacturing facility. It will begin to immediately ramp production on the Plastic Logic reader. <http://www.plasticlogic.com>

RFID for contactless access control is too easy to compromise warns Peratech

Contactless RFID is well established for access control for buildings; simply wave your pass near the reader and the door opens. This technology is now being rolled out in the UK and around the world for so called biometric passports and credit cards because there are no physical contacts or magnetic stripe to wear out. However, it is generally not realized just how easy it is for unauthorized people to access the information on these devices without the owners realizing, warns Peratech, a developer of new materials designed for touch technology solutions. With chip and pin or magnetic stripe, the owner makes a conscious decision to authorize the reading of information by physically handing over the device. Contactless RFID uses a short-range wireless link from a reader to activate a chip, which can then be interrogated to provide information stored on it. Peratech has announced that it has a solution to hacker problems that puts the owner back in control of who accesses their information. A very thin, pressure-sensitive material that acts as a switch is embedded in the circuit and then can be laminated in the same way as current credit cards are produced. Only when the switch is squeezed by the owner will the device become active. The switch is only possible in such a thin application because it is made from Peratech's Quantum Tunneling Composites (QTCs). At only 70 microns thick, the switch is even thinner than the chip enabling it to be easily embedded into a credit card, passport or access pass. QTC technology has no moving parts and requires no air gap between contacts and is robust enough to survive many years of switching on and off. Peratech is already in discussion with manufacturers of these devices about using its QTC switches. <http://www.peratech.com>



CDT and Silvaco develop a new universal organic TFT

CDT announced that in collaboration with Silvaco Data Systems, they have developed a new Universal Organic Thin Film Transistor (UOTFT) SPICE model. Circuit designers can now design and simulate circuits using OTFT technology. The rapid development of organic electronics is mainly driven by applications that require low cost electronic circuits covering large areas with mechanical flexibility. Examples are: e-skin, e-paper, e-nose, smart-fabrics, flexible displays, printed electronics or radio frequency identification tags (RFID). OTFTs form the basis of future organic electronic circuits. The model is implemented in Simucad SmartSpice, a leading analog circuit simulator. The UOTFT SPICE model combines universal charge-based field effect transistor modelling with OTFT specific channel charge, mobility bias, temperature dependences, and nonlinear contact resistances. <http://www.silvaco.com>
<http://www.cdtltd.co.uk>

University of Strathclyde researchers develop novel bistable LCDs

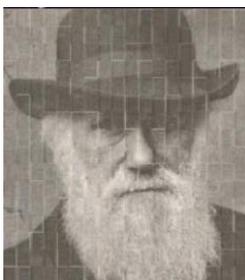
According to a report in *Electronics Weekly*, researchers at the University of Strathclyde say that they have demonstrated a flexible bistable reflective LCD and believe that it is ready for commercialisation. The display is passive matrix driven so not suitable for motion video or other fast response time content but the researchers say that their displays could be used for large format displays to replace paper displays. The technology is being tested for suitability to roll-to-roll manufacture and progress so far is favourable with several components having been proven. The LCD material is contained in small wells on one substrate rather than being a continuous layer across the whole display surface. The polygonal shape of the wells is used to define the LC alignment so there is no need for a rubbing process. The bistable nature of the device is also down to the shape of these wells. The display is constructed of two sheets of plastic, one with the LC wells embossed in it and the second bonded on top to seal the wells. ITO electrodes are patterned to form the addressing lines and the back of the display has a mirror layer applied through vacuum deposition and a polarizer is applied to the front. <http://www.strath.ac.uk>

PHOSFOS project aims at exploiting flexible photonic skins for sensing

The EU project PHOSFOS (Photonic Skins For Optical Sensing) began in June and will run until March 2011. It will develop and build on a new paradigm for optical sensors integrated in an unprecedented manner with opto-electronic and electronic circuitry in flexible and stretchable skins for applications in diverse fields including structural health monitoring, automotive industry, aeronautics and aerospace, robotics, healthcare etc. PHOSFOS intends to develop a technology that provides an answer to essential issues that have so far prevented fibre sensors from penetrating the market, which include packaging, fully-fledged system integration, optical coupling and interfacing, dependable strain transfer and reliability. The project positions itself at the pre-competitive intersection of optical fibre sensing and integrated optics. It aims at developing a flexible and stretchable foil in which all necessary optical sensing elements can be integrated; that if relevant to the application can include optical and electrical powering as well as onboard signal processing and wireless communications; that can be wrapped around irregularly shaped objects; that will allow quasi-distributed sensing. To do so the sensing elements in PHOSFOS will rely on special highly bi-refractive micro-structured optical fibers (MSF) and polymer optical fibres with fibre Bragg gratings. http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_RCIN=10060407 The silica fibers will be designed to exhibit almost zero temperature sensitivity whereas POF fibres will be used for their very specific property that their length can be stretched up to 300% before breaking. The optimal Bragg grating writing technology in these fibres, both silica and POF, will be developed. PHOSFOS will focus on embedding these into the sensing skin and on the optical coupling/interfaces to the peripheral opto-electronics and electronics. PHOSFOS will end with two proof-of-concept demonstrators, the first targeting structural health monitoring of civil engineering structures, the second aiming at the automotive industry.



Shoothill shows off Charles Darwin in Silverlight DeepZoom



Shoothill recently developed a webpage that celebrates the bicentennial of Shrewsbury, England's most famous son, Charles Darwin, utilizing Microsoft's Silverlight DeepZoom technology. The web page is made up of each of the pages of the original edition of "*Of the Origin of Species*", published in 1858, pieced together in a likeness of Darwin. The zoom enables viewers to go beyond the level of the recognizable. The image to the right is an excerpt from the treatise and is

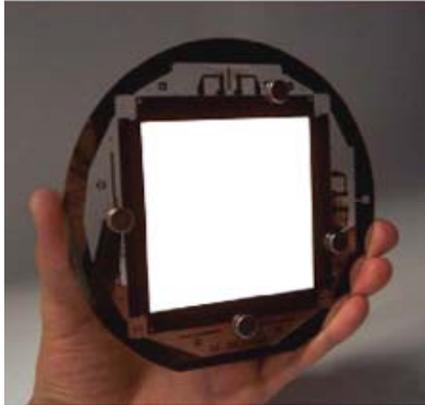
embedded near Darwin's nose in the mosaic of Darwin seen on the left.

<http://www.shoothill.com>

Hence it seems that, on the one hand, slight changes in the conditions of life benefit all organic beings, and on the other hand, that slight crosses, that is crosses between the males and females of the same species which have varied and become slightly different, give vigour and fertility to the offspring. But we have

OLLA project reaches final milestone

At the end of the project period, the EU OLLA project consortium presented its final milestone: the basic technology for a white OLED light source, with an efficacy of 50.7 lumens per watt at an initial brightness of 1,000cd/m² based on the Novaled PIN OLEDT technology. The OLLA project is a joint basic research consortium, headed by Philips Lighting. The OLED technology is



Example of a 10x10cm white OLED on a HC Starck Clevious PH510 PEDOT layer
(picture source: Fraunhofer IPMS)

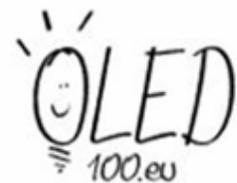
generating a novel and very attractive class of solid-state light sources, which are flat, thin, and very lightweight. Due to its freedom of design, OLED lighting technology offers many possibilities for new lighting applications achieving substantial energy savings. Within OLLA 24 partners of 8 European countries have been working closely together developing OLED technology for lighting purposes with the goal to reach an efficacy of 50 lumens per watt combined with a lifetime of over 10.000 hours at 1.000cd/m² initial brightness. Philips Research and Novaled, together with the partners reached the project targets in efficacy, colour rendering and brightness. The lifetime of the Novaled device even exceeded the promised value by one order of magnitude. Besides the record values listed above, the OLLA project delivered the first large sized ITO-free OLEDs, the first large-area printed OLEDs and several ICT demonstrators. <http://www.olla-project.org>



Pan-European OLED development project to succeed OLLA

The EU has funded OLED-100.eu, a research and development project that is funded for three years with 20 million euros as a successor to the OLLA project. The new project is viewed as critical to the long-term development of the European OLED industry. The OLED100.eu goal is to develop all the necessary technologies needed to produce efficient OLED products for exploitation by the European lighting industry. The project has a set of challenging goals, including 100 lumens per watt power efficiency, 100 thousand+ lifetime hours, unit area of 100cm by 100cm, at a cost of 100 euro per square meter or lower.

Artificial lighting consumes a significant part of all the electrical energy produced worldwide. In homes and offices from 20% to 50% of total energy usage is due to lighting. OLEDs are very promising candidates to substitute conventional light sources like incandescent bulbs and fluorescent tubes. The rate of OLED development is such that soon they will be more efficient than CCFL and they offer many advantages in ease of manufacture and in providing a variety of light form factors. Partners include: Microsharp, Philips, Bartenbach, Corning, Evonik Degussa, European Photonics Industry Consortium, Fraunhofer Institute for Photonic Microsystems, Novaled, Océ Technologies, Osram Opto Semiconductors, Federal Physical and Technical Institute of Germany, Saint-Gobain Recherche, Siemens, Technical University of Dresden, and University of Gent. http://cordis.europa.eu/fetch?CALLER=EN_NEWS&ACTION=D&SESSION=&RCN=29665

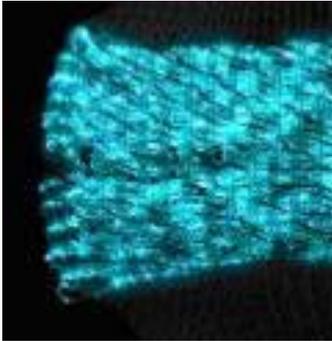


Nanoco appoints KISCO Ltd as exclusive Asian distributor

Nanoco Technologies has signed a distribution agreement appointing KISCO as the exclusive Asian distributor of Nanoco's advanced quantum dots materials. Next generation electronic applications will be the first to benefit from this collaboration as KISCO begins by working with Japanese, Korean and Taiwanese electronics customers to incorporate Nanoco's quantum dots into products including electroluminescent quantum dot displays (EL-QD), solid-state lighting and photovoltaic devices. Nanoco is unique in the nanomaterials market as a company that manufactures large quantities of quantum dots, using its patented manufacturing process. The bulk manufacture of quantum dots provides technology companies around the world the platform to develop a wide variety of next-generation products. Nanoco's development of high performance RoHS compliant cadmium free quantum dots is seen as a key breakthrough towards adoption of quantum dot technology in industrial and other applications. <http://www.nanocotechnologies.com>

University of Manchester develops electroluminescent yarn

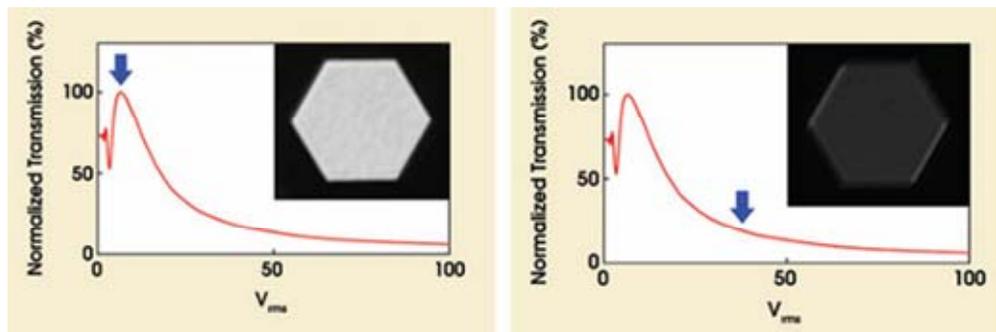
A team at the University of Manchester has produced yarns based on thin-film electroluminescent technology that emit light when powered by a battery. The yarns are based on commercially available conductive yarns, onto which carefully chosen polymer layers are added. The team is currently using silver-coated nylon, although yarns based on polyethylene monofilaments with a carbon core have also been tested. The process involves applications of one to two nano-layers of a dielectric polymer in such a manner that an extremely thin and flexible layer is created around the silver surface of the core yarn. On top of the dielectric layer, a polymeric layer embedded with EL particles such as phosphors is applied. The structure is then covered with a layer of conductive transparent polymer. The different polymer layers create a textile capacitor, with the EL particles trapped between two electrodes. The conductive core forms one electrode, while the other is the conductive transparent layer. When the yarn is powered, the resultant electric field causes the electroluminescent coating to emit light. To date the team has produced prototype yarns to demonstrate the feasibility of the technology, and will now work on optimization and scaling-up for commercial applications. <http://www.manchester.ac.uk>



UK and Russian researchers build an LCD with graphene

According to a team of researchers from the UK and Russia, thin sheets of carbon could improve LCDs. The group recently demonstrated that graphene – a two-dimensional layer of carbon – can be used to make the conducting transparent thin films required as electrodes in LCDs and other photonic devices. Unlike the metal oxides now used for such electrodes, graphene is chemically stable. Furthermore, metal oxides suffer from non-uniform absorption across the visible spectrum, and the new material does not. Indium tin oxide is the most commonly used electrode material, but it can inject oxygen and indium ions into the active media of a device. Indium tin oxide films also can be highly resistive when optical transmittance is above 95%. In building demonstration LCDs, the investigators used graphene flakes for one electrode and InO₃ for the other. They created the flakes on a glass slide via micro-mechanical cleavage. They located the flakes using a Nikon microscope and confirmed that they were mono-layers by using a Raman microscope from Renishaw of Wotton-under-Edge, UK. The researchers deposited 55-nm chromium/gold contacts

around the monolayer flakes, causing the graphene to cover holes in the otherwise opaque metallisation. They applied a 40-nm-thick polyvinyl alcohol alignment layer on top of the graphene and topped that with liquid-crystal material. They also built a control, which was the same as their device except that it did not contain graphene. When they applied a voltage across the test device, the transmission of both white and monochromatic 505-nm light through the device changed, but the control was unaffected. The contrast ratio – the difference between maximum transmission and the level of opaqueness when 100 VAC was applied – was better than 100:1 for the demonstration device. The electrical resistance and the light transmission of the flakes also were better than what could be obtained with In₂O₃. The work was published in *Nano Letters*, April 30. The team was comprised of representatives from the University of Manchester, Russia's Institute for Microelectronics Technology, and Graphene Industries Ltd. <http://www.grapheneindustries.com>



The insets show two stages of an LCD built using graphene instead of the commonly used indium tin oxide for one of its electrodes. The graphs show the normalized transmission — as a percentage of the maximum — versus the voltage applied to the electrode. As with other LCDs, the transmitted light falls as voltage is increased, eventually dropping to less than 1 percent.

transmission of both white and monochromatic 505-nm light through the device changed, but the control was unaffected. The contrast ratio – the difference between maximum transmission and the level of opaqueness when 100 VAC was applied – was better than 100:1 for the demonstration device. The electrical resistance and the light transmission of the flakes also were better than what could be obtained with In₂O₃. The work was published in *Nano Letters*, April 30. The team was comprised of representatives from the University of Manchester, Russia's Institute for Microelectronics Technology, and Graphene Industries Ltd. <http://www.grapheneindustries.com>

Chris O'Shea and Cinimod Studio shows off "Beacon" kinetic light system

"Beacon" is a kinetic light installation with a mind of its own. An array of emergency beacon lights interacts with visitors, tracking their movement through the space, creating an immersive and playful experience. A collaborative project between Chris O'Shea and Cinimod Studio, the installation exploits a transfer of technologies from existing industrial products. The beacon lights have had their internal parts replaced with custom hardware, enabling the rotation of the reflector and lamp brightness to be individually controlled. Thermal imaging cameras have been adapted to track the participants' movement through the space. "Beacon" is orchestrated in real-time by a bespoke control system, which uses tracking information from the cameras to coordinate an interactive and highly responsive behaviour. <http://www.pixelsumo.com>



"Beacon" is a specialty lighting installation that reacts to the movements of people as they walk by...

Zytronic touch sensors enable 5-metre long interactive table-top exhibition

Zytronic's ZYBRID touch sensors have enhanced the visual impact of several imaginative exhibition display projects, and the latest is the Silent Heroes Memorial Centre, which opened recently in Berlin. By embedding eleven 32-inch ZYBRID sensors in a glass-topped media table over 5m long, exhibition designers have created an interactive presentation that can be updated quickly and easily to include new content in the future. The Silent Heroes Memorial Centre highlights the actions of the German Resistance,



which protected persecuted people during the Nazi dictatorship. The media table is used to display many presentations including 187 short biographies, which visitors can call up by touching the screen directly. There are also over 100 texts explaining the subjects and historical context, as well as 38 glossaries. ZYBRID uses projected capacitive technology (PCT) to achieve touch-screen functionality even when placed beneath a glass or plastic protective front panel. The sensors have no surface-active components such as coatings, transducers or optics, and therefore the touch screen combines high sensitivity, durability, resistance to damage, and ease of use. The sensor is based on an array of micro-fine sensing elements embedded behind the glass front panel, capable of

detecting the approach and touch of a finger on the front surface of the glass. PCT also incorporates palm rejection, which is critical for table-top applications. In the media table, Zytronic has combined the ZYBRID sensor with its recently developed 64-channel touch-screen controller to combine large form factor sensors with high resolution and touch sensitivity. <http://www.zytronic.co.uk>

Haque Design creates “Primal Source” for City of Santa Monica

Specially commissioned by the City of Santa Monica, California, for Glow 08, Primal Source was an all-night performance/installation brought to life through the active participation of festival-goers (estimated at approximately 200,000 over the course of the night). <http://www.haque.co.uk>



Located on the beach near the Pier in an area that had been specifically landscaped over the course of several days, and making use of a large-scale outdoor water-screen/mist projection system, the mirage-like installation glowed with colours and ebullient patterns created in response to the competing and collaborative voices, music and screams of people nearby.



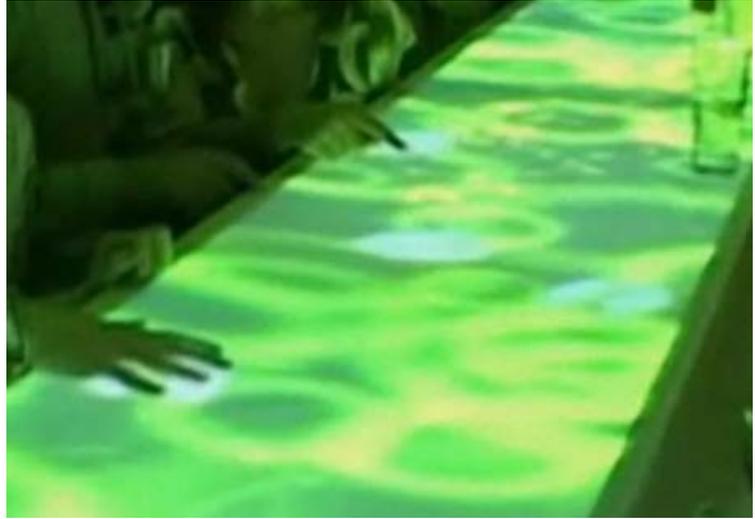
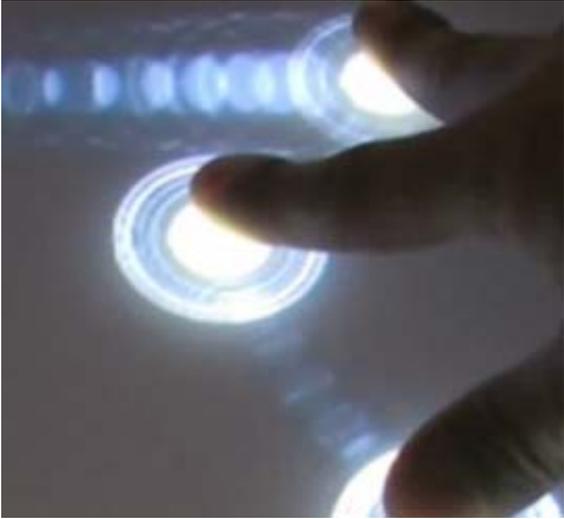
Responding to sounds emanating from the crowd, the system's modes changed every few minutes depending on how active the crowd participation was (more quickly when there was more noise). Each mode responded in a slightly different way to the individual voices and sounds picked up by eight microphones distributed towards the front.



Some modes created “creatures” whose colour, shape and movement followed the frequency and amplitude dynamics of individual syllables and sentences picked up; other modes responded to wider collective phenomena, e.g. distorting a grid in response to the crowd volume, or creating a rush of wind through a wheat-field landscape.

Mindstorm shows off variety of interactive surface solutions

Mindstorm claims to be the world's foremost interactive surface company, known for its focus on quality, innovation, and leading-edge technology. Over the past five years, London-based Mindstorm has developed a wide range of software technology solutions to businesses ranging from retail and hospitality to corporate branding and events. Mindstorm's solutions are already in use in a variety of capacities around the world. <http://mindstorm.com>



Mindstorm's portfolio includes a variety of interactive surfaces, both functional and decorative

Wasp develops capacitive switching system

Wasp has developed a capacitive switching system that can be adapted for use in almost every situation where non-mechanical switching is required. A conventional printed graphic overlay protected by clear acrylic or polycarbonate is used together with a circuit design that operates a switch with the user's natural body capacitance. The switch panel uses a proprietary capacitive sensor IC to detect operation by the user. The IC's project sense fields (from conductive sensors) up through dielectric, translucent material that can be up to 10mm thick. The use of capacitive switching enables designers to backlight the switch positions while allowing clear material to be used in capacitive touch-screen assembly. The use of such materials means that the switch is easily cleaned and impervious to accidental liquid ingress. A complete lack of moving parts means that mechanical failure is eliminated and sense fields can be predicted through dielectric material, enabling vandal-resistant panels to be easily produced. <http://www.waspswitches.co.uk>

Culloden Battlefield Visitor Centre uses imaginative AV techniques from Electrosonic

The National Trust for Scotland recently completed its largest ever construction project, a new £9 million visitor centre at the Culloden Battlefield. The centre is based on the latest scholarship and includes an exhibition that follows the progress of the Jacobite Army. Electrosonic was the AV Systems Integrator for the project. The interactive exhibition follows the progress of the Jacobite army on their campaign, and offers a unique insight into what life was like in Scotland at the time of the Battle. <http://www.nts.org.uk>



- Visitors are taken to the very heart of the conflict in a 360° immersion film, and shadow real-life characters through the years of the Jacobite rebellion and find out what happened to them in the often brutal aftermath of the Battle.
- There are 14 “Character Stations” by which visitors become acquainted with people who lived at the time of and through the battle. Each one consists of a 46-inch LCD monitor installed behind a diffusing panel to give a “ghostly” effect, compounded by the video sequences themselves being “shadows”. Visitors select the character by means of a touch screen, and hear the character speaking over directional loudspeakers mounted overhead.
- There are two “Campaign Table” exhibits. Each is a table surface on which images are projected from above. Two projectors are used on each table in order to give an image of sufficient size and resolution. The images are animated maps, which show the movements of the participants in the overall campaign. Visitors can choose whose movements to follow by touching icons on the map. The icons are projected onto the table surface, and underneath the projected icon images there are capacitive sensors.
- There is also a battle immersion in which visitors see a reconstruction of the battle. The intense experience lasts around 12 minutes, and is presented on four screens surrounding the audience. Each screen is served by two projectors, with image edge blending, to achieve a wide-screen image of high resolution.

Black Cat provides “twin-headed” touch screen kiosks for National Galleries of Scotland

Black Cat Displays, an England-based manufacturer of information kiosks and customized digital displays, has developed and supplied customized, portable, twin-headed kiosks for the National Galleries of Scotland in Edinburgh, Scotland. Dubbed Gemini, the touch screen kiosks provide gallery visitors with up-to-date information about the exhibits. According to Black Cat officials, the twin-headed displays provide visitors with an ergonomic and comfortable operating position from standing to sitting. Additionally, the gallery is able to relocate the kiosks with minimum hassle by simply wheeling the units to the next available power point in any of the rooms. The Gemini kiosks are equipped with a pair of 20.1-inch colour TFT LCDs mounted on a pedestal with a customized finish and silk screening to match the environment. Besides the standard sound from the integrated speakers, there are optical illuminated bezels, hearing loop amplifier capability, keyboards, trackballs, telephone handsets and cameras. The PC comes with network support and a complete system power supply. <http://blkkat.com>



Luminivision projection systems offer more than 100 interactive effects

Luminivision recently updated the ADVIS Interactive Projection System. Their software and hardware package can turn ordinary computers and projectors into a virtual interactive wall, floor, table, ceiling, or virtually anything that can be projected onto. The audience has the ability to interact with whatever is projected. Marketing and advertising, lighting effects, education and entertainment are just some of its uses; the system has been used successfully at exhibitions, parties, corporate events, nightclubs, shopping centres, and product launches. The components that make up an interactive projection system have been split down to make the system much more affordable. Luminivision supplies the software and hardware needed to turn an ordinary projector and PC into a complete interactive projection system. The software has the ability to link multiple systems together to make larger projections. Future releases from Luminivision will include Interactive "Touchless" screens. It is similar to a touch screen but based on motion detection technology so the screen can be controlled from a distance. This will be a multi-touch system so many users can interact with it at the same time. <http://www.luminivision.co.uk>



Promethean and University of Barcelona evaluate the potential of interactive white boards

Promethean presented the final information from an investigation to evaluate the potential of interactive whiteboards to improve the processes of teaching and learning, carried out by the UAB, Autonomous University of Barcelona. The results show how this technology stimulates and favours the participation and the learning of the students while allowing the teachers to have a greater repertoire of didactic and methodological resources. In order to guarantee the validity of the investigation 400 teachers from 60 different primary and secondary schools were included who had experimented with the didactic modes of using the interactive whiteboards. Throughout the two school years, four seminars were carried out to evaluate the use of the interactive whiteboard and to reflect upon the educational activities realized, with the support of six regional coordinators who monitored all of the participating teachers over the course of the two years of the investigation. <http://www.prometheanworld.com> the main conclusions follow:

- 96% of teachers consider that the interactive whiteboards contribute to the increase in class motivation and help to capture the attention of the students.
- 93% indicate that the interactive whiteboards allow access too many educative resources that facilitate the understanding of the lessons.
- 85% perceived an increase in the participation of the students in the development of the activities.
- 88% state that the use of the interactive whiteboards in the classroom facilitates the teaching, the learning and the achievement of educative objectives.
- 84% indicate that the interactive whiteboards facilitates teamwork and allows for the sharing of resources.
- With respect to the didactic models applied in the use of the interactive whiteboards, 91% of teachers use them for the presentation and explanation of the material (video, images, audio resources, etc.) while 71% of teachers polled, declared they used the interactive whiteboards to carry out searches and to share resources over the Internet.

Clear Channel Outdoor introduces new lighting technology for billboards

Clear Channel Outdoor UK is working with Way Forward Technologies to replace fluorescent tube lighting systems across its backlit billboard portfolio with a new energy efficient linear LED "Luminaire" lighting system. Following a successful trial in Chiswick, London, Clear Channel Outdoor has begun its conversion of backlights and scrollers to the LED Luminaire system, with the aim of converting a substantial percentage of its back-lit London estate across 96-sheets, 48-sheets and mega 6-sheet sites by Q1 2009. Each "Luminaire" consists of hundreds of LEDs. Luminaires operate in banks of 10, which are then linked together via an IP65 rated (dust and waterproof) plug and socket system to a 97% efficient power supply. While the illumination and presentation of the advertising creative is improved with a clearer, crisper display, the electricity consumption is reduced by 75% through the introduction of LED "Luminaire". <http://www.clearchannel.co.uk>



Clear Channel Outdoor unveils spectacular new banner site at London's Astoria

Valve, the creator of game franchises, is promoting its new survival action game "Left 4 Dead" on Clear Channel Outdoor's latest banner site in London – the Astoria. Booked by US agency Gibson Media Inc, the site, in the heart of London's West End, enables Valve to build the brand awareness while achieving precision proximity targeting due to the banner's location adjacent to stock lists of the game. The striking creative maximizes the impact of this spectacular new banner site located on one of central London's most iconic buildings. Measuring 16m wide by 8m high, the banner offers a unique opportunity to reach a huge number of pedestrians heading between London's Oxford Street, Soho, Tottenham Court Road and Holborn/Covent Garden, as well as two lanes of traffic headed between Holborn and Tottenham Court Road. The only banner location in Westminster, the site is particularly appealing to international and electronics clients, such as Valve, as well as entertainment brands due to the heritage of the Astoria. <http://www.clearchannel.co.uk>



SmartGlobe brings out the world's first Internet-updateable globe



SmartGlobe comes with interactive lessons, complete with 30 English and 6 Spanish activities. It has quiz games about countries, capitals, major cities, populations, languages, currencies, time, distances, history, science and current events. The Smart Pen can be programmed for age-appropriate content, and works with headphones. Downloadable information is kept current with weekly Web updates. SmartGlobe is for PC use only and is not currently Mac-compatible.

<http://www.oregonscientific.co.uk>

UK pumps £15 million into photonics projects

Development of a range of more energy efficient lighting, lasers and displays is to be accelerated following the announcement of UK government funding for twelve innovative research projects. The total value of the projects is in excess of £15 million (\$26 million), with the Technology Strategy Board contributing over £7m. The Engineering and Physical Sciences Research Council is contributing nearly £1m to five of the projects. The projects that will benefit include work on developing more efficient LEDs, new laser diodes, white-light fiber lasers and holographic optics. Some projects will see the integration of new and existing component technologies into working systems. <http://www.innovateuk.org> The projects to be funded include:

- MENDIPs: manufacturing emissive nanotechnology devices in polymers.
- Enhanced Display Viewability using High Efficiency Advanced LED Backlight Arrays (ENDVIEW): applying high performance LED arrays and novel optics systems to displays.
- Compact Frequency Converters – from RGB to Emission Effusimetry (CFC-FREE): developing a commercially disruptive laser platform based on miniature frequency converters at visible and IR wavelengths.
- LED lighting for the 21st Century [LL21C]: demonstrating a novel GaN LED capable of 95% light extraction and designed for general lighting applications.
- ETOE - II: using new AlInGaAs/InP materials in complex laser structures.
- Advanced White Light Fiber Laser and Applications in Medical Imaging (WhiteLase): developing advanced white light (supercontinuum) fibre lasers and their applications within biomedical imaging.
- Willet: producing a low cost, low power, high pixel count plastic display for electronic paper applications.
- Low Cost Holographic Optical Elements for Next Generation Lighting Systems, NAHO (Nano Aligned Holographic Optics): developing edge-lit lighting devices for use in buildings, based on silver halide holographic optical elements (HOEs) illuminated by LEDs.
- High Efficiency Laser Processing Systems (HELPS): demonstrating fibre-coupled diode laser sources with beam qualities good enough to be applicable to broad range of mainstream applications.

SISA stores lining up to go digital with ZBD electronic shelf edge labelling solution

ZBD and its Italian partner, Proxima Centauri Informatica, are accelerating the roll-out of their electronic shelf edge labelling solution to keep pace with demand from SISA, the Italian supermarket giant. Following successful pilot projects at stores in Bernareggio (MI) and Rovellasca (CO), dozens of other SISA outlets in its 230-strong Nord Ovest (North West) region are lining up to go digital across their fresh

food departments. This is an exciting time for ZBD as the pace of the changeover from paper to electronic shelf labelling means the company is now well on track towards its target of converting 50 stores during the first quarter of 2009. Up to 15 supermarkets have been chosen to form the next tranche that will receive the electronic point of purchase (epop) displays before Christmas. In total, several thousand of ZBD's epop500 displays, together with epop Communicator devices and Bounce communications software, have been earmarked for the project and the total order could increase further still.

<http://zbd-solutions.com>



E/T/C Paris creates 40-megapixel video projection extravaganza

E/T/C Paris created a new world record in large format video projection as part of the festivities for the 400th anniversary of the City of Quebec, which ran from June through August. “Le Moulin à Images” (The Image Mill) was a spectacle of imagery and sound created by media innovator and artist Robert Lepage and his team at Ex Machina, recalling the history of Quebec City. Each evening at sundown the grain silos on the banks of Louise Basin in the Port of Quebec will be transformed into an immense projection screen measuring 657 meters long and 33 meters high – some 40 million pixels – revealing this stunning work. E/T/C Paris installed a total of 27 Christie Roadster S+20K DLP video projectors for the project. Onlyview, E/T/C’s multi-media control platform, handled the programming, transmission, and broadcasting of thousands of spectacular images, animations and videos during the 40 minute show, plus synchronization of the soundtrack which was simulcast on local radio. Given the sheer size of the projection area – two thirds of a kilometre in length – E/T/C faced some significant logistical challenges.

- The projectors needed to be strategically placed to avoid any obstructions that would create shadows on the images. These – primarily the buildings directly in front of the silos – were therefore used as platforms for certain projectors, while custom towers were built for the rest.
- The average 33-meter height of the projection is normally too high to cover with a single device, which E/T/C overcame by placing the video projectors vertically (on their sides), thus maximizing their active DLP area and brightness.
- Control issues included the main control room – containing the Onlyview system of one master and 25 display computers – being located directly in front of the grain silos and thus too close up to see the entire projection surface. So a second control room was installed at the other side of the Port from where the full projection surface is viewable.
- The video projectors are all linked together via TCP/IP and the video distribution is made by DVI via a fibre optic network. Over 1km of network cabling covers the distance between the projectors, and a staggering 8km of fibre optic cable runs from the projectors to the principal control room.

Patrice Bouqueniaux, E/T/C Paris’ director of marketing comments, “It is a huge achievement to accomplish such an immense video projection without loss of quality, luminosity or synchronization.” <http://www.projecting.co.uk>



Brief Report on Lighting – January 2009

by Gareth Jones

This is the first in a regular series of articles covering a concise roundup of some of the news in the LED lighting industry. If you wish to have items from your company or institution included in this section then please provide the information to info@ukdisplaylighting.net.

Dr Gareth Jones is chief technology officer at Enfis Group plc. Enfis is a leader in the design and manufacture of intelligent high power LED arrays and smart light engines. The products combine the numerous advantages of LEDs as a light source with our patent-pending SMART array feedback technology for use in a growing number of energy efficient lighting applications. Gareth has 20 years experience in the technology of semiconductor based optoelectronic components such as laser diodes and high brightness LEDs and has published a number of papers in peer reviewed journals and presented at numerous international conferences. He is currently representing Lighting and Energy in the UK Photonics Leadership Group (PLG) and an advisory board member of the UK Displays and Lighting Knowledge Transfer Network. In the past, he has served as advisor on UK panels concerned with the photonics and semiconductor industry and its links with academia. He has been invited to talk at a number of international conferences and is a named inventor on several patents. He has previously represented the UK on a LED lighting technology mission to Japan and India. Gareth is a Member of the IEEE, Lasers and Electro-Optics Society and business member of IEE, and the Institute of Directors (IoD).



LED news

Bridgelux, from Sunnyvale California, emerged from LED chip design to provide array offerings. The first generation of arrays will use the LED technology that the company is already producing on a scale of millions of chips per month. These offer 50-60 lm/W efficacy for the 3000 K warm-white emitter, and up to 75-85 lm/W efficacy for the 5600 K cool-white array.

VPEC, (Visual Photonics Epitaxy Co) from Taiwan, is leaving the LED supply chain as fierce competition and global recession impacts the sector's pricing. VPEC ceased operations in its LED business on January 15 and is understood to be selling process equipment and LED patents to Crystal Light Optotech. Since 2006, revenues from VPEC's ultra-bright red and yellow AlGaInP LED lines fell from 40 percent to just 18 percent of its overall revenue. During 2007-2008 a rapid expansion of LED production capacity in Taiwan occurred, both by existing players and new entrants to the industry. Those companies are now implementing measures to adapt to increased LED supply and softening demand, as illustrated by VPEC's departure from the business. The patented LED production technology from VPEC deals with bonding AlGaInP LEDs to silicon substrates with a metal surface, before removing the original GaAs substrate. The use of Silicon substrates provides better thermal conductivity than the original GaAs substrates, hence allowing the LEDs to dissipate more heat under high power operation. Global leaders, Epistar are likely to benefit from this closure as companies such as VPEC add downward price pressure on LED chips which erode margins.

ENFIS, a UK LED lighting company; this month announced a trading update on its performance, stating that the company has traded in line with management expectations for the year ended 31 December 2008. The strong performance for the period has been underpinned by a number of new contract wins, distribution agreements and design wins during the period. Looking forward, the company has established a strong pipeline in excess of £20 million. The company continues to win new contracts and attract new global distributors. This is predominantly fuelled by a suite of new products released during 2008 and technological improvements due for release Quarter 1 2009 that will increase the typical light output of existing light engines and arrays by 50%. The company welcomed the recent EU and international initiatives that accelerate the use of more energy efficient lighting within the coming years and believes the

company is well positioned to capitalise on its strong market position, as businesses and governments alike are looking to invest in efficient technology that aims to reduce energy costs.

CREE recently reports quarterly LED revenue of \$127 million. Growth in demand for LEDs for lighting has been offset by lower demand in consumer device, mobile telecom and automotive applications. Cree's total revenue of \$148 million for its second quarter ended December 28, 2008. This represents a 24% increase compared to revenue of \$119 million for the same quarter last year. LED revenue was ca\$127 million, or 86% of the total, compared with \$99 million last year and \$123 million in the previous quarter. LED sales growth was driven by a double-digit increase in XLamp LED components and new LED lighting product sales for lighting applications. However, LED chip component sales declined by single-digit percentages, due to lower demand in consumer, mobile and automotive applications. Interestingly, the company's overall revenue figure includes \$5.6 million in upfront patent licensing fees from the company's agreements with Mitsubishi Chemical Corporation and Bridgelux. This income, and additional one-time tax-related revenue, was the main reason that Cree beat analyst's revenue estimates of \$141 million by a significant margin. Current uncertainty in global economic conditions makes it particularly difficult to predict demand, said the company. For the quarter ending March 29, 2009, Cree believes that its revenue will fall sequentially, dropping to the range of \$128 million to \$135 million.

LED lighting news

DOE news: In the next newsletter we will provide an update on the work of the DOE in attempting to provide clarity in terms of performance criteria and with their CALIPER programme some hard facts on the performance of luminaires using LEDs compared with the "claims" made by the manufacturers.

LED downlighters: Also in the next newsletter, we will give a summary of some new LED downlighters which are a rapidly growing and exciting area for white LED adoption. Many companies are now providing LED downlighters to the commercial and industrial markets at reasonable cost and with very encouraging luminaire efficacy and CRI characteristics from warm white to cool white colour temperatures.

Colour rendition of light sources – CRI to transform to CQS? It is well known that LED light sources are not wholly compatible with the current assessment technique for the quality of a light source through the Colour Rendering Index (CRI). In response to this problem a Colour Quality Scale (CQS) is being developed at NIST in conjunction with close discussion with the lighting industry and the CIE to address the problems of the CIE Colour Rendering Index (CRI) for solid-state light sources and to meet the new needs in the lighting industry and consumers for communicating colour quality of lighting products. The CQS evaluates several aspects of the quality of the colour of objects illuminated by a light source. This metric involves several facets of colour quality, including colour rendering, chromatic discrimination, and observer preferences. The method for calculating the CQS is derived from modifications to the method used in the CRI. Though simulations support the appropriateness and usefulness of the proposed metric, visual tests are also being planned. The results of the vision experiments will be used to improve upon and eventually verify the CQS, which is to be proposed as a new international standard for colour quality. A discussion can be seen at: <http://physics.nist.gov/Divisions/Div844/facilities/vision/color.html>

Transistors on Plastics Seminar

24-25 February 2008

The Møller Centre, Storey's Way, Cambridge

UKDL is holding its 4th annual seminar on transistors on plastic and will include leading speakers from industry and academia from across Europe to discuss challenges and opportunities in plastic electronics. As part of the event there will be an opportunity to visit CAPE to see their world renowned laboratories. The keynote address will be given by Professor Henning Sirringhaus of Cambridge University.

The search goes on!

by Myrddin Jones

Myrddin Jones has over 25 years experience in the display industry. Following four years R&D activity on LCD technology at Racal Research Ltd, Myrddin worked for Hitachi Displays for 21 years both in Europe and Japan. The activity was centred on the development of customised LCD solutions to industrial, automotive, computer and mobile phone customers throughout Europe. From 2003 Myrddin was general manager of Hitachi's display business in Europe responsible for a group with sales in excess of 120M€ per year. Myrddin was chief executive of OLED-T Ltd. from February 2006 to September 2008. OLED-T developed high efficiency, long life-time materials for the emerging OLED display industry. Myrddin now provides consultancy support to UK Display and Lighting (UKDL).



Why is it, that after years of innovation and development and billions of dollars of investment in alternative display technologies, LCD still dominates? Based on all the excellent ideas emanating from Universities and money injected by governments and investors, might we not have expected more new display technologies to have been established by now? I believe the following are some of the issues that determine the emergence of new display technologies into the mainstream to compete with LCD:

1. What does the new technology offer that LCD does not and what new types of products are enabled that could not be made before? Electrophoretic (e-ink) is an example of a display technology that enables unique new products to be developed due to properties such as sunlight readability and bistability. Electronic books are not practical with LCD. However, electrophoretic technology doesn't compete with LCD in existing mainstream applications and is likely to remain niche. OLED on the other hand has the opposite problem. It improves on the thickness, power consumption and visual performance in current applications but has not yet enabled unique new product categories to be developed. OLED is competing with LCD in MP3 player and mobile phone applications where price competitiveness is at its most severe. Is this improved performance enough to assure the success of OLED? Time will tell!
2. Is it possible to build the infrastructure for mass production capacity, materials supply chain, production equipment etc? LCD technology has been around for over 30 years and the infrastructure was built up at huge costs over the period. Perhaps new display technologies should be able to utilize existing LCD production capacity in order to ramp up smoothly and rapidly.
3. What are the risks (perceived or real) to equipment manufacturers and consumers of implementing a new display technology into a product? Equipment makers remain conservative about using a new technology due to quality and reliability risks and continuity of supply if the supplier base is limited. LCD is the safe option. Lifetime and reliability are well proven and if one supplier doesn't offer the necessary quality or support, another supplier can easily be found.
4. LCD is "good enough". In fact, LCD is more than good enough for most applications and improving all the time. It's a moving target for new technologies. This year, the module thickness for a mobile phone may be 3mm, next year it will be 2.5mm and so it continues. Benchmarking new display technologies against LCD products in the market is useless if the technology takes five years to develop. LCD will have moved on.
5. Pricing. The LCD market is extremely price competitive. New technologies can achieve a price premium from equipment makers and consumers for their unique benefits but technologies that offer only marginal improvements over LCD in the same application will be rapidly sucked into direct price competition.

New technology innovators sometimes claim "in 10 years, this technology will displace LCD". In my view, that requires the technology to offer significantly improved performance in existing applications as well as enabling new applications that are not practical with LCD. It hasn't happened yet, but the search goes on!

An Interview with Bob Raikes from Meko

Bob started his working career in the steel tube industry, where there's a new product every 20 years, whether the market is ready or not! He has been working in the Display Industry since the early 1980s, when he joined a distributor of monitors and printers in a sales and marketing function. Becoming more involved in the product management side, he was a founder member of two subsidiaries for Japanese companies that wanted to develop in the UK market. He was, for five years, managing director of Eizo UK Ltd. In 1994, Eizo sold the subsidiary and Bob started Meko Ltd – intending it to be a “solo consultancy”. However, customer demands for more data and services led the business to expand and it now specialises in the European market for TVs, desktop monitors and digital signage. It supplies country-by-country market research, consultancy and publishes the *Display Monitor* newsletter. In the odd moments away from work, Bob has become, in recent years, a keen (although not very good) cyclist and plans to compete again in the “Etape de la Tour de France” in July of 2009.



Please give us some background information about Meko. Meko is a specialist market research consultancy company that focuses on the European market for displays as products – i.e. TVs, monitors and digital signage. Europe is incredibly complicated, especially in TV and broadcasting, and Meko employs seasoned industry veterans to help clients, especially those coming from outside Europe, to get an understanding of the market. For worldwide data, we partner with DisplaySearch, with whom we have run seven DisplayForum conferences, the most recent in Düsseldorf in November.

Can you share an overview about the size of the overall display industry in the UK? We haven't looked back at the total industry size (including R&D and the supply chain), but the UK's love of TVs means that the market for TVs, monitors and digital signage is on track for more than 12 million unit sales in 2008.

Some time ago you posited “Bob's Laws”. Tell us about them and give us your thoughts about whether these laws are immutable or occasionally need some adjustments... Well, Bob's first law still seems to be working. I first noticed back in the mid-late 80s that once users tried computing, it was hard to give it up, so the first law is: “Everyone that buys a computer, always buys another”. That may seem obvious now, but in those days, not everyone in Europe understood the nature of the PC revolution.

The second law came later, when I met resistance to the idea of higher resolutions, when I realised that displays are fundamentally a communication medium for a person. A display without a person has no function (hence our unofficial motto “Don't forget the people!”). Like any communication channel, bandwidth is the key. So the second law is: “Anything that increases visual bandwidth wins in the end”. This is based on an observation that since I started in displays in the early 1980s, most people think that whatever we have at the time is good enough. In the 80s, the questions were “Who needs colour?”, “Why do computers need graphics?” etc. Remember, the IBM Professional Graphics Controller had 640x480 resolution and was targeted at CAD professionals who needed **really** high resolution. Bob's Second law predicts that 3D will arrive in the end, because it brings displays closer to the visual bandwidth of humans.

Bob's Third Law is that “Channels only multiply”. In the early days of PCs, the only way to buy a computer was from a professional dealer. Now you can get one free with your mobile phone and supermarkets sell them.

The UK has a rich history in the development of display technologies and devices. Do you foresee a time when the UK will expand beyond academic leadership to actual commercial leadership in the display industry? I think this is extraordinarily unlikely. The UK is too dominated by “money men” that demand a quick return on invested capital. Commercial leadership requires “patient capital”.

What do you regard as the single most significant historical display-related invention that has come out of the UK? This is really not my field, but you could pick out the development of radar, which helped the CRT to move from a laboratory instrument to a volume-produced display. The work at the University of Hull by George Gray and his team has been described to me by a chemist that I know as some of the best chemistry of the 20th century. More recently, the work on long molecule OLEDs from the University of Cambridge could be very significant in the long term.

Does the UK market for display-related products tend to lead, lag, or mirror global trends? Are there any things the rest of the world can learn from UK display-related companies? The UK has a very strong and innovative broadcast market and that helps the TV market to be innovative. The BBC does a lot of good work in the EBU and other organisations and commercially, companies such as Sky are developing great services for consumers.

Hit simultaneously with the global credit crisis and a substantially weakened currency, the markets in the UK have been struck particularly hard in the past months. How long do you think the PC and consumer electronics markets will be down in the UK? The British like their TVs and as Paul Gray from our partner, DisplaySearch, said at our recent DisplayForum conference “If their TVs break down, they’re not going to take up reading”. Value will be down as consumers look for bargains and there are real pressures because of exchange rates, but we’re pretty confident that the TV market will hold up reasonably well in volume terms. Monitors will be hit by the downturn in IT generally. Napoleon Bonaparte is said to have described the British as “a nation of shopkeepers” and we have strong retailers. They will help to drive the market over the next year (or at least, those that survive will!). We’re keenly watching out for any effect from the entry of Best Buy into Europe, through its tie-up with Carphone Warehouse.

What happened to UK-based global brands in the consumer electronics and PC industries? Do you foresee a day when a UK brand might re-emerge to a level of global prominence? It’s a long time since there were any global CE brands from Europe apart from Philips and Bang & Olufsen. Part of the reason for this goes back to “patient capital” again. Worldwide CE brands have a lot of investment in technology and manufacturing in Europe, and in technology in the UK. In recent years, the TV manufacturing has moved out of the UK, Spain and Italy and into Central and Eastern Europe. Dyson has shown that innovative products combined with clever design and marketing can drive markets. However, we don’t see a trend of the resurgence of UK manufacturing.

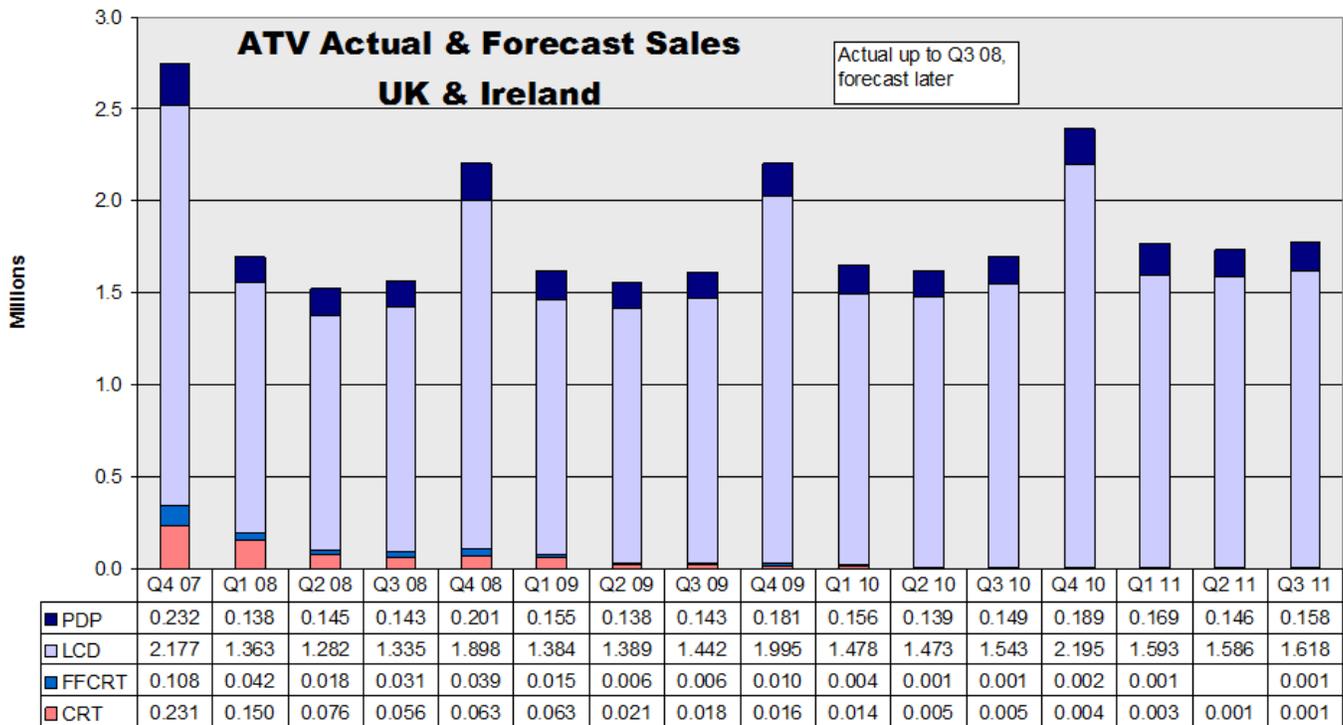
Is the UK likely to fare better than the EU generally in the face of the current economic crisis, or will the UK drag down moves toward recovery? The success of the UK in financial services over the last twenty years has made the economy more vulnerable than most to problems in that industry. However, the UK is considered to be a more flexible job market and so I’m confident that new businesses and industries will appear to exploit the imagination and creativity of my countrymen.

Do you think emerging markets related to alternative lighting and energy sources will help sustain innovation in the display market, or are the markets really quite independent? The TFT LCD really owes a lot of its success from having a single compelling application, i.e. notebook computing. OLED has suffered from a lack of such an application. It seems to me that if OLED is to seriously challenge LCD, then a market where technology, supply chains and materials can evolve is essential and if that’s lighting, so be it.

Tell us about your expectations related to the digital switchover in the UK. I think that the digital switchover will happen as planned in the UK (apart from anything else, if people can’t watch the Olympics in London in 2012 on their TVs, there will probably be a second revolution). The country has provided a good model that shows the kinds of areas that need to be addressed to make a smooth transition and the kinds of organisations needed to coordinate all the different aspects of digital TV. There is a move to HD over digital terrestrial TV by the end of 2009 that will use the latest DVB-T2 standard and that will be the first implementation worldwide. The FreeView model of rolling out digital TV has been very successful and attractive to consumers. Other countries, especially those that are in the early stages, could learn a lot.

When do you foresee 3DTV reaching a reasonable level of popularity in the UK – or is 3D still likely to be relegated to niche markets? I think 3D TV is still some way away. I see 3D as being a reasonable “next step” after HD and while Sky has a good service in HD, the other broadcasters have hardly got started. Freesat offers a low cost way to get the kind of bandwidth needed for 3D, but that service is very new. Standardisation would also be important for widespread acceptance.

Tell us about the current status of customs duties related to the importation of LCD and PDP TVs into the UK? How does this apply to new classes of products such as PCs with integrated TV tuners, or TVs with enhanced PC connectivity? Basically, like the rest of the EU, TVs carry 14% duty and monitors carry 0% when imported from outside the EU. However, the EU Commission and the monitor industry have disagreed on how to tell these two kinds of products apart. Just as I was writing this, new proposals were issued by the Commission to exempt monitors of 22-inch and below in 4:3, 5:4 and 16:10 aspect ratios from the TV duty, but there are legal challenges to the EU’s stance on this issue which are before the European Court and the results of the cases could affect the legal position. The US has a case before the WTO against the EU over duty on monitors, among other things, and that could also lead to changes.



Meko expects the ATV market in the UK and Ireland to stay stable from 2008 to 2009. From 2009 to 2010, the growth is expected to be 5.4%.

Give us your inputs about the next big display-related trends that will start to emerge 2009? How about by 2015 – what trends should we prepare for? Well, from a global point of view, we’re getting to the “end game” on large area LCD. The three main markets for large area LCD, notebooks, monitors and TVs, are now converted, in the Western world. Digital signage is still not close to an explosion, at least in Europe, so there will be a battle between the major players for long-term survival. This is when the “Get big, get niche or get out” should be the focus of everybody in the LCD business.

Looking further out to 2015, flexible, low power and bistable technologies for e-books and other applications look to me like disruptive technologies. Whether they are making a dent in LCD by 2015 is probably unlikely, but perhaps by 2020? If PDP survives, it will be a niche technology for Panasonic – as Sony’s Trinitron was. OLED may be making some headway into portable applications, but will still be a niche or premium market for TVs – the “LCD monster” will not give up easily and image quality and power

consumption will be much improved based mainly on LED backlights, although it would be ironic if one of the applications that enables the development of OLED is its use as a backlight in LCDs!

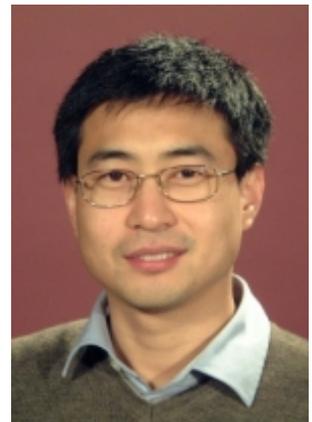
I'm doubtful that 3D can get into the broadcast TV market by 2015, there is still too much to be done in HD and digital roll out, but it's feasible that something could be happening using packaged media such as Blu-ray. Certainly, the integration of the Internet into TV will open up new ways of using our TVs that really haven't been thought of yet. It may not be my generation that drives the convergence of TV and IT, but the younger generation really don't see a boundary between the two.

Any suggestions about how the UKDL might be more effective in promoting the displays and lighting community in the UK? The UKDL seems to be doing a good job, so I'm certainly not going to "teach my grandmother to suck eggs" as we say here!

Any closing thoughts you'd like to share with the readers of the UKDL newsletter? Don't forget the people! Not only are people needed to give displays a purpose, but it is those same people that spend the money on products and investments.

Interview with Aimin Song from Nano ePrint

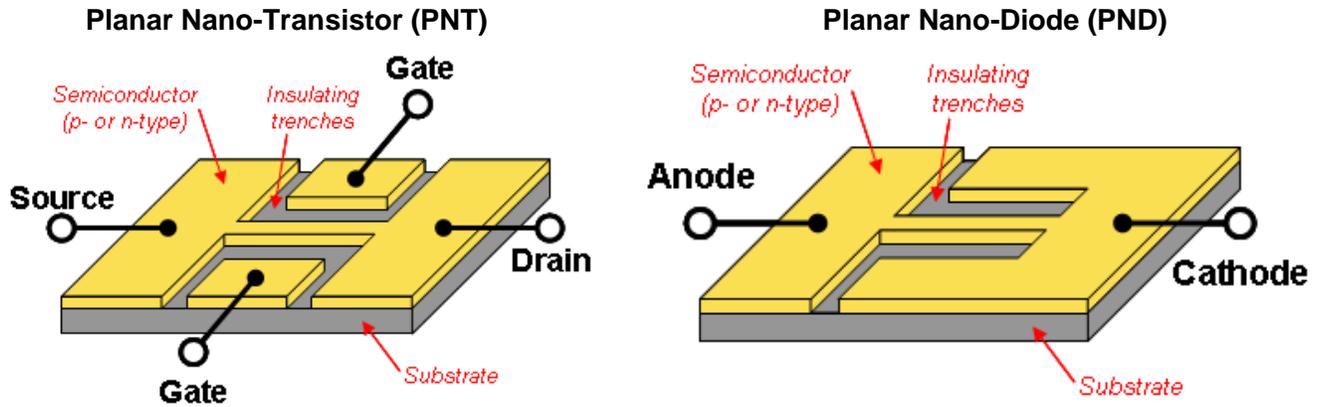
Aimin Song holds the post of Professor of Nanoelectronics at the University of Manchester. Related to his work on nano-scale electronic devices, he and his research team have recently won a Royal Society Brian Mercer Feasibility Award, "Researcher of the Year" and "Postgraduate of the Year" medals of the University of Manchester, the Rolls-Royce Prize at the annual Reception for Britain's Top Younger Engineers in the Parliament, and Best Conference Paper Awards at three international conferences. Aimin has previously been awarded prestigious fellowships by the Royal Society (at the University of Glasgow) and by the Alexander von Humboldt Foundation (at the University of Munich). He has also worked at the Nanometre Consortium, Lund University.



Please give us some background information about Nano ePrint. Nano ePrint was formed in 2006 following pioneering research at the University of Manchester in the UK. Nano ePrint's technology enables planar nanoelectronics devices that can uniquely be fabricated in a single layer of semiconductor via single-step patterning, which are hence exceptionally suitable for printed electronics. Nano ePrint's devices achieve very high speeds while dramatically reducing circuit size and simplifying manufacture. The Nano ePrint approach opens up prospects for low-cost, high-performance printed electronics across a range of applications.

Your development of planar nanoelectronics is rather novel – please describe how you came to realize this approach enabled some improvements over more typical approaches to fabricating electronic devices. Prior to the devices that we now work on within Nano ePrint, I developed a different nanodevice concept, called the Ballistic Rectifier. This is a four-terminal planer structure and is similar in functionality to a classical four-diode bridge rectifier but with extremely high speed. This work was a good learning experience for our current devices. Firstly, planar device structures enable very low parasitic capacitance and, hence, can operate at much higher speed than typical multi-layered vertical devices. Secondly, a planar structure allows a lot of more design freedom in a 2D plane and, hence, greater controllability of electrons than a vertical device where the freedom of structural change is limited to the single dimension perpendicular to the layers. Such a freedom indeed allowed to me to develop Nano ePrint's PND/PNT devices after the work on ballistic rectifier. Since entering the area of printed electronics a few years ago, I realised that planar nanodevices also offer great printability since they only require a single layer of semiconductor and a single-step patterning.

Tell us about the technology behind your "Planar Nanoelectronics". Nano ePrint has developed and patented a unique architecture for constructing electronic devices and circuits. Our planar nano-transistors (PNTs) are dramatically simpler than traditional field effect transistors (FETs), and deliver higher performance in a wide range of semiconductor materials. Planar nano-diodes (PNDs) can also be constructed via a similar approach.



You plan to design planar circuits and then reproduce them through an embossing process. Can you describe this in more detail? We can fabricate electronic devices in a single layer of thin-film semiconductor, deposited on a flexible substrate, using a single-step patterning approach. The patterning is performed using nano-embossing, analogous to the earliest forms of printing (wood block, letterpress, etc) but on a much finer scale. This printing process is compatible with roll-to-roll, and has been in use commercially for around 20 years for the production of optical microstructures (such as the security holograms that are embedded in modern bank notes and passports).

Does the process require special production equipment, or can you utilize the existing manufacturing infrastructure? Much of the equipment and tools can be translated directly from security printing – although as with other printed electronics technologies we have higher requirements for cleanliness and environmental control than conventional printing.

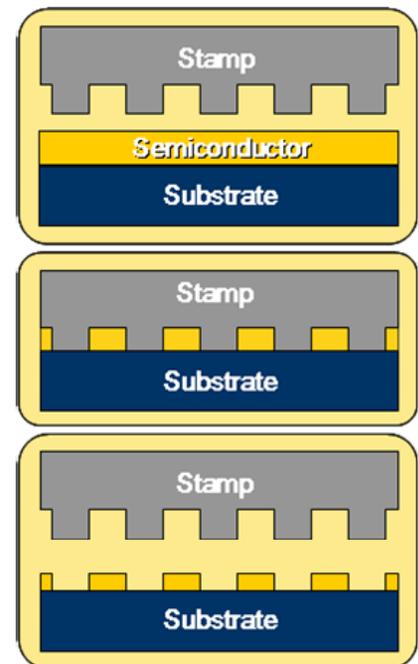
Is the process applicable to both flexible and rigid substrates? Yes, we can employ almost any substrate including plastic or glass, and possibly paper in the future.

Are there any specific substrate materials that seem to be best suited for your process? PET is the most attractive substrate for rotary printing.

Are you primarily focused on developing the process for organic semiconductors, or do you see breakthrough opportunities in the inorganic semiconductor space? Our technology is material agnostic and has been demonstrated in printable organic and inorganic semiconductors, in addition to silicon and also high-end semiconductor materials such as InGaAs. We see printable inorganic semiconductors as the best balance between performance and cost.

What are the primary advantages associated with your single layer device structure? Because PNTs and PNDs are fabricated within the semiconductor layer itself, they do not require dielectric materials, or conductive contacts for source, drain and gate. Eliminating this conventional multi-layer material stack also eliminates the registration issues of aligning successive material or process steps while dealing with a flexible substrate. This allows much smaller feature sizes, resulting in both dramatically reduced circuit footprint and significantly increased performance. Interconnect is also improved using Nano ePrint's approach. For relatively simple circuits or functional units – such as logic gates (AND, OR, NOT, etc) and basic analogue blocks (rectifier, amplifier, modulator, etc) – the interconnect between adjacent PNTs and PNDs can be achieved directly within the semiconductor layer. For more complex circuits, a separate conductive interconnect layer may still be required, but the routing problem is substantially simplified.

Nano-Embossing Process



Is the focus of your development work currently directed at displays or other devices, such as high-speed RFID tags? We have developed a toolkit of functional blocks that can be flexibly interconnected to address a variety of applications. Our primary focus is on printed programmable logic and mixed signal circuits – including but not limited to RFID. We are less focused on displays since these relatively simple circuits do not leverage the full benefits of the transistor density and performance we can achieve.

What sort of performance results are you seeing at the present time with regard to your development prototyping? For any given semiconductor material, we typically see at least an order-of-magnitude improvement in performance relative to conventional transistor or diode architectures. For example, our published results include HF (13.56MHz) performance using a low-end organic semiconductor with a mobility of around $0.01 \text{ cm}^2/\text{Vs}$. With a couple of other printable semiconductors that we are also working, UHF performance can also be achieved.

Are you limited by materials – or can you work effectively using a variety of nano-materials? Materials development continues to be a key area for everyone in the industry. We have now identified a number of materials that can deliver high performance in our device architecture and are compatible with our fabrication process.

Is your current development effort still focused on materials development or have you transitioned to more of a device-level development effort? Our current focus is on optimising device performance and yield.

Do you envision in the future that Nano ePrint will be described as a materials company, a printing company, a device company, or some other sort of company? We see ourselves as a device company which builds on our core expertise and know-how, though currently we face similar challenges to other printed electronics businesses with materials and process optimisation. Fortunately we are working alongside excellent and committed development partners who are helping us to establish a versatile manufacturing platform on which to roll out our device technology.

Please describe the sort of business plan you intend to implement. Nano ePrint will sell printed electronic circuits, with a particular focus on programmable logic that can be easily configured for multiple applications. Over time, as the material specification and fabrication processes become more mature, we will also consider licensing our technology to established printing businesses that are looking to add electronics functionality.

Do you plan to become a global entity, or will your efforts stay primarily in the UK? Printed electronics offers great potential as a pervasive technology – our customers and development partners are global businesses. We have already initiated discussions with companies in Europe, Asia and the US.

What market opportunity currently seems most exciting for you right now? In the near term, we see the most exciting applications as being those that already have proven markets based on very simple silicon chips, but where a printed solution offers a better product form factor (thinner, flexible, transparent, etc) as well as being ultimately lower cost. Examples include novelty products, electronic toys, and sensors. This is why we are focusing on programmable logic, which allows us to address multiple applications with a single printed circuit architecture.

What things relating to Nano ePrint's technology or market position are most exciting to you at this time? Our planar nanoelectronics technology is the only printed electronics approach today that offers both high performance and small device footprint, bringing it on par with silicon electronics. This allows us to immediately address a range of existing product applications via a programmable logic approach.

Tell us about the support you are getting from the UKDL and what areas, if any, you would like to see addressed in more depth. We have been strongly supported by UKDL since its inception with introductions to partners and participation in a number of the ongoing seminars. On the back of this support we have been able to secure two TSB grants for technical development.

Touch-screen & Interactive Display Technologies Seminar

October 8, 2008, Microsoft Research Labs, Cambridge

Overview from *Nick Kirkwood*; presentation summaries by *Mark Fihn* from iSuppli, Touchbase, Wacom, Microsoft, and MacDermid Autotype

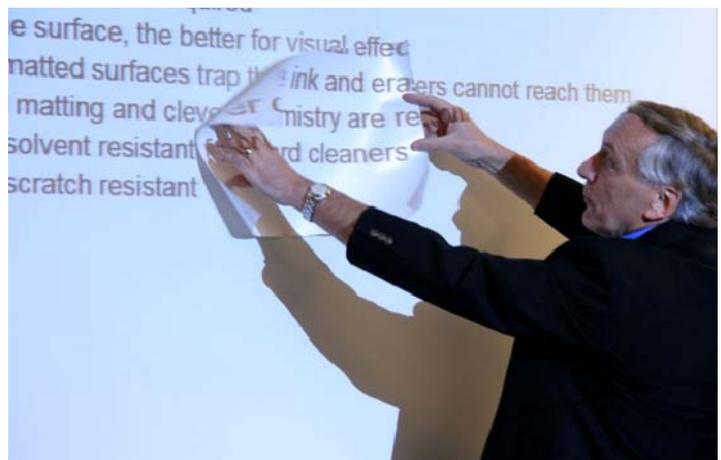
by Nick Kirkwood

After the usual welcome and introduction by Ric Allott, the day started on time with the opening talk from Andy Murray of iSuppli Corp who gave a very comprehensive overview of touch screen technologies; stating easy intuitive use, faster input and reduced labour costs, innovative applications with improving hard and software and dropping prices as significant drivers to market demand.

Andy went on to talk about the value chain, the different screen technologies and applications and the screen market forecast. A significant growth in the number of manufacturers is up from 120 in 2007 to 150 in 2008, using 20 different screen technologies in 12 different application areas; resistive touch-screen technology being by far the most common. The market is forecast to grow from \$2.46 billion in 2007 to nearly \$6.4 billion by 2013, mobile phones, navigation devices and games/entertainment being the three biggest applications for 2007.

Next to speak was Prof Steven Abbott of MacDermid Autotype and Leeds University, his talk titled "Touching plastic, the functional needs of the top surface", was a real insight into the fundamental issues of touch technology. Steven covered all the issues in depth, from the choice of plastics and surfaces, anti-everything to the science of touch; he stated that the wish list of perfection was impossible with manufacture and user requirements full of contradictions, but concluded that knowing what the trade offs are, makes it easier to get the right balance of cost, performance and haptic happiness.

Steve Herron, European sales director at Wacom Components Ltd, Germany, gave delegates his take on the touch screen and interactive display industry; pen technology being his main interest, he told the audience how it works, and spoke about multi touch and two-finger gesture touch in further detail (and no, not what first comes to mind!). Steve went on to talk about the challenges facing suppliers, trends, fashions and form factors; quoting the ubiquitous iPhone as a great example of unified design and referenced an article extracted from the Wall Street journal dated August 2008, "Hewlett-Packard is hot on the prospects of touch screen technology and recognize the potential of touch!"



Steven Abbott from MacDermid Autotype making a point about touch-screen materials during his presentation

The next speaker was Steve Bhattacharjee, director of Touch-Base Ltd, a leading developer and supplier of touch-screen and pointer device drivers. Established in 1989, they supply branded drivers to hardware manufacturers and distributors worldwide as well as direct sales to end users. Steve spoke at length about touch drivers and his company's development of a new Universal Pointer Device Driver (UPDD) which now positions them to deliver the latest driver technology for any type of pointer device.

Steve Hodges from Microsoft spoke about the potential for "surface computing", a new way of using computers which is set to revolutionize everything from retail kiosks to the common coffee table. At its core, the device known as "Milan" which is a PC running Windows Vista, but don't expect to use it with a

keyboard and mouse. Instead, Milan uses a touch-sensitive display that enables multiple users to navigate the system's interface. By detecting every touch and gesture, Milan offers a very tactile way of interacting with digital information and files. Users must actually grab files and images with their fingers without the use of a mouse or keyboard. The system also allows multiple users to interact with the display at the same time; it can detect dozens of contact points.

Finally, from Veritas et Visus, Mark Fihn's talk was titled, "Beyond touch, the next steps in touch revolution". This was a very comprehensive overview of interactive devices and covered just about every application and technology out there, giving the audience a lot to think about. From gaming to holographic printing, 3D camera systems, e-books, desktop solutions, keyboard alternatives, GPS devices and musical instruments, haptic modelling, 3D manipulation, multi-touch and touch-less technologies and the next step towards immersive interaction devices; wow, take a breath. Perhaps the most interesting aspect Mark spoke about was, "proprioception", a sub-set of the sense of touch. This is the unconscious ability we have to control the position and movements of our bodies, some neuro-anatomists believe that this is altogether a different sense to that of touch. How is this going feature in new technologies?

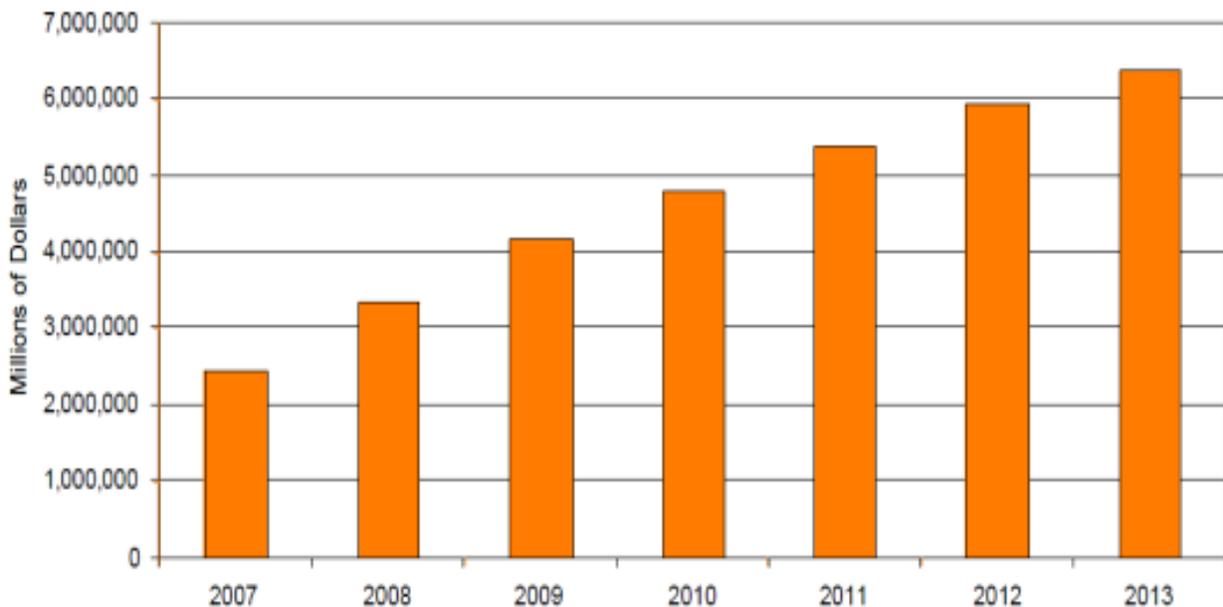
The day was brought to a close with thanks from Ric Allott to all the speakers and delegates. Feedback forms from the delegates were very positive and seven new members joined the UKDL Knowledge Transfer Network.



Touch screen, the right touch for high growth?

Andrew Murray, iSuppli Corporation, Bracknell, England

Andrew Murray from iSuppli offered a broad summary of the technologies and applications currently involved in the touch market. He briefly covered resistive, surface capacitive, projected capacitive, surface acoustic wave (SAW), infrared, optical imaging, bending wave, active digitiser, photo sensor in pixel, Duo sense, IR with fibre, multi-touch, touch screen materials, and ITO replacement technologies. He emphasized that resistive touch screens are the most common type due to their low cost, representing 91% market share in unit terms; 52% revenues. He noted that the touch screen industry will grow from \$2.46 billion in 2007 to nearly \$6.4 billion in 2013. Mobile phones, navigation devices, and games/entertainment were the three biggest applications for touch screens in 2007. By 2013, games/entertainment will be the second largest application by volume. Retail will be the second largest application by value.



iSuppli predicts steady strong growth for the touch-screen market

Touch Drivers and User Interface

Dave Bhattacharjee, Touchbase, Poole, England

Dave Bhattacharjee opened with a history of Touchbase’s driver development, indicating how rapidly various operating systems and touch screen developments have exponentially increased the difficulty of sustaining driver updates. He revealed the model that Touchbase has developed to manage new touch screens. There are several things that Bhattacharjee suggested need to be considered in a touch driver including the target OS, hardware interfaces, touch data processing, controller initialisation, controller firmware manipulation, mouse port interface, development standards, multi-monitor and multi-device support, video rotation, calibration consideration, filters, cross-platform graphical development, multi-language support, application programming interface, device remote wake-up, and phew! – maintenance and support. Clearly a complex process for which Touchbase has developed a notational structure by which to manage more than 150 touch controllers from the last 20 years. Future developments will include the expansion of touch utilities (such as real-time draw), OS touch support integration, (for example Vista touch utilities), keep up-to-date with OS and touch controller update, point of touch control application, and support for multi-touch capabilities and gestures...

Today’s touch and pen solutions and challenges that suppliers face for the future

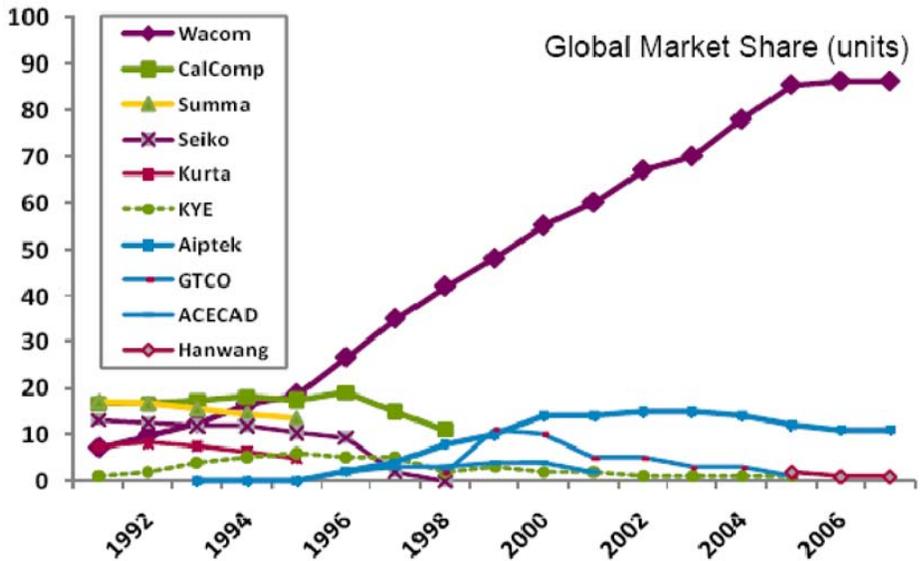
Stephan Herron, Wacom Components, Krefeld, Germany

Wacom’s Stephan Herron discussed many of the challenges facing the touch market. He offered several strategic concerns that face the industry:

- What are the “killer apps” and interface designs that will rely heavily on interactive displays?
- What are the proper form factors for portable and desktop computing of the future?
- Will the cost points and performance of 2FGT and MFT get to the point where SFT technologies become effectively obsolete and when might this happen?
- Will consumers and office workers of the future be surrounded by many application-specific interactive displays, or is there a valid argument for general-purpose devices?
- Can gestures “become” intuitive enough, fast enough, to effectively complement simple pointing and handwriting and, in the future, voice recognition, eye tracking and facial expression recognition?

Herron also discussed several questions for the industry for the next 12 months:

- What is going to happen to SFT technologies?
- What is going to happen to pen technologies?
- Where will 2FGT go?
- Where will “in-cell” touch emerge?
- Where will MFT emerge?
- When will Windows 7 launch?
- What applications and interfaces will support 2FGT?
- Who should you talk to about all of this?

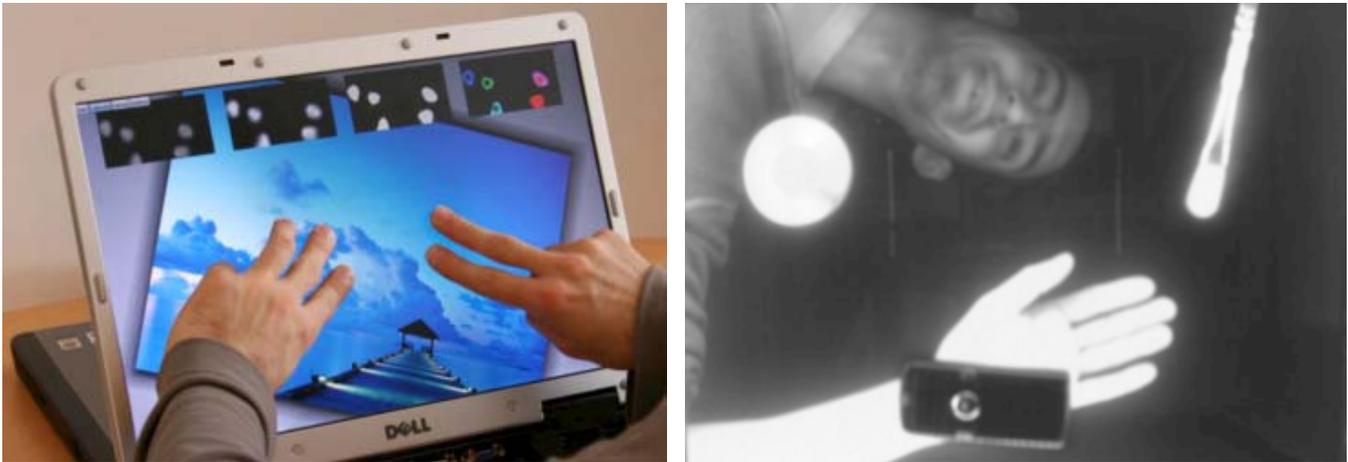


Wacom’s estimates about their domination of the market size and relative position of pen-based touch manufacturers

Surface computing: the post-PC experience

Steve Hodges, Microsoft Research, Cambridge, England

Steve Hodges gave an overview about Microsoft's Surface research. The Surface concept is based on a philosophy of blending physical and virtual interaction. This involves direct input, display-centric interaction, multi-user functionality that also involves tangible objects. The presentation expanded beyond the projection-based developments related to the Surface products to describing ongoing research efforts. ThinSight expands the Surface concept to thin form-factor surface computing. SecondLight adds interaction beyond the display. Hodges advised that Microsoft Research considering ways to combine the ThinSight and SecondLight concepts – but more work is required in each area before the combination can be considered.



On the left is a demonstration of the ThinSight solution, using Surface technologies in a flat format. On the right is a photo from the display's perspective – showing the SecondLight concept which enables two-way interactivity, among other things...

Touching plastic: functional needs of the top surface

Steven Abbott, MacDermid Autotype, Wantage, England

Steven Abbott from MacDermid Autotype talked about what it would take to create a “perfect” touch solution. Features would include low cost, crystal clarity, no iridescence, hard, scratch resistant, tough, stain resistant, no finger marking, easy to read in bright light, feels great to the finger and to the touch pen, really thin, great for small screens, and great for large tables and white-boards... And ideal surface would be deformable, such that the substrate physically moved in reaction to pressure, but this is very difficult to implement with precision electronics and the need for thin and light structures. Because there are no obvious solutions, the search is for “soft touch” solutions – but it's very difficult to incorporate “soft touch features” into a smooth/gloss structure. Perhaps ideal soft touch solutions would incorporate fabric substrates. Rubbers tend to harden/crack with age and use; foams are genuinely compliant but not natural candidates for touch surfaces; soft touch surfaces are soft, and sharp objects easily gouge them. Still, there are many research efforts underway to identify soft touch solutions.

Abbott discussed problems with ITO as a transparent conductor for touch screen solutions. Problems include that it's yellow and highly reflective, it's expensive, and it's brittle, but so far the industry has not identified comparable solutions, unless perhaps moving to a non-electric sensor.

He emphasized that touch-screen surfaces need to be “Anti-Everything”: anti-scratch, anti-stain, anti-reflection, anti-glare, anti-fingerprinting, and anti-microbial. These are difficult requirements, suggesting that finding “the perfect touch screen” is filled with contradictions, and may well be impossible. Abbot urged that knowing what the tradeoffs are makes it easier to get the right balance of cost, performance, and “haptic happiness”.

Report from IDTechEx Printed Electronics USA

December 2-4, 2008, San Jose, California

by Eifion Jewell



The worsening economic conditions on both sides of the Atlantic did not prevent nearly 750 delegates being drawn to the IDTechEx “Printed Electronics USA 08” in San Jose, California. The delegates were drawn by 43 conference speakers together with 56 exhibitors in the parallel exhibition.

A 9-speaker plenary session opened the conference on the first morning and this was followed by triple tracking with dedicated sessions. Raghu Das of IDTechEx (UK) launched the event by summarising the developments in the markets. Globally, the number of companies and research institutions active in PE could be broken down to 660 in PV, 540 in transistors, 510 in displays and lighting and 540 in other devices. Primarily companies from the organic materials sector were driving the market but slowly interest in machine manufacturing sector was increasing showing the developing maturity of the market. The 2008 market was estimated to be \$850M for OLEDs, \$550M for PV, \$240M other inks, \$150M for sensors, \$75M for e-paper displays, \$60M for inorganic electro luminescent and \$75M other technologies. In these markets approximately 30% will be printed, while the remainder will use other traditional electronic fabrication processes. OLED would remain to be the major market and most of this would be small molecule small displays for mobile applications deposited using vacuum technology. PV would see a significant increase in 2009 and be a lead technology for R2R production. The PV market remained to be reliant on government support. Plastic transistors would see a gradual increase while e-paper displays would increase significantly in 2009 as devices came to market.

The opportunity within the mobile market was highlighted by Tappi Ryhanen of Nokia. Globally, there currently there are 3 billion mobile subscribers. This will double over the next three years. Also, mobile Internet and mobile digital services will reach 3 billion subscribers in three years. Mobile services offer challenges and opportunities for flexible electronics and displays. Some interesting concept devices were outlined. Of these, the morph concept developed with Cambridge University was well received. The morph device demands transparency, smart surface materials (e.g. self cleaning), conformability and flexible batteries and energy sources. Transparency was being addressed through the use of CNT networks as a semiconductor and ZnO nanowires as sensors and PV for autonomous operation. The issue of surface conditioning and conformability and was being addressed through nano engineering of surfaces. At present there was no technology that met the power and energy density requirements. Nokia were sure that the challenges laid down by this concept could be met and many of the technologies proposed in the concept were already beginning to appear in Nokia handsets.

Tod Riedel of Structural Graphics (US) gave an honest description of the now famous *Esquire* E Ink cover. In all six partners were involved in the project which took only 6 months from initial concept to launch in September 08. Typical unforeseen problems included five separate bindery tests were required to ensure that the devices could withstand all the rigours of the magazine finishing. Significant lessons were learnt through the project (for example establishing common vocabulary between partners from diverse industries) but its sell-out within 48 hours and its marketing exposure had made it a fantastic return on investment for *Esquire*.

The challenges in R2R manufacturing were outlined well by Joe Midlionico of Avery Dennison (US) who has a worldwide business based around pressure sensitive labels and office stationery. The company have diversified into RFID and battery labels. They use gravure printing to manufacture a 21-layer battery tester based on conductive inks and thermo-chromic ink technology. A key lesson learnt is that any mass manufactured printed device (>100,000) probably needs to reduce its design specifications if they are to be manufactured economically since testing of individual devices at speed has a significant penalty in complexity and cost. It is one thing to make a high specification device in the lab, it is quite another to make a million.

The driving force for printed electronics from Toppan's (Japan) point of view is the information explosion. The human/electronics interface is the key in order to allow this information explosion to be enhanced information interchange and not an information fog. Printing flexible displays and sensors, particularly for mobile applications, is a clear way in which this can be achieved. Two examples of the intelligent map and the intelligent security envelope were met with enthusiasm from the audience.

The first commercial scale plastic electronics product and fabrication plant was introduced by Plastic Logic (UK). The e-reader market is the meeting of the digitisation of content, the display technology and human mobility. Plastic Logic's prediction is that number of units shipped in plastic electronics will overtake the number of units shipped in silicon electronics in the future. This is based on a 40-50% reduction in cost and a significant (>70%) reduction in carbon output. The market credibility created by the Plastic Logic e-reader will accelerate the adoption of new technology.

Many devices based on organic semiconductors are sometimes limited in performance by the mobility of the semiconductor, which is poor compared to silicon. Kovio (US) have taken a novel approach by printing a silicon based ink which maintains silicon mobility of above 80 while maintaining all the advantages of additive printing. Their technology was now beginning to be used in RF barcodes to add item level intelligence. The present cost limitations for silicon RFID tags is 20c. In three years, Kovio are aiming for a 3c tag using liquid silicon technology. These tags will be printed and be able to store 128 bits of data using printable silicon with a mobility of 100. As well as costs, the liquid silicon option has resource impact of 5% of chemicals, 0.005% of hazardous gases and 25% of the energy compared to traditional silicon fabrication technology. Item level technology would have applications in the \$75B annual "market" in counterfeit pharmaceutical or the \$104B "market" in stolen retail goods. There is also significant opportunity for new applications based on additional consumer interaction devices such as diet guides, recipe guides or promotional links.

An often overlooked material in printed electronics is paper. Stora Enso (Sweden) educated the delegates in the challenges faced in placing electronics on paper for the packaging industry. Brand owners are only willing to pay a few percent of the product cost on the packaging. As costs to the shelf are essentially fixed, then the packaging electronics needs to add a consumer based benefit in order to make room in the packaging economics. Healthcare packaging which controls/records dispensing regimes was highlighted as one such application. Commercial success in this area is currently limited by material costs.

The afternoon split into three sessions. In the "electronics as arts, signage, human interfaces - large area displays", EL displays for the poster and POP markets are the key interest of Durel, part of the large Rogers Corporation. The key to their technology is full capability and understanding of screen printing. Fine features can be obtained by balancing material flow capabilities and screen characteristics. A pre-coated film with ITO, phosphor and dielectric was being brought to market. This allows the rear electrode to be digitally printed as required. This would allow a quick turnaround with minimal tooling for POP EL. A relevant question was raised on the economics of this technology given that penetration of EL into the POP market was limited by phosphor cost. Using a pre-coated reel of EL, then apparent wastage of the expensive phosphor was significant as the majority will not emit light.

E Ink (US) is one of the success stories of the printed electronics industry supplying front electrophoretic planes. Their technology provides durable, sunlight readable, high contrast paper like displays and is used in many commercial e-readers as well as iconic displays. In the e-reader market E Ink point to their role in greening the reading process, saving trees, water and ultimately CO₂. The switching speed of their current commercial products is currently 250ms which is suitable for reading applications. Their laboratory research is pushing this to 33ms suitable for 30fps displays; sufficient for video displays on an e-reader. In organic transistor based backplanes the current refresh speed is being held back by the switching backplanes and not the E Ink. E Ink also presented their colour displays which are capable of showing near video speeds on flexible substrates with colour saturation considered better than a modern 4-colour printed newspaper.

According to Tred displays (US) the global large format display and signage market is around \$100B. Digital signage is increasing as a proportion of this with LEDs and LCDs being the technology of choice.

Many of the markets highlighted by forecasting companies (e.g. video quality OLEDs) are too demanding for printing but there are a number of "low hanging fruit" around which a successful business can be formed, large pixel size displays and signage is one such application. Tred displays' technology is based on a magnetic fibre which is coated with two colours on opposing portions of the circumference. Applying a magnetic field from a back plane twists the fibre such that only one colour is visible on the display; a reverse of the magnetic pole twists the fibre again, switching the pixel to its other colour state. This technology is bi stable for lower power usage and any colour can be coated to the outside of the fibre. The initial application for Tred is outdoor displays where it is possible to combine digital signage with conventional printed display boards seamlessly offering high-resolution static images with dynamic low detail information such as prices or promotions.

A timely reminder for those who believe that printed OLEDs are about to become common place came from Gabriel Marcu of Apple (US). Any display will need to oust the incumbent technology of LCD in terms of colour rendering, contrast, speed of update and cost. Apple gave a wonderful explanation of colour perception and the limitations on its measurement to the relatively uninitiated printed electronics community. The moving target of LCD technology such as adaptive LED backlights and additional primaries were being brought to the market for LCD and these minimised the improvements seen with OLED technology.

Low functionality displays and transistors by conventional printing processes was the topic of the presentation by Mats Robertson of Acreo (Sweden). A transistor or display pixel switch time of 1s has many applications for labels and point of purchase segmented displays. Under the EU funded "Sustainpack" project, Acreo were developing a temperature and humidity data logger for food and pharmaceutical packaging. This needed to be in the 1c to 10c range in order to be competitive. By using temperature dependent and temperature independent electrolyte they have created a temperature logging system only 0.3mm thick. Practical demonstrations have also been made with a discount/time label which increases the discount applied to a perishable product as it nears the end of its shelf life. All these devices are powered by Acreo's own MgZnO printed battery. The final technology presented was an embossing/circular cutting technology which can be used to create three-dimensional structures on a R2R substrate.

There are many where PE devices are to be interfaced with the human body. The topic of Stephanie Lacour's (Cambridge University, UK) presentation was how PE can be interfaced and incorporated on/into the human body. In doing so, the devices need to be bio-compatible without sacrificing the mechanical and electronic performance. Classical silicon devices have mechanical characteristics that are at odds with soft tissue such as skin. Even classic plastic electronics materials such as PET and PEN do not behave like soft tissue. An alternative material which could be used for the manufacture of electrical interconnects in soft tissue is PDMS. The group at Cambridge is working on how semiconductor and conductive elements materials can be deposited on PDMS and incorporated within the body. One of the more novel applications was the used of electronically patterned PDMS to act as nerve junctions. The successful interfacing of the nerve with PE would allow muscles to be simulated and senses to be measured using PE.

In the author's view the award for most innovative applications of electronics on plastic was clearly won by Babek Parviz of University of Washington (US). The team at UoW is developing a contact lens based display and sensing technology which would allow head up display of information as well as health diagnostic based on cornea and tear chemical analysis. All this was to be transparent (opacity being allowed towards the outside of the lens), be less than 10mm in diameter and run autonomously from power generated on board by RF coils. Manufacturing each component and assembling each on the compliant contact lens is a huge challenge. Their approach was to manufacture each sub device on a minute discrete device using traditional silicon processing techniques. In order to ensure that each sub device is placed in the correct location, each device is made a different shape. The corresponding female shape is made on the template on the lens and passing the template through a liquid suspension of the devices allows self-assembly. In a similar principal to a child's shape sorter, only those devices that are the correct shape are allowed to bond at the correct position. Although the display and sensor on contact

lens technology may be some way away, the novel manufacturing techniques developed by the group are genuinely useful outcomes.

Optomec (US) aerosol jetting provides an alternative digital deposition method to inkjet. The ink is first atomised to droplets in the 1 to 5 micron range using an air stream and is then directed towards the substrate at around 100 m/s. This aerosol allows further target distances, allowing 3D objects to be patterned, and is capable of rendering 5-micron objects and has been used successfully to print organic semiconductor transistor arrays and ring oscillators on PET and polyimide substrates with high yields. As well as small feature size, a clear advantage of aerosol technology is that it does not have the rheological and surface energy constraints of ink jet printing, easing the formulation process. Optomec have over 60 installations of the technology worldwide with another 15 already on order. Optomec also took part in UKDL's Metallisation event, January 13th and 14th.

Single walled CNTs are a rolled up atomic thick layer of graphite and due to their structure it has a number of unique electronic and mechanical properties. CNT promise low cost materials with high performance electronic properties. Eikos Inc (US) commercially manufacture coatings and inks based on CNT, primarily for transparent coatings for the displays industry. Their natural self assembly during the drying process enables highly transparent (>90%) layers with a sheet resistance of 100 Ohm/sq. This resistance can be lowered at the expense of transparency. Inks and coatings can be formulated for all printing and coating processes allowing optimised lay down for a given transparency/resistance requirement. Ensuring the correct adhesion of the CNTs to the substrate using a binder is the key to Eikos technology and their patent and publication list reflects this. If the world of CNTs for display manufacture is of interest, then more information on CNT and graphene structures was given at the UKDL Metallisation event on January 13th and 14th.

Continuing the theme of carbon based ITO replacements Goki Eta of Rutgers University (US) spoke on the use of graphene as transparent conductor. The graphene layer is one atom thick and has remarkable electronic behaviour with high conductivity. The problem is that there are no simple deposition processes to create a mono layer of graphene. The method presented first starts by oxidizing graphite to graphite oxide which is soluble in water. This can then be applied to the substrate using a liquid deposition method such as spin coating or printing. This is then chemically reduced and the resultant layer is a relatively coherent mono layer of graphene with occasional multi layering. To date, the films made with this method do not possess the resistance/transparency of ITO but improvements are seen when processing is optimised. Given the relative cost of this technology compared to ITO, then graphene may replace ITO in many large area applications where cost structure is tight or where lower conductivities can be tolerated.

Silver remains to be the conductor of choice for printed electronics due to its electrical conductivity and conductive oxide. In its large particle flake form it is widely used in conductive ink formulations, which require sintering at high temperature (>500°C) if conductivities near bulk silver are to be reached. As particle sizes reduce to the nano level, the temperature at which the sintering process reduces such that sintering can take place on plastic substrates. This effect is the basis Nanomas technologies (US) which manufacture nano particles and inks for inkjet printing which can be sintered at below 150°C. Nanomas are currently working on nano manufacturing other metals such as gold, palladium and platinum as well as inks for other printing processes.

As explained by Nanomas, raising the temperature of the ink is the traditional method of sintering silver nano particles. NovaCentrix (US) has made a significant step forward by adopting high intensity pulsed light for sintering the particles. Their PulseForge technology allows sintering on temperature sensitive substrates as the time scale of light pulse is short, of the order of ms, although the power can be of the order of MW to ensure full sintering. This technology is currently capable of curing at 100ft/min with future versions raising this to 1000ft/min. The system has been tested with all printing process, even thick film screen printing, and with a wide variety of silver nano inks. As processes move to R2R this technology will become more important in order to reduce processing times and thermal loads on the substrate.

The growing commercial maturity of organic electronics is clear when the chemicals giant BASF (Germany) state that organic electronic materials are to be a major activity for them. The core business of

the organic electronic division is to manufacture materials and formulate these materials into inks. Currently the focus is on semiconductor and dielectric inks for the inkjet and gravure although other printing processes are at research stage. BASF partner with printers and end customers in the value chain to manufacture inks suitable for applications. One clear lesson learned from these partnerships is that there is no one material that fits all applications, e.g. mobility may need to be sacrificed for the sake of air process ability. Through these co-operations, they have developed a suite of products suitable for given markets, e.g. RFID or displays. Their background as large chemical suppliers meant that they were now able to produce kg batches of organic semiconductors such as P3HT.

Flexography is often touted as a means by which large volume manufacture of printed electronics. Asahi Kasei (Japan) gave a summary of their Adless plate technology, which they are currently developing with the printed electronics market in mind. Instead of UV exposing the plate the Adless system uses a laser that ablates the plate on a rigid round carrier. Laser ablation allows more solvent resistance polymers to be used that can be made compatible with more aggressive solvents such as toluene or xylene, which are commonly used in organic electronic materials. Laser ablation allows closer control of feature geometry on the plate. As the plate is exposed on the round, mis-register caused during plate mounting is also eliminated. This type of enabling technology from a company new to the printed electronics arena is a good indicator that scale up of printed electronics will occur.

Ridium (US) is a new commercial company manufacturing RFID aerials using subtractive and additive process depending on the volume required. Their laser ablated based technology allows metal subtractive patterning in either copper or aluminium. 25 micron spacing resolution is achievable with metals up to 3 micron thick. Their large volume additive printing allows 100 micron feature sizes and metal thickness of approximately 1.2 micron. This operates by printing in a waxy material, which prevents aluminium vapour deposition under vacuum.

Transparent (or translucent) solar cells would allow windows to operate as energy harvesting and such windows could fit seamlessly into building and electronic device designs. Such a technology is being developed by Solamer (US) a spin out from UCLA. Their goal of a cell with 8% efficiency with a 3+ year lifetime by Q3 2009 is certainly ambitious given that they have manufactured cells at around 6.15% at present. They have a set of materials allowing 5% efficiency on reel-to-reel and a suite of IP for the necessary flexible transparent anode and cathode connectors. Their technology can also be coloured such that it appears as a translucent coloured coating that is compatible with the building theme. In contrast to many working in organic PV materials, Solamer also want to manufacture the cells in volume themselves. This attitude in taking on a high-risk portion of OPV manufacture is admirable.

MIT have been a world leader in scientific invention and exploitation (E Ink is based on MIT technology). One of the most recent is in the field of solar concentrators for OPV. The cost model for OPV means that it must beat the incumbent CdTe cost of \$1.12/W. In order to improve competitiveness of OPV then the issue of efficiency needs to be addressed since 1% improvements are worth \$0.1/W. Tandem cells can increase efficiency but at the expense of additional complexity which is expensive for large area PV. An alternative approach is to utilise solar simple concentrators with organic cells. If a suitable dye is introduced to a sheet of glass or plastic, then it may act as a conversion site for light and turn the sheet into a light pipe (or sheet) through total internal reflection. A large area of light can thus be collected inexpensively. Cells placed around the edge of the light sheet are then subjected to high intensity light, which increases efficiency without the additional costs of large area. MIT have now spun off a company to commercialize this light guide technology.

Exhibition: An immediate observation of the exhibition was the interest in manufacturing and in particular R2R printing. Although the exhibitors were dominated by material suppliers, there was a substantial input from machinery and printing equipment suppliers such as Daetwyler (gravure cylinder engraving) and Asahi Kasei (flexographic plates). With true physical demonstrations available (such as the pulse forge from NovaCentrix) it begins to feel more like an exhibition for a product manufacturing industry than one dominated by R&D. The general buzz on the exhibition floor and the number of discussions being held at each booth certainly shows the value of the exhibition alongside the conference.

Plastic electronics

Analysis of competence matrices for UK and Germany

by Zella King and Cathy Curling

Zella King is a senior lecturer in the School of Management at the University of Reading, and Fellow of the Advanced Institute of Management Research. She has a BA in Social and Political Sciences from Cambridge University and a PhD in Occupational Psychology from Birkbeck College, London. Before joining the academic world, she worked for five years as a consultant for Accenture, and as a corporate finance executive for the investment bank Schroders. She joined the University of Reading in 2002, where she conducts research on a broad range of topics related to career optimisation, including social networks, research collaboration and employability. Her current research project, funded by the Economic and Social Research Council, examines research networks in plastic electronics. The project is part of a targeted initiative concerned with the UK's competitiveness in innovation. With the help of industry experts such as Cathy J Curling, Zella King is investigating how individuals and the organisations that employ them capture value from collaborative research networks in plastic electronics in the UK and Germany. The findings should help inform managers and policy-makers seeking to foster and support research networks.



Cathy J. Curling is an accomplished international strategic business developer and technologist, experienced in defining, leading and delivering on innovative high-tech programs through to successful industrialisation via international partnerships. As a domain expert in disruptive thin-film electronics, her skills sets cover a core of displays and sensors, processed with both conventional and printed electronic materials and techniques. Cathy's early career covered technology management across corporate (Philips International) and SME (CTO at Plastic Logic Ltd, UK) businesses. Cathy is now founder of Curling Consulting, an independent technical consultancy covering an advisory portfolio to industrial, VC and university-based clients. Centred on the commercialisation of new business opportunities, activities include the delivery of growth strategy, investment decisions, technical direction, key partnering and due diligence, as well as board-level advisory roles. Her ability to translate complex technology solutions to mixed audiences is internationally recognised through her regular invitations to present.



An analysis of the UK's and Germany's competence in printed and plastic electronics was funded by the UK's Economic and Social Research Council. Dr. Zella King of the University of Reading and Cathy Curling of Curling Consulting recently did an analysis of the research and drew conclusions comparing the two countries. Plastic electronics comprise a new electronics industry covering the following:

- Devices processed on flexible and robust substrates (e.g. plastic or stainless steel foils)
- Large area, low cost production techniques and equipment sets
- Novel functional materials deposited and defined with low temperature processes

Production challenges related to plastic electronics include such things as:

- Flexible substrates offer manufacturing efficiencies in that they can permit the use of reel-to-reel or reel-to-sheet production.
- BUT flexible devices also create production challenges such as materials component layers must remain intact and bonded together when the device is flexed, exposed to heat or cold, air or water, as well as scaling up from single-unit lab-scale work to volume product production, the inter-related materials, design, functionality and process all need to be developed in step. Only then can product manufacture

Plastic electronics

Plastic electronics comprise products with radically different price points, performance, and functionality relative to conventional electronics are anticipated. But few companies have reached high volume production.

Current processing techniques in the plastic electronics industry



Conventional electronics processing

Source: Intel

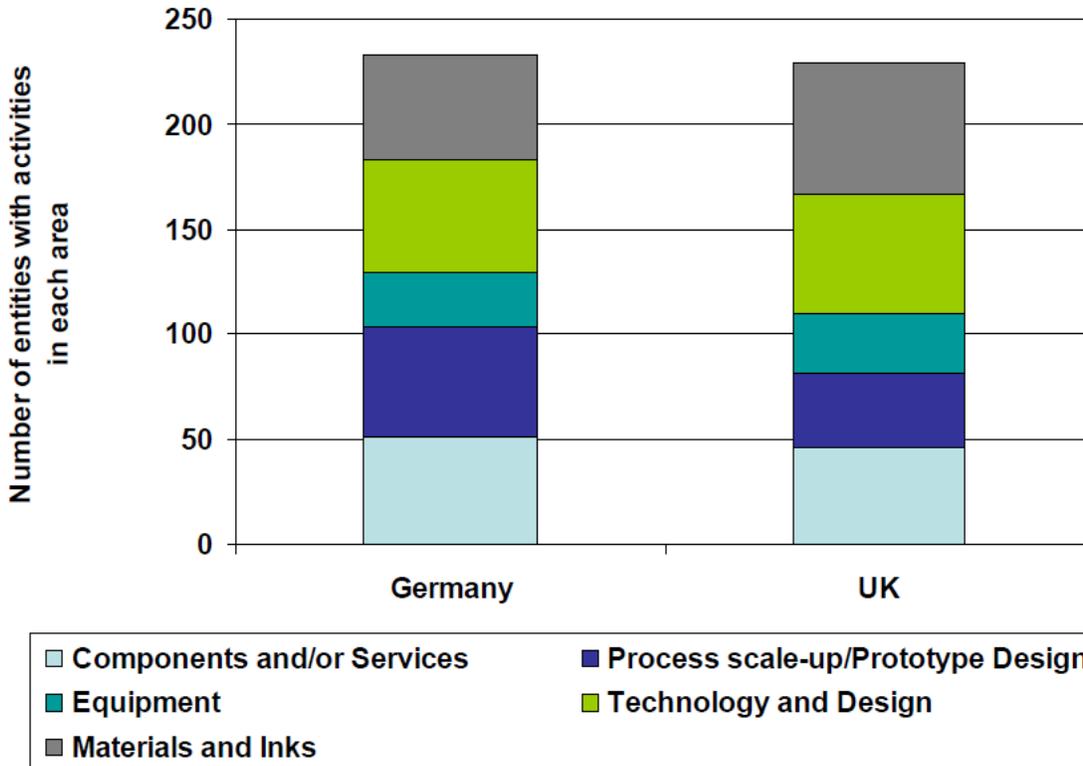


PE processing

Source: PolyIC

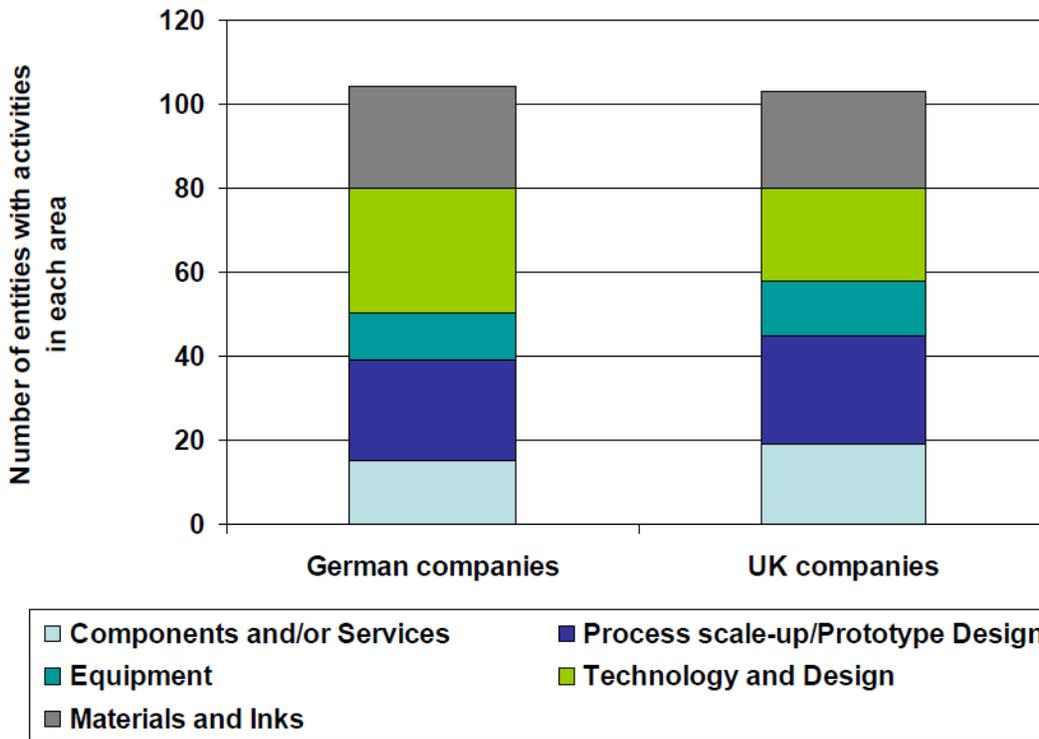
Subtractive batch processes (sheet deposition with photolithographic + etching layer definitions)	Additive continuous processes (printing material only in the required areas)
Controlled (e.g. vacuum) environment	Ambient (temperature and pressure) conditions
Fixed, long production runs of "same product"	Flexible, short production runs – "flexible" product functionality
High equipment, materials and infrastructure costs	Lower equipment, materials and infrastructure costs

Where are the UK and Germany entities positioned in the whole value chain?



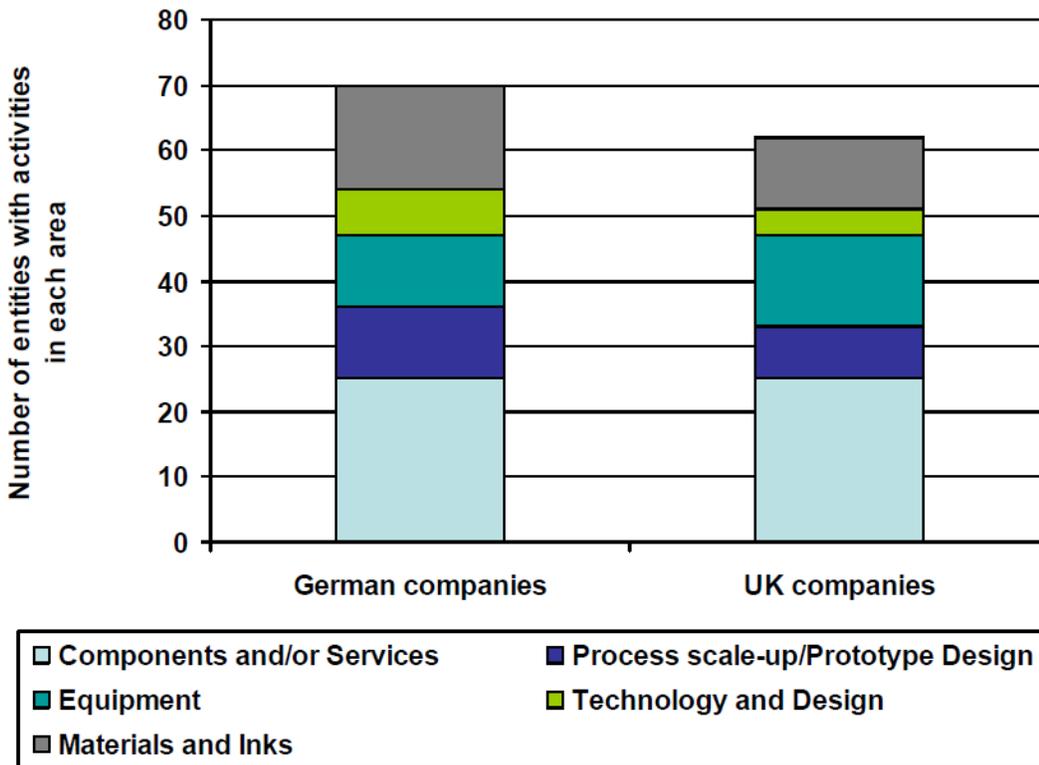
The UK is more active in early value chain activities such as materials and inks, and less active in the later stages of process scale-up/prototype design

Looking at innovative developers: comparing UK and German companies



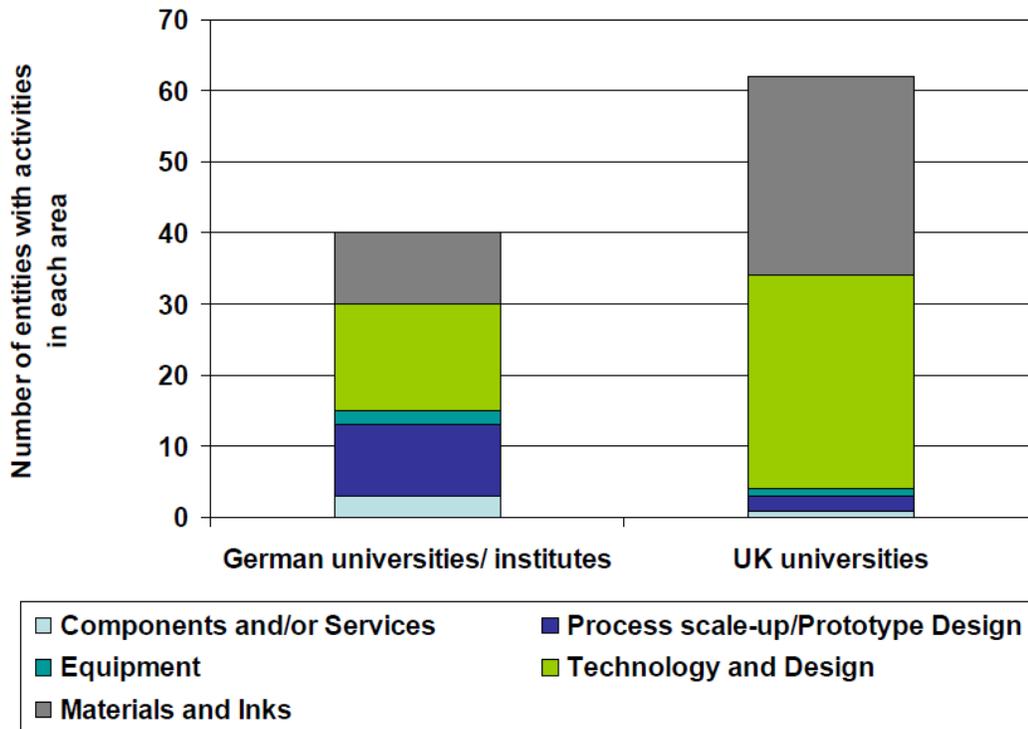
In terms of the total number of innovative developers across all parts of the PE value chain, UK and German companies are very similar

Looking at Supplier/manufacturers: Comparing UK and German companies



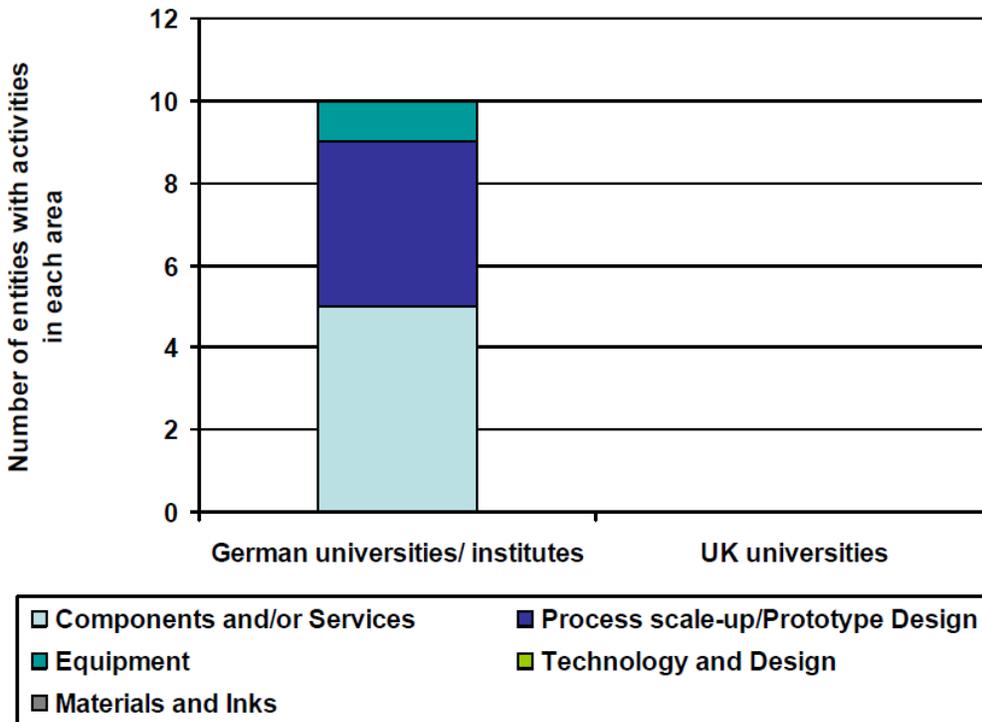
Germany leads the UK in the total number of supplier/manufacturers, especially in the sectors of materials and inks and technology and design

Looking at innovative developers: comparing UK and German universities/research institutes



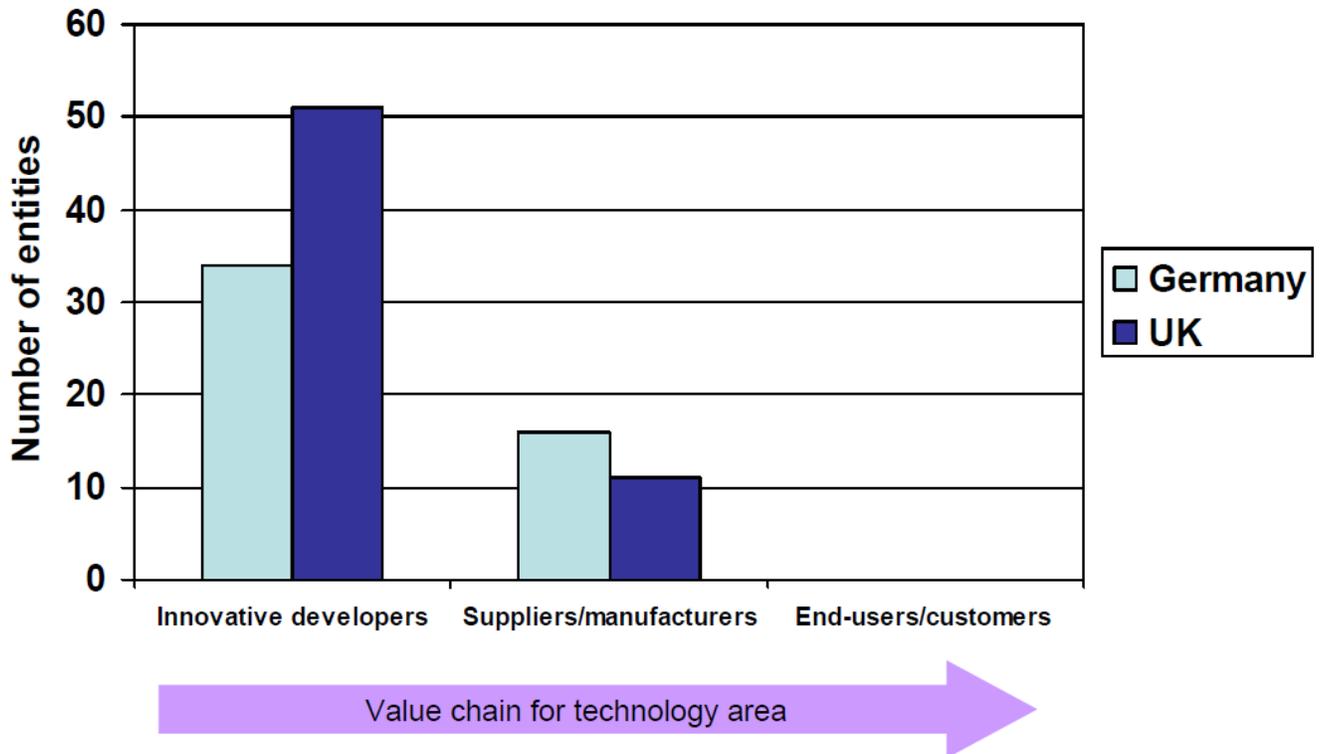
*UK universities are dominant developers of innovative materials and inks, technology and design;
German entities are more equally spread across the whole value chain*

Looking at supplier/manufacturers: comparing UK and German universities/research institutes



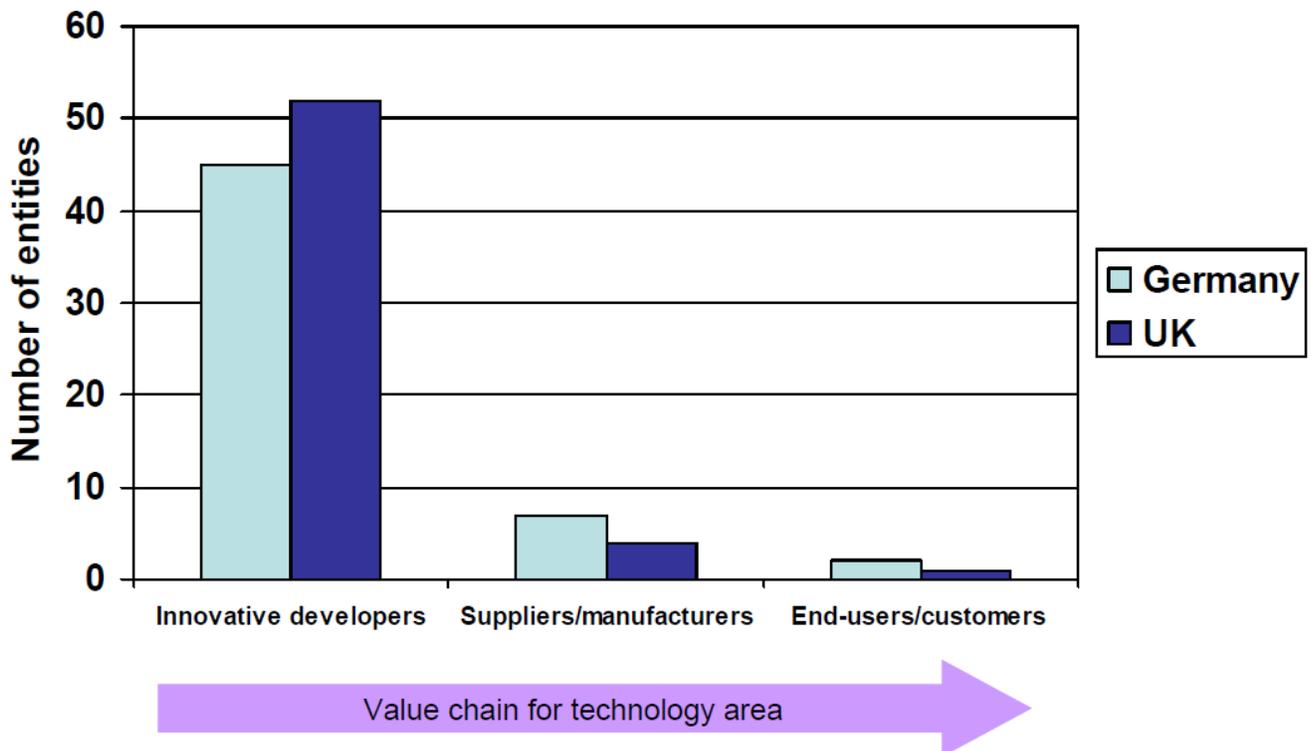
German universities/institutes (e.g. Fraunhofer institutes) are supplying/manufacturing some PE elements at the latter part of the value chain; such revenue is not undertaken by traditional UK university departments

Within the value chain: materials and inks



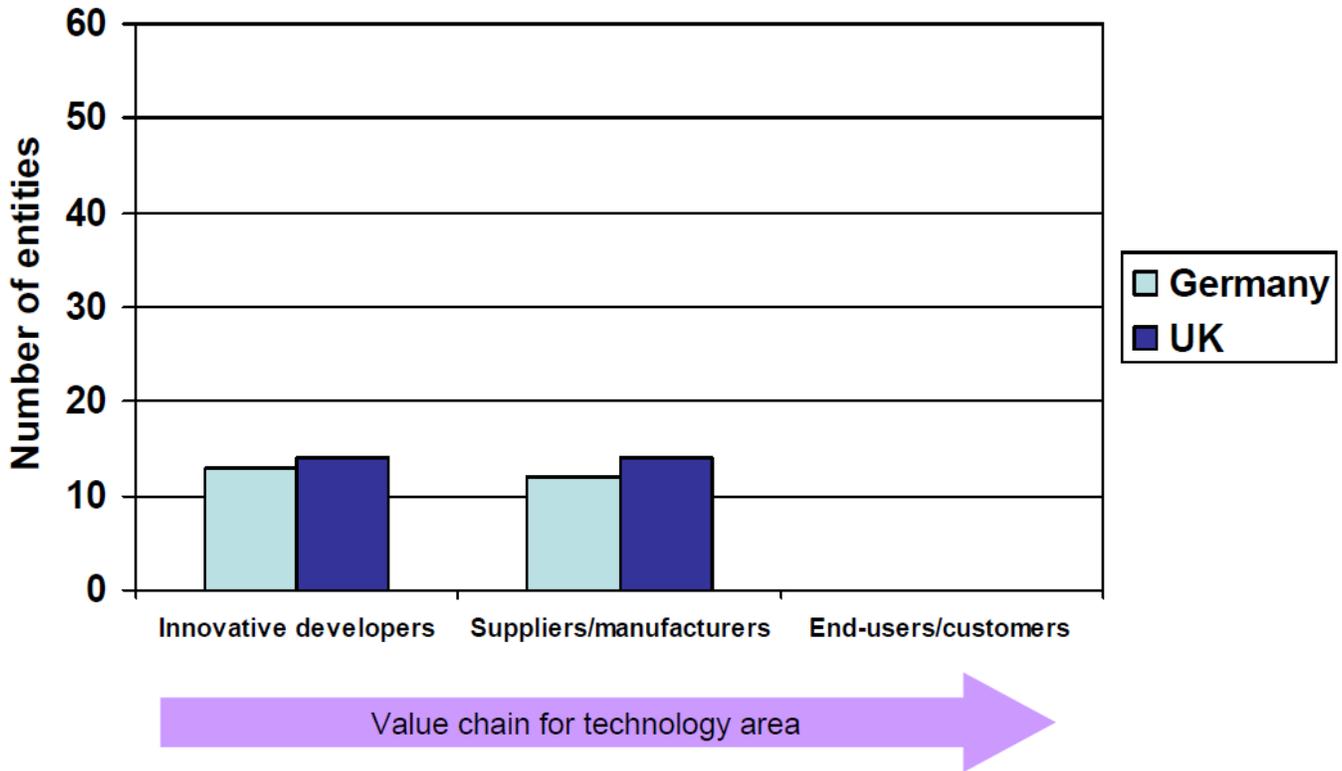
The UK leads the way in the innovative development of materials and inks; Germany has slightly more suppliers/manufacturers than the UK

Within the value chain: technology and design



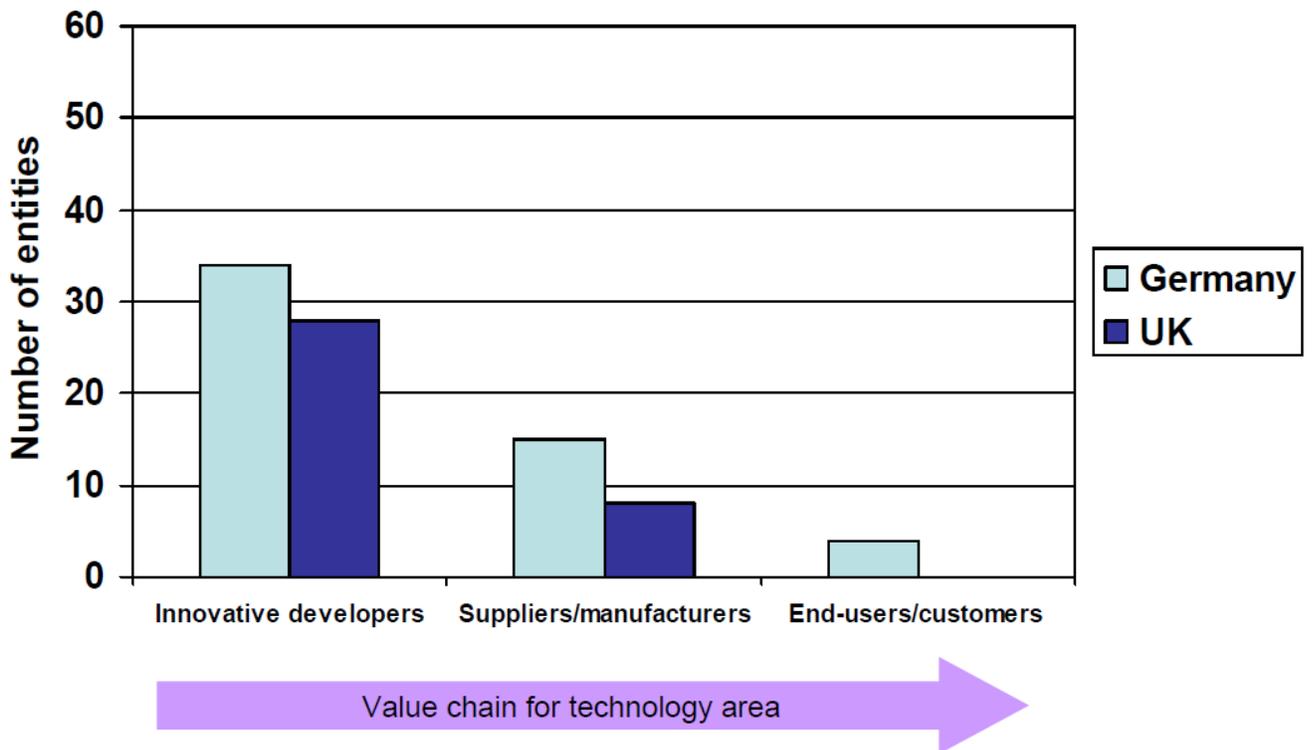
The UK has marginally more Innovative developers of technology and design than Germany

Within the value chain: equipment

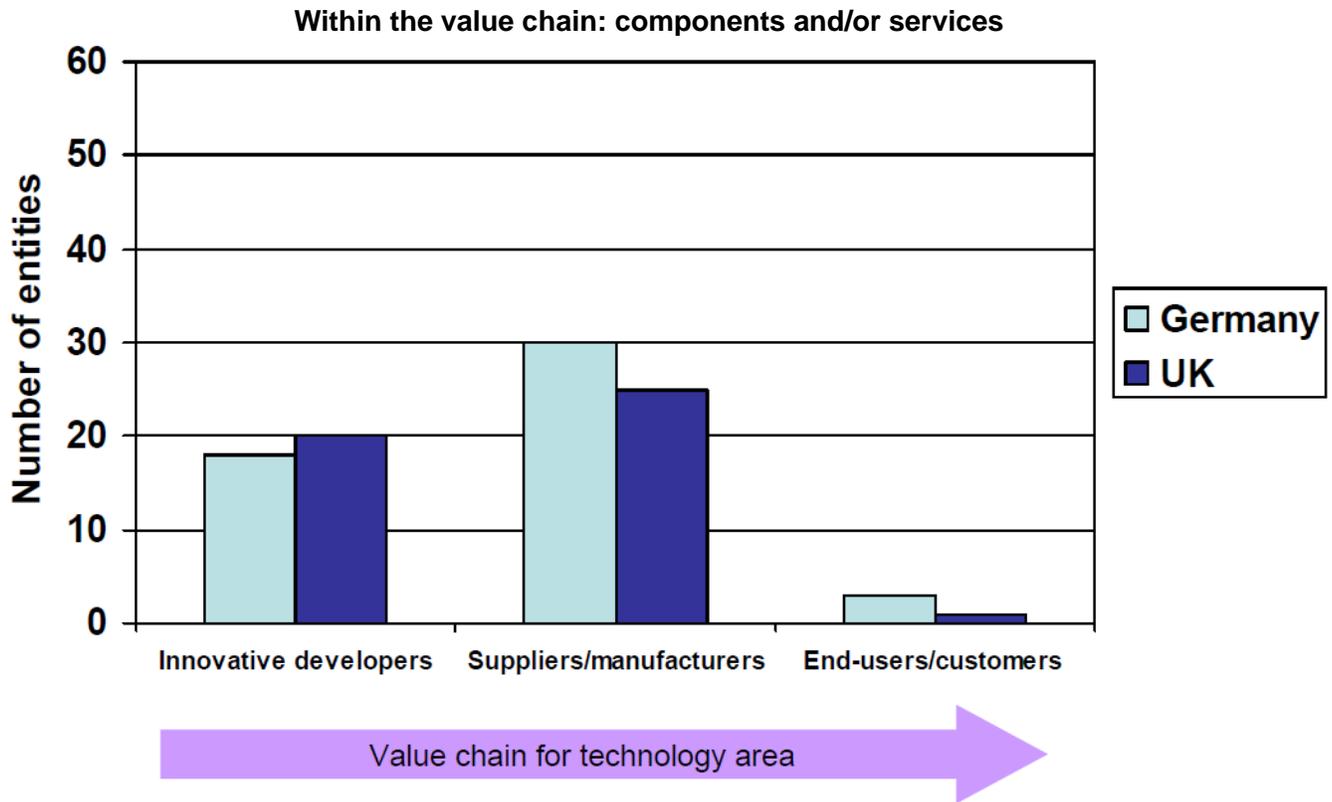


The two countries have similar levels of activity surrounding equipment for plastic electronics

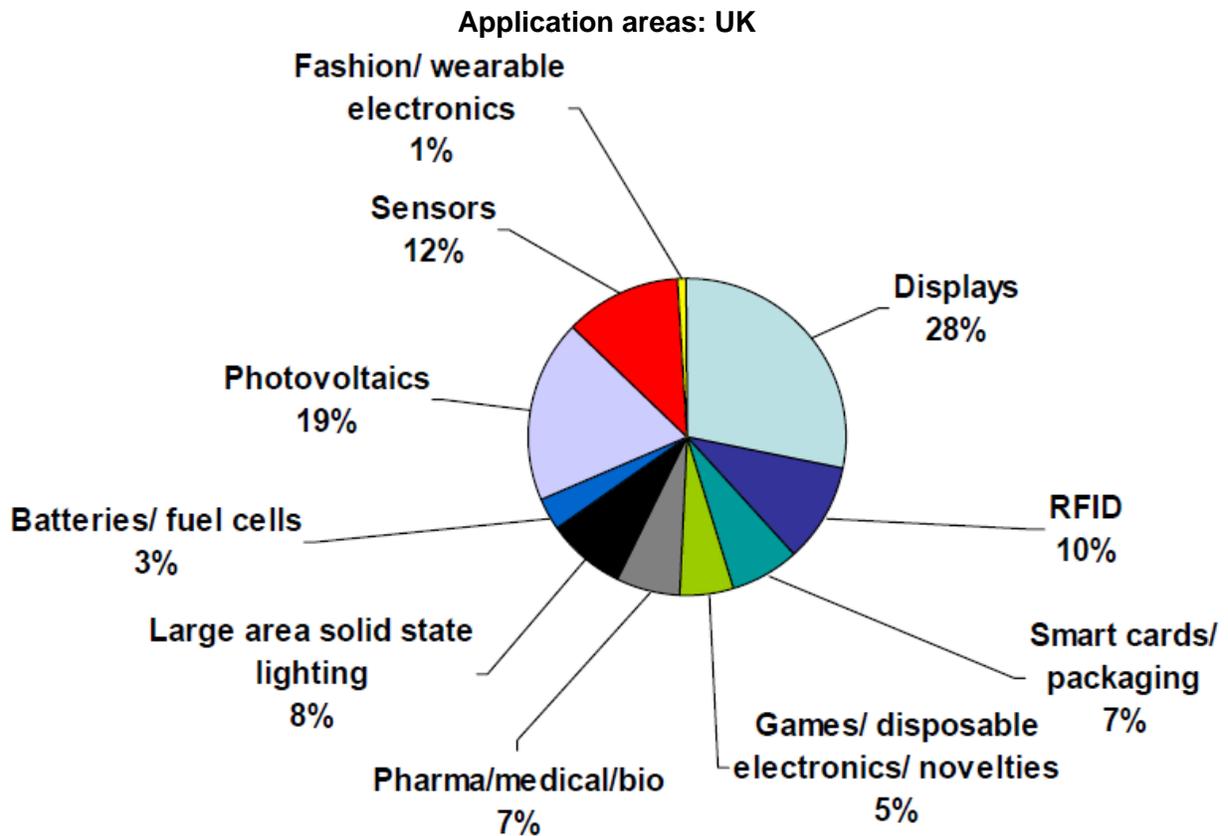
Within the value chain: process scale-up and/or prototype design



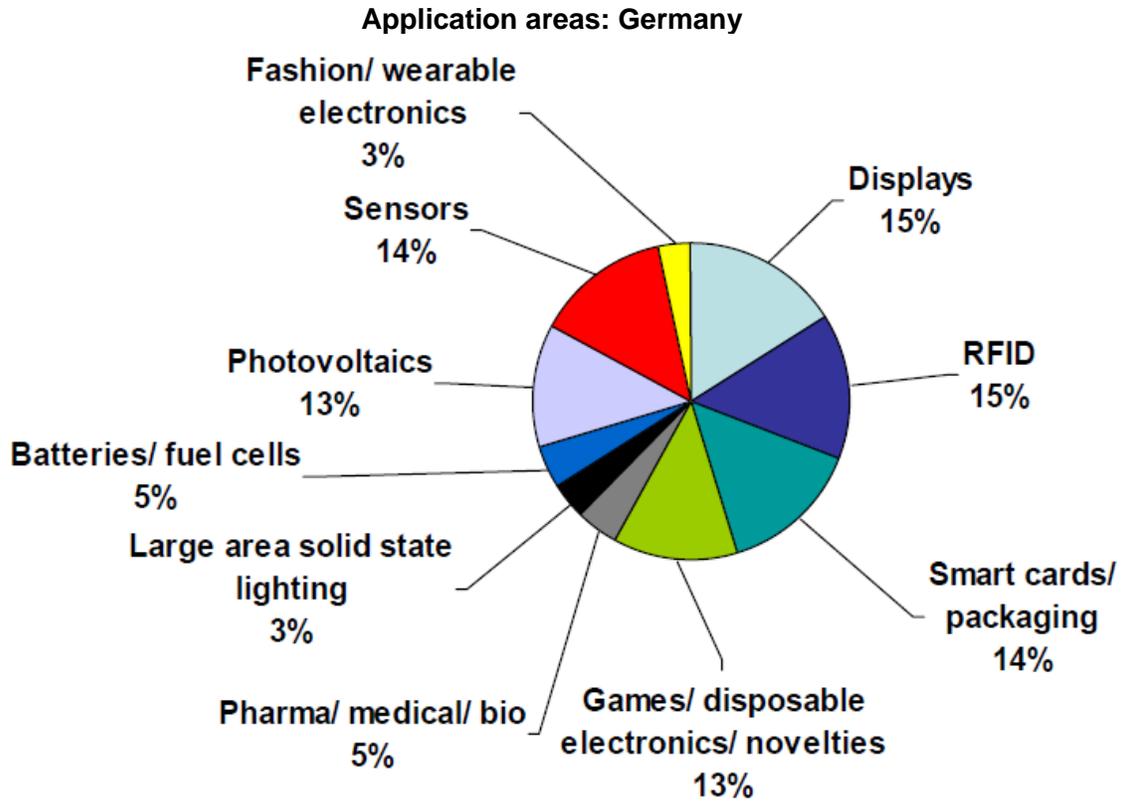
Germany has more activities within process scale-up and prototype design activities than the UK



UK is behind Germany in the supply/manufacture of components and services

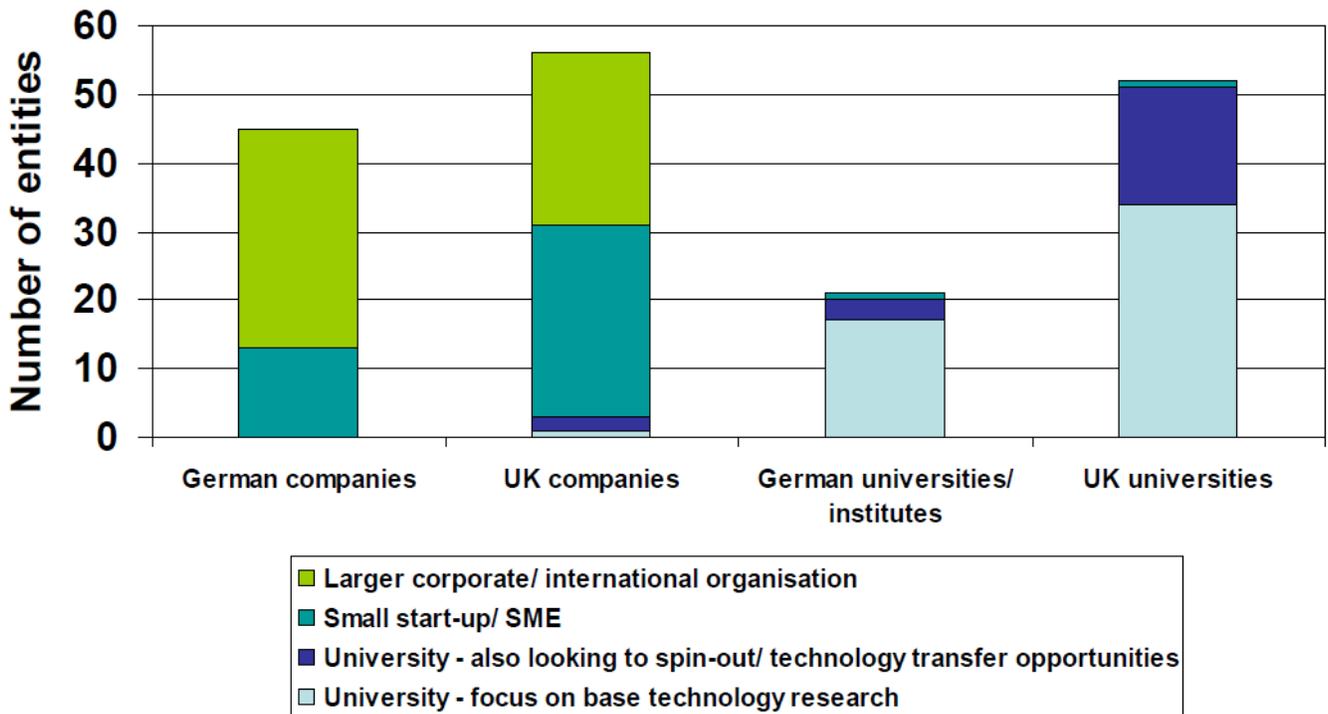


UK is most active in displays and photovoltaics



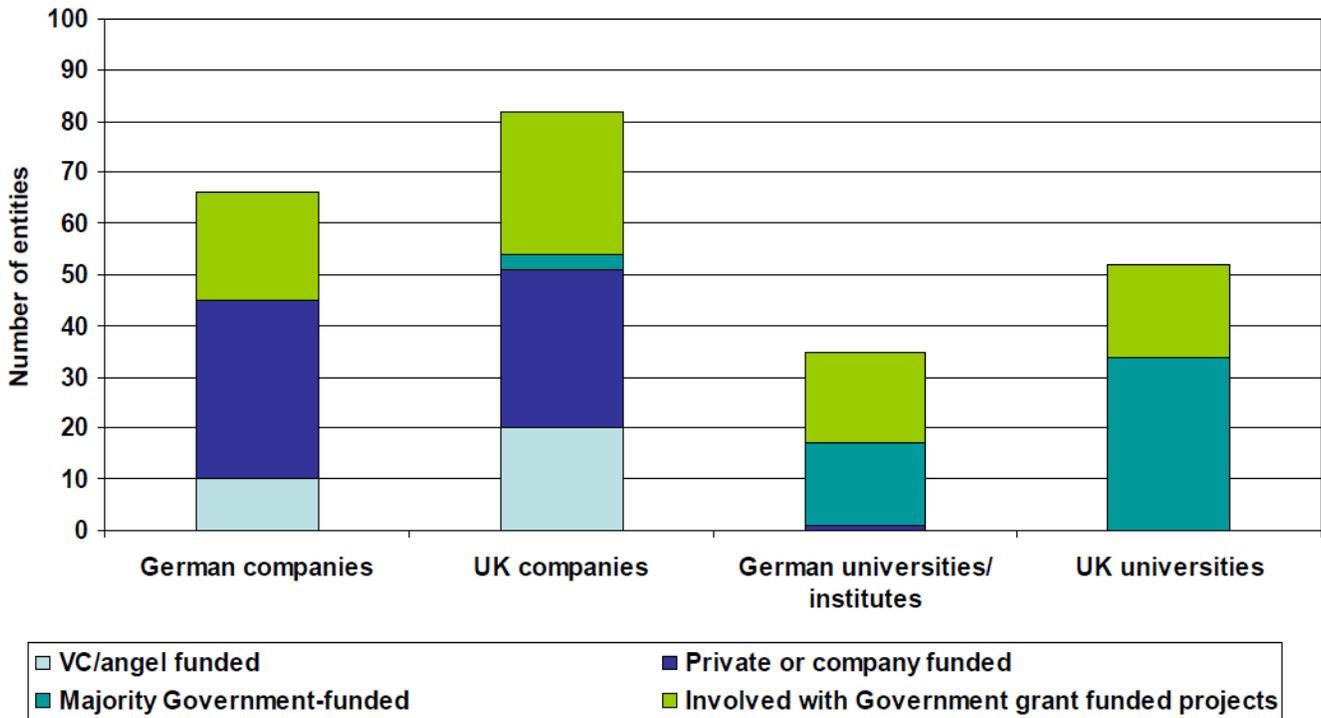
Germany has more activities in RFID (including antennas), packing, games, and disposables

Current status of printed electronics entities in UK and Germany



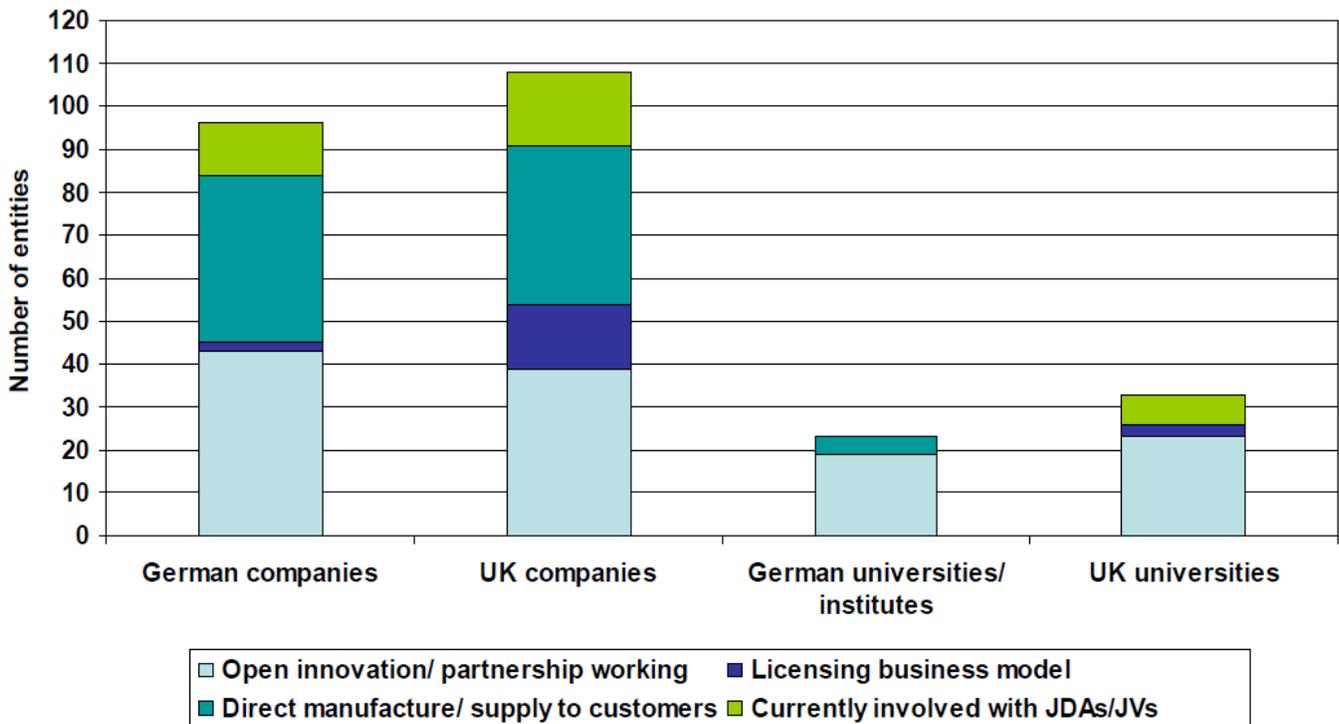
UK has more small companies and fewer large corporate; greater emphasis in UK on spin-out technology transfer from universities through VC funding of start-ups/SMEs

Funding of plastic electronics entities in UK and Germany



UK companies rely more heavily on government-funded and VC/angel funding; similar levels of involvement with public-funded projects (EU, UK Government's Technology Strategy Board, etc.)

Main business models of plastic electronics entities in UK and Germany



UK companies make a greater use of licensing models; UK entities are more involved with JDAs and joint ventures to help address issues of scale mentioned on previous slide

Current status and funding implications:**Germany**

- More large/corporate home-grown companies, reflecting German's continued strength as an industrial nation.
- Universities and institutes less focused on spin-out SME formation, owing to extent of government funding to bring technologies to market and integrated nature of Fraunhofer activities.

UK

- More small companies; greater emphasis in UK on pipeline of spin-out technology transfer from universities through angel/VC equity funding into an SME entity
- VC/angel community more active in the UK to support spin-out activity
- Fewer large corporates; UK has lost many of its big home-grown corporates; any UK corporate entities are foreign-owned (Philips, Merck, DTF)

Issue of scale for the UK: If UK entities are to capture value by licensing IP (following conventional UK business models), sufficient capital expenditure and skills sets to take ideas through to proof-of-product validation are required.

Main business models implications:**Germany**

- Very limited use of licensing models; greater focus on direct manufacture and supply (strength of the Fraunhofer institutes).
- Fraunhofer Institutes less reliant on revenue generating projects through joint venture with licensing partners as they have access to core competence and equipment funding sources from government.

UK

- Both companies and universities make a greater use of licensing models.
- UK universities are more involved with JDAs and joint ventures; JDAs are often necessary for testing of their early stage IP to take steps toward the proof-of-product and finished component stage.
- UK universities (e.g. WCPC) doing JDAs as part of a spin-out vehicle that may also have standalone sources of revenue e.g. selling components and services; but not doing direct manufacture and supply.

UK depends on licensing business models with tech-transfer from universities to VC equity-funded SMEs; Germany has greater focus on early routes to direct manufacture and supply

Areas of risk for the UK

- UK limits its access to revenue streams and some customer types by not testing through to the level of complete systems and application prototypes, for this new platform manufacturing technology
- UK players need to de-risk the technology sell within IP licensing/royalty deals by demonstrating early prototype/proof of product functionality; as time progresses and more rival technologies become available, less value will be captured by UK players who hold core IP not already licensed
- Lower government investment in (especially) capital expenditure will limit UK universities' access to all the available additional revenue streams
- Risk that innovative developers in the UK (especially universities) will not be able to fully develop the process and device know-how necessary to support and add value to their IP where they pursue licensing models.

If the UK is to capture greatest value from its IP in PE, sufficient capital expenditure and skills sets to take ideas through to proof-of-product validation must be available

Governance of the UK Displays and Lighting KTN

ADVISORY BOARD

Chairman Robert Simpson
Board Members Stuart Evans, David Monk, Paul May, Gareth Jones

STEERING COMMITTEE

Chairman Robert Simpson
Members Chris Williams Director UKDL
 Mike Biddle Technology Strategy Board
 Ian Williams BERR
 Keith Rollins (DuPont Teijin) representing FLEXYNET
 Chris Rider (Kodak) representing ET
 Chris Winscom (Kodak) representing LABL
 Ken Vassie (NPL) representing SPURSS
Tim Claypole University of Swansea
Bill Milne University of Cambridge

FLEXYNET (Plastic Electronics) Sub group Industrial Committee

Chairman Keith Rollins DuPont Teijin Films
Committee Members: Plastic Logic, Kodak, CDT, MDS, Dow Corning, Merck, DSTL, Xaar, Oerlikon, WCPC, Qinetiq, CENAMPS, CPI, PRL, M-solv

LABL (Lighting & Backlighting) Sub group Industrial Committee

Chairman Chris Winscom Kodak
Committee Members: Vossloh-Schwabe, Elumin8, LEDs Magazine, Polymer Optics, Enfis, WOF, NPL, University of Durham, University of Cambridge, University of Sheffield, Thorn Lighting, Ceravision, WCPC, Sharp Labs, MARL International, Pilkington Group, PRL, Tridonic Atco, M-solv

ET (Emerging Technologies) Sub group Committee

Chairman Chris Rider Kodak
Committee Members: Pelikon, Sharp Labs, HP Labs, Dow Corning, CAPE, University of Swansea, University of Manchester, CDT

SPURSS (Systems, Professional Users, Regulations, Safety, Standards) Sub Group Committee

Chairman Ken Vassie NPL
Committee Members: CAA, Ginsbury Electronics, DSTL, POPAI/IQ Group, Philips Lighting, iSuppli, Commonwealth Broadcasting Association, PACSnet, RNIB, HSE, Health Protection Agency, U o Middlesex, DeMontfort University, CIE

Contacting UKDL

Most of the information you will need about the UK Displays & Lighting KTN and its events and activities are found on the website: <http://www.ukdisplaylighting.net>. General queries can be sent to info@ukdisplaylighting.net, but if you would like to have direct contact with us, please feel free to do so:

Dr. Eifion Jewell, who is located at the University of Wales, Swansea, is seconded to UKDL, and is responsible for part of our FLEXYNET and ET activities, particularly with skills training in printing of functional inks. eifion@ukdisplaylighting.net.

Dr. Ric Allott, Deputy Network Director, has responsibility for organization and delivery of all domestic events and activities, and is specifically responsible for FLEXYNET and ET. ric@ukdisplaylighting.net.

All marketing and promotion of UKDL activities is handled by Nick Kirkwood, who is also responsible for SPURSS. Contact Nick at nick@ukdisplaylighting.net.

All event planning, including location booking around the UK and overseas, is handled by Louisa Chanter Louisa@ukdisplaylighting.net.

Administration is handled by Kay Davenport. Kay is based at our Bletchley Park Headquarters, and is the friendly voice that enquirers will first meet if phoning through to us. Kay can be contacted at Kay@ukdisplaylighting.net.

Finance and accounts matters are handled by Cathy Williams, cathy@ukdisplaylighting.net.

Overall responsibility for the KTN, and specific responsibility for UKDL's overseas activities lies with the Director, Chris Williams. He can be contacted at chris@ukdisplaylighting.net.

If you prefer to contact us by phone, the general number is +44 (0)1908 276665. This number is manned during normal UK office hours, and reverts to voicemail at all other times.



With the Kingsclere House as a backdrop, the UKDL team stands from left to right: Ric Allott (Deputy Network Director), Nick Kirkwood (Marketing Manager), Kay Davenport (Bletchley Park Administrator), Chris Williams (Network Director), Louisa Chanter (Events & Exhibitions), Cathy Williams (Managing Director of UKDN Ltd, the administration company that runs UKDL), Eifion Jewell (UKDL Embedded Research Fellow Swansea University)

UKDL Events

The UKDL is hosting/sponsoring numerous events in the coming months. Dates highlighted in **red** are still tentative. For the latest updates and registration information: <http://www.ukdisplay.net>

February 2009			
10	The Application of Flexography for the Volume Printing of Electronics	Swansea University	Workshop
19	OLED for Lighting – Can we turn the Promise Into Workable Solutions/	BDP, London	Seminar
24-25	Transistors on Plastics	Møller Centre, Cambridge	Seminar
March 2009			
2	Kinetica Art Fair and Technologies Workshop	P3, London	Workshop
10	Integrating Plastic Electronics	Williams F1 Centre, Grove	Meeting
17-19	Emissives Module DisplayMasters	Nottingham Trent University	Seminar
25	Surface Analysis for Lighting Applications	Aston University, Birmingham	Tutorial
31	ALD Workshop	Rutherford Appleton Laboratory, Oxford	Workshop
April 2009			
1	De La Rue Tutorial	Hampshire	Tutorial
7-8	Printed Electronics and Photovoltaics	Dresden, Germany	Exhibition
20	Centre for Defence Seminar	Harwell, Oxfordshire	Seminar
20-21	4 th Integrated Manufacturing by Printing Colloquia	Gregynog	Workshop
May 2009			
13	Laser Processing for Plastic Electronics	Abingdon	Seminar
June 2009			
2	Dynamic Digital Facades – Lighting Utopia or Blade Runner Revisited?	BDP, London	Seminar
3-4	S2K 2009	Cardiff	Conference
October 2009			
13-14	Wayne Cranton Tutorial	Nottingham Trent University	Tutorial

