THE MAGAZINE OF THE INSTITUTE OF MEASUREMENT AND CONTROL INSTMC.ORG

WHAT ARE THE BENEFITS OF EDGE COMPUTING IN AN IIOT MANUFACTURING PROCESS?

FEATURES//

LEVERAGING THE EDGE IN IIoT

LIGHTS, CAMERA, DATA

100 YEARS OF WOMEN ENGINEERS

ISSUE FOURTEEN

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INSTMC END OF YEAR REVIEW

As we near the end of 2019, now is a good time to look back and reflect on the past year, as well as a chance to look forward and think about 2020 and beyond.

As you probably already know, this year has seen some big changes for the Institute. The biggest was the sale of the office at 87 Gower Street. We have settled in well to our new space at the IOM3 up the road, and will stay here a while before we find a more permanent home. The move offered the perfect opportunity to start to upgrade IT systems and working practices.

We have had a number of staff changes at Head Office. Patrick Finlay retired as CEO in March, and we said goodbye to several members of staff and welcomed some new. From January 2020 we will welcome a new President, Honorary Treasurer and Honorary Secretary.

2019 marked 75 years since the founding of the Institute and we celebrated with a very successful Gala dinner organised by the London Section. In preparation for the 75th anniversary I read lots of past articles including some of the documents from 1944, and it was interesting to see how much things have changed. I think the difference in the next 75 years will be even more dramatic, but we want to ensure that the Institute is still around to see those changes, and still relevant to measurement and control professionals.

In October a collection of Trustees, Staff and Council representatives spent a day considering a future strategy for the Institute. There was some good discussion and the day ended with a collection of new ideas and approaches. We will be turning these into a 3 to 5-year developmental plan for the Institute, with the aim of improving the member experience, growing our influence and adapting to the new challenges facing Engineering.

In the New Year we will be issuing an annual membership survey, alongside some more details about our future plans, and your feedback will make sure that the Institute adapts in a way that works for you.

I wish you all a Merry Christmas and a Happy New Year, and look forward to working with you in 2020.

Steff Smith, Chief Executive,
Institute of Measurement and Control

2019 marked 75 years since the founding of the Institute and we celebrated with a very successful Gala dinner organised by the London Section.

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LOOKING FOR CONTRIBUTORS

Do you have something to say? Would you like to share your thoughts and opinions with InstMC members?

We are keen to hear from potential contributors so please get in touch, sending your ideas to marketing@instmc.org

LOCAL SECTION NEWS

Events within the Teesside Local Section include visits to the Tees Cottage Pumping Station and the North Lincs Brewery, as well as the Reunion Dinner and 2019 Instrument, Control & Electrical Exhibition.

22-23

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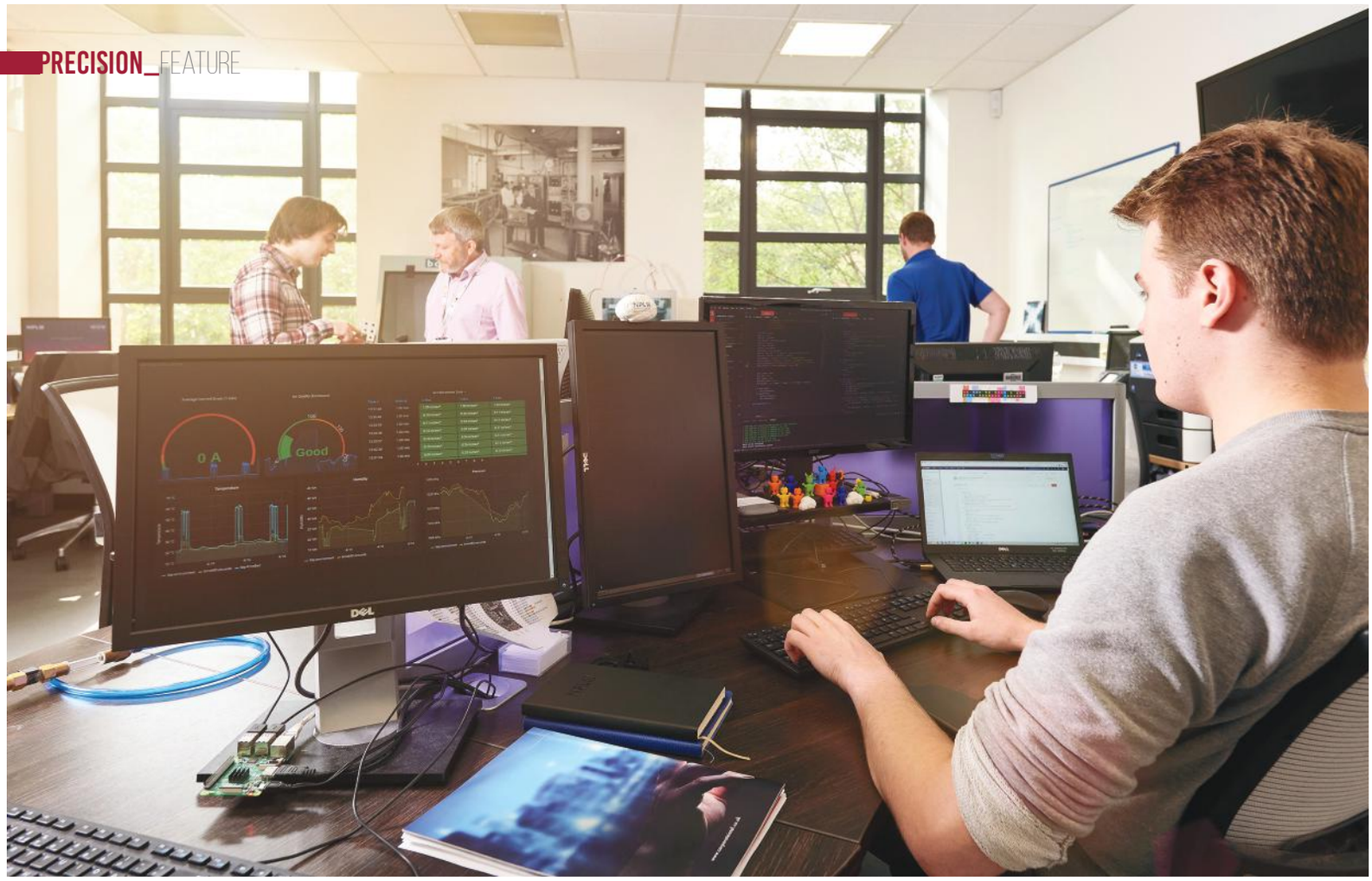

LEVERAGING THE EDGE IN IIoT

Working primarily on the measurement challenges associated with the Industrial Internet of Things (IIoT) as part of the Manufacturing Metrology group, Daniel Povey, Research Scientist at the National Physical Laboratory, discusses the prospective benefits of edge computing as part of an IIoT-enabled manufacturing process.

The Internet of Things

By now, the Internet of Things has become a household phrase: from phones to fridges, a staggering proportion of electronic devices in use today collect and transmit data in some form or another. The picture is no different for businesses pursuing Industry 4.0 and the technologies it represents: predictive maintenance, autonomous process modification and machine learning, amongst many others. As the application of Industrial Internet of Things (IIoT) solutions mature, more attention is paid to its optimisation. In a rather primitive picture, an IoT system consists primarily of two

points of contact: the IoT device and the cloud.

The Edge

Historically, edge computing referred nearly-analogously to content delivery networks (used to assist the upload and download of media). In the age of IoT, "edge" is more-often used to refer to a location that is on the same premises as the user. In Industrial IoT, it commonly refers to a point of contact in the transmission of data that is on site with the data acquisition devices (Fig 1).

Consider an industrial manufacturing process, of any kind, and imagine its equipment has been equipped with appropriate IIoT devices. Network-enabled microcontrollers fitted, for example, with sensors such as accelerometers recording conveyor system vibrations or platinum resistance thermometers (PRTs) recording the temperature of a Coordinate Measuring Machine, etc.. Each IIoT device captures data at regular intervals and sends this data somewhere to be processed and eventually analysed. In a typical IoT application this somewhere is usually a server or data centre that forms part of a cloud platform, whereas an application that makes use of the edge will route its data through an "edge node" before it reaches the cloud.

An edge node could be any one in a range of devices, but the most basic example would be a computer – which could be anything from a single-board computer to a high-performance workstation. An edge node is capable of limited data storage, processing, and/ or visualisation. Data can subsequently be processed to some extent before it is sent to the cloud.

Benefits

Naturally, an edge node should offer value to the process it is integrated with. Advantages associated with edge computing range from increased operational robustness to the all-important bottom-line cost savings.

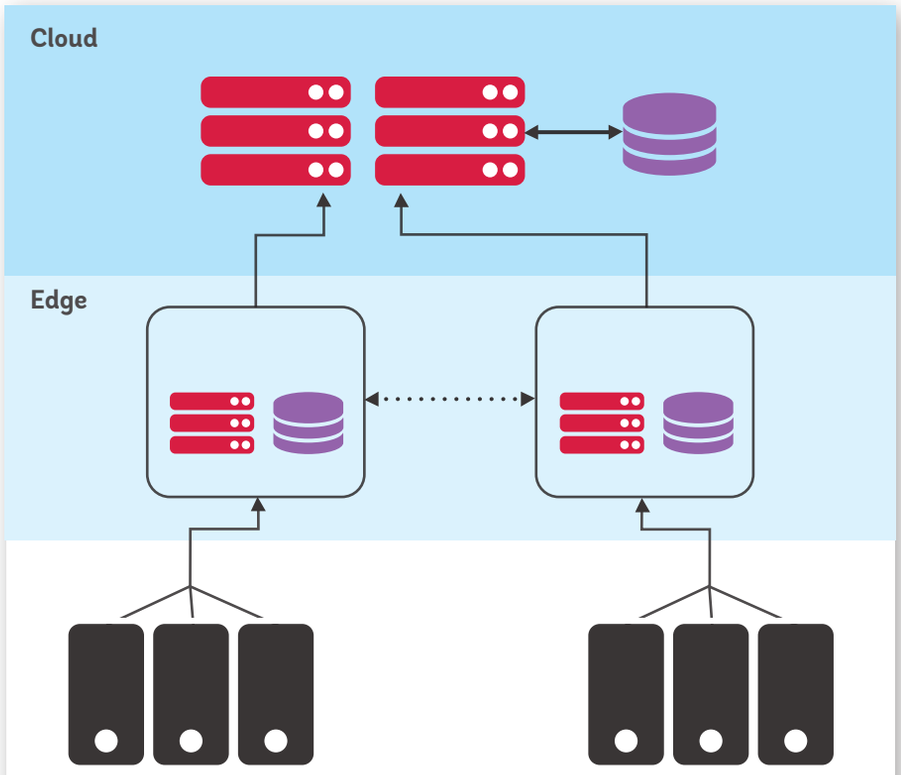

Fig 1 Edge Computing Set-up

- **Robustness**

As manufacturing processes mature and methods for integrating data back into the process become feasible, it becomes more important that the data is handled in a timely manner. Even more so for any critical outputs, the data should be processed as close to the process as possible to mitigate the risk of network latency, or a cloud platform's technical issues impacting the process. There is also something to be said about not sending sensitive data off-premises.

- **Interoperability**

The use of a cloud platform is typically provided as a monetised service by companies with the infrastructure to do so (the most popular being those provided by global technology giants), and so by using a cloud platform, data is subject to any constraints or restrictions enforced by the operator. Using an edge node allows finer-grain control over the final form of collected data – making it easier to conform to these constraints and simplifying the task of altering the format should the need arise.

- **Flexibility**

As the edge node becomes responsible for aggregating data from the IoT devices, it is no longer necessary for the IoT devices to use - or even be capable of – WiFi or cellular communications to transmit their data. Whilst the former is still an option, an edge node adds feasibility to the prospect of using low-power wide-area networks (LPWANs) such as Sigfox and LoRa. Sufficiently localised devices could use communication protocols such as Bluetooth or Zigbee. Enabling additional options allows businesses to tailor their solution to their own process.

- **Cost Saving**

By and large, any necessary processing performed at the edge saves on the costly compute times offered by the various cloud platforms. In the same vein, storing local archives of data instead of in remote data centres can help reduce costs.

Demonstrators

NPL has been developing IIoT demonstrators for a number of years, notably with increasing

utilisation of edge computing. These demonstrators were developed to show industry how IIoT can be implemented in practical systems and how the data collected can inform decision making. For many of the reasons listed above, using an edge node to handle at least some of the data processing produces demonstrators with greater redundancy measures and improved real-time features.

For example, one of the demonstrators currently in development is a 3D printer (Fig 2) retrofitted with a range of off-the-shelf sensors (Fig 3). Sensors including PRTs, tri-axial accelerometers and integrated environmental sensors are used to monitor ambient conditions and operating parameters of the printer. The data from each sensor is collected by a microcontroller and subsequently sent to an edge node which performs various statistical averages and discrete Fourier transforms (DFTs) of the accelerometer data.

This data is explicitly stored during print-runs of identical 3D artefacts – with ideal dimensional measurement features associated with the CAD drawing of the part. Each is then dimensionally analysed on one of NPL's coordinate measurement machines. Once a sufficient number of parts are analysed, the dimensional data can be compared with that from the retrofitted sensors in an attempt to attribute process variabilities to ambient or operational parameter variations that arose during prints.

Considerations

The potential benefits of using the edge in an IIoT application are hard to argue with, however they are not completely without drawbacks. The first barrier is the requirements placed on process knowledge. There must be some initial understanding of the manufacturing process and subsequently the appropriate handling of the output data. Another issue to consider is the scale of the

Fig 2 3D Printer

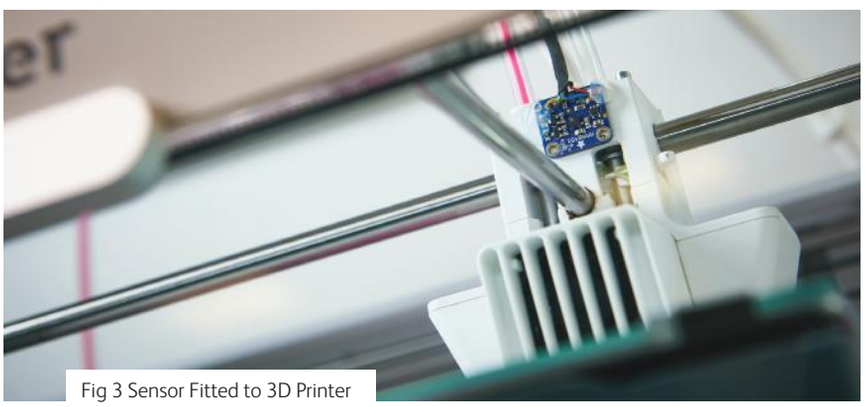

Fig 3 Sensor Fitted to 3D Printer

solution, in combination with the type of data collected. If the edge node needs to process (for example) imaging or machine vision data from multiple sources, the data throughput is likely to be extremely demanding, requiring more expensive hardware and potentially affecting computation times.

The primary consideration to make in this context is the reduced 'distributed-ness' of a solution that routes all data through an edge node. In routing data this way, some of the benefits associated with an IoT device's independence are negated. From a security perspective, a compromised edge node represents a much greater security risk than a single IoT device: instead of access to one device's data and operation, entire data sets are at risk. Similarly, mission-critical operations are more likely to be performed on an edge node than an individual microcontroller.

This is not to suggest that an edge node is a net drawback for the security of an IoT solution. The use of an edge node may allow the associated IoT devices to use networking technologies that are easier to secure. Additionally, the superior hardware of an edge node (in comparison with a microcontroller) may allow for more robust encryption and security protocols to be used.

As such, the security of data should be a chief concern at every stage of the operation: from acquisition to transmission to storage, but especially so if one component of the operation represents a disproportionately large risk. It should be ensured that communications are sufficiently encrypted and ideally should use ISO-standard protocols.

Conclusions

Edge computing is yet another entry in the toolkit of IIoT solutions. With the potential to reduce costs, accelerate process improvement and lay the groundwork for exciting technologies, edge computing is a natural choice for innovative businesses looking to forge ahead. By building on the lessons learned and the good practice outlined by organisations such as NPL, businesses are enabled to implement and experiment with these technologies and extract additional value from their processes and stay abreast of the latest innovations in industry.

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LIGHTS, CAMERA, DATA

BY PRIMARY ENGINEER

Bringing statistics to life is key to engaging with the tech-focussed students of today who will grow to be the engineers (and Institute members!) of tomorrow. One national programme, designed by Primary Engineer innovatively named STATWARS, has its eye set firmly on supporting teachers to gain and maintain student-interest in STEM subjects needs your help to bring its programme to life.

"Everyone loves a good film or binge watching a good box set. This made us think that if we pull together the likes of the BBC, Netflix and Amazon Prime who all use extensive data analysis to create many of their most popular TV series and films, then we can surely engage with the younger generation to demonstrate the power of statistics in a dynamic environment that everyone can relate to?" explains Dr Susan Scurlock MBE, founder of Primary Engineer.

STATWARS was launched last year to much fanfare. It's a new competition that is designed to encourage a generation of young people to engage with data by designing a film or TV series based on … data. The competition's structure encourages pupils to apply mathematics not just creatively, but logically, to collect, analyse and present data, whilst drawing on their own personal experiences of what makes great entertainment. "It's the perfect engagement tool that captures the youngest of children and encourages them to think behind the screen." adds Dr. Scurlock.

The competition requires teams of pupils to produce two posters, one advertising the film or TV series, clearly designed to appeal to its demographic audience, and the other to communicate through infographics, the data used to influence the decisions made. Teams also produce a 60-second film to 'elevator pitch' their idea to the judging panel.

"The competition provides an entry point for young people to become excited about analysing, interrogating and presenting data. It also helps them develop the skills to use data securely in an inspiring subject area that touches everyone's life," says Susan. It does this by delivering meaningful and engaging mathematics, numeracy and data literacy to pupils, by bringing the enchantment of the entertainment industry to their doorstep.

"The competition's structure encourages pupils to apply mathematics not just creatively, but logically, to collect, analyse and present data, whilst drawing on their own personal experiences of what makes great entertainment."

When Ivan McKee MSP, Minister for Trade, Investment and Innovation spoke at the launch of STATWARS earlier in 2019, he said: "The Scottish Government's STEM Strategy highlights the importance of young people being confident in data and digital skills for work and life in the modern world. We want to encourage school pupils to get involved in data and digital at an early age – opportunities like this are fantastic in helping to make this happen."

STATWARS provides free teaching resources including lesson plans, activity sheets and video tutorials that help unlock the value of data. It also encourages organisations and engineers to get involved by designing programmes alongside schools, providing interviews with data professionals and judging entries as well as attending the awards ceremony.

The STATWARS competition structure encourages pupils to apply mathematics not just creatively, but logically, to collect, analyse and present data, whilst drawing on their own personal experiences of what makes great entertainment! The nature of the project therefore encourages teamwork, leadership, curiosity, critical thinking and resilience, as teams are asked to consider indeterminate problems and develop data driven hypothesise. Teachers are provided with whole-class differentiated resources, alongside videos from industry professionals to ensure a real-world, careers driven context is provided for pupils. Teachers can request visits, or internet calls from data professionals to help support the project in school and answer the many questions pupils will have!

The competition requires teams of pupils to produce two posters (each, no larger than A2) one advertising the film or TV series, clearly designed to appeal to its demographic audience, and the other to communicate through infographics, the data used to influence the decisions made. Teams will also be required to produce a 60 second film to 'elevator pitch' their idea to the judging panel. Shortlisted teams will be invited to an awards day to talk through their project with the judges and engage in fun data related activities.

For more information:
www.statwarscompetition.com

1st "EMPRESS 2" Workshop

Enhanced temperature measurement techniques for improved process control 2

Tuesday 5 May 2020

Advanced Forming Research Centre (AFRC), UK
Organised by AFRC and NPL

EMPRESS 2 is a European project with the goal of enhancing process efficiency through improved temperature measurement. This workshop is an excellent opportunity to bring together scientists and engineers from academia, research institutes and industrial establishments to present and discuss both:

- The latest developments in traceable temperature measurement for process control
- End-users' requirements and challenges

WORKSHOP THEMES

Technologies

- Thermocouples
- Phosphor thermometry
- Surface temperature probes
- Combustion and flame thermometry
- Fibre-optic thermometry

Application areas

- Heat treatment
- Casting
- Forming
- Welding
- Forging
- Gas turbines
- Internal combustion engines

WORKSHOP HIGHLIGHTS

- Invited speakers will present reviews of the latest developments and state of the art
- Opportunities to contribute with oral presentations on process control challenges as well as technical solutions
- Networking opportunities

LOCATION AND VENUE

The workshop will be held at
Advanced Forming Research Centre (AFRC)
85 Inchinnan Dr
Inchinnan
Renfrew PA4 9LJ

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EMPRESS 2 TEMPERATURE METROLOGY FOR PROCESS EFFICIENCY
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NPL National Physical Laboratory

Details at: **www.npl.co.uk/events** • Contact: **jonathan.pearce@npl.co.uk**

Q&A

Cevn Vibert

Under the spotlight this issue is Cevn Vibert, Director of Vibert Solutions and Chair of the InstMC Cyber Security SIG.

What was the root of your interest in Engineering?

Family roots on both sides nudged me towards Engineering. My Welsh grandfather worked in the steel and power stations of South Wales. My English/Scottish grandfather was a Cambridge Professor of Geophysics, who showed me mathematics, astronomy, mechanical computing engines, invented games, and built crystal radios with me. From an early age I was excellent at dismantling things, but it took many years before I was competent to rebuild them! Early Lego, Meccano and numerous serious-risk-of-death electrical projects in my bedroom were all part of the coming-of-age Engineer.

An HND in Electrical and Electronic Engineering at Ponty Poly – now University of South Wales – was an ideal education and I excelled at subjects like Control Theory. This led to a sponsored placement with Strachan and Henshaw in Bristol. What an adventure! I worked on huge barge and train tippers, nuclear power fuelling machines and stringer handlers. Now, after decades of creating, managing and reporting on Control Systems in most industries I focus on physical and cyber security using the concepts of people, process and technology.

What is your vision of Engineering in Britain for the next ten years?

Britain has always had a good reputation for Design, Innovation and Collaboration. The globalisation shifts in information and enabling technologies for collaboration, partnering, and data-exploitation must be taken advantage of or risk reputational and commercial side-lining.

A lot is being done by UKGov and UKPLC to be a part of that future. The UK Manufacturing Centre, Innovate UK, The Cyber Security Alliance and new Council are all part of the endeavours to compete. We need to do much more.

“The globalisation shifts in information and enabling technologies for collaboration, partnering, and data-exploitation must be taken advantage of or risk reputational and commercial side-lining.”

> From an early age I was excellent at dismantling things, but it took many years before I was competent to rebuild them! Early Lego, Meccano and numerous serious-risk-of-death electrical projects in my bedroom were all part of the coming-of-age Engineer.

What should the UK government do to address the shortage of UK engineers?

There are UK Engineers. No real shortage. There is a shortage of SQEP Engineers (Suitably Qualified and Experienced Personnel). There are some simple fixes to the lack of experience. Ensure ALL Schools, Colleges and Universities have 110% capacity of experiential vacation work employer placements, and 110% capacity for graduate and post-graduate placements in engineering industry. The current shortage of good places in industry for qualified graduates is shocking and just means these good minds slide into alternative employment, leave the UK, get disillusioned and we lose the Suitably Qualified workforce.

What do you do in your free time to relax?

Walking, chair community groups trying to save spaces from developers and create communities, make some jams, wines, beers, curries and cakes, and travel the world. I love the Nordics, the midnight sun, northern lights, rugged emptiness and lots of sea!

Given one wish what would that be?

I wish I could meet and talk with every person in the World.

100 YEARS OF WOMEN ENGINEERS

A list of 100 influential women engineers from history was recently compiled as part of a project to celebrate the achievements of women in engineering over the past 100 years.

Exactly a century ago, in 1919, an organisation called the Women's Engineering Society was formed to inspire, support and encourage women to become engineers, technicians, electricians, motor mechanics, pilots and construction workers. A hundred years later the many women who excelled, often against the odds, in these professions are being celebrated through the Women in Engineering campaign. A judging panel made up of Dawn Bonfield, Nina Baker, Henrietta Heald, Anne Locker, Gordon Masterton and Will Whittow, compiled the list after a period of initial public nomination. The criteria for inclusion was that the women should have been influential in the UK in all engineering fields, lived some time between 1919 and 2019, and be deceased.

The list includes founders of the Women's Engineering Society such as Rachel Parsons and Laura Annie Willson MBE, and its first secretary, Caroline Haslett DBE, as well as presidents of the society, including the pilot and engineer Amy Johnson and the founder of the Electrical Association for Women, Mabel Matthews. It includes well-known women from the Second World War period such as Tilly Shilling, who developed the valve that prevented Merlin engines from stalling when diving; and Hilda Lyon, who developed the 'Lyon Shape' used for the airship R101.

In the words of judge Nina Baker, who was part of the recent heritage project to erect a blue plaque to commemorate the life of Hilda Lyon in Market Weighton, "It would be lovely if local heritage groups could pick up some of these women and celebrate their lives through the Heritage Blue Plaque scheme in the same way as Hilda Lyon and Laura Annie Willson have been commemorated during the past year".

The list also includes groups of women, including the unnamed construction workers who rebuilt Waterloo Bridge during the Second World War, also known as the Ladies Bridge, which opened in 1945, and the women of Bletchley Park whose stories have only recently come to light.

Among more recent examples are Baroness Platt of Writtle, who has been a champion of Women in Science and Engineering, and whose work contributed to the establishment of the WISE campaign in 1982; and Elizabeth Killick, the first female fellow of the Royal Academy of Engineering, who died in August 2019.

The list also coincides with the publication of a book charting the early years of the Women's Engineering Society. "Magnificent Women and their Revolutionary Machines" by Henrietta Heald, tells the stories of these pioneering

The list also includes groups of women, including the unnamed construction workers who rebuilt Waterloo Bridge during the Second World War, also known as the Ladies Bridge.

women and their influence on the engineering landscape during a discouraging time for women in this male-dominated profession, when – in spite of their tremendous work in munitions factories during the First World War – a successful attempt was made to outlaw the employment of female engineers.

Prominent physicist Jess Wade describes 'Magnificent Women' as a "remarkable tribute to the pioneers who paved the way for modern Britain", serving as a reminder of "how far women have come, and a source of inspiration for how far we still need to go".

According to Dawn Bonfield, chair of the panel that chose the 100 Women, and Past President of the Women's Engineering Society: "It has been inspiring to learn more about these magnificent women who were pioneers in their field and had to contend with not only a legal system which prevented their participation, but an engineering profession which made it very difficult for women to succeed in the workplace. Despite these hostile conditions, many women did thrive, and that makes their stories even more compelling. Thankfully our profession has changed enormously in the past 100 years, and we can celebrate our progress through learning more about the achievements of our predecessors".

The stories of women from our science and engineering history are slowly emerging and being added to Wikipedia and other websites such as 'Magnificent Women' (www.magnificentwomen.co.uk), in an attempt to reclaim our engineering heritage, and use these inspiring stories to encourage future generations, where the percentage of women in engineering is still only 12%. The majority of these women on the list now have an online presence, but there is still more work to be done.

It has been inspiring to learn more about these magnificent women who were pioneers in their field and had to contend with not only a legal system which prevented their participation, but an engineering profession which made it very difficult for women to succeed in the workplace.

Milestones for Women in Engineering taken from the book '*Magnificent Women and their Revolutionary Machines*' by Henrietta Heald

1898 **Hertha Ayrton** becomes the first female member of the Institution of Electrical Engineers. In 1904 she is the first woman to read a paper on her work at the Royal Society. In 1906 she receives the Hughes Medal of the Royal Society – another first.

1910 The Anglo-Irish journalist and pioneer aviator **Lilian Bland** is the first woman in the world to design, build and fly an aircraft – the Bland Mayfly.

1917 **Eily Keary** is the first woman to be elected a Fellow of the Royal Aeronautical Society. She is researching aeronautics at the William Froude National Tank at the National Physical Laboratory, Teddington, Middlesex, where she stays for 14 years.

1919 The Women's Engineering Society is founded by **Katharine and Rachel Parsons** and several others, with **Caroline Haslett** as secretary.

1921 **Margaret Partridge** sets up her electric power supply company, M. Partridge and Co., Domestic Engineers, offering to install electrical power in rural homes in southwest England.

1924 **Verena Holmes** becomes the first female associate member of the Institution of Mechanical Engineers and of the Institution of Marine Engineers, having worked for the New London Ship and Engine Co.

1926 **Dorothy Rowntree** is first woman to qualify as a naval architect, gaining her BSc Engineering Naval Architecture from the University of Glasgow and worked with her father, who was a Lloyds' ship surveyor.

1930 **Amy Johnson**, the first woman to qualify as a ground engineer, makes the first solo flight by a woman from England to Australia.

1940 Air Transport Auxiliary (ATA) is formed by members of the Women's Engineering Society, including **Pauline Gower** who becomes its commandant. During the Second World War it employs 166 female pilots.

1941 **Netta Harvey** becomes one of only four women to be trained as shipyard electricians on Clydeside. She wires ships under construction at Harland and Wolff and later at John Brown & Co.

1945 Completion of Waterloo Bridge in London – known as the Ladies' Bridge because it was largely built by women.

1947 **Helen Maurice**, electrical engineer, with the rank of lieutenant-colonel, is part of a British intelligence mission to Germany to inspect certain specialised industries. From 1951 to 1979 she is managing director of Wolf Safety Lamp Co.

1951 **Lesley Scott Souter**, electrical engineer, becomes team leader at General Electric Co., working on properties of germanium for radar and TV. She was the first woman to receive a BSc in Engineering at Glasgow University, in 1940.

1957 **Molly Fergusson** is the first female Fellow of the Institution of Civil Engineers. In 1948 she was appointed Britain's first female senior partner in a civil engineering firm, Blyth & Blyth.

1983 **Barbara Sabey** is awarded the Imperial Service Order for her contribution to road safety during a 40-year career at the Transport and Road Research Laboratory, where she was recruited as a young physics graduate in the 1940s.

1984 **Baroness Beryl Platt** established WISE – Women into Science and Engineering - whilst at the Equal Opportunities Commission to highlight the career opportunities for girls and women in science and engineering professions.

2019 Women's Engineering Society celebrates its centenary

For the full list of the Top 100 Women in Engineering, visit the Magnificent Women website.

https://www.magnificentwomen.co.uk/top-100-women.html

ASK THE EXPERTS

Are Asimov's Three Laws of Robotics enough?

David Green, Certified Machinery Safety Expert, TÜV Nord

Risk Assessment:

It's over 75 years since Isaac Asimov formulated his three laws of robotics but, in today's busy automated factory, maybe we need more specific safeguarding for robots. I've seen a few videos on LinkedIn where robots have hit the fence-line, so shouldn't they be far enough away that they can never hit the fences/ guards? Organisations are required to ensure that there are adequate controls in place that prevents this impact with guarding to occur.

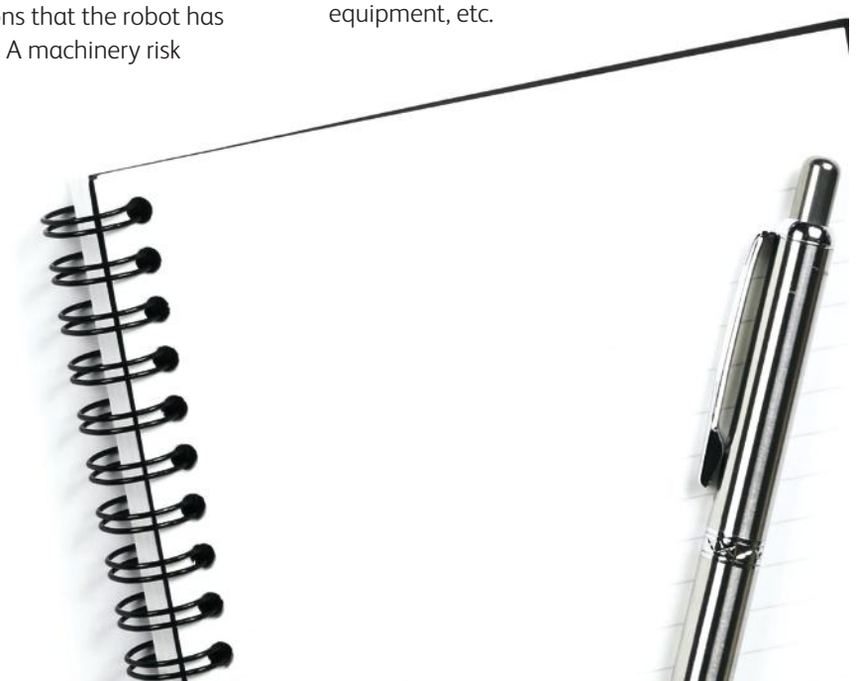
The integration of robots into cells is covered by the international standard ISO 10218-2[i]. This standard requires an evaluation of the integrated cell looking at above other things the space limitations that the robot has to work within. A machinery risk assessment should be conducted to the ISO 12100 standard[ii].

The integration standard (clause 4.5) defines the priority of eliminating the risks:

a) the elimination of hazards by design or the reduction of their risk by substitution;

b) safeguarding to prevent operators coming into contact with hazards or to ensure the hazards are brought to a safe state before the operator can come into contact with them;

c) the provision of supplementary protective measures such as information for use, training, signs, personal protective equipment, etc.



Do you have a question for the our experts? Please send them to publications@instmc.org

The placing of the guarding outside of the robot's maximum reach would be a way of achieving the safeguarding.

This cannot be achieved for all installations due to a number of reasons:

- Integration with other machine parts or systems
- Interaction with personnel in collaborative robot areas
- Floor space availability in the factory.

How have robot suppliers tried to address this issue? Robot suppliers have been working hard to resolve the issues and evolve the technology to support the elimination of hazards and safeguarding to prevent harm to the personnel in the area of the robots.

The limitation of the movement of the robot needs to take account of the use to which the robot will be put and the tasks required of it. If the robot has very limited movement requirements then the robot can be fitted with 'hard stops' which physically stop any further movement in the axis limited.

There are many manufacturers who now integrate safety software within their robot controllers. The setting of the software with allowable zone definitions for the exact movement areas for the robot. These settings are three dimensional, usually, as the robots have x, y and z movement abilities. There are many alternative solutions provided by different robot suppliers.

The safety software usually provides rules and settings for the extremities of the robot movement (all parts) and extremities of the tool locations. This must be set-up for each installation and commissioned and tested with the integration activities.

So, with this software I won't need any further protection. Correct? Unfortunately, the fact that the software is within the control system means that there is usually still a requirement to supplement the protection for personnel with other systems. The machinery risk assessment conducted should include malfunction of the robot leading to impact with personnel. This is heightened when robots work in collaborative spaces with personnel (operator loading parts for the robot to weld for example).

It is likely that secondary protection is required designed and installed in line with the requirements of IEC 60204[iii], ISO 13849[iv] and ISO 13850[v]. These protection circuits are normally hardwired to limit the robot movement to a maximum speed (in teaching mode on a pendant) or to stop movement of the robot if the detection sensor (gate interlock, area scanner, light curtain, emergency stop device etc) is activated.

Conclusion

There is no one simple answer, this is a scenario in which adequate risk assessments and designs are required. In the European Union these requirements and commissioning of the systems are part of the requirements to be assessed and controlled under the Machinery Directive for providing the whole machine with a Declaration of Conformity (CE mark).

EUR ING **David Green** BEng(Hons) CEng MIET FInstMC RFSE CMSE®

FS Expert (TÜV Rheinland, # 277/17, S I S), CMSE® - Certified Machinery Safety Expert (TÜV Nord)

Associate Director – Warrington, ESC Ltd (www.esc.uk.net)

InstMC Local Section Chair – Central North West

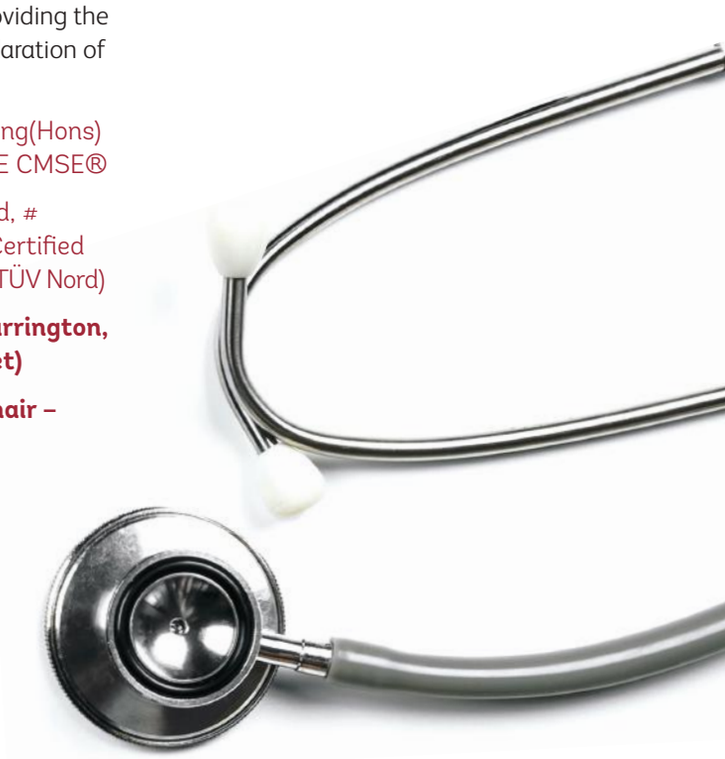
[i] ISO 10218-2 (Robots and robotic devices — Safety requirements for industrial robots Part 2: Robot systems and integration)

[ii] Safety of machinery — General principles for design — Risk assessment and risk reduction

[iii] IEC 60204 Safety of machinery - Electrical equipment of machines

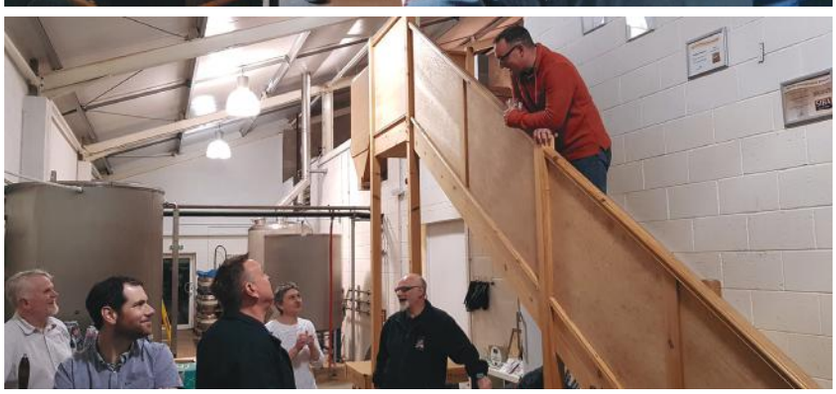
[iv] ISO 13849 Safety of machinery — Safety-related parts of control systems

[v] ISO 13850 Safety of machinery — Emergency stop function — Principles for design



LOCAL SECTION NEWS

Events within the Teesside Local Section include visits to the Tees Cottage Pumping Station and the North Lincs Brewery, as well as the Reunion Dinner and 2019 Instrument, Control & Electrical Exhibition.



NORTH OF SCOTLAND

TRANSFORMING CONTROLS, SAFETY AND SECURITY – HOW SAFE IS YOUR ASSET?

The InstMC North of Scotland Section hosted their first section conference in collaboration with SPE (Society of Petroleum Engineers), Aberdeen at Aker Solutions on 30th October. The conference was titled "Transforming Controls, Safety and Security – How Safe is your Asset?". SPE Aberdeen run conferences once a month in and around Aberdeen's energy sector with their Mearns & Gill events team on a variety of topics. To view their full event programme, visit their website at https://www.spe-aberdeen.org/event-category/spe.

The event focused on functional safety and cyber security and, specifically, how these two topics influence each other. Cyber security dominated the day, as it is still an unknown quantity for many in the offshore energy industry, mostly down to a lack of sharing information when attacks do happen. Interesting concepts were floated, such as changing the language around cyber security in order to change perception and improving funding for cyber protection methods within organisations – how much better funded would you be if it was called cyber safety rather than cyber security? There is no doubt that cyber-attack holds potential to transform from an issue of security to an issue of safety should a process system become sufficiently compromised to go kinetic.

In the North of Scotland, we wanted to do something different from the norm for our first conference, providing actionable strategies which can be utilised on return to the office. A key component of this were our afternoon workshops. The conference broke out in to three areas and delegates could choose to attend two of the three following workshops which ran back to back;

- The Business Case for Cyber - Vibert Solutions
- Functional Safety Insights - ABB
- Emergency Response to Cyber Attack – Schneider

We also welcomed Kevin T from the Network Cyber Security Council, part of GCHQ, to give guidance on the cross-industry approach being adopted by the government. This is the first time that all three industry sectors using the Network and Information Systems regulations can be compared for cyber preparedness. The UK wants to become the safest cyber nation in which to do business and these regulations go a long way to ensuring we minimise the risks of cyber-attack across the whole industry.

No doubt there is work to be done to continue to adapt and understand the cyber threat to our industry, but through events that promote the sharing of knowledge and ideas, such as this conference, we can continue to build on our already robust processes. Existing procedures such as emergency response planning and adoption of established technical standards such as IEC 61511 and IEC 61508 can be further adapted to protect against this growing and evolving threat.

Duncan Hutton, Neptune Energy, leading the panel of speakers.


Tim Harwood, CEO Sike Cyber, addressing attendees.

by Megan Hine, Draeger Safety UK

The School of Mathematics, Computer Science and Engineering presents

National Symposium: The Need for System Integration Capability

Wednesday 8th January 2020, 9am

ELG15, City, University of London, EC1V 0HB

Event Agenda

9:00	Registration
9:30	Introduction and Opening Remarks
10:00	Session one: Gaps in current position and the need for change Dr Claudia Eckert, The Open University Dr Benjamin W. Watson, 3M Prof Jennifer Whyte, Imperial College
10:45	Refreshment Break
11:00	Discussion & Debate
12:30	Lunch
13:30	Session Two: The Way Forward – New teaching and initial training proposals Prof Peter Childs, Imperial College Dr Stuart Burge, Burge Hughes Walsh Limited
14:00	Discussion & Debate
15:30	Conclusions – Proposals for change
16:00	Close of event

Introduction

You are warmly invited to attend the National Symposium 'The Need for System Integration Capability' organised by the School of Mathematics, Computer Science and Engineering at City, University of London and the Institution of Engineering Designers.

The objectives of this seminar is to explore the current situation within the UK in the education and industrial experiences of Engineers, Product Designers and Computer Scientists in taking a systems approach to disciplinary integration. We wish to identify potential shortfalls and examine potential changes required in curricula and initial training to meet higher demands for system integration.

Register and find out more at:
http://bit.ly/CitySystemIntegration

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SPOTLIGHT ON STAFF:

Q&A with InstMC Staff Member Arthur Armitstead, Accreditation & CPD Officer

How long have you been with InstMC?
I've been here about eight months now, having started back in March.

What is your background?
I have a BA in Philosophy and have spent most of my professional life to date working in education. All quite a far cry from the world of Control Engineering!

What is your role at InstMC?
I'm responsible for organising academic accreditation, training approval and CPD. I've also recently taken on some responsibility for processing new members' applications. We've yet to devise a neat job title…

Can you describe a typical day in the office?
I usually get in at about 9:00-9:30, I read my emails and look through any new applications we've received. I then look at my list of tasks and decide which take priority. As my role is quite multi-faceted, these can include anything from updating databases, writing member communications and studying various policies to ensure I can provide accurate information to members or other organisations. No two days are the same.

What do you bring to the team?
I'm a good writer and communicator, which is especially important for more formal correspondence. I'm also quite an analytical thinker, having studied Philosophy.

What do you like best about working for InstMC?
The small staff size means I am allowed a lot of autonomy in choosing how to organise my work. It also means work remains varied.

What do you do to unwind, once your working day is over?
I'm a keen Liverpool supporter and enjoy keeping active by running and climbing. I'm also a cinephile.

Can you tell us a fun fact about yourself?
I'm a fluent Spanish speaker, having spent several years living in Spain.

> I'm responsible for organising academic accreditation, training approval and CPD.

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Inst MC

www.instmc.org

For further details and application forms please visit our website or contact the Dirtector of Membership & Registration on +44 (0) 20 73878 4949 Ext 3 or email: membership@instmc.org

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Aberdeen: **Weekends: 8-9 + 15-16 February** *(run over two weekends)*
2-5 March
1-4 June
7-10 September
Weekends: 7-8 + 14-15 November *(run over two weekends)*
7-10 December

Paris: **8-11 June** ***&*** **16-19 November**

FS Engineer PH&RA:

Aberdeen: **18-22 May** ***&*** **30 November - 4 December**

Manchester: 5-9 October

FS Technician:

Aberdeen: **23-26 March** ***&*** **5-8 October**

Introduction to Functional Safety:

(The ideal 1 day workshop for any staff/managers or to prepare for the FS Engineer course)

Aberdeen: **27 March** ***&*** **9 October**

C & C Technical Support Services is an accepted course provider of the TÜV Rheinland Functional Safety Training Program.

We also run in-house training on request.
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