



Journal of the Institute of Circuit Technology

Vol.8 No.2 Spring 2015 Issue

2014 Events

- 5th June **ICT Annual Symposium**
Thursday at Great Western Railway
STEAM Museum, Swindon
bill.wilkie@InstCT.org
- 23th September **ICT Evening Seminar**
Tuesday at Newton House Hotel, Hayling Island
bill.wilkie@InstCT.org
- 18th November **ICT Darlington Evening Seminar**
Tuesday at St George Hotel, Durham Tees Valley Airport,
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2015 Events

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- 3rd March **ICT Northern Seminar and AGM**
Tuesday at Chimney House Hotel, Sandbach
www.instct.org
bill.wilkie@InstCT.org
- 13th -16th April **ICT Annual Foundation Course**
Tuesday - Friday at Loughborough University
bill.wilkie@InstCT.org
- 3rd June **ICT Annual Symposium**
Wednesday at Black Country Museum
bill.wilkie@InstCT.org

I'm very proud to have been given the opportunity to become Chairman of the ICT.

I take over the Chairmanship with the Institute in very good health: membership is at an all-time high whilst the evening seminars and annual symposium are strongly supported and the Foundation Course is well-attended. Thanks to Bruce Routledge the ICT journal is now well established and the website designed and maintained by Richard Wood-Roe is first class. The current strength of the ICT is in no small measure down to the hard work of Bill Wilkie and the outgoing Chairman Martin Goosey whilst our Treasurer Chris Wall has skilfully navigated us through some tricky financial waters over the last few years. It will certainly be one of my ambitions to ensure that the ICT remains in this very healthy state.

Martin Goosey has been very keen to encourage the ICT to participate in research projects and this is something I will continue to support. I think it is essential that for the UK PCB industry to survive we must continue to innovate, invest in research and keep abreast of all the current research that is relevant to our industry. There is funding out there via the EU (Horizon 2020), Innovate UK and the Knowledge Transfer Programme (to name but a few).

Although I spent 20 years in the PCB industry I'm now a full time academic and so I'm very pleased that I have Steve Payne as Vice Chairman who will ensure that the industry has a prominent voice. I'm also very lucky to have the advice of John Walker (Secretary) to fall back on and a very experienced and supportive council (Pete Starkey, Francesca Stern, Lawson Lightfoot, Maurice Hubert and Bob Willis)

As ever I would ask that you give the Institute plenty of feedback on how we are representing you. What are your concerns and issues and is there anything the Institute can do to help you with these?

I look forward to working with all our members and the ICT council over the next year to ensure the ICT goes from strength to strength.

Andy Cobley

(Chairman)

Council Members 2015	Andy Cobley (<i>Chairman</i>), Steve Payne (<i>Deputy Chairman</i>), John Walker (<i>Secretary</i>), Chris Wall (<i>Treasurer</i>), William Wilkie (<i>Membership Secretary & Events</i>), Bruce Routledge (<i>the Journal</i>), Richard Wood-Roe (<i>Web Site</i>), Martin Goosey, Maurice Hubert, Lawson Lightfoot, Peter Starkey, Francesca Stern, Bob Willis.
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Membership

New members notified by the Membership Secretary :-

10346 Lynn Houghton F.Inst.C.T.

(This Member Entry was previously reported in the Supplementary Vol.8No. 1Sup)

Corrections and Clarifications

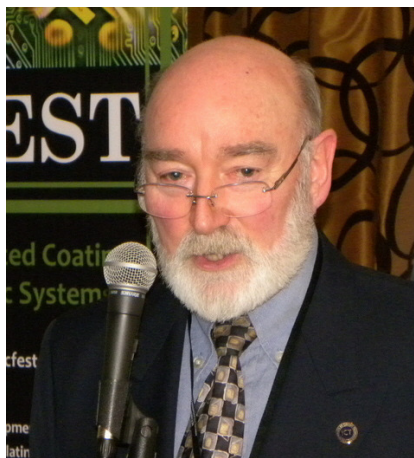
It is the policy of the Journal to correct errors in the next issue. Please send corrections to :-
brucer@john-lewis.com

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Review of :-

The Institute of Circuit Technology Sandbach Seminar, 3rd March 2015

by Peter Starkey F.Inst.C.T,



Bill Wilkie

Sandbach, in Cheshire, UK, was venue for the well-attended Annual General Meeting of the Institute of Circuit Technology, followed by an informative and enlightening seminar programme introduced by Technical Director, **Bill Wilkie**.

STOWURC

Metal Reclamation using crab shells.

an **ICT** multi-partner R&D project.



Professor Martin Goosey

Retiring ICT Chairman, **Professor Martin Goosey** reviewed the ICT's two current multi-partner R&D projects, **STOWURC** and **MacFest**, which addressed key issues of interest to the UK PCB industry and were both part-funded by Innovate UK (formerly the Technology Strategy Board).

He commented that the bizarre acronyms were a consequence of the supervising authority's requirement for short names that reflected the theme of the project. So STOWURC stood for Sustainable Treatment of Waste Using Recycled Chitosans, and MacFest for Manufacturing Advanced Coatings for Future Electronic Systems

The principle of the STOWURC project was to use waste from one industry sector to treat waste from another industry, specifically to use materials derived from crab shells to treat metal-bearing effluent from the PCB and metal finishing industries. The two-year project was currently past its half-way stage, and due to finish at the end of November 2015.

The project consortium covered the whole supply chain, from raw material to dissemination, and included a crab-fishing and dressing company as raw material supplier, a chemical process supplier, a printed circuit board fabricator, a research and technology exploiter and a process equipment fabricator. The Surface Engineering Association and the Institute of Circuit Technology were responsible for disseminating the results and conclusions.

Professor Goosey explained that the requirement to remove low levels of metals from PCB manufacturing effluent could be achieved by using ion exchange resins but that certain natural products could also absorb these metals.

The STOWURC project was investigating the use of a natural waste product to both capture and recover metals from effluent. Chitin, a long-chain polymer of a N-acetylglucosamine, was a constituent of crab-shells which had the ability to adsorb metals such as copper from dilute solution. Chitosan, a derivative of chitin produced by a deacetylation treatment, was a more effective adsorbent. And once adsorbed, it was possible to elute the metal and recover it by electroplating. He showed how the rates of copper absorption compared for crab-shell, chitin, and chitosan, and how they varied depending on solution parameters such

as temperature, pH, initial concentration, rate of mixing and metal speciation, and chitosan parameters such as amount of adsorbent, degree of deacetylation and particle size. Copper had been desorbed and recovered by conventional electroplating techniques and the materials had been evaluated through multiple cycles. The project was currently focused on optimising materials and processes for specific applications.

Solderable finishes development
- **MacFest** the 2nd ICT R&D
multi-partner R&D project.

The two-year **MacFest** project had begun in January 2015 with the objectives of developing solderable finishes with improved solder joint reliability in harsh environments, whilst reducing the toxicity of chemicals used in PCB manufacturing processes and reducing energy input, and was based on deposition of metals from ionic liquids.

The initial objective was the development and evaluation of new nickel-palladium-gold solderable coatings. Full literature and IP searches were currently being undertaken, together with an assessment of actual end user requirements, and trial formulation and deposition studies were under way at the University of Leicester.

Thermal management:
the role of substrate



Geoff Layhe

Next presentation, entitled “**Thermal management: the role of substrate**”, came from **Geoff Layhe**, Technical Manager at Lamar Group, who listed several established technologies for supporting heat dissipation for carrying high current on printed circuit boards, including water-cooled PCBs, thick-copper PCBs, copper inlay technology, insulated metal substrate, copper bus-bar technology and copper wire in PCB, before considering the option of dissipating heat through the substrate itself. The thermal conductivity of conventional FR4 material was less than 0.4W/mK but over recent years various substrates with thermal conductivity in the range 1W/mK to 5W/mK had been introduced into the market. Layhe described the characteristics and typical applications for a series of proprietary materials.

The first was a CEM3 substrate, with a woven-glass-epoxy construction similar to FR4 in the surface layers, but with a core of non-woven glass. This material had a thermal conductivity in the 1W/mK to 1.5W/mK range and typical applications were in LED lighting, displays and power supplies.

Next was a bendable material based on flexible polyimide with different thickness of copper cladding top and bottom - thin copper foil on the top for the LED circuit and thicker foil on the bottom for heat dissipation. Even though the thermal conductivity of polyimide was relatively poor, its superior electrical isolation characteristics enabled the use of thin substrates, for example 25 microns, to achieve very low thermal resistance. This material was an alternative option for automotive LED applications, with the attributes of flexibility and weight and thickness reduction.

Layhe’s third example was a halogen-free epoxy-based FR4 material with a thermal conductivity of 1.5W/mK, designed for building multilayer PCBs for automotive and industrial applications. Its higher thermal conductivity gave the option to reduce copper thickness whilst reducing the operating temperature of components in electric and hybrid vehicles and electronic power modules.

The second session of the seminar featured presentations from Electronics Yorkshire and iNEMI

Electronics Yorkshire is an **IPC-authorised training, technology and resource centre** focused on supporting the electronics industry across the UK. Managing Director **Stuart Flack** described the role of IPC in the Electronics Industry, beginning by explaining the derivation of the name - originally in the late 1950s the Institute of Printed Circuits,

IPC
its role
in the Electronics Industry



Stuart Flack

later the Institute for Interconnecting and Packaging Electronic Circuits, and since 1999 simply IPC (the association connecting electronics industries). With its headquarters in Bannockburn, Illinois, USA, IPC was the electronic industry's leading source for standards and training, supporting programmes to meet the needs of an estimated \$2 trillion global electronics industry, with emphasis on design, PCB manufacturing and electronics assembly. IPC was accredited by the American National Standards Institute as a standards-developing organisation, and was a member of the World Electronic Circuits Council.

Flack discussed IPC standards, training and accreditation. Standards defined accepted inter-departmental and inter-company workmanship criteria in a common language, and provided a means to avoid or resolve disputes. There were currently more than 225 active IPC standards, developed by committees of volunteer experts representing the global electronics community. Training and certification provided proof of education in the use of those standards, and in the UK there were currently over 11,000 individual certifications, spread over 800 companies. Furthermore, the IPC accreditation programme provided a traceable system which was simple to verify through the IPC website.

International Electronics Manufacturing Initiative (iNEMI)



Steve Payne

The **International Electronics Manufacturing Initiative (iNEMI)** is a not-for-profit, R&D consortium of electronics manufacturers, suppliers, associations, government agencies and universities, whose mission is to forecast and accelerate improvements in the electronics manufacturing industry for a sustainable future. **Steve Payne**, Manager of European Operations, explained how iNEMI's technology roadmap was generated and examined its benefits: assessment of where the industry was at and identification of where it wanted to be, comparison of various technology paths and clarification of what was needed to get there, visibility as to what was happening, enhanced communication along the supply chain and defining where collaboration and innovation was necessary.

The iNEMI roadmap gave an outlook for the following 10 years, updated every two years, for the full supply chain for electronics manufacturing, based on the input of over 650 participants from 350 companies and organisations in 18 countries. iNEMI collaborative projects reduced costs by leveraging resources, reduced risks of technology introduction by accelerating the deployment of new technologies, developing industry infrastructure and ensuring reliability and technology readiness when required, as well as reducing environmental risks by ensuring that sustainable solutions were put in place and in step with industry.

Current project areas included packaging & component substrates, test, inspection and measurement, environmentally sustainable electronics, optoelectronics, board assembly, organic PCB interconnect, electronic connectors, MEMS and sensors, medical and automotive.

Bill Wilkie brought proceedings to a close, thanking speakers for sharing their knowledge, delegates for their attention and Lamar Group for their generosity in supporting the event. A supper of bacon barm cakes and chip butties was enjoyed by all, and networking continued until late in the evening.

Pete Starkey,

I-Connect007,
March 2015

A visit to see the Eurofighter assembly at Airbus Defence and Space by EIPC Conference delegates

If you can drive a car, you can fly a Typhoon!

Limited to sixty participants and heavily oversubscribed, the bonus programme of the 2015 EIPC Winter Conference in Munich was a visit to the Manching site of **Airbus Defence and Space**, a centre for specialist activities relating to manned and unmanned military aerial vehicles. The major attraction was the opportunity to see the final assembly line for Eurofighter Typhoon multi-role combat aircraft destined for the German Air Force,

Our party was greeted by Manching's Head of Protocol, **Hilmar Eckert**, and after a basic security briefing: "Don't touch anything, don't push any buttons and don't take any photographs", we were led into a long brightly-lit hangar, with a faint aroma of laminating resin and a general atmosphere of quiet industriousness. Various airframe sections were recognisable among the working decks and gantries on either side of the central aisle.

Hilmar Eckert was generous with his comprehensive knowledge, responding to innumerable questions with meaningful and enlightening explanations and descriptions except when a truthful answer might divulge sensitive information, when he would simply smile and say "I don't know...."

He explained that the Eurofighter Typhoon was Europe's largest defence programme, its development and manufacture being based on an international partnership of governments, industry and air forces in Italy, United Kingdom, Spain and Germany. The work of building wings and fuselage sections was divided among the primary contractors BAE Systems, Alenia Aermacchi and Cassidian, and major sub-assemblies were brought together in Manching for final assembly. An international consortium of Rolls-Royce, MTU Aero Engines, Avio and Industria de Turbo Propulsores was responsible for the development and production of the Typhoon's twin Eurojet EJ200 turbojet engines.

The airframe was constructed mainly from carbon fibre composites, with titanium and aluminium alloys for the control surfaces, and designed to be deliberately unstable for manoeuvrability and supersonic capability. So it relied heavily on highly integrated electronic systems to assist the pilot.

The cockpit and "Human Machine Interface" had been developed to provide a low pilot workload in adverse mission and threat situations, so that a single pilot could carry out a swing-role mission where he might be called on to deal with an air-to-surface attack and with an air-to-air threat at the same time.

The job of the pilot had changed dramatically as the "one aircraft - any mission" concept of the Typhoon had evolved; his priority was the mission rather than flying the aeroplane. Four computers operated a digital fly-by-wire system designed to enable the pilot to concentrate on the tactical tasks and to fly the aircraft "head-up", with unique features such as "Direct Voice Input/Output" and "Hands On Throttle And Stick" control functionality applied to cockpit design, and displays to show the pilot "what is needed, when it is needed!"

Eckert, clearly a highly-experienced hands-on specialist remarked "I have trained over 150 pilots to fly this aircraft. It's so easy - if you can drive a car, you can fly a Typhoon!"

We didn't talk about weapons systems, but understood that an adequate range of options was available....

Back to our trip along the production line: There was no great rush to get these aircraft built - annual production was nine units, limited by budget, not by capacity - and Eckert explained that a two-shift system operated, with thirteen technicians per shift backed up about four-to-one by test and inspection engineers. Documentation was ever-present - every operation, however minor, was meticulously recorded. Apparently, if all of the production and test procedures were printed-out, it would need about three tonnes of paper. And the working language was English - to translate everything into German would cost around eighteen million euros!

Every sub-assembly had coils of wire hanging seemingly from every orifice - all of the myriad sensors and systems had to be interconnected, and every piece of cable was printed its whole length with a unique address. Something like seventeen kilometres or nine hundred kilograms of wire per Typhoon if I heard correctly!

As assembly progressed, the aircraft were moved gradually towards the far hangar doors, but even after they had reached the open air the process of testing and calibration continued for another month before they finally left the ground.

Elsewhere on our tour, we were able to see a NATO Airborne Warning and Control System (AWACS) aircraft, a military version of the Boeing 707 "With a cockpit like a clock-shop, and propelled by four fuel-to-noise converters!" undergoing extensive repair and upgrade. Also the Lockheed P-3 Orion maritime patrol and surveillance aircraft and the Transall C-160 military transport aircraft for which Airbus Defence has responsibility for engineering support and maintenance.

Our tour finished with a step back in time - the Messerschmitt Museum, a spectacular collection of historic aircraft, with the Me-109 attracting almost as much attention as the two little KR-200 bubble cars.

All-in-all, a spectacular and memorable experience. Many thanks to EIPC for organising the visit, to Airbus Defence and Space for making us so welcome, and especially to Hilmar Eckert for his patience and good humour in response to our countless queries.

Pete Starkey,
I-Connect007,
February 2015

Southern Manufacturing & Electronics

Farnborough, Hampshire, England 10th-12th February 2015

Report from - John Ling

The initials in the title are SME, and are entirely appropriate, by and large. It is true that there are many large companies represented, but the other SMEs, the Small to Medium Enterprises, were here in droves, and they covered the very best in British manufacturing and electronics. 700 exhibitors in two enormous halls were there to cater for the myriad needs and diverse interests of over 7000 visitors. The visitors came from a split between aerospace, automotive, defence, electrical engineering and mechanical engineering industries, many of whom were within an hour's drive of the show.

Milling and drilling, cables and labels, detectors and connectors, enclosures and disclosures, hydraulics and ergonomics, the complete inventory of manufacturing was present, and within the many aisles were the stalwarts of the UK PCB industry as well as many of the assembly houses and assembly equipment suppliers.

Graphic PLC has been coming to this show for many years. Between 60 and 70% of their production in Crediton is for the Mil/Aero sector, and much of that is exported.

According to **Trevor Sanders** one of the biggest impediments to increasing that export business is export licensing. The allocation of human resources to the requirements demanded of HMG impinge upon both supplier and customer, and thus it is that a potential customer in, say, France, or Germany, faced with the onerous paperwork required should they wish to deal with a British supplier, may, and often does, choose a supplier from within their own country where no such demands are made. However, with customers in the multi-million pound bracket, Graphic are in a league at the top of the market.

Spirit Circuits see their exports increasing, however, although much of their production is for the UK market. Spirit can offer a complete engineering service for assembly, all under one roof. **Peter Dobromylski** their Sales Manager said that being at this show enabled them to meet with most of their UK customers for whom an annual visit to Farnborough is a must.

Anglia Circuits have been in the business for 46 years now, and sales increase quite satisfactorily thanks to an excellent reputation for reliability. They have now been awarded **AS9100** certification, and specialise in the quick-turn prototype market, which is of great value to the smaller start-up company for whom the larger board shop is not equipped. Customer sales are from the £100 account to the £100K account, and their pre-engineering and full testing ensure that Anglia is a company that really has grown by default; this was their first year with their own stand and **Laura Robson**, their Sales Manager, is now a member of the *Institute of Circuit Technology*, and joins MD **Matthew Kember** who has been a stalwart supporter of that organisation for many years.

Merlin PCB Group are a bit like the birds wings, they are pretty spread out. Lancing Sussex, Hartlepool, Co.Durham, and Chester in Cheshire are not exactly adjacent. But they do have a great proximity with their customers in the rapidly expanding flex and flex-rigid fields, and can offer 12-24 layer flex-rigid boards from Hartlepool, and from 1 to 32 multilayers boards from Cheshire, as well as conventional flexible circuitry from the South Coast. Turnover had doubled in the last year, and just under 50% of sales are now for export. **Colette Bentall** is their Sales Manager and relayed the news that **Dennis Price** is indeed retiring this year, which will be a major loss to an industry that has benefited from his vast experience and knowledge over many years.

The **Southern Manufacturing & Electronics Show** is like a mini-Productronica, and has been successful in making it possible for companies, not only from the UK, to exhibit at a modest cost in a logistically convenient location to their customers, old and new alike. That they have pretty much sold all the stand space for next year says it all, really. Without the costs of going all the way to Munich, and the beer is better, too.

AS9100 (BS EN 9100) is the single common quality management standard for the aerospace industry. It is used and supported by the world's leading aerospace companies

**Celebrations at :-
The Institute of Circuit Technology Sandbach Seminar,**



Dennis Price

They said it would never happen, but nevertheless, **Dennis Price** is retiring! We took time-out at the recent ICT Sandbach Seminar to honour and thank Dennis for his contribution to the Institute. Dennis has served on Standing Committees on our behalf, as well as delivering many presentations at our events and lecturing at our Foundation Course.

As many of you know, we operate an unofficial helpdesk at the Institute and Dennis has been unstinting in his help for both Technical and Standards queries.

Dennis's experience extends right back to the very beginnings of the UK PCB Industry and I am sure that his encyclopedic knowledge will still be available to us for many years to come.

Dennis was presented with an inscribed Quaich (and something to put in it) by Lynn Houghton, our newest member.



It's not often we get the chance to present Membership Certificates in person, but at the recent ICT Sandbach Seminar, Martin Goosey was able to present a certificate to Lynn Houghton.

Lynn was the Standards Lecturer at the old NUKCG Basic Course in Galashiels and will take over as the Standards Lecturer at our Foundation Course next year following the retirement of Dennis Price.

It is probably not well known, but Lynn and Tom Parker were both at ICL at the same time and worked for Richard Houghton, now running Hi5 Electronics in Stockport.

Bill Wilkie
March 2015

Corporate Members of The Institute of Circuit Technology

April 2015

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Institute of Circuit Technology 41st Annual Symposium

The 41st Annual Symposium will be held at the
at Black Country Museum, Dudley

Event Info.

Wednesday

June 3rd 2015

Registration at 09:30

Symposium begins at 10:00



41st Annual Symposium

The Symposium will include the following papers :-

Photonic Print Head Technology
Supercapacitor Development
Annual 'state of the nation' address
Flame retardants
Mesmoproc Project
LED Development
Ventec-Europe recent Developments
Crabs Project STOWURC

Trevor Elworthy
Darren Southee
Francesca Stern
Professor Martin Goosey
Andy Cobley
Les Round
Ian Mayoh/Martin Cotton
Emma Goosey

A complete programme will be on www.instct.org

Members and non-members - £85 (Inc. Museum Entry)
Tabletops - £50

Information from Bill Wilkie at bill.wilkie@InstCT.org