

# RAF FIGHTER AIRCRAFT INSTRUMENTATION SERVICING: BATTLE OF BRITAIN



DIGITAL TRANSFORMATION –  
THE FUTURE'S NOT  
WHAT IT USED TO BE

LAB-GROWN MEAT AND THE  
FUTURE OF FOOD

A BUILDING MANAGEMENT  
SYSTEM FOR KURDISTAN

AT CFM WE TRUST IN  
MEASUREMENT &  
METROLOGY

SEPT 2020 \_ ISSUE SEVENTEEN

# PRECISION



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[www.instmc.org](http://www.instmc.org)



## INSTMC WELCOMES NEW HONORARY TREASURER IAN CRAIG

I was encouraged to join the Institute as a student at Teesside Polytechnic by Harry Orr, one of our lecturers. It was not until I started work that I discovered what a key member of the InstMC Harry was in many areas.

When I began working in London, in the Oil and Gas contracting world, the London Section monthly lectures seemed to be the place to go to keep up with developments, not to mention networking and associated social events. I was drawn into the London Section committee in the early to mid-nineties - always enjoyable but continually challenging. I ended up becoming Treasurer of the section for 11 years and saw the efforts of the committee pull us from break-even to a healthy bank balance, as well as being able to help Gower Street (as we referred to Head Office) redecorate, upgrade IT etc over the years. I then had the honour of being London Section Chairman for six years, putting a lot of effort into spending the bank balance that had built up when I was Treasurer.

In the last two issues of Precision, Martin Belshaw and Billy Milligan have outlined the strategy going forward and some of the exciting opportunities for the Institute so I shall focus on the financial status and future.

Following the financial issues that led to the sale of Gower street in 2019,

the Trustees, guided by our previous Hon.Treasurer Colin Howard, set up an Investment Advisory Group (IAG). The overriding strategy of the group was to change the status of the Institute from an Asset Rich/Cash Poor Organisation to an Asset Sustainable/Cash Generative set-up.

Following the guiding principles of the Charities Commission for Charities Funds Investment the IAG proposed an investment strategy going forward for the Trustees to approve, as they have the legal requirement to make or approve

investment decisions. When it came to selecting where to invest the bulk of the money from Gower Street, the IAG shortlisted various possibilities and laid out the investment criteria that would have to be followed.

We are now in a position, approved by the Trustees and Council, that the money has been invested with a reputable company with experience of working with charities, and is regularly monitored by the IAG on behalf of the Trustees, putting the Institute in a good position for the challenges ahead and expansion into the fast developing digitisation of industry.





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Our resident expert, Trevor Thompson from bestmeasurement.com, is here to answer your questions on measurement, traceability and laboratory accreditation. If you have a question for Trevor, please email him at [questions@bestmeasurement.com](mailto:questions@bestmeasurement.com) and we will publish the answer in a future issue.

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## DIGITAL TRANSFORMATION – THE FUTURE'S NOT WHAT IT USED TO BE

At the end of 2018, I wrote an article about the formation of the Digital Transformation Special Interest Group (SIG). The group now has 133 members, with a very active core group, which has now met six times.



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## PRECISION

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# RAF FIGHTER AIRCRAFT INSTRUMENT SERVICING: BATTLE OF BRITAIN

BY PETER NORMAN, IENG, MINSTMC, MIET



The Battle of Britain, which began on 10<sup>th</sup> July 1940 and lasted many months, will see its annual commemoration on 15<sup>th</sup> September 2020, marking 80 years.

The event will inevitably celebrate the two most famous RAF fighter aircraft: the Hawker Hurricane I and Supermarine Spitfire Mk.I along with the valiant effort and bravery of the young airmen who flew them up into the aerial dog-fight in the skies above southern England and sacrificed their lives as a result.

This is a great opportunity to focus on the sterling work and performance of the RAF maintenance ground crews within this modern-day Institute of Measurement and Control publication. An historical focus can be appropriate if we recognise the RAF's core values of 'efficiency second-to-none' which should 'remain unimpaired' by any lack of alert minds for the job.

Imperial War Museum RAF videos show that the fighter ground crews typically worked as six-man teams, simultaneously following the Air Ministry's detailed, 24-hour routine maintenance schedule specific to the aircraft type. In the case of the iconic Spitfire, the combined work procedure took about an hour to complete by this team working around the aircraft in an anti-clockwise direction.

Bearing in mind that these fighter aircraft had relatively simple flight

control systems which were multi-disciplined, the six-man ground crew consisted of: Flight Rigger, Flight Mechanic, Wireless Operator, Electrician, Instrument Repairer, and Armourer.

Thinking mainly of the aircraft's cockpit Instrumentation, this was actually jointly covered by the Flight Mechanic, the Electrician, the Armourer and not wholly by the Instrument Repairer.

When we consider modern-day focus on health and safety to prevent accidents, we might be surprised that the initial step in servicing a landing aircraft was to refuel it straightaway in the open air. This was partly to avoid build-up of condensation inside the fuel tank which otherwise might lead to a serious accident due to water in the petrol. Aircraft were never refuelled inside a hangar due to potential fire risk. A technical point here is that the RAF had converted all Hurricane

and Spitfire squadrons to using US-produced 100 octane fuel during the early part of 1940. This was mainly to improve Merlin engine performance for shorter take-off distances and better acceleration but the higher octane would have also required higher spark energy to ignite than lower octane fuels. It still made perfect sense, of course, to carry out refuelling, from the small bowser vehicle, in the well-ventilated, oxygen-rich, open-air environment!



Once pushed inside the hangar for the regular maintenance routine it was the Flight Mechanic who would check that the instrument panel fuel gauges were indicating full tanks. In addition to all his mechanical checks on the engine pumps and fluid levels, he would clear the vent system and radiator, check for any oil or fluid leaks and confirm the propeller blades and spinner condition and operation.

The **Wireless Operator** would naturally check the fuselage-mounted RT unit and its 12v accumulator plus the mechanical security and wiring plus connections condition and security. He would then inspect the antenna cable, mast and insulators and the in-cockpit RT control switches.



The **Electrician** naturally had the tasks of checking the engine-mounted electrical components and the main 12v accumulator. He also checked the illuminated gun-sight lamps and tested other cockpit illumination and indicator

lamps; navigation lights and landing lights; recognition beacon lamp; fuel gauges and ammeter. The electrician would conduct insulation tests and check the audible undercarriage warning. An important instrument function the electrician tested was the under-wing-mounted, pitot airflow head heater. This was intended to prevent ice forming in the pitot tube at high altitude which would cause the air speed indicator on the cockpit panel to read untrue for the pilot. Aircraft of the day were developing more electrical features which added to the tasks of the electricians.

The **Armourer's** job was to check the illuminated gun-sight function in addition to maintaining the guns and reloading the spent ammunition magazines. The important safety task before starting this maintenance was to ensure that the firing button on the stick column was locked safe and then if any unspent bullets were found in a magazine, to ensure the gun breech was emptied before replenishing fully with new ammunition. The armourer was also responsible for loading the coloured very-recognition flare cartridges before later marks were fitted with recognition bubble lamps on the top of the fuselage.

All battery (accumulator) checks would include searches for evidence of leaking battery acid which could cause corrosion to the metal airframe. This was an important aspect for vigilance in addition to other signs of structural cracking or physical deformity which may have occurred.

The **Instrument Repairer** would check and adjust the following analogue instruments:

- the zero setting of the rate-of-climb indicator to adjust with a small screwdriver
- the subsidiary pressure scale of the altimeter to read the correct height above sea level of the hosting air field
- the security of the blind flying instrument panel and its anti-vibration device springs
- the pilot's oxygen system hose

- and bayonet connector condition
- the oxygen cylinder contents by viewing the panel-mounted pressure gauge
- the setting of the panel clock to read the correct time of day

The **Fight Rigger** took the responsibilities for the following mechanical aspects:

- the undercarriage and its steel control cables
- the hydraulic system oil
- wheel brakes, tyre pressures and condition
- the cockpit and air pressure
- ailerons, wing flaps, elevator, rudder and landing flaps
- fuselage and tail plane condition
- safety harness security and condition
- windscreen and canopy condition and operation
- oil cooler security and ensuring the air intake was not blocked

Each technician would then be required to sign the aircraft's maintenance form upon completion of his tasks in order to maintain the record log. The final signature on the record form would come from the pilot himself.

The aircraft was then pushed back outside for the engine run-up using an electrical starter trolley with high-capacity accumulators to first enable the Flight Mechanic to check the correct function of all in-cockpit gauges prior to the pilot taking charge for take-off.

Between-flight checks for aircraft turnarounds were also made but these were not required to be recorded on the daily maintenance form. Refuelling and re-arming would be the priority concerns.

Looking back, we can only be impressed by the teamwork and detailed record-keeping procedures of those war-time mechanics. Even though the aircraft were being sent into a battle zone, the priority of the ground crew was always maximising pilot safety by ensuring that all their systems were working correctly and reliably.



# A BUILDING MANAGEMENT SYSTEM FOR KURDISTAN

BY SAMAR RASSAM,  
DIRECTOR AT SOMER  
INDUSTRIAL PROJECTS



In the engineering world we often hear the terms Building Management System (BMS), Building Automation System (BAS), or Building Management Control System (BMCS). All these terms are equivalent, and perform the same function to monitor, control and automate the building's mechanical and electrical equipment functions for ventilation, lighting, power supply systems, fire-prevention systems and security systems. In addition to their engineering skills, any reputable company needs a project management team in order to build good working relationships with existing or new customers

and to maintain quality business communications with them.

## Project Management Team (UK Based)

Here, at Somer Industrial Projects (SIP), we were asked to get involved with a project for Northern Iraq's Kurdistan Regional Governate (KRG). We have great experience of working with EWA Controls Ltd., of Isleworth, in West London, who specialise in the field of Building Automation with a track record of over 30 years. They became our working partners for the project management and we travelled to Erbil in Iraq to meet the client and the main, local contractor for the kick-off meeting.

## BMS Project Scope, Site Location and Arrangements

The project scope was to provide a Building Management System (BMS) to control and monitor the Heating, Ventilation and Air Conditioning (HVAC) plant which serves the offices and also the critical electrical switchgear room for the facility.

The facility is based in Dhahuk which, being a highly sensitive one, demanded a great deal of thought and consideration for the whole process which was discussed at length during

several meetings over several months.

The SIP team, headed by myself, continued assisting EWA Controls in order to maintain a relationship of trust with the client. This partnership was then able to not only supply the BMS; but, also to deliver the project in an energy-efficient manner. With personnel training being part of the scope, we provided the local technicians with ease of access to both obtain historical data and to make adjustments for viewing the status of all the equipment within a matter of seconds.

We had previously worked closely with a local Mechanical & Electrical contractor, and this was part of the success of the BMS project. We were able to cover any changes quickly so that no delays occurred; but, more importantly, the local presence in Iraq was always there to assist the client, on demand.

The levels of electrical and mechanical skills in Iraq are extremely high and this progressively assisted us to grow and improve our engineering service provision. Engaging with our local team was a highlight of the project, knowing that many more projects are waiting to be carried out and that we have a good team with us.

## Engineering Scope and Strategy

The project's design scope needed to incorporate acceptable and suitable logistics, site installation, systems operation and ease of end-user facility management and maintenance for the duration of the equipment's operational life-cycle. In our UK facility, the team put together the work plan for the manufacture of the control panels; their testing and the software generation plus graphical interface software. All this was done before the equipment was exported from the UK. EWA Controls provided control panels made specifically for the project requirements.

We carried out the system design in the UK, with our team of highly experienced engineers, ensuring that all project safety aspects were covered and that the system itself was designed and built to be fail-safe. The work was based upon a philosophy of keeping all control methods simple so that others may be able to interpret and understand the design. The benefits of this are ease of commissioning and maintenance fault-finding in the future.

The combined UK engineering services included complete support on all controls: from the very basic controls to the sophisticated, intelligent web-based systems by continuing to work closely with the client and having follow-up meetings as the information was changed occasionally; or, shall we say, on a regular basis. With teamwork, however, we managed to achieve the end results in compliance with health and safety procedures and working methods documentation plus regular risk-assessment reviews.

Handling all the equipment export logistics from the UK was managed using a West London shipping company providing truck transport all the way to Iraq.

## Instrumentation and Control Equipment Supply

Within the scope of our project was the provision of all the field

monitoring devices such as temperature and relative humidity sensors, which were all provided by E.C. Products Ltd., our in-house company based in Hounslow, West London, who are a main supplier for BMS parts. Consequently, with the majority of the equipment being made in the UK, we were confident that these products could withstand the harsh Iraqi summers with temperatures reaching more than 50°C, plus sandstorms, along with the industrially harsh operating environment of an oil facility. The client requested that we also supply the necessary 12km of cable for the BMS project, taking care of the associated documentation and procurement provision.

## Control System Equipment Panels

All the control panels were IP-rated



to protect against moisture and dust ingress and they incorporated the best quality electrical switchgear.

Our systems are able to be connected via many different mobile devices including electronic tablets and computers. This allows us to upgrade and remotely check the system from the UK. The control system that was installed and site-commissioned was supplied by a known global player in the BMS and monitoring sector.

## Future Work

Now that this BMS has been operating for over two years, periodic servicing will ensure many years of functionality. We have a stock of spares for the project in the event of any replacements that are required urgently, so there should be no long delays in service replacement support.





## Digitalisation of Process Control

Delivering more data with cyber security in mind



VIRTUAL CONFERENCE

11-12 November 2020

PLATINUM SPONSOR



**Digitalisation seems to be the new industry buzzword, but what does it actually mean for the process industry?** A need to reduce costs drives our desire for increased efficiency and a new generation of digital technology claims to make this possible. Do the rewards of digitalisation outweigh both the risks and the expenditure? Digitalisation isn't just about introducing new technology, it often means that systems can be rendered more vulnerable, processes have to be updated, work forces have to be trained, systems have to be successfully integrated and the data captured has to be processed.

The second annual conference, jointly organised by InstMC and SPE Aberdeen, will run virtually on 11th-12th November.

**For more information on the programme and timings, visit [www.spe-aberdeen.org/events](http://www.spe-aberdeen.org/events); email [aberdeen.events@spe-uk.org](mailto:aberdeen.events@spe-uk.org) or call 01224 646311.**

## SPE ABERDEEN & INSTMC ANNUAL CONFERENCE MOVES ONLINE

# DIGITALISATION OF PROCESS CONTROL DELIVERING MORE DATA WITH CYBER SECURITY IN MIND

The InstMC North of Scotland section will hold their second annual conference on 11th and 12th November 2020.

Titled 'Digitalisation of Process Control | Delivering more data with cyber security in mind' it aims to bring a rounded view of both the benefits and challenges of implementing digitalisation to existing brownfield sites. The aim of the conference is to delve beneath the buzzword of 'digitalisation' with subject matter experts and organisations who have experienced these challenges first-hand.

The conference will bring key industry insights from newly released research into the adoption of digitalisation in the energy industry, as well as live demos and workshops. The conference will strike a balance between a move towards digitalisation to achieve efficiencies and the ever-present threat of cyber security. We cannot overlook the impact of the workforce on adoption

of digital technologies and resistance to cyber-attack. The human factors which influence the integrity of our businesses will underpin many of the topics discussed, giving an event which focuses on the holistic approach required for effective digital transformation.

The conference will be held online to account for the current challenges around social distancing, however we hope that this will attract a wider geographic audience. It will host speakers from four global operators including an opening keynote speech from Shell and a case study from Neptune Energy on adoption of the Network Information Security Directive.

Please visit <https://www.spe-aberdeen.org/events/spe-aberdeen-instmc-digitalisation-of-process-control/> to be kept up to date with the full conference programme announcements and how to purchase tickets.

**Megan Hine,**  
Conference Chair



ORGANISERS



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# INTRODUCTION TO INSTMC SIGS

InstMC Special Interest Groups provide an opportunity for like-minded engineers to network, share ideas and expertise, collaborate and learn, and keep updated on industry news and developments.

Our SIGs cover technical topics within the measurement and control fields and are driven by groups of volunteers who work, or have expertise, within the topic area. SIGs promote the sharing and advancement of knowledge through a range of activities including white papers, briefing notes, conferences, seminars and exhibitions.

Members can join any SIG through the members only area of the InstMC website. If you are interested in finding out more about a particular Special Interest Group visit <https://www.instmc.org/Special-Interest-Groups> or email the following relevant contact.

**Cyber Security** Cevn Vibert  
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Maurice.Wilkins@instmc.org



# FOCUS ON A SIG: STANDARDS



“What’s the best way of doing this?” That one question is the foundation of the first developed standard.

The early 19th century saw the first standardised screw thread sizes by Henry Maudslay and we all know how the standards world has evolved and harmonized requirements nationally and internationally since.

We read in the last edition of Precision how standards play a critical role in all measurements. The impact goes beyond process industries and ranges from shoe size to the medical device industry, giving confidence to the end-users.

Reflecting on my own personal and professional life, I can share a range of examples where I have been using standards, often without knowing e.g. my organisational-technical document templates are based on BS ISO/IEC/IEEE 15289:2019. More recently, our national standards body BSI has made available free standards which offer information and practical advice for businesses and individuals, to help organisations navigate the challenges and potential risks associated with the current global crisis. Similarly, BSI standards are referred to while specifying automotive testing conditions, guidelines for PPE, body armour for bikers and the list goes on, and one may ask “Who makes these standards?”

**A standard is a collective work. Representatives of organisations having an interest and expertise**

**in the subject matter are brought together by BSI to form a technical committee to draw up the standard. Typically, our technical committees comprise representatives of industry bodies, research and testing organisations, local and central government, consumers and standards users.**

UK National Standards Body BSI

It is imperative to have the voices of the above groups to create a relevant and usable standard. One of the BSI’s technical committees is GEL/65 which, along with its sub-committees, helps to create and maintain standards for systems and elements used for the industrial process measurement and control. InstMC members, as expected, play a vital role along with members of other institutes, organisations, manufacturer’s associations and universities.

GEL/65 and its sub-committees mirror the structure of the international technical committee IEC TC65. Committee members are eligible to vote/comment on standards and represent at various working groups within IEC. One of the sub-committees, GEL/65/2, is responsible for preparing standards for measurement devices including thermocouples, RTDs, pressure, flow, level sensors, recorders, analysing equipment, actuators, the PLCs and covering aspects such as performance evaluation, interchangeability and functionality definition. Other GEL/65 sub-committees focus on vital topics including industrial automation and networks, HMI, functional safety, operational conditions (including EMC), cybersecurity and the IoT. It is most likely that the standards we use within the measurement and

control field have been reviewed by the GEL/65 committee. Due to the growing importance of smart manufacturing and associated technologies, GEL/65 has recently taken over responsibility for SyCSM (Smart Manufacturing Systems Committee).

With over 150 members, InstMC’s Standards SIG brings together:

- **existing members** representing InstMC on BSI committees and external bodies within the areas of measurement and control, smart manufacturing and IoT
- **interested members** who wish to take part in the discussions on the standards environment or in standards-making

Our goal is to share knowledge and help develop standards by bringing together people with diverse backgrounds and experiences.

To keep up with the fast-evolving technology, the SIG welcomes new and existing members from end-users, manufacturers and researchers groups to bring fresh ideas from their knowledge and experience. As a member of BSI’s Young Professional Advisory Panel, I urge our young professionals to take part in standards-making to guide and steer the direction of international standardisation.

If you would like to participate in SIG-Standards or GEL/65 (UK representation only), please contact Navdeep Mehay ([navdeep.mehay@instmc.org](mailto:navdeep.mehay@instmc.org)) or Dr Maurice Wilkins ([maurice.wilkins@instmc.org](mailto:maurice.wilkins@instmc.org)) Chair, SIG Standards and GEL/65.

**Navdeep Mehay CEng**  
Member – SIG-Standards, BSI GEL/65/2 and BSI YPAP panel



# LOCAL SECTION NEWS

## INTERNATIONAL

A round-up of the latest news and activities from our four international local sections.

### MALAYSIA

In October 2019, committee member, Mr Johnson Tan, was invited to sit on a panel of judges for the International Automation & Control Enhancing Innovation Competition organised by the Universiti Tenaga Nasional Malaysia. The competition is aimed at improving collaboration between universities and industry in the automation and control sector and the theme was 'Embracing the Change of the Industrial Revolution 4.0.

On 12th March 2020, the InstMC Malaysia section hosted a one-day Technical Forum, in partnership with Malaysian Chapters from the following organisations, Institute of Engineering and Technology (IET), Instrument Society and Automation (ISA), Institute of Electrical and Electronic Engineering (IEEE), as well as the Institution of Engineers Malaysia (IEM). The forum was held at the IEM Auditorium in Petaling Jaya, Selangor and despite the impending COVID-19 pandemic (just a week before the Movement Control Order (MCO) was enforced), the participation was very encouraging. Five papers were presented by distinguished speakers from each

society with a panel discussion at the end, as well as a representative from the Malaysian certifying authority, SIRIM.

With a Movement Control Order set to stay in place until 31st August, there are no further plans for any events at present.



### QATAR

The Qatar section is currently looking to appoint an Events Co-ordinator to put a more structured events schedule in place. Last year the section conducted a number of Professional Review interviews for IEng & CEng registration.

### TEXAS

Former Chair, Clive Wilby, has now relocated to another US state so the Texas section is seeking a replacement. If you are interested in taking up the role, please contact us at [member.communication@instmc.org](mailto:member.communication@instmc.org)

### HONG KONG

Congratulations to Chair, Gary Tse, who has recently been appointed to one of the two InstMC Vice President roles, along with Maurice Wilkins.

## UK

### CENTRAL NORTHWEST

Following evaluation of technical capability and willingness of the presenters, CNW have begun delivery of the monthly technical talks online utilising Microsoft Teams. So far we have held two presentations.

The first presentation, held in June, explored the benefits of advancing technology in the piping connections for instrumentation within high hazard industries. Deborah Pollard of Parker Hannifin Manufacturing Limited showed us the advances, in her presentation entitled 'Connecting Your Instruments to Your Plant: 10 steps to a leak free system'. The session was well attended and there were some good questions for Deborah. Using the power point slides linked with video to demonstrate cut out models was very effective.

In July we welcomed Danny O'Connor from United Utilities to present on the 'Water Industry – Digital Transformation 2020 – 2025'. The talk was very insightful on the challenges being faced by the water industry, with the price review cycle and trying to innovate in everything that is being completed in the industry, with some requirements not even covered by

**UK Water Industry – Digital Transformation 2020 – 2025**  
 Danny O'Connor  
 Senior Engineer  
 Digital Services & Central Operations

**Background:**

- Started my career in the Royal Navy.
- Endress + Hauser ~ 5 Years.
- Yokogawa ~ 5 Years.
- Sellafield ~ 3 Years.
- United Utilities ~ 4 Years.
- Main role is managing Instrumentation Frameworks, including Contractor engagement and Commercial engagement.
- Provide SME into ongoing maintenance reviews.
- Technical Lead on projects across Water Treatment, Wastewater Treatment, Networks and Bio processing.
- Provide business support in specialist areas i.e. MCerts.
- Participate in workshops with Regulators to help review and define policy/guidance.
- Links into other parties such as Sensor City, CSA, WRC and supplier engagement events.
- Regular working groups with other UK Water Companies.
- I think we have some of the most arduous and diverse applications of any industry!

manufacturers when they are being specified. A great example was used, as to how the development of analysis has been changed for sites which are less accessible. Once again, the attendance was good and there were some great questions for Danny.

The benefit of the presentations being online is that we can attract members who may have previously not been able to make the location for travel reasons. In the second session I know that there was a London Section member online as he introduced himself! We are continuing online sessions for the remainder of this year and I'm sure that in the future this

will be something that we look at expanding, as long as the presenters continue to be willing of course. Thanks to all those who have attended so far. Check the Events page on the InstMC website <https://www.instmc.org/Events> for details of the events scheduled in September and November. We would love to see you there! We are still hoping to run our Annual Dinner in October in Manchester. For details on how you can get tickets, visit the CNW Local Section page on the InstMC website <https://www.instmc.org/Local-Sections/Central-North-West>.

**Dave Green**  
 Chair, Central Northwest  
 Local Section

### LONDON Webinar: 'Digitized Workforce Management Pandemic Response and Business Now Continuity Solutions'

A Honeywell webinar presentation: Digitized Workforce Management (DWN) on 14th July, was very well received by the London Section membership.

Honeywell took the time to condense an in-depth insight into the proposed solutions to improve productivity, safety and compliance for employees, contractors and visitors to process production

plants, factories and all engineering facilities. The DWN leverages real-time data and digitization to improve the productivity and safety for all personnel. Part of an integrated, end-to-end plant and personnel portfolio, DWN provides real-time enforcement and monitoring capabilities and integrates with access control and enterprise resource planning

systems to streamline the workforce management activities.

The London Section now looks forward to our next webinar on September 8th 2020 which will be presented by SENSIA. Topic still to be confirmed.

**Barry O'Regan**  
 Hon. Secretary,  
 London Local Section





## Professional Registration with the InstMC

### HOW ?

To obtain professional registration individuals must be a member of a recognised Professional Engineering Institute such as the Institute of Measurement and Control.



InstMC is licensed to award:

- Chartered Engineer (CEng)
- Incorporated Engineer (IEng)
- Engineering Technician (EngTech)

### WHEN ?

**Now!** Whether you are looking to achieve the next level in your professional registration journey or are just starting out, the process is easy to complete online.

To find out more and start your application today, visit: <https://www.instm.com/Membership-Registration/Professional-Registration>.

### WHY ?

Being professionally registered demonstrates to employers that you are committed to maintaining and enhancing the knowledge, skills and competence required to meet the engineering and technological needs and standards of today.

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Supporting Documents:

- A current CV
- An Organogram of your company
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- Attested copies of Academic Transcripts



# JACK GILBERT MINSTMC 1928 - 2020

It is with great sadness that the family of Jack Gilbert announced his passing on Sunday 26th July 2020 at the age of 92.

Jack was a familiar and well-liked figure within the InstMC, as well as a valued member of the InstMC London Section Committee. He contributed with great enthusiasm to many of the Institute's events and activities. Jack was also one of the Institute's longest serving members, for 68 years, and was awarded a platinum membership in recognition of this.

Jack did his national service in the RAF, just after the Second World War with the hope that he would become a pilot, however his eyesight let him down with this ambition. After three years national service he joined Electroflo Meters, located in Park Royal, working as an instrument engineer for the pulp and paper industries. When Electroflo was purchased by Elliotts, Jack furthered his career with Wimpey Engineering at Chiswick. His career continued there until 1975, when he started work on a project in Algeria with his wife and two daughters joining him there for a period. After a successful completion of this project he returned to the UK and worked as an instrument engineer in London

with several major engineering companies and also for a short time in Aberdeen.

Earlier in his life, Jack joined the Air Training Corps RAFVRT in 1962. He was Commanding Officer of 406 Willesden Squadron, which he enjoyed immensely. Annual trips followed in various RAF camps scattered around the UK and also in Germany and Malta. The RAF Association, of which he was a life member, intend to drape his coffin with an RAF Flag. Jack led a fruitful and full life, both professionally and privately. He was an Arsenal supporter from an early age, and later in life he discovered the joys of rugby and was a Wasps supporter.

Jack's friendly good nature will be sadly missed by his wife and all his family as well as the Institute of Measurement and Control. I can certainly say from all the London Section Committee it was a privilege to have worked with him and have him serve on the Committee.

**Barry O'Regan**  
Hon. Secretary London Section



Jack was also one of the Institute's longest serving members, for 68 years, and was awarded a platinum membership in recognition of this.



BY KATIE NOBLE

# LAB-GROWN MEAT AND THE FUTURE OF FOOD

The world's first laboratory grown beef burger cost a remarkable £230,000 to produce.

Lab-grown meat, commonly termed 'cultured meat' or 'clean meat', is an exceptionally innovative bioengineering advancement that has the capacity to fundamentally transform the current global food system. In a highly anticipated unveiling, broadcast live through the BBC in 2013, Dutch Pharmacologist, Professor Mark Post, presented the world with a brief glimpse at the future of food. During the live tasting, food critics Hanni Rutzler and Josh Schonwald were impressed by the meaty smell, aesthetic and mouthfeel of the burger, remarking

that it was "like meat", although the absence of fat left much to be desired.



Credit: Mosa Meat

Seven years on from this milestone event, lab-grown meat technology has advanced exponentially. Production costs have been drastically reduced to around £90 per kilogram, and there are now over 60 companies worldwide specialising in clean meat production, all of which are racing to be the first to market. Advancements in cell-based biotechnology have overcome many of the initial critiques of the world's first lab-grown beef burger, with an

increasing number of taste-testers now proclaiming clean meat to be essentially indistinguishable from that which is grown on an animal.

Existing at the intersection of science, technology and agriculture, the ability to grow clean meat offers a viable and promising solution to many of the issues inherent in modern meat production systems. Most consumers are unaware of the extent of animal welfare issues and the immense ecological and climatic impacts of modern-day animal agriculture. Increasing scientific literature on the environmental perils of livestock farming and the efforts of animal welfare groups, such as People for the Ethical Treatment of Animals (PETA) and Compassion in World Farming (CiWF), has however, led to a rapidly surging number of consumers choosing to remove animal products from their diets.

The Food and Agriculture Organisation (FAO) of the United Nations attribute 14.5% of all anthropogenic greenhouse gas (GHG) emissions to livestock. This figure places animal agriculture as a primary cause of anthropogenic climate change, with the industry surpassing total emissions from the entire global transport sector combined. The FAO estimate that the livestock sector produces 7.1 gigatonnes CO<sub>2</sub>-equiv per annum, and if we are to stay within the 2-degree global warming target set by the Intergovernmental Panel for Climate Change (IPCC), drastic changes need to be made.

In addition to its immense climatic impact, animal agriculture is also the sole leading cause of global environmental degradation and ecological destruction, with one third of Earth's total landmass being utilised for livestock production. Adding to this repertoire of

destruction, it is also the leading driver of deforestation in the Amazon rainforest, the "lungs" of our planet, which is disappearing at a rate of approximately 10,000 km<sup>2</sup> per year to make room for growing ecologically devastating mono-plantations of soybeans for animal feed and providing additional cattle grazing land. Environmental degradation and climate change have now become two of the most pressing issues of our time and innovative technologies are urgently needed to remedy the damage done and create a more sustainable global food system. This is what clean meat has been created to achieve.

Three key solutions are regularly proposed to address the issue of meeting the rapidly rising global demand for meat products whilst mitigating the environmental impacts of its production. These are: dietary change; animal productivity improvements; or technological

advancement. Dietary change has historically proven difficult to achieve as diet is deeply intertwined with human culture and traditions, and livestock production appears to have reached its maximum productivity capacity in many areas. This positions technological advancement as the most promising solution to creating the drastic emissions reductions necessary, bringing the future of meat production firmly into the realm of science and technology. Lab grown meat may sound futuristic but through the rapid advancement of the technology, enabled by large investments from sources such as Google co-founder Sergey Brin and American meat giants Tyson and Cargill, producers anticipate clean meat will be available to consumers by 2022.



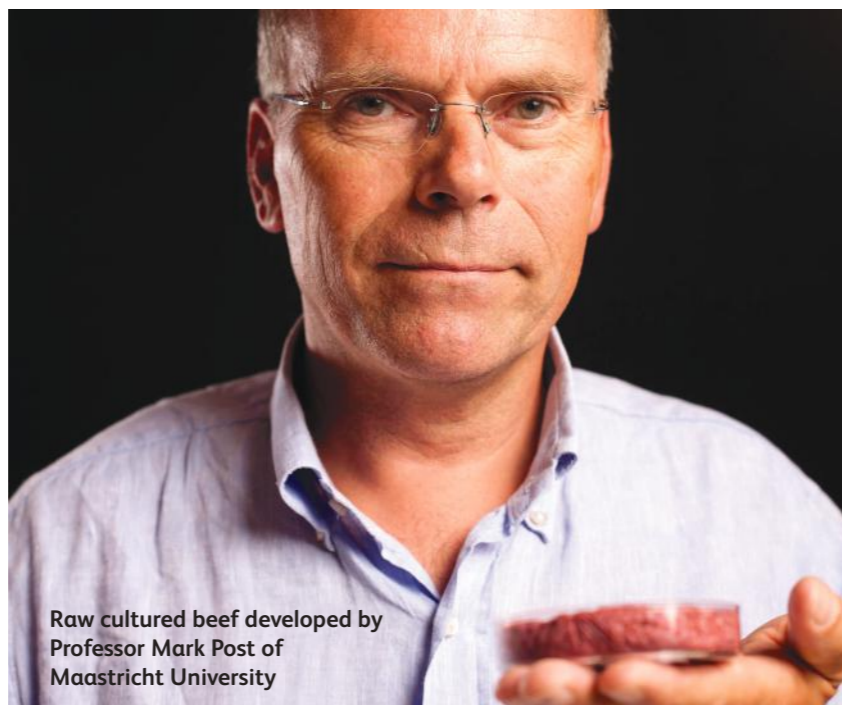
The process of bioengineering clean meat is similar to that of growing livestock meat except the cells are grown outwith the animal's body. The process begins by obtaining myosatellite cells, the stem cells of muscle tissue, from a live animal, through a small and painless biopsy done under anesthesia. Industry leader, Mosa Meat, have found they can create 800 million strands of muscle fiber from a single cow sample, which is enough to produce approximately 800,000 beef burgers. Once the cells have been extracted, they are placed into a bioreactor and encouraged to form strips as muscle cells do in living tissue. These strips are then attached to a scaffolding material, such as textured soy protein, and perfused with a naturally occurring, nutrient-rich culture medium. The cells then fuse into myotubes which subsequently differentiate into myofibers (muscle fibers). The resulting product is meat which can then be harvested, shaped, seasoned and cooked for consumption.

Growing meat without killing animals is possible. The rapid surge in confined animal factory farming operations to meet the ever-growing demand for cheap meat, necessitates the need for alternative protein production systems. In a Life Cycle assessment of clean meat, it was found that clean meat produces approximately 78-96% less GHG emissions than conventionally farmed meat whilst also requiring 99% less land and using 7-45% less energy. Transitioning towards clean meat production systems therefore not only mitigates the climatic impact of conventional meat production and frees up large areas of land for other uses, but also removes animal suffering from our food chain.

There are however, significant technological challenges that need to be overcome before clean meat hits supermarket shelves. To mass produce clean meat, the industry requires the development of large bioreactors. At present, the largest bioreactor has a volume of 25,000



Credit: Mosa Meat



Raw cultured beef developed by Professor Mark Post of Maastricht University

Credit: Mosa Meat

litres which could produce enough meat for around 10,000 people. To scale up clean meat production, many bioreactors of this size or larger will be required. Powering these energy intensive facilities presents an additional challenge which clean meat companies are seeking to mitigate through powering their facilities using renewable energy sources.

Under a microscope, clean

meat is indistinguishable from conventionally produced meat. It is cleaner, safer, significantly less environmentally damaging and does not require the suffering of sentient beings to produce. Through bioengineering technology, humanity has found a way to overcome one of the most challenging issues of our time - feeding Earth's growing population in a sustainable way.

# ACCREDITATION CORNER **ASK TREVOR**

**Our resident expert, Trevor Thompson from [bestmeasurement.com](http://bestmeasurement.com), is here to answer your questions on measurement, traceability and laboratory accreditation. If you have a question for Trevor, please email him at [questions@bestmeasurement.com](mailto:questions@bestmeasurement.com) and we will publish the answer in a future issue.**

In our last issue, Trevor provided some informal definitions to aid understanding of the terms used in laboratory accreditation for testing and calibration. Some of these terms, as used in metrology, differ from definitions in ordinary English dictionaries and more formal metrology definitions may be found in The Vocabulary of Metrology (JCGM 200 :2012). Here are some more terms that are sometimes confusing.

**Assessment and Audit (Assessing and Auditing)** – In the same way as accreditation is about competence and certification is about conformity:- Assessment is the term used by accreditation bodies when they examine laboratories for accreditation. This is because Assessment is taken to be qualitative, about competence and degrees of compliance. Auditing is the term used about establishing conformity with a requirement. A laboratory undertakes internal audits to see that it follows its own procedures and certification bodies audit their customers for conformity. These different uses arise historically, and I would argue that modern management systems whether for accreditation or certification are better served by qualitative examination, whether internal

or external. This is particularly apposite when considering risk and opportunity as is nowadays required.

**Precision and Accuracy** – When we make measurements, we aim to get a valid result. However, no result is absolutely correct or exactly known. There is always a lack of knowledge leading to an uncertainty of measurement. That is why all measurement results should have an associated uncertainty of measurement stated. In a future issue we shall consider that topic further. Meanwhile, precision and accuracy are terms easily described.

**Accuracy** – how close to the true value.

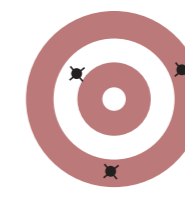
**Precision** – how repeatable (the closeness of values to each other).

If the centre of the bull's eye represents the true value then:

Good precision  
Poor accuracy



Poor precision  
Good average accuracy



Good precision  
Good accuracy



## ISO/IEC 17025

The transition to the 2017 version of ISO/IEC 17025 was scheduled to be completed by 30 November

2020, with many accreditation bodies aiming to achieve this by June 2020. Because of COVID-19, ILAC (The International Laboratory Accreditation Cooperation) has deferred the deadline until 1 June 2021. The 2005 version of ISO/IEC 17025 will no longer be valid or recognised after that date. If this affects you, you should consult your local accreditation body as operational deadlines vary internationally.

Trevor was the UK's national representative for the writing of the ISO/IEC 17025:2017 and is often asked about some of the changes. A frequent question is about why "Risk and Opportunity" was introduced for laboratories. This was for two main reasons.

- 1) To align the requirements of ISO 17025 with those of ISO 9000 and similar management system standards so that laboratories can easily comply with both
- 2) A desire by the Working Group writing the standard to enable modernisation and future proofing of requirements by removing detailed prescription and replacing with outcome specification. This means that by using a risk and opportunity basis one may vary the depth and breadth of implementation to suit the needs of the particular laboratory.

This is an important philosophy that runs throughout the Standard rather than just in individual clauses and is described in the Foreword and Introduction of ISO/IEC 17025:2017.

Please send your queries or comments to [questions@bestmeasurement.com](mailto:questions@bestmeasurement.com)



# COMPANION COMPANY SCHEME (CCS) SHOWCASE

The InstMC Companion Company Scheme has been running since 1992, enabling companies to raise their profile amongst our membership of 3,000 professional engineers in the measurement, automation and control sectors.

There are opportunities to network with other businesses, InstMC accredited universities and with individual members at local and regional level through Local Sections and Special Interest Groups. At present we have 92 CCS members and look forward to introducing some of them to you through this regular feature.



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## AN INTRODUCTION

The Institute of Measurement and Control is committed to promoting the professional excellence and standing of engineers and technologists at all levels in the automation, instrumentation, control and related industries. Our aims are to serve the public by advancing the science and practice of measurement and control technologies and their various applications, to foster the exchange of views and the communication of knowledge and ideas in these activities, and to promote the professional development and qualification of our members.

In 2017 the Institute launched a new quarterly magazine which is a high quality journal with technical features related to measurement and control. This new coffee table type magazine is circulated to the InstMC 3002 individual and 100 company members. It is also aimed at anyone interested in the various uses of measurement and control. It is a positioning and marketing tool for the Institute as well as raising awareness to a wider audience of the use of measurement and control in the world today.

### RATES

Discounts can be given if 3 or more adverts are taken. POA.

Full Page	£1,375
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# PRECISION MAGAZINE



BY SANDRINE GAZAL, DIRECTOR,  
COLLÈGE FRANÇAIS DE MÉTROLOGIE (CFM)

# AT CFM WE TRUST IN MEASUREMENT & METROLOGY

The Collège Français de Métrologie (CFM) is a French association with an objective to disseminate the best practices for measurement and metrology.

CFM has 700 members representing 450 companies and organises training workshops, publishes technical guides and hosts the biennial International Congress of Metrology (CIM).

All industrial and technical sectors are represented including mechanical, energy, agri-food, pharmaceutical, healthcare and chemical. Training is targeted at technicians, laboratory and quality managers, R&D, engineering, production, control and management.

The CFM was created by the LNE (Laboratoire National de Métrologie et d'Essais), CETIAT (the technical centre for the aerualic and thermic industry) and the car manufacturer, PSA Group.

Under the banner "In Measurement

we Trust", the next International Congress of Metrology associated with the exhibition "Measurement World" will take place from 28th to 30th September 2021, in Paris. The congress is organised with the support of the major international bodies: Euramet, European cooperation for Accreditation, BIPM, OIML, NCSLI. Several European metrology institutes are also part of the organisation: NPL for the UK, PTB for Germany, SPF Economie for Belgium and LNE for France. Industrial and technical experts complete the organisation. The CIM, is a unique event in Europe, and a showcase for industrial applications, advances in R&D and prospects dedicated to measurement, analysis and testing processes. Addressing

the international community of all metrology players, this event focuses on the latest metrological advances which interact with the technological developments that surround our daily lives.

CIM2019 attracted 850 participants and exhibitors to the Metrology Village, representing 41 countries with 38% of attendees being international. The event was greeted with enthusiasm and praise for its relevance and content. As one participant summed it up: "The event proved again to be the best opportunity anywhere in the world to bring together the users of measurement and the national and international bodies that promote its development and dissemination."

CIM2021 will focus on the three main topics: Industry 4.0, Green Deal and Healthcare. The programme is still a work in progress but the initial highlights are:

## **Industry 4.0** **Optimised industrial processes**

The first focus will be on the new generation of smart sensors being developed to optimise industrial production. These multifunctional sensors are used in many indicator networks for monitoring processes leading to the introduction of more and more artificial intelligence into production control.

Workflow measurements, additive manufacturing, robotic assistance devices and similar new production models are creating technical and metrological challenges and a major topic will be how metrology can help to speed up the transfer of research to industrial innovation.

## **Data processing and uncertainties**

Day-to-day disciplinary fields like Digitalisation, Data Science, Machine Learning, Deep Learning, Artificial Intelligence, Data Mining and Data Protection are all major challenges for measurement and analysis. Economic competitiveness depends on having more digital power available coupled to more

and more advanced algorithms to reduce data processing uncertainties. CIM2021 will show how metrology is at the forefront of data analysis for improving end-user decision making.

## **Jobs in the factory of the future**

New technologies, applications in automated production and associated measurements need new knowledge. Training and trades evolve and renew themselves in parallel but at different speed rates. Recruiters looking for technical profiles adapted to these new and often complex measurement needs are faced with the very rapid evolution of technologies and business development strategies. They face supply and demand in the labour market correlated with competition between companies in this segment. The conference, therefore, is perfectly placed to promote the professions related to measurement and training opportunities.

## **The Green Deal**

Mastering the monitoring of essential climatic variables for atmospheric, oceanic and terrestrial domains is a cornerstone for a better understanding of changes. Quantifying climate change and monitoring indicators are therefore crucial and, as a whole, a central topic of our ecological transition. CIM2021 will be looking at how metrology allows us to optimise the management of the energy mix. "Smart" energy networks require the development of new measurement tools (instrumentation, AI etc) that will ensure better interoperability between available energy sources such as nuclear, hydro-electric, solar and wind.

Beyond the management of energy sources metrology has to support the development of new cleaner technologies particularly in production and transportation.

## **Healthcare**

The impact of metrology aims ultimately to sustainably improve the living world ecosystem.

Metrology is playing an increasing role in the prevention of chronic diseases such as diabetes and Alzheimers by detecting precursors like cholesterol and triglycerides. As an ideal objective, metrology aims to improve the quality of life and allow the state to save money by prevention rather than cure. The development of metrological references in biology (methodology, biomarkers, certified reference materials and so on) is proving to be a priority area of investigation and therefore, an important topic for CIM2021.

In Measurement you Trust as well?

See you in Paris next year!

For more details on the CFM association visit [www.cfmometrologie.com](http://www.cfmometrologie.com) and for next year's conference, [www.cim2021.com](http://www.cim2021.com).



# DIGITAL TRANSFORMATION – THE FUTURE'S NOT WHAT IT USED TO BE

BY MAURICE WILKINS,  
CHAIR, DIGITAL  
TRANSFORMATION SIG

At the end of 2018, I wrote an article about the formation of the Digital Transformation Special Interest Group (SIG). The group now has 133 members, with a very active core group, which has now met six times. The team has developed terms of reference and is working on several themes related to digital transformation, which I will discuss later.

This will require high current flow, towards the upper end of the domestic 13A-rated fittings, for a number of continuous hours of battery charging. That is, of course, subject to any smart control within the charging equipment to help avoid the broader peak electricity supply demands on the national grid supply infrastructure – an improvement to charging equipment which is already under development.

The latest meeting in June reflected the way things have changed in such a short time, with digital transformation (DT) at the forefront. I have attended several webinars during the COVID-19 crisis and the general feeling is that the pandemic has accelerated DT by up to five years. Companies no longer see DT as something they need to

do in the near future but something they have to do to survive.

Let's briefly remind ourselves what digital transformation is. As the term implies, DT uses digital technology through interoperable systems, modelling and simulation, intelligent automation and networked sensors to analyse data and disseminate information throughout the entire manufacturing lifecycle. This allows companies to proactively manage manufacturing operations with informed and timely decision-making. But more than that, DT enables new business models and encourages innovative approaches.

## New Normal

Many of us have been used to working from home or remote locations and using the web for meetings and presentations. But now, everyone is doing it. We are getting used to seeing Zoom style video images on our TVs in the evening, and the entertainment industry has embraced it for delivering their content. Ordinary people have now become more comfortable using the technology and seeing themselves on screen. Humans are social animals and it has provided a vital means for staying in touch. I even heard one story where people were able to Zoom in to a funeral. This may sound strange, but it enabled friends of the family to say their goodbyes from locations as far away as Australia and Canada and could become a thing of the future. Online shopping, which was already taking off, has now taken over.

As things start to revert to normality, we will see digital technologies help to change the way we work. As part of the return to work, one company did a survey of employees to see who wanted to return and who wanted to continue to work from home or a blend of both. Almost half wanted to continue working from home and well over half were in favour of a blend. This will mean fewer people driving to the office and fewer people travelling long distances to meetings. The remote meeting technology will improve, as one thing people miss with these meetings is the personal interaction. We have already seen changes to meeting systems, allowing people to put up their hands, vote and so on.

As we have seen, the reduced numbers of planes in the sky and cars on the road is having a positive impact on the environment. We need to use DT to make sure this sticks, not only to improve the technology in cars but also for renewable fuels and reusable items and packaging.

Digital technologies are also helping to fight the COVID-19 virus itself. As researchers work toward finding a vaccine, they are now able to analyse and compare samples at a much faster rate than in the past. Artificial intelligence (AI) is helping them to find patterns that previously could have taken months to find. When a vaccine is eventually found, it is said the discovery rate will be many times faster than during previous pandemics such as SARS.

## What is the DT SIG doing?

The DT SIGs terms of reference declare that we will be the eyes, ears and voice of InstMC on digital transformation matters and we will also provide reference materials and guidelines for InstMC members. To

help guide our members through the DT maze we are currently working on several guideline documents, as follows:

- **Introduction and overview:** introduces DT and the DT SIG.
- **Assets and asset efficiency:** provides guidance on digital transformation for assets, including business cases and cost/benefit analysis. It looks at some of the more 'popular' DT devices such as edge devices and gateways and explores the impact of data, such as platform design considerations. Finally, it investigates data analytics and some use cases.
- **People:** it is said that people and organisational issues are the biggest single factors in a digital transformation project. This theme starts by looking at these organisational challenges and opportunities. It then moves on to help with guidelines for competence management and offers advice on training and skills development. Another key aspect of DT is visualising the data. This theme discusses the various things to consider and shows some examples.
- **Successful adoption:** one of the first questions a senior sponsor will ask the DT project team is what does good look like? This theme looks at the factors of successful adoption, how to define what the project will achieve and how to make sure the technology is used correctly. In conjunction with the other themes, it explores ways to effectively exploit data, how to overcome organisational barriers and how to overcome resistance and conservatism. It explains the key differences

between digitisation, digitalisation and digital transformation. Finally, it highlights the differences between starting from scratch or renovating and refurbishing the process.

- **Process:** DT will cause changes in the actual process and equipment. This theme looks at some of those changes and provides guidance.

The theme guidelines are currently in development and consequently are living documents. We anticipate they will start to be available in 2021.

## Future Normal

As I said in my 2018 article, the process industries tend to be very conservative, but they are now using innovative technologies to continue to operate their facilities as workers have had to stay at home or work remotely, during the lockdown period. In the post-pandemic world, companies will continue their push to move people from harm's way, out of operating facilities in a drive towards autonomy. Drones and robots are already being used for surveillance and inspections in areas which have traditionally been dangerous for humans without extensive safety measures being taken, for instance, inside tanks and vessels, at the top of flare stacks and columns and for surveillance in remote locations. In the future, the process itself will decide when to deploy these technologies. The process itself will be driven by artificial intelligence (AI) applications, analysing process data for the prediction of impending maintenance issues or process incidents.

The SIG will continue to monitor digital transformation activities and provide information and updates to the members of InstMC.





# SPOTLIGHT ON STAFF:

Q&A with InstMC  
Staff Member  
**Ernest Kyei,**  
Marketing Executive

**How long have you been with InstMC?**

A little over 4 years.

**What is your background?**

I studied Microelectronics and Computer Programming at University and thereafter, began working in the IT industry in the fields of PC System Configuration and IT Networking Administration for several years. I then acquired an industry level qualification in the year 2000 (Microsoft Certified Professional) and worked for Microsoft for 7 years as a MS Software License Specialist, then went on to manage a small team of 7 for the MS Premier Support division covering UK and EMEA.

Adjacent to this, and in my spare time, I occasionally provided freelance work of music pieces I composed to small outfits for corporate production, short-film and media.

**What is your role at InstMC?**

I am responsible for creating the designs for all marketing material. This involves making sure that the organisation's branding continuity is apparent across all material and promotional efforts. I also assist where needed in the development of our quarterly magazine Precision, and liaise regularly with the Local Sections to help promote their events on our website.

**Can you describe a typical day in the office?**

With the advent of the current pandemic, all staff are setup to now work from home. In these times a

typical day now, although varied, would be to start my day with a cup of coffee, sign in at my desk (usually between 9:00 – 9:30am), firstly check and deal with emails and then run through my task list. I communicate with my colleague, Jane, almost on a daily basis as we work closely on several projects.

**What do you bring to the team?**

I have a keen eye for visual design and a creative streak where I use these attributes to produce professional results for the institute. I also like to bring humour to the team environment just as others do, and we all get along well. Good communication is essential when dealing with colleagues and members alike.

**What do you like best about working for the InstMC?**

I find that working within a small team has its rewards and challenges. The challenges are varied and present interesting situations which result in one adapting to new workflows, or improving or learning new skills to meet the challenge. The rewards provide the ability to self-manage workflow and interact seamlessly with colleagues in order to achieve goals. There is also a sense of mutual respect across all staff members and everyone gets along fine while maintaining a professional attitude – I like that!

**What do you do to unwind, once your working day is over?**

When I get the chance, I like to compose music in my little home recording studio which is relaxing. I generally like catching up with TV-shows, listening to music, reading, and occasionally playing video games. I recently took up the hobby of photography and enjoy that too. When I'm in a healthy mood I enjoy cycling.



**Can you tell us a fun fact about yourself?**

In the late 90's I produced a dance record (UK Garage) that was played on the radio a few times. In the early 2000's I appeared in two music videos and in 2005, another dance record I produced was played on the Norman Jay show for BBC London radio. Those were good fun times!

# OUR CORE TEAM

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- TUV Rheinland<sup>®</sup> Functional Safety Technician Certificate Training
- Introduction to Functional Safety and SIS (1 day)
- Layer of protection Analysis (LOPA) Workshop (1 day)
- SIL Determination Workshop (2 day)
- SIS Design and Development Workshop (2 day)
- Alarm Systems management Workshop (1 day)

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.*

*Please contact us for more details or to register for an existing or future course:*

Email: [info@silsupport.com](mailto:info@silsupport.com)  
Or Tel: +44 (0) 13398 86618

View our full Global schedule at:  
[www.silsupport.com](http://www.silsupport.com)