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Volume 73 Number 1 **Spring 2018**

Landwards

TECHNOLOGY TRANSFORMED

FROM FITTER TO AG-TECH SPECIALIST

In this issue

Biosystems Engineering

Biosystems Engineering, owned by IAgrE, and the Official Scientific Journal of EurAgEng, is published monthly with occasional special issues.

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IAgrE

EurAgEng

The Managing Editor of Biosystems Engineering, Dr Steve Parkin, has kindly summarised a selection of papers published in the last three issues which he thinks will be of interest to IAgrE members.

Biosystems Engineering
Volume 165, January 2018, Pages 70-76
Special Issue: Sensing and Control of Crop Water Status
A novel dielectric tensiometer enabling precision PID-based irrigation control
of polytunnel-grown strawberries in coir
Martin S. Goodchild, Malcolm D. Jenkins, William R. Whalley, Chris W. Watts
Delta-T Devices Ltd., Cambridge, UK
Rothamsted Research, Harpenden, St Albans, UK

The benefits of closed-loop irrigation control have been demonstrated in grower trials. Managing water use, by controlling irrigation in response to soil or substrate moisture changes, to meet crop water demands is a popular approach but requires substrate specific moisture sensor calibrations and knowledge of the moisture levels that result in water deficit or over-watering. The use of water tension sensors removes the need for substrate specific calibration and enables a more direct relationship with hydraulic conductivity. A novel dielectric tensiometer that has been designed specifically for use in soil-free substrates such as coir, peat and Rockwool with a water tension measurement range of –0.7 kPa to –2.5 kPa. This new sensor design has been integrated with a precision PID-based (drip) irrigation controller in a small-scale coir substrate strawberry growing trial: 32 strawberry plants in 4 coir growbags under a polytunnel. The data illustrates that excellent regulation of water tension in coir can be achieved which delivers robust and precise irrigation control - matching water delivery to the demands of the plants.

Biosystems Engineering
Volume 164, December 2017, Pages 31-48
Review: Internet of Things in agriculture, recent advances and future challenges
Antonis Tzounis, Nikolaos Katsoulas, Thomas Bartzanas, Constantinos Kittas
Department of Agriculture Crop Production & Rural Environment, University of Thessaly, Greece
Institute for Research & Technology, Centre for Research and Technology – Hellas, Volos, Greece

The "Internet of Things" (IoT) is a highly promising family of technologies which is capable of offering many solutions towards the modernisation of agriculture. Scientific groups and research institutions, as well as the industry, are in a race trying to deliver more and more IoT products to the agricultural business stakeholders, and, eventually, lay the foundations to have a clear role when IoT becomes a mainstream technology. At the same time Cloud and Fog Computing provides sufficient resources and solutions to sustain, store and analyse the data generated by IoT devices. The management and analysis of IoT data ("Big Data") can be used to automate processes, predict situations and improve many activities, even in real-time. The agricultural sector is expected to be benefited by the IoT. In this article, a survey of recent IoT technologies, their current penetration in the agricultural sector, their potential value for future farmers and the challenges that IoT faces towards its propagation is presented.

Biosystems Engineering
Volume 163, November 2017, Pages 15-27
Investigating air leakage and wind pressure coefficients of single-span
plastic greenhouses using computational fluid dynamics
Takeshi Kuroyanagi
Western Region Agricultural Research Center, National Agriculture and Food Research Organisation, Zentsuji, Kagawa, Japan

Air leakage from greenhouses not only influences heating load and the carbon dioxide supply, but also affects wind loads on the greenhouse structure. Quantitative evaluation of the greenhouse air leakage is essential to estimate variable costs and achieve reasonable designs for greenhouses with adequate strength. In this study, greenhouse leakage rate was estimated through a combination of CFD simulation of the external pressure coefficients of the greenhouse cladding and modelling of airflow through leakage paths on the greenhouse walls. The simulation results of the leakage rate were validated by the experimental results obtained from two greenhouses with the same structure but different orientation. The correlation coefficients between the simulated and measured values ranged from 0.82 to 0.99, and the RMSE of the simulated leakage rate ranged from 0.014 to 0.052. The simulation results indicated that a strong transverse wind created lower leakage rate and internal pressure coefficient. These findings and methodology will be helpful for designing light-weight greenhouses in windy regions.

EDITORIAL: PLAYING CATCH UP

A generation, that's all its taken. A single lifetime to move from a time when pneumatic tyres on tractors were the game-changing development to today when we discuss the place of GPS, of robotics, or driver-less tractors. And what on earth would the founding fathers of IAgrE 80 years ago make of a feature in their journal considering the Internet of Things?

In many ways, it's not the technological advances themselves, but the pace of change that's been so staggering. Todays young generation regard the internet, mobile phone technology, social media as the norm, but perhaps forget that they only came into being just over two decades ago. We, of more advanced years, are playing catch-up!

This issue of Landwards perhaps ideally packages the strengths, the opportunities, the new-thinking of those who will lead the drive for food production and the care of the countryside in the future – whilst providing a nod of gratitude and appreciation to those who set the IAgrE ball rolling in 1938.

In a strange way, we are today faced with a similar time in history. The early years of IAgrE were dominated by the need to feed the nation through a lengthy and bloody war – and rebuild agriculture after the end of hostilities.

In 2018, we are faced with a similar, albeit bloodless challenge to the well-being and prosperity of our nation. None of us really know how the next couple of years will turn out as we negotiate our exit from Europe (presumably). One thing is for certain however, we have the tools, the expertise – and yes, the spirit - to adapt and flourish whatever the outcome.

Co-incidentally, there is another feature in this issue regarding a report on the effectiveness, or otherwise, of the UK's 40-odd professional engineering institutions such as IAgrE. The main issue seems to be that just three of these bodies represent 70% of engineering membership. If there is a problem, could it be that it is they who have become too big and now lack focus?

Smaller institutions such as IAgrE surely benefit from being nimble and reactive to rapid change, of being closer to their membership and thus able to speak with focussed authority.

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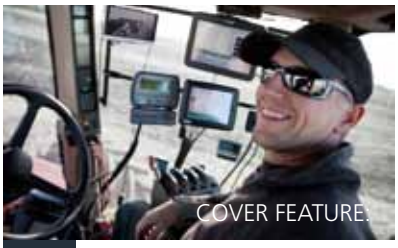

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MICHAEL GOVE AT OXFORD FARMING CONFERENCE

Singles out Cranfield and Harper Adams

During his keynote speech to the Oxford Farming Conference in January, Environment Minister Michael Gove, name-checked the work of Cranfield University in soil science and the innovative work being under taken by Harper Adams University with the 'hands free hectare' project.
Whilst much of his speech was devoted to the likely impact of Brexit, he took a forward-looking approach to the importance of embracing change.
"The world's population is growing at an unprecedented rate, with a worldwide migration from rural areas to cities and a growth in the global middle class which is driving demand for more, and better quality food" he said "Technological change is at an inflection point. Developments in big data, artificial intelligence and machine learning mean that processes which would have required the intellect and effort of thousands of humans over many hours in the past can be accomplished automatically by digital means in seconds".
"If we want to preserve that which we cherish - a thriving agriculture sector, a healthy rural economy, beautiful landscapes, rich habitats for wildlife, a just society and a fair economy - then we need to be able to shape change rather than seeking to resist it".
"We can, and should, invest in both technology and infrastructure. We can direct public money to the public goods of scientific innovation, technology transfer and, crucially, decent universal super-fast broadband".
He said that there was no inherent tension between productive farming and care for the natural world – in fact quite the opposite.
"I have seen for myself how many of our best farmers – our most productive farmers – place thoughtful environmental practice and careful husbanding of resources at the heart of their businesses".
"Take the vital question of soil health. Min or no-till approaches, which require less expenditure on inputs and keep more carbon in the soil, are both economically more efficient and environmentally progressive".
Under the CAP, farmers have been encouraged to focus on yield rather than productivity, he said, which had led to decades of damage in the form of significant and destructive soil erosion – estimated in one study by Cranfield University to cost the economy around £1.2billion a year.
"We now have opportunity to reverse this unhappy trend. Sustainably managed land is far more productive than land that is stressed and stripped of its nutrients".
On technology, he said, we should build on the innovations pioneered by our superb higher education institutions like Harper Adams by investing in automation and machine learning, moving from the hands-free hectare to the hands-free farm, with drilling, harvesting, picking and packaging all automated, precision mapping of every inch under cultivation with targeted laser treatment of pests and weeds and highly-focused application of any other treatment required.

EXTERNAL QUALITY ASSURANCE FOR APPRENTICESHIPS

Employers can nominate Engineering Council as provider

From 2 January 2018, employers are now able to nominate the Engineering Council as the provider of quality assurance (known as External Quality Assurance or EQA) for engineering-related Trailblazer Apprenticeships.
This has been agreed by the Engineering Council's Board, following a successful trial in autumn 2017. The Institute for Apprenticeships (ifA) website sets out the quality assurance requirements for apprenticeships and how these will ensure quality, consistency and credibility.
The Engineering Council supports the alignment of Trailblazer Apprenticeships with professional registration and welcomes the IfA's guidance that 'Apprenticeship standards must link to professional registration where this exists at that level in the occupation'.
The engineering profession has embraced the opportunity afforded by this new approach to apprenticeships to raise standards and to encourage professional registration.
The Engineering Council say they are the most appropriate body to carry out this quality assurance for engineering-related apprenticeships, because they currently license thirty five professional engineering institutions to carry out the assessment of individuals seeking registration, in accordance with required Engineering Council standards and prescribed processes. These standards apply across the profession, regardless of sector or discipline, making the Engineering Council the sole UK body that can assure consistency and quality of assessment of professional standards across the professional engineering institutions.
In line with the Engineering Council's role and remit, its quality assurance activity will be limited to professional competence. It will work in partnership so that other elements of the assessment, such as occupational competence, are quality assured by bodies with that expertise.
Employers interested in nominating the Engineering Council as their quality assurance provider for will find more details on their website on how to make a request and what information is required.
The Engineering Council will review this quality assurance activity after 12 months, and may choose to modify its approach.

LAMMA LOSES SECOND DAY

Site deemed unsafe after heavy rain and high winds overnight

LAMMA, was forced to abandon the second day of the show (18 January) at the East of England Showground, Peterborough.
After heavy rain and overnight high winds, the organisers initially announced that the show would open late, but after a full assessment of the site they confirmed that the show had been unable to open to the public *"due to safety reasons"*.
Elisabeth Mork-Eidem, group head of events at Briefing Media, which owns LAMMA, said, "*It is with great regret that we have had to close LAMMA today following an excellent day yesterday, but the safety of our visitors has to be paramount. As many of you have seen, there was significant damage across the site and due to the nature of the showground, it is not possible to section off specific areas"*
The delay to opening and subsequent cancellation caused considerable chaos on the roads surrounding the East of England Showground.
The event was the final LAMMA outdoors show, held first at Newark, then Peterborough, before it moves indoors to Birmingham's NEC next January.

AUTOMATION SAVING LABOUR

AHDB to focus on labour efficiency

An AHDB Horticulture survey has revealed 82 per cent of UK growers believe recent developments in automation have helped reduce their reliance on labour. Growers also report key areas for future investment should be focused on harvesting and improvements within the pack-house.
Areas of production with particularly high manual labour inputs – such as harvesting – are high priority for future research and investment, with nearly 60 per cent of growers identifying this as an area to focus on.
Other responses highlighted a need for developments in transplanting and planting, crop monitoring, application of crop protection products (including biologicals), transport systems, grading and packing.
Dr Debbie Wilson, AHDB's head of knowledge exchange, said: "Labour utilisation is a clear priority in our current strategy. Many growers look to robotics as a solution to labour availability issues for the sector, although they recognise that new developments are likely to be long term. This is where AHDB will focus its effort alongside our labour efficiency and developing best practice in business management."

LANDWARDS WINTER ISSUE 2017

A feature in our last issue, ***Listening to Pests*** by **Dr David Chesmore** lost some of the text in the final printed version when it was hidden beneath a picture. We pass on our apologies to Dr Chesmore for this error to the article which has been replaced and can be viewed in the Members section of the IAgrE website.

NEW STUDENT AWARDS

In collaboration with CNH Industrial

IAgrE in partnership with CNH Industrial has announced new, prestigious student awards, which are open to students in higher education. The two awards are directed at undergraduates and post-graduates and will be made for a dissertation/ thesis demonstrating innovation and practical application in the land-based industry.
"We are delighted to be partnering with CNH Industrial to launch this award. Over the past years, the Company has collaborated with us to sponsor the Johnson New Holland Trophy Award. We felt it was the right time to move forward and offer additional benefits. This is an opportunity to raise the profile of the awards and reward the innovation and hard work of students in higher education", said Alastair Taylor, CEO of IAgrE.
"As a key player in the Agricultural Equipment sector, the future of our industry relies on nurturing the best possible engineers to design and build the products of the future. Our partnership with these awards strengthens this possibility", said Rob Alker, current Product Improvement Manager at CNH Industrial.
The prizes are £500 for post-graduates and £250 for undergraduates. Both winners will receive a trophy for their respective universities to hold for one year, a VIP visit to the CNH Industrial Basildon Tractor Plant and internship opportunities.
Deadline for applications is 31 March 2018.

Rob Alker

PEOPLE

DAVID ROBERTS

David Roberts, managing director of Kubota UK has left the company after a long association with the Japanese manufacturer. Following 21 years of service, he left the company in 2010 to join dealers Farol Ltd as Operations Director. He spent two years at Farol before returning to Kubota in 2012 as Sales and Marketing General Manager, to head up their three product sectors - Construction, Engines and Tractor & Groundcare. In May 2013 he was appointed Managing Director, the first UK national to hold that position, responsible for heading up all UK operations.

MARK ORMOND

Mark Ormond has joined Manitou from SAME-Deutz UK where he was managing director. He has previously managed UK subsidiaries of other leading European manufacturers, and has spent time in the dealer side of the industry. He is the current President (2017-2018) of the Agricultural Engineers Association. "I am delighted to join Manitou and look forward to working with the team, and with our dealer network, to continue the great success of the brand in the UK and Irish market," says Mark. "My background is agriculture but I look forward to learning about the construction and industrial sectors, and to seeing how I can add value to this highly successful company".

DOUBLE DELIGHT FOR MZURI AT LAMMA *Striptill seeder wins IAgrE Ivel Award*

The Pro-Til Xzact striptill precision seeder by British manufacturer Mzuri Ltd, has won not one but two prestigious trophies at this year's LAMMA Innovation Awards. The innovative seeder was chosen to be the winner of the 'Best Product or Innovation for the Environment' Category and awarded the IAgrE Ivel Trophy for its positive impact on the environment. The high standard of engineering and innovation of the Pro-Til Xzact was further acknowledged by the judges with the product going on to become the Overall Winner of the Awards and receiving the David Baggaley Memorial Cup. Marking a huge advance in seeding technology, the innovative Mzuri Pro-Til Xzact combines a striptill drill and a precision seeder in just one piece of equipment, meaning that one drill can now seed all types of arable and precision crops – in a single pass. Speaking of LAMMA Innovation Awards 2018, Martin Lole, Managing Director at Mzuri Ltd said: "We are delighted to have won the prestigeous IAgrE Ivel and David Baggaley Memorial Trophies this year. As a manufacturer of conservation equipment, soil and wildlife preservation have always been high on our agenda. We pride ourselves in producing highly engineered products that last and make our customers' operations more efficient, whilst preserving the land for future generations. Pro-Til Xzact and Razorback designs build on years of innovation at Mzuri, with the company receiving a number of international awards over the past few years."

Read more about the Pro-Til Xzact on page 24

2017 TRACTOR SALES UP by 13.5%

Average power at 162hp, up from 158hp in 2016

The Agricultural Engineers Association have reported that the number of agricultural tractors (power over 50hp) registered for road use in 2017 was 12,033. This was 13.5% higher than in 2016.

Most of the growth during 2017 came in the middle of the power range, with more than two-thirds of the additional machines being between 140 and 200hp.

There was also further growth in the high-power end of the market but only a modest increase for lower-powered machines, between 50 and 140hp. There was good growth in the number of tractors below 50hp (not included in the total figure above or the regional analysis below), though, where registrations were up 22%, at 1,735.

Continuing the historic trend, the average power of tractors over 50hp registered during 2017 rose to 162.2hp, up from 158.3hp in 2016. The total power sold was just over 2 million hp, for the first time since 2012, when machines below 50hp are included.

Regionally, there was fairly consistent growth across most of the English regions. With the exception of the small Home Counties/London and North East regions, all parts of England saw increases of between 12% and 22%, with no obvious bias towards livestock or arable regions. Outside England it was a more mixed picture, however, with growth in Scotland, albeit slower than in England at 10%, little change in Northern Ireland and a small decline in Welsh registrations.

TAPPING THE TALENT

Other sectors are 'hoovering' up the graduate output

IAgrE President
Dr ROBERT MERRALL MIAgrE, EngD

President's Musings

I had a feeling that 2018 could bring a wealth of opportunities for our sector. That's not to say that the UK's food producers have it easy at the moment. Whilst exchange rates bolster UK exports of machinery, farms that rely on overseas seasonal labour face a serious twin challenge: the exchange rate *and* Brexit uncertainty.

Time then, for the UK's engineering and financial sectors to get behind efforts to further mechanise food production, I hope. What an opportunity for the UK to lead the way in sustainable intensification.

For those in the financial sector looking for horses to back, there ought to be no shortage of candidates, and Greg Clark's announcement at this week's NFU conference of £90 million in support of agri-tech should de-risk things sufficiently to make for some really attractive opportunities.

Greg Clark

The UK Government are seeking to bring together AI, robotics and earth observation to improve supply chain resilience in the agri-food sector, and there are plenty of opportunities for this to happen.

Machine vision really is going to be the big game changing technology for agricultural engineering, but I have real concerns about whether we can attract the required talent going forward.

Our automotive and consumer products sector appears to be hoovering* up good engineering graduates as fast as we can turn them out. Many of these excellent graduates and undergraduate apprentices come from a land-based background.

Machine vision really is going to be the big game changing technology for agricultural engineering

That says a lot about what bringing up children on a farm does for children in general and is one of the reasons I feel so lucky to have been able to offer some of these experiences to my own children. Children from farms understand responsibility, are practical, resourceful, understand risk, understand the weather and typically have more of an awareness of plants, animals and the environment as a whole.

This is the pool from which our land based HE & FE institutions draw, and they in turn do a great job of turning out multi-talented, highly employable people. What we need to do is funnel more of these back into agri-tech to bolster what can be a real rural renaissance.

Something rather a little less abstract to focus their intellect on

The challenge is the need to guard against a race to the bottom on price by the supermarkets, and I am becoming increasingly convinced that this is one of the main factors holding back innovation and improved sustainability. Provided investors keep calling the supermarkets to task on delivering their CSR obligations, I am reasonably confident that we can hold this in check.

ASTROPHYSICISTS

I recently had the opportunity to see some great work on agricultural robotics at the University of Lincoln, where I bumped into the astrophysicist Prof Sarah Bridle (Manchester University) who told me about the experiences of some of her researchers. She told me that many brilliant astrophysicists get frustrated by a perceived lack of impact.

She observed that after a few years of diligent particle physics work, some become disillusioned by the realisation that their career might not be following the same trajectory as Peter Higgs or Brian Cox, and they begin to look for something rather a little less abstract to focus their intellect on. Something where they feel they can *make a difference*.

This is where we need to work at making agri-tech a more attractive opportunity. Our sector needs to attract folk like these to help tackle the "hard bits" in machine learning and the modelling of highly complex biosystems that we really need to crack in order to progress from where we are.

In short, our sector needs good technical people at all levels, from whatever background. We need to lose fewer of the best people who see the agri-food as less appealing than aerospace or automotive, and we simply need to encourage all of our kids, from whatever background, to "#think like an engineer".

** Sorry Sir James, the verb is still hoovering despite the fact that Dyson are as hungry for good graduates as Jaguar Land Rover*

CNH link up with The Climate Corporation

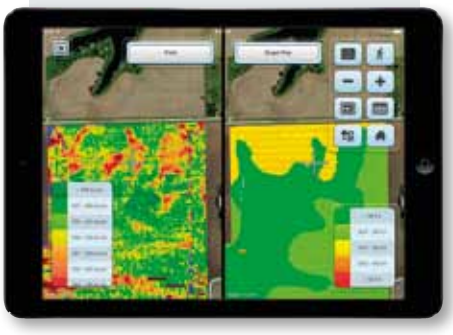
Developing portfolio of data sharing capabilities

CNH Industrial and The Climate Corporation, a subsidiary of Monsanto Company, have announced a new partnership that will extend and develop a portfolio of data sharing capabilities to help farmers with real-time agronomic visualisation and decision-making solutions.

Case IH and New Holland Agriculture, the global agricultural brands of CNH Industrial, will provide their customers two-way data connectivity between their AFS and PLM Connect precision farming platforms, and The Climate Corporation's industry-leading Climate FieldView™ digital agriculture platform.

This partnership offers Case IH and New Holland customers' unique functionality due to the depth and breadth of real-time machine and field data, including agronomic prescriptions, which can be both received and transmitted to Climate FieldView using the CNH Industrial brands' precision farming management systems. To date, this integration with Climate FieldView provides one of the most extensive data sets available. This additional level of real-time data connectivity will enable agribusinesses to fine tune field operations to further enhance in-field productivity and efficiency across their existing machinery fleets.

In addition to the in-field benefits, this partnership foresees further development to provide those Case IH and New Holland dealers offering Climate FieldView additional tools to proactively support their customers. Both companies are working to enable farmers the ability to share real-time machine information with their local Case IH or New Holland dealer, in order for them to receive support even more quickly.



DEERE ACQUIRE BLUE RIVER TECHNOLOGY

Machines use computer vision, robotic and machine learning to target weeds

Deere and Company has signed an agreement to acquire Blue River Technology based in Sunnyvale, California described as a leader in applying machine learning to agriculture.

As an innovation leader, Blue River Technology has successfully applied machine learning to agricultural spraying equipment and Deere is confident that similar technology can be used in the future on a wider range of products.

"We welcome the opportunity to work with a Blue River Technology team that is highly skilled and intensely dedicated to rapidly advancing the implementation of machine learning in agriculture," said John May, president, agricultural solutions and chief information officer at Deere. "As a leader in precision agriculture, John Deere recognises the importance of technology to our customers. Machine learning is an important capability for Deere's future."

Blue River has designed and integrated computer vision and machine learning technology that will enable growers to reduce the use of herbicides by spraying only where weeds are present, optimising the use of inputs in farming - a key objective of precision agriculture.

"Blue River is advancing precision agriculture by moving farm management decisions from the field level to the plant level," said Jorge Heraud, co-founder and CEO of Blue River Technology. "We are using computer vision, robotics and machine learning to help smart machines detect, identify and make management decisions about every single plant in the field."

In 2017, Blue River Technology was listed among Inc Magazine's 25 Most Disruptive Companies and the Top 50 Agricultural Innovations by the American Society of Agricultural and Biological Engineers.

Deere said it will invest $305 million to fully acquire Blue River Technology. Deere plans to have the 60-person firm remain in Sunnyvale, with an objective to continue its rapid growth and innovation with the same entrepreneurial spirit that has led to its success.

May said the investment in Blue River Technology is similar to Deere's acquisition of NavCom Technology in 1999, which established Deere as a leader in the use of GPS technology for agriculture and accelerated machine connectivity and optimisation.

DATE FOR YOUR DIARY

2018 IAgrE Landwards Conference

Advance details have been announced for this years IAgrE Landwards Conference which will be held at the Royal Academy of Engineering, Prince Philip House, Carlton House Crescent, London on Tuesday 6 November, 10am to 4.00pm

The conference theme will be **Engineering Collaboration for Success**: *Strategies and best practice for knowledge exchange in agricultural engineering and agri-tech.*

CEO
Reflections on a changing world

THE ROLE OF SUBSIDIES

Public good, or public goods?

Alastair Taylor *IEng CEnv MIAgrE*

There is no doubt that the subject of farm subsidies is complicated. Ask ten people and you will get ten views.

On the one hand there is the history of famine, dust bowls and world wars which put food supply at the top of the agenda with successive governments putting in place support mechanisms to ensure a constant food supply thus avoiding public riots, crime and revolution. It would be a brave politician who allowed the vagaries of the climate and the market economy to risk the supply of food in the shops.

On the other hand, there are those who ask why public money should be used to prop up an industry which fails to modernise, with people in it "just for the lifestyle", large landowners reaping huge rewards when they don't need it. We could go on.

Those who ask why public money should be used to prop up an industry which fails to modernise.

For my part, I have always thought that if the free market was allowed to run its course, the impact on a stable food supply and prices would be too worrying to contemplate. Food Banks would be for the majority. If a farmer receives a significant proportion of income from subsidies, and with the stability that brings them, does this in fact mean that the true beneficiaries of the subsidy are the consumers.

So it was interesting to hear the Secretary of State for Environment, Food and Rural Affairs, Michael Gove, talking about subsidies at the Oxford Farming Conference, and especially how this might look in a post EU world.

It is all about the public benefit and there were two themes which struck me as being important to us Agricultural Engineers.

Gove suggested that supporting technology in agriculture is for the public benefit, through employment and rural resilience as well as production. "We can and should invest in both technology and infrastructure. We can direct public money to the public good of scientific innovation, technology transfer and crucially super-fast broadband."

This sounds like an opportunity for Agricultural Engineers but we probably need to make sure our voice is heard in terms of the technological solutions we can bring to the fore. It is time to speak up for our industry and what we can offer. Be it robotics, precision farming, the connected farm, smart machines, increased traceability, it is all our domain.

It is time to speak up for our industry and what we can offer.

He went on to tell the conference: "Building on previous countryside stewardship and agri-environment schemes, we will design a scheme accessible to almost any land owner or manager who wishes to enhance the natural environment by planting woodland, providing new habitats for wildlife, increasing biodiversity, contributing to improved water quality and returning cultivated land to wildflower meadows or other more natural states".

This latter point comes under the general concept of "subsidies for public goods", what is meant by "public goods" and is this different from "the public good"

The quote from the Secretary of State will have made many people very happy including those who like to see footpaths, wildlife and have access to our countryside. I would include myself as one of those.

If we expand on this further, then surely "public goods" could include improved soil conditions, better drainage, less run-off and a whole multitude of matters at the heart of Agricultural Engineering.

Could it be that in the future a farmer might receive a subsidy for using minimum tillage over the plough, or for reintroducing the four crop rotation? In my book, all of this is for the public good as well as being good for us Agricultural Engineers.

2018. THE YEAR OF ENGINEERING

2018 YEAR OF ENGINEERING

Year-long Government initiative to promote engineering opportunities is supported by Royal Academy's digital marketing campaign #ThisisEngineering

The UK government has pledged to work with hundreds of industry partners throughout 2018 to encourage young people and their parents to take a closer look at engineering.
Launched in response to an estimated shortfall of 20,000 engineering graduates a year, and growing reports from industry that the skills shortage is having a significant impact on productivity and growth, the **2018 Year of Engineering** plans to galvanise industry, MPs, parents and teachers in a national push to inspire the next generation of engineers.
Activities will include large-sale outreach programmes, such as a £1 million investment from Shell in the interactive Tomorrow's Engineers Energy Quest programme for thousands of schoolchildren, a children's book on engineering from publisher Usborne, and behind the scenes tours for families.
The campaign, which aims to build on existing engagement initiatives such as Engineering UK's Big Bang Fair and the Royal Academy of Engineering's Ingenious programme, will also highlight the role that individuals can play – from parents helping children with their maths homework or enrolling them in a coding club, to engineers from all backgrounds sharing their experience and advice in schools or via social media.
By bringing young people from all backgrounds face to face with engineering experiences and role models, the campaign aims to showcase the creativity and innovation of engineering careers and widen the pool of young people who consider the profession, diversifying a workforce that is 91 per cent male and 94 per cent white.

#ThisisEngineering

The Royal Academy of Engineering is a partner in the Year of Engineering, and has launched an exciting new digital marketing campaign, **#ThisisEngineering**, which seeks to rebrand engineering for young people aged 13-18.
This project has been developed with support from industry to be a more visible, powerful and unifying campaign than previous initiatives for a teen audience, providing content that all engineering organisations can use to attract the next generation of talent.
#ThisisEngineering and the **2018 Year of Engineering** will work together to catalyse greater public awareness of engineering, using aligned messages about engineering's appeal and impact.
#ThisisEngineering will then continue beyond 2018, building on the Year of Engineering with a sustained effort to encourage more young people to pursue engineering.
Ann Watson, Chief Executive of ***Semta*** says "Part of the problem is patchy careers advice; the Year of Engineering needs to be the start of a consistent cycle of engagement between the worlds of engineering and education. We don't just need careers talks and facility visits this year, we need them every year – this cannot be a one-year initiative.
Research conducted by YouGov on behalf of **#ThisIsEngineering** shows that 63% of young people (aged 13 to 18) think they will have a career that taps into their existing passions.
Young people are increasingly turning to the internet for information about careers (52%), with search engines overtaking conversations with parents (41%) and teachers (37%) as a source of advice and inspiration.

LANDBASED ENGINEERING LAUNCHES NEW CAREERS ADVICE

The Landbased Engineering Training and Education Committee (LE-TEC) has published a new careers brochure, **World of Opportunity**, aimed at providing 16-18 year olds with information on its different industry sectors, agriculture, garden and turf machinery, dairy equipment, forestry and off-road vehicles.
The 16-page brochure, which is also available in digital format, has been compiled by Landwards editor Chris Biddle – and features brief pen pictures and quotes from dealer and manufacturer staff.

UFF REVIEW

LOOKING INWARDS AT ENGINEERING

Three of the largest professional engineering institutions (PEIs) have commissioned a leading barrister, Prof John Uff QC, to report on the engineering profession. His conclusions were largely critical of the present set-up. CHRIS BIDDLE has been digesting the Uff Review, and reports on its findings and subsequent responses.

There used to be over 50 professional engineering institutions (PEIs), a number that has reduced to 35 over the years, largely by mergers. There are concerns however that recruitment into the sector is under pressure and not enough engineers are engaging with the PEI's because they are too great in number and too fragmented.

Last year, the three largest professional engineering institutions, Institution of Mechanical Engineers (IMechE), Institution of Civil Engineers (ICE) and the Institution of Engineering and Technology (IET), who together claim to make up 70% of the UK engineering community, commissioned an independent review of UK Engineering by Prof John Uff QC.

The aim was two fold;

- To examine whether the engineering profession required 35 different PEI's to represent the sector – and if this fragmentation resulted in duplication of effort and lack of focus on the vital task of 'selling' the engineering sector to young people.
- To examine why there were only 300,000 current registrants to the 35 PEI's out of an estimated 3 million engineers in the UK with the right credentials?

In his opening summary, Prof Uff said "The current structure of the UK engineering profession has evolved piecemeal over many decades. Despite great changes in society and in technology, it has repeatedly proved itself resistant to change. There is a strong body of opinion that it no longer serves the best interests of the profession, members or employers in the UK and overseas" He added that only the major PEI's (such as the sponsors of the review), together with the Royal Academy of Engineering possessed the strength and influence to bring about real change, but that the existence of a large number of separate PEIs presented problems. "Repeated attempts to impose mergers have been rejected by the institutions" He added "Whilst future mergers deemed beneficial by the institutions themselves are to be welcomed, a further campaign to promote mergers seems unlikely to succeed. However, many of the institutions do recognise the benefits in combining certain organisational activities and they should take urgent steps to pursue these in the wider interests of the profession"

He suggested that as an alternative to full mergers, existing institutions should seek to break down barriers to movement between the branches of engineering that they represent, with the aim of establishing a single "membership" of the UK engineering institutions with the right to participate in the activities of any of those institutions.

> The system is still hampered by much historical baggage

MEMBERSHIPS

Prof Uff urged PEI's to find ways to increase their membership, which has been in general decline for over a decade. He said they should take urgent steps to bring in up to three million "engineers" who currently have no formal affiliation with the profession. The PEIs, with the support of EngineeringUK and Engineering Council, should mount vigorous campaigns to identify and inform by all possible means the "missing" engineers and to offer a form of membership at modest cost.

PEIs should also undertake, through the Engineering Council, a review of all registration and membership

grades with the objective of creating new grades which better suit the demands of members. He adds "While Chartered status continues to hold value there is clearly little appetite for registration at either Incorporated or Technician level". His suggestion was to consider the replacement of the present three grades with two, namely "Chartered Engineer" and "Registered Engineer".
Prof Uff aimed some concern at the effectiveness of EngineeringUK. He said "Their efforts to promote increased entry to the profession have not achieved notable success, the UK is still a long way off achieving the increased numbers taking either A level Physics or NVQ3 Technical/ Engineering qualifications"
"Although there is some evidence of increased take up of STEM subjects, there is also a strong case for a wide ranging review of all promotional activities, including those of EngineeringUK, and a preferred option is that their activities be merged with the promotional work of the Royal Academy"
Finally, Prof Uff said the education and training of engineers had evolved over some two centuries. "Whilst there is late and grudging acknowledgement by academia of the importance of engineering, it is still a long way from the system required by an advanced technology-based economy in the 21st century".
"The system is still hampered by much historical baggage, not least of which is the contrast between university courses and employment-based or apprenticeship training - a viewpoint still promoted through ill-informed prejudice and snobbery".
He said that engineering requires a combination of theoretical knowledge and its practical application, coupled with many other skills. The overall aim must be for a common framework of standards to cover both apprenticeships and college-based training. There should be an overall national system of technical education and standards with an integrated framework of routes to cover all employment-based and college-based technical education.

RESPONSE AND REACTION

There has been limited response to the Uff Review by the major Institutions who commissioned the report despite him saying that the institutions were "inward facing, elitist and insular" and "do little to engage with the wider engineering community or with society at large".

Q AND A with Alastair Taylor

Landwards puts some of the issues raised by the Uff Review to IAgrE CEO, Alastair Taylor for his comment

Do you broadly agree with Prof Uff's observations?
An opportunity to reflect on where we are as a wider profession is always a good thing and in that respect, I welcome the Uff review. It makes some interesting points and to hold a mirror up to the profession has been helpful.
Some of the observations make uncomfortable reading but we should not fear that or be defensive. It is right to examine the question of the missing three million and to challenge institutions as to whether they should work differently to bring more people into membership. There is no easy fix here. If there was, there wouldn't be a missing three million.

Could there, should there, be more co-operation between PEI's?
Definitely. We already collaborate. The elephant in the room is one of the poaching of members and any collaboration must be on the basis of no predatory behaviour. We can collaborate on so much but fundamentally there are 35 engineering institutions for a reason and those of a very specialist nature, such as IAgrE, and many others, have a place to stand up on their own. That said, we are already thinking about how we might collaborate through the 21st Century PEI Initiative and there is some good work going on in the Engineering Council and Royal Academy of Engineering to introduce more collaboration.

Is one of the issues that 3 institutions dominate the remaining PEI's - and that itself might be the barrier to change?
As one of the smaller institutions, we obviously look to the bigger institutions with a range of emotions. With their resources and economies of scale they can do so much more than IAgrE but on the other hand, the highly specialist nature of Agricultural Engineering and especially the biological element of our work means that we have a different eye.
I would like to think that the smaller institutions are more able to respond to change and to act quickly where we can. In the case of IAgrE, things are complicated by the fact that we are more than an engineering institution given our work with the Society for the Environment. It's complicated!

What do you think of Prof Uff's suggestion of two grades of engineer, Chartered and Registered?
The Chartered Engineer is a well-recognised grade of professional registration and it has a great future.

He said that misperceptions or enquiries relating to the engineering profession are inadequately addressed. "With the result that STEM options are, for some young people, loaded with perceptions of limitations".
In an interview for the IMechE website, CEO Stephen Tetlow said that as a response to the Uff Review, the three main institutions are now working with the Royal Academy of Engineering to coordinate better advice to the government, and working to reform how the professional engineering institutions and EngineeringUK promote engineering in schools.

As to mergers, he said "I don't think we'll ever merge into just one mega-institution, there will still be institutions wanting to go their own way, and that's fine. If you have one big monolith, I don't think it serves the purpose either - people need identities".
"The problem is when a young person enters engineering, this array of 35 different institutions is totally confusing. If we provided an entry into professional engineering where you could join an organisation which would register you on the path of a professional engineer - you could adjust what you wanted to do as your career develops and engage with different technologies that suit you and your employer".
"Fundamentally, we don't have to stay doing the same thing we've been doing for the past 50 or 60 years. We've been given a big wake-up call by the Uff Review and if we fail to grasp that and take it forward, then all of engineering is going to lose"
Meanwhile, EngineeringUK, the body set up and funded by the engineering profession to promote the sector, particularly in schools, responded to the criticism of its performance.
The chief executive at the time of the report, Paul Jackson, said he disputed Prof Uff's view that its promotional efforts had failed to work. "Festivals and other events such as the annual Big Bang Fair, organised by EngineeringUK, regularly attracts over 70,000 visitors".
"Where the report claims there has been "no material" increase in the numbers of young people interested in STEM topics, we can point to higher numbers taking physics and maths A-levels as proof of increased interest among teenagers in engineering subjects".
The question now is will the Uff Report prompt change? Even Prof Uff doubts that radical changes are unlikely, although there were some positive thoughts and ideas contained in the review that may be implemented in the long run.

At IAgrE we have a steady flow of people wanting to register as Chartered Engineer and I can only see that going from strength to strength. I am not against the concept of the Registered Engineer and I can see the title of "Registered Agricultural Engineer" as an appealing option. The challenge is in relating this to a level of learning and experience and the current registrations of Incorporated Engineer and Engineering Technician are very clear in that respect. Providing that proper recognition of the technician and the graduate can be maintained, then I think there are many engineers who would wear their "registered" badge with pride. The devil will be in the detail.

Is there merit in having a single entry point for registration and then allocation to appropriate PEIs? (obviously funding issues here)
In theory this sounds good but in practice I can't see it working. Who would allocate registrants to a PEI? How would this be an objective process? Perhaps more important is for all PEI's to have similar entry systems and procedures. At present, we all operate to the same standard through our Engineering Council licence but when it comes to the detailed approach to gaining, say Incorporated Engineer status, the applicant may well come across a multitude of application forms and guidance. I am not sure that is helpful. We have one chance to get it right. People are easily put off.

Has, or would IAgrE have discussions with other PEI's complementary to our industry?
We maintain a working relationship with one or two other PEI's and where needed we will collaborate on things such as events or responses to consultations. Our members are proud Agricultural Engineers so identity is important in this respect. I am sure there is more we could do around training, conferences and events.

What more should the engineering sector in general be doing to attract new recruits?
If I had the answer to that I would be a very rich man. There are many initiatives to promote engineering as a career but this is often dominated by the large and global companies. As ever, money talks – and the challenge we have is to support the many small engineering business in the UK. In agricultural engineering, we promote careers quite well through our relationship with trade bodies and the education sector but you can do that in a smallish sector where many people know each other. The real issue is one of societal change. We need to showcase the industry as it is. Influencing parents and teachers is vital if we are to gain more recruits. I think we are pushing at an open door – if only we can find the door …

NOTE THE DATE: THURSDAY 24 MAY 2018

ICONIC LOCATION FOR 80th ANNIVERSARY AGM AND AWARDS

The 2018 AGM and Awards will be held at the Grade I listed house, the focal point of the Wrest Park Estate and Gardens on the exact day, 24 May, that the Institution of Agricultural Engineers was founded in 1938.

The venue has close association with agricultural engineering for it was acquired in 1946 by the Ministry of Works who leased it to the National Institute of Agricultural Engineering (later the Silsoe Institute) and became world renowned for its research into farm mechanisation and trials of new techniques and equipment.

AWARDS
A new addition to the Awards this year will be an **80th Anniversary Team Award** which will be presented along with the Student Project Award, Student Safety Award, Award of Merit, Contribution to Landbased Sector Award, President's Award, Branch Meritorious Award, Douglas Bomford Paper Awards and Special IAgrE Branch Award

PROGRAMME
Full details are on the back cover of this issue of Landwards, but the day commences with coffee from 10.00am, followed by AGM, the handover to the new President, **Prof Jane Rickson** CEnv FIAgrE and a glance back at the last 80 years – and a look forward – by **Prof Dick Godwin** FREng CEng CEnv Hon FIAgrE and **Prof Paul Miller** FREng CEng CEnv HonFIAgrE

For further information, please contact Sarah McLeod at IAgrE 01234 750876

NOTICE OF MEETING

Notice is hereby given that the **Seventy-second Annual General Meeting** of the Institution will be held at Wrest Park, Silsoe, Bedfordshire on **Thursday 24th May 2018 at 10.45am**.

Agenda

1. To receive and confirm the minutes of the seventy-first AGM held on 27th April 2017
2. To propose as an Ordinary Resolution: ***"That the Annual General Meeting authorises the Trustees of the Institution to review members' subscriptions and to make such adjustment, if any, as may be required with effect from 1 January 2019"***.
3. To consider and adopt the Annual Report for the year ending 31 December 2017.
4. To receive and adopt the Accounts for the ending 31 December 2017.
5. To announce nominations for election to Council for the 2018/2019 Session.
6. To re-appoint Lander & Co, registered auditors, as reporting accountants and to authorise Council to fix their remuneration.

By Order of the Trustees

A.J. Taylor.

Alastair J Taylor, Chief Executive & Secretary
ALL PAPERS ARE AVAILABLE ON THE IAGRE WEBSITE

PRELUDE TO IAgrE 80th ANNIVERSARY: MAY 1938 – MAY 2018

TECHNOLOGY TRANSFORMED

Charting an extraordinary era for IAgrE

The so called 'golden age' of food supply in the 19th and early 20th Century with it's strong reliance on imports from the US came to a shuddering halt with the German sea blockade during the First World War. Suddenly, the focus was on food production at home, aided by the importation of 5000 Fordson tractors from across the pond in 1917.

The war over, and the resumption of international trading slowed the progress of farm mechanisation, but the 1930's saw the introduction of combine harvesters, balers and other mechanised farm machinery on UK farms.

It was against this background, that a group of agricultural engineers decided to form The Institution of British Agricultural Engineers at an inaugural meeting held on 24 May 1938 at the offices of the

Institution of Mechanical Engineers. The original Council comprised of manufacturers and even farmers. The present title had been registered by others, but not taken up at the time of the formation. But when that lapsed, the institution dropped British from its title in 1949 to become the Institution of Agricultural Engineers.

The average size of farms at the time was less than 100 acres, and a census of Oxfordshire farms carried out at the time revealed that there were 5.4 tractors per 1000 acres of arable land. Technology was in its infancy, pneumatic tyres had only been introduced for tractors in 1933 – and there were concerns that 'tractor-sickness' was prevalent with the many paraffin fuelled tractors in use.

The focus of IAgrE at its inception was firmly on tractors, tillage and harvesting machinery. However, over the years many more disciplines have been embraced, such as dairying, amenity, soil science, forestry and the environment.

LANDWARDS 80th ANNIVERSARY SPECIAL ISSUE

To chart the 80 year progress of IAgrE, we have invited leading specialists from the areas covered by IAgrE to contribute a personal view on the developments in their field. The topics will include:

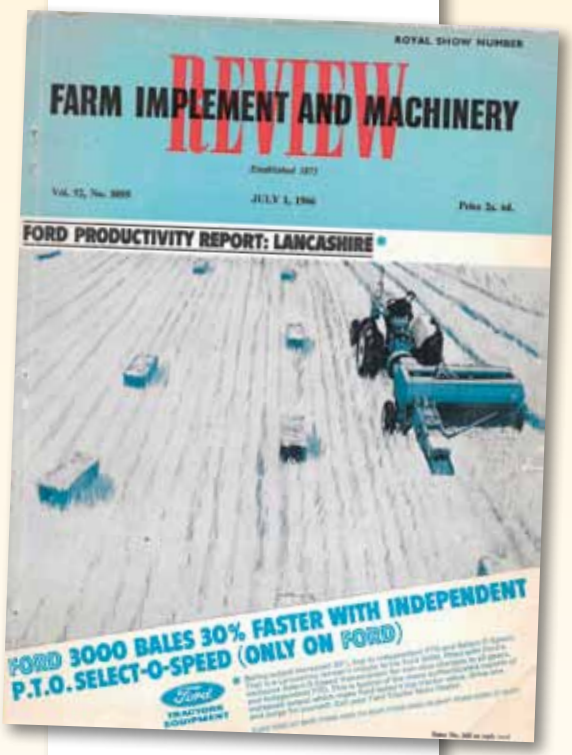
- The Tractor
- Cultivation and Tillage
- Post Harvest Technology
- Spraying & Pest Control
- Forestry
- Milking & Dairy Engineering
- Turf and Groundscare equipment
- The Technician
- The Professional Engineer
- Soil Science
- Energy
- Health & Safety and Working Life
- . . . and others

These editorials will be published in a special 80th Anniversary issue of Landwards towards the end of 2018.

In the meanwhile, and to give a flavour of the forthcoming content, we are delighted to publish one of the submissions already received and written by former President, Peter Leech HonFIAgrE on the changing role of **The Technician**

IAgrE in the Press

Two contrasting editorials appeared in ***Farm Implement and Machinery Review***, a leading trade journal



MAY 1938 EDITORIAL

". . we believe that to form an institute of agricultural engineering, which would likely embrace people without the necessary engineering qualifications, would do a disservice to agricultural engineering itself"

JULY 1966 EDITORIAL

". . we never hesitate to applaud the efforts of the Institution of Agricultural Engineers, a body which - sometimes against fearful odds – has striven over the past twenty eight years to enhance the professional status of agricultural engineering

THE EVOLVING ROLE OF: THE LANDBASED TECHNICIAN

From the blacksmiths shop to a computer-laden agri-tech service centre, the role of the landbased technician has changed out of all recognition during the past 80 years. Former President **Peter Leech**, Hon FIAgrE, who spent 42 years with John Deere, charts the march of progress.

THE land-based technician role is one that has evolved through many stages as technology has developed into a role that bears little or no resemblance to its origins.

In the very early days of agricultural mechanisation, everything was essentially made by the blacksmith. This was typically a local facility where hand tools, harrows and simple implements were made for horses to pull and of course, the blacksmith was responsible for shoeing the horses too. So all the farmers' needs were met by the local blacksmith and when their implements needed repair or renewal they simply went back to the local blacksmith.

The blacksmith could design (usually with chalk on the floor), manufacture, repair and modify essentially any implement on the farm. Most of today's farm equipment manufacturers started from small beginnings in a blacksmith's shop, even the major international companies like John Deere. Many implements are still made on a bespoke basis by local blacksmiths who are today more like fabricators rather than traditional blacksmiths with a forge.

As mechanisation progressed, the age of steam arrived on the farm with large ploughs and cultivators pulled by steam engines (usually on cables) and new and larger barn machinery such as threshing drums and stationary balers driven by belts from the steam engines.

These machines required repair and maintenance but were essentially very simple and a blacksmith with common sense and simple tools could still do most of what was required. Hence, the term journeyman came into being; a journeyman was employed by the blacksmith or the equipment manufacturer and was a basic fitter who travelled to where a machine needed repair, since in most cases the machine could no longer be brought to the blacksmith's forge.

SERVICE VEHICLES

It was around this time and for this reason that travelling to an agricultural machine in the field to perform repairs began and has become generally accepted as the norm in agriculture. Today's technicians operate from service vehicles run by the dealerships and carry out repairs on site. This is one key difference to the technicians who today repair cars, trucks and other types of vehicle which are brought to the technician in the workshop.

During the steam era the term "fitter" became quite widely used as a name for the journeyman who came to repair the steam engine or other machines. This name came from the railways and really implies a person who fits parts, it gives no credit for the powers of deduction in diagnosing a problem and the ingenuity in developing a repair based on what was available at hand to get the machine running.
Eventually the internal combustion engine took over from the steam engine on the farm in the form of very simple tractors. As these were usually manufactured a long way from where they were being sold (most early ones came from the USA) then the era of specialist dealers came into being.
These were businesses (often owned by blacksmiths) which were set up to sell and support these machines as well as an ever broadening line of more ingenious machines that were being developed for cultivating, sowing, harvesting and processing farm crops.
The technicians working from these dealerships continued the now normal practice of travelling to the farms to service and repair the new tractors and machines; and the term generally used for these technicians was "mechanic" as well as "fitter" which continued.

ABOVE: *A typical blacksmiths forge manufacturing and repairing everything for the farm*

During the steam era the term "fitter" became quite widely used

DIAGNOSTICS

Spool forward fifty years and two world wars to a point where tractors and agricultural machines were developing fast and much more technology was employed. This is the time that professionalism in our industry had started to come to the fore with the IAgrE having been formed in 1938.
It came about in recognition of the rapid development of farm mechanisation and the professionalism of the people involved in making it happen. This included the fitters and mechanics (technicians) at the front end keeping it all working and always has included them.
The diesel engine and tractor/implement hydraulics were probably the two most important advances at this time, both of these brought new requirements for the agricultural technician. It was no longer enough to use common sense and logic in diagnosing problems (although still required in abundance) but now training was required on how the systems worked, how to test and diagnose as well as repair and adjust them.
Manufacturers had to develop comprehensive workshop manuals and training courses to support the mechanics in maintaining these machines. In addition, this ushered in the need for formal apprenticeships, the agricultural colleges stepped up

ABOVE: *Chris Whetnall CEO of IAgrE (1999 to 2013) as apprentice for Penfolds of Arundel in the early 1960's*

as well as the industry as a whole in developing curriculum, and courses to deliver them.
Several methods of delivery were tried and the block release system of training soon won out as the most practicable. This means the apprentice technician attends one month per term (three months per year) at college over a three year period with the rest of the time on the job working with a qualified technician back at the sponsoring dealership. This also allowed the colleges to organise their academic year around the three year apprenticeship with three year groups coming into college in one month blocks.
This all added to the professionalism and the need for skills and status to be recognised through qualifications and IAgrE membership.
Tractors and machines developed rapidly during the 60's, 70's and 80's with the machines generally getting much larger and more productive. Systems and technology continued to increase with the focus on electrics and electrically operated hydraulics and sophisticated transmissions systems like powershift and IVT. This era also saw the introduction of other technologies such as air conditioning systems, hydrostatic drives and the beginning of electronics. Technicians required more and more training and specialist diagnostic tools to be able to look after these machines but apart from the apprenticeship, there were no further qualifications or recognition available. In addition, they continued to be known as fitters and mechanics, which was becoming rather derogatory in the modern era considering the level of knowledge and skill they required.

ABOVE: *A typical modern day Master Technician with all the tools and technology as well as his name and LTA qualifications on the door*

SKILLSETS

There were many other engineering disciplines who needed the same skills as the agricultural engineer and many of them made attractive options to earn more and have a somewhat less stressful and seasonal life. These included the oil and gas industries, aeronautical, automotive and construction industries. Therefore finding, training and keeping good agricultural technicians became a real problem to the industry during this time.

The skillsets that were and remain very attractive to others are; self-sufficiency (working alone on site), adaptability, ingenuity, common sense and a broad knowledge of many different technologies and systems. Also the ability to work directly with the customer and his staff and manage their expectations often under stressful time pressure. And not forgetting a good understanding of agriculture and what the customer is trying to achieve with the machine, its seasonal criticality and need for adjustment to differing soil and crop conditions.

These skillsets and the demand from other industries for them created a serious shortage of technicians in the land-based industries during this time, which continues to some degree to this day.

Various initiatives took place in the 90's to try to focus on this industry-wide problem and develop actions to improve it. One was the Careers Project, which focused on communication and recruitment of new talent with many activities focused around young people and schools.

Another was the development of manufacturer sponsored apprenticeship programmes where the larger machinery suppliers developed their own bespoke apprenticeship programmes covering the national curriculum but adding much more content concerning their products and company procedures, ethos etc.

The first of these was developed by John Deere but within a few years most leading manufacturers had similar programmes working with specific colleges. These were very successful and that success continues today.

From a technical perspective, everything changed up a gear in the 90's and into the new millennium. The electronic age reached agriculture and made a huge impact. This meant yet more to learn for the technician in addition to everything that had gone before.

There were more and more systems added to tractors and machines including electronic control

SKILLS AND COMPETENCES	Pre 1900 Blacksmith	1900 - 1940 Journeyman	1940 - 1970 Fitter	1970 -1990 Mechanic	1990 to Today Technician	The Future Tech of Tomorrow
Practical common sense and logic	X	X	X	X	X	X
Ingenuity to solve problems	X	X	X	X	X	X
Adaptability to invent solutions	X	X	X	X	X	X
Self-sufficiency (working alone on site)		X	X	X	X	X
Customer relationship management	X	X	X	X	X	X
Good understanding of farming operations	X	X	X	X	X	X
Work with steel and welding	X	X	X	X	X	X
Work with spanners and hand tools		X	X	X	X	X
Understanding and working with IC Engines			X	X	X	X
Transmissions			X	X	X	X
Complex transmission systems PST, IVT				X	X	X
Hydraulics, hydrostatics				X	X	X
Air Conditioning systems					X	X
Electro Hydro systems					X	X
Electronics, CAN bus systems					X	X
Emissions systems					X	X
Telematics					X	X
Robotics						X

management of each of them individually. In addition, inter-system communication with CAN bus communication came into play and yet more new and advanced technologies were added. The most significant of these being GPS starting with mapping and monitoring but soon developing into auto steering and prescription control of seeding, spraying and fertilizing.

We have since seen the addition of telematics which has enabled remote monitoring and even remote diagnostics.

From the technician's point of view this means that he or she is now a truly high-level technician being trained and skilled in all these multi-facetted systems and interactions, the daily use of electronic diagnostic equipment in addition to all the prior knowledge and skills of his or her predecessors. See the chart, previous page, which tries to demonstrate how the skills and competences required have developed and increased over the past hundred plus years.

ACCREDITATION

In recognition of this ever-increasing requirement for skills and competencies, the industry led by the manufacturers' training managers, in the form of the AEA Training & Education committee in conjunction with IAgrE and BAGMA, developed the Land-based Technicians Accreditation (LTA) Scheme, which was launched in 2005.

This scheme accredits the training provided by the manufacturers and recognises the skills and experience gained by the technician to the point of certifying four distinct levels of attainment and thus providing a career path for qualified technicians post-apprenticeship. The highest level known as Master Technician recognises the top level of the modern landbased technician.

This is the individual that given sufficient information and tools could diagnose and repair any equipment found on the modern farm. The IAgrE manage the scheme and a new body was formed providing overall governance and direction for land-based training. This body is made up from the three main organisations in the industry with an interest in technician training and development these being BAGMA (the dealers' association), AEA (the manufacturers' association) and IAgrE. This body is known as LE-TEC (Land-based Engineering Training & Education Committee).

> It was no longer enough to use common sense and logic in diagnosing problems

So what will the technician of the future be like? That of course depends on the technology and mechanisation on the farm but it is likely he or she will be more and more involved with electronics and telematics as they relate to the machines we know but also in relation to robotic equipment.

One big difference is that this could mean there will be no operator to quiz and discuss the symptoms of any problems to assist with diagnostics and even more reliance on error codes and the studying of telematics recordings of functional performance.

There will probably be a lot less spanner work repairing engines and transmissions as machines could well be smaller and predominantly driven with electric motors.

Another change this could bring about is that the technician may well spend less time on the farm and more time in the technical communications centre and workshop at the dealership.

The one thing for sure is that the land-based technician has played a key role in the mechanisation of agriculture and the position is one that is highly respected by all who work with them.

The name technician is definitely the only one appropriate for these highly skilled and trained personnel.

While technology will undoubtedly continue to develop, there will always be a need for the logical thinking and adaptable people that keep our agricultural equipment moving, The Technicians.

ABOVE: *No operator to quiz about the performance of a robot machine*

Why Should Farmers be Interested in the Internet of Things?

Anthony Furness, Visiting Professor Harper Adams University, urges support for the IAgrE special interest group which seeks to provide a platform for the agricultural community within the UK in which a cohesive approach to IoT developments can be incrementally introduced.

Farming, like most businesses, is geared to making profit and ensuring a good return on investment. Equating this need with the demands on farmers to meet food security requirements, rising competition and the growing impact of technological change is exacting and can be frustrating. This is especially so where opportunities are masked by hype and difficulties of finding time and effort to gain sufficient awareness in order to make informed decisions.

Where new technology is concerned, change is increasingly rapid and the daily bombardment of information on all sorts of technology make it increasingly difficult to navigate the possibilities and opportunities that these new developments present.

So, where the benefits are not immediately obvious, why bother pursuing them?

Concepts, as well as technology, are generally long in gestation from their initial exposure and where the promises exceed the capability, confidence wanes and the incentive to adopt is either missing or disappears. Such is the situation it would seem with the so-called Internet of Things (IoT).

Expounded as a concept way back in 1998 through the Massachusetts Institute of Technology (MIT), its initial claims and expectations of object tagging and connectivity through radio frequency identification (RFID) were quickly shown to be overstated. Despite a decade or so of money spent on European and national projects, it is only now that the potential is beginning to be realised, assisted by the growing commercial interests and the impact of other IoT-supporting developments in telecommunications, embedded sensing and actuation devices, data acquisition platforms (static and mobile ground based systems, aerial and satellite systems) processing and Internet-based (Cloud computing) services.

> Despite a decade or so of money spent on European and national projects, it is only now that the potential is beginning to be realised

Characteristically, these developments are accompanied by the developments of commercial platforms to accommodate or exploit specific applications or application sectors, such as transport, manufacturing, health care and so forth.

IoT is no exception in this respect and with increasing numbers of platforms arising in this way the inclination to navigate and understand the opportunities they aim to provide becomes exceedingly difficult for the individual or small enterprises to exercise. Platforms in this context are "foundations on or through which others provide useful tools and applications to perform specific tasks" (IoT UK March 2017) On the same level – An Introduction to IoT Platforms, IoTUK.org.uk)

ROUTES TO UNDERSTANDING

The recently announced IoTUK Database (IoTUK.org.uk) seeks to help in defining and selecting platforms for IoT applications, but again a technical 'hill-climb' coupled with an absence of obvious financial incentive is unlikely to attract the interests of farmers in general.

The IoT is about connecting to the physical world at an unprecedented level, linked-to and exploiting developments in the Internet, networking and communications technologies. As such it is of primary significance in the evolution and development of precision farming. However, to maximise the benefit

To maximise the benefit of its potential requires the strategic intervention of agricultural pioneers and practitioners

of its potential requires the strategic intervention of agricultural pioneers and practitioners to specify the infrastructure, platforms, security measures and standards that have relevance to agriculture, primary food production and the interests of the agricultural industry.

For those unfamiliar with the concept, platforms and the associated technologies, incentives for adoption need to be distinguished together with a route to understanding them and the way in which they can be exploited to realise business benefits through cost-effective applications.

For farmers, and other businesses alike, a route **can** be identified, a route that exploits the foundational understanding of business processes and how they can be radically improved, coupled with an understanding of the foundational imperatives underpinning the potential of the IoT.

By identifying the various processes that make up a business and examining the relationships between them and how effectively they perform, insight can be gained that often allows technology to be selected, which can radically improve those processes.

Radical in the sense that when effectively applied the attendant improvements in performance, productivity and quality can generally be measured in tens of percentage improvement rather than one or two percent, and with rapid returns on investment. The key to this improvement is through understanding the capability of identification and the use of automatic identification and data capture (AIDC) technologies.

MACHINE-TO-MACHINE COMMUNICATIONS

Tagging of cattle, sheep and other farm animals is possibly the most evident of AIDC technologies being used in agriculture, wherein by automatically identifying those animals the facility is presented for animal-specific process development. For example, individual feeding regimes can be related to individual yields, as in milk production. It presents a foundational component for precision farming, yielding data and information too that can be used in other aspects of farming development and production.

By taking it a stage further identifiers may be used to effect in machine-to-machine communications and applications exploiting other technologies, the Internet, and the application layer presented by the world-wide web.

By way of example of exploitation of GPS/GNSS supported remote sensing for field mapping, coupled with application-specific analytical services, such a soil condition, enable arable farmers to achieve a better understanding of their field resources and process developments that can then be exploited to yield greater commercial benefit.

Taking the soil management as an example, click-to-service facilities are now available that allow analytical services, such a soil analysis, to be selected that prompt the physical collection of soil samples which are then delivered to a processing laboratory to be analysed.

The information sent digitally from the laboratory to the service provider, integrated with other associated information, and is delivered to the client farmer through the online website. The soil analysis can be used to maximise performance with respect to input usages, irrigation considerations and crop production management.

It is not difficult to recognise potential for other service-based applications along these lines, some of which will beneficially exploit the increasing quantities of data that these processes generate. With the push to greater precision the prospect is further presented for reduced use of inputs, increased productivity and care

for the farming resources and the environment.
Even within these basic applications scope exists for further accommodating IoT features, such as cloud-based usage of computing capability and storage for on-going farm related statistics and evidenced-based decision support. Similarly, other aspects of the dairy cattle process pathway, such as pasture and housing management, weaning and so forth, may be considered for developments that exploit the IoT capabilities.
The guiding principle in this respect, and with regard to other farming and supply chain activities, is to establish if the development can provide economic or other benefits that can justify the approach.

Enable arable farmers to achieve a better understanding of their field resources

While these are highly simplified insights into IoT applications the fact remains that they are developments that reflect the growing importance of both concept and technologies that underpin the Internet of Things and its possible applications in agriculture. However, as with any technology and mix of technologies within a business concept, the detail and associated issues, that include legislation, standards, enterprise opportunities, risks and competitive positioning, for example, can appear formidable, even when commercial benefits can be seen. Under these circumstances having a representative industrial body and an interest group that can accommodate the various needs of interested parties has distinct advantage.

SPECIAL INTEREST GROUP

The IAgrE special interest group seeks to accommodate this need. It seeks to provide a platform for the agricultural community within the UK in which a cohesive approach to IoT developments can be incrementally introduced. The SIG would align support for practical business developments with radical attention to productivity, profit, entrepreneurship and global outreach. In order to present the case for the Interest Group in more detail, and provide a precursory view on what the IoT might mean for Agriculture, a one-day workshop is being organised. With representative examples of how the IoT concept can be pursued to achieve profitable applications, it will also seek to define a set of initial guidelines on how the Interest Group can best serve the Agricultural Industries through exploiting the IoT concept in very practical terms and providing an agricultural-specific forum for considering IoT developments and issues of agricultural significance. Initially, attention will be directed at:

- Process-based developments that can radically impact upon performance and profitability,
- Machine-to-machine (M2M) developments in relation to connectivity,
- Sensing, and embedded systems,
- Commercial-off-the-shelf products and services supporting IoT developments,
- Normative and emergent standards, supporting IoT developments,
- Open and big data developments.

Above all the Interest group will be focused upon assisting farmers and other primary food producers in engaging and exploiting the revolutionary and radical potential that the IoT appears to offer – relieving them of the need to delve individually into the technological details and providing a forum for on-going support in respect of:

1. Addressing collectively issues concerning the adoption and development of IoT in agriculture.
2. A forum for specifying and initiating IoT initiatives.
3. A forum for networking and developing partnerships concerning commercialisation of IoT innovation.
4. A forum for identifying and partnering in research and business supporting funding bids.
5. A UK collective voice on issues concerning the use and development of IoT in agriculture including standards and controls on opt-in or opt-out provisions in commercial services.
6. A role in organising and delivering awareness and training events on IoT in agriculture.
7. A platform for demonstrating and promoting IoT agricultural developments and services.
8. A platform for promoting and celebrating innovation in IoT applied to agriculture.
9. A role in influencing education, research and development in areas associated with IoT in agriculture.

For more information on the IAgrE Special Interest Group for IoT contact IAgrE secretariat

DOUGLAS BOMFORD TRUST

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@BomfordTrust Secretary: Alan Plom
Administrator: Elizabeth Stephens

Alan Plom, The Douglas Bomford Trust's new secretary, provides this update on the Trust's recent activities.

Douglas Bomford Scholarships presented

The six Harper Adams University (HAU) undergraduate students chosen to receive a Douglas Bomford Scholarship this year received their Awards officially at the well-attended and well-'choreographed' annual HAU Development Trust Scholarship Presentation Ceremony, held on 14 February.

The Trust was represented by Trustees **Dr Paul Miller** and **Dr David White**, and the Trust's Secretary, **Alan Plom**. Paul kindly did all the hand-shaking on behalf of the Trust and then addressed the packed Queen Mother Hall.

From his perspective of working with Harper Adams over the past 8 years as Secretary of the Trust and now as a new Trustee, Paul commented: "I have always been struck by the enthusiasm and excellent contribution Harper's engineering undergraduate students make, and we look forward to working with this year's scholars, and continuing to work with HAU and its students in the future."

Harper's Development Trust are rightly proud to have raised £500k for this year, from many diverse charities and organisations. This is funding 151 Scholarships, supporting 133 students.

In addition to the 6 undergraduate students chosen to receive a Douglas Bomford Scholarship this year, quite a few other recipients of Scholarships have an interest and involvement in agricultural engineering in its widest sense too, so the discipline was well-represented. The Trust also funded a party of HAU students to attend AgriTechnica this year.

I am sure that 'our' scholars enjoyed this opportunity to meet with the three of us again rather more than back in November, when they were being interviewed. All are clearly enjoying their studies (and life!) at Harper immensely, and their increased confidence and growing 'stature' was noticeable. This bodes well for their futures in the industry.

The Class of 2017-18. Harper Adams University Scholars with the Douglas Bomford Trust representatives
Back row L-R: Mr Alan Plom (Sec), David Kelso, Dr David White (Trustee), Hua Ying Baker, Alex Williams, Dr Paul Miller (Trustee)
Front row L-R: Anita Woolf, William Flittner, Amy Boothby

Liaison with the Agricultural Engineers Association

Paul Miller had this in mind when he spoke to the **Agricultural Engineers Association *Farm Equipment Council (FEC)*** meeting on 21 February. Paul recalled that AEA members played a significant part in the Trust in its early days and was pleased that the AEA's Keith Hawken had recently become a Trustee. Paul described our role and funds available to support students at all levels - including supporting undergraduates and PhD's, funding travel to shows and study tours, special projects and capital investments in facilities. He also explained how we monitor projects and saw potential for the AEA to suggest projects.

FEC members agreed that the 'Arkwright' Scheme chimed well with the AEA and manufacturer's desire to attract young people into agricultural engineering, and hosting visits was a good model for future collaboration. The Trust have been invited to speak to AEA's Training and Education Committee and we look forward to making arrangements with manufacturers for this and future years.

IAgrE Landwards Conference

The Trust funded the transport of a number of sponsored students to exhibit at the Annual Landwards Conference, ***'Decarbonising UK Agriculture- Perspectives and Policy for Change'***.

'Feeding Tomorrow' at the Science Museum

The Trust is one of the sponsors of a new exhibit being developed at the Science Museum, aiming to advance knowledge and understanding of the application of engineering and technology in the agricultural sector. Trustee **Paul Miller** has been advising the curators on content of the ***'Contemporary Agriculture Gallery'***.

Under the banner ***'Feeding Tomorrow'***, this innovative new display is intended to "give people the tools to understand the world around them: the reasons for changing environments, the possible ways of combatting this and fighting common misconceptions, allowing visitors to make informed choices around food and how they are affecting the environment".

The current plan is that the Gallery will be split into four 'clusters', each examining a different issue faced by modern farmers, as well as introducing how innovations in science, technology and engineering are being used to address them. In particular:

- **Soil**: How can we work the land to produce enough food and keep the fragile soil healthy?
- **Wildlife**: How can we grow enough food and leave space for wildlife?
- **Animals**: How can we rear animals to produce food and look after their welfare?
- **Climate**: How can we grow enough food and adapt to a changing climate?

The aim of the Trusts' involvement is to ensure that the contribution of agricultural engineering has a high profile, alongside the emphasis on environmental and sustainability issues in maintaining and increasing agricultural production to meet an expanding world population.

Visitors will be introduced to working objects and have the chance to handle exhibits and get up close and personal with contemporary agricultural tools. The gallery is due to open in 2019.

THE INNOVATORS

Mzuri Pro-Til Xzcat striptill precision seeder

Two drills in one

The high standard of engineering and innovation won Mzuri the Overall Winner of Awards at LAMMA 2018

Topped up from the drill's main 2800 litre seed hopper, the Xzact precision metering system is an optional extra that can be fitted to most Pro-Til striptill drills to provide non-stop seeding of precision crops including maize, sunflower and soya. The drill can just as easily be converted back into a standard Pro-Til drill for crops such as wheat, oilseed rape and beans.

Pro-Til Xzact provides seeding accuracy, typically awarded by conventional precision seeding drills, in a form of a single pass drill, yet without any of the downsides. The innovative 'one pass precision seeding' approach eliminates ploughing and power-harrowing operations, which are widely recognised as huge contributors to erosion and loss of moisture, meaning that the soil's natural structure can be preserved to the benefit of the crop and the environment.

Capable of drilling straight into previous crop residue, the Pro-Til Xzact precision striptill drill has been proven to retain moisture, reduce soil and water erosion and improve soil structure whilst cutting diesel requirement by up to 80% compared with conventional seeding – without penalty to the yields.

With soil deterioration and lack of moisture proving an increasing problem in some heavily cultivated areas, partial or severe crop losses caused by the weather extremes, water erosion or draught are fast becoming commonplace.

Extensive trials comparing conventional establishment and Pro-Til Xzact one pass precision seeding have shown that crops drilled with the Mzuri Xzact have consistently outperformed conventionally established maize right through to harvest. During extremely dry conditions, some plough and press maize failed to germinate whereas the Xzact precision striptill method produced a viable, healthy crop thanks to the system offering the optimum environment for the seed to develop and reach its full potential.

Pro-Til's seeding arm moves up and down to follow the contours of the ground, as well as pivots side to side to ensure the seed is always placed centrally in the pre-tilled area.

Vacuum metering

The Xzact system features an electronic precision seeding unit and coulter assembly to deliver single seed placement whilst the constant hydraulic pressure exerted onto each coulter arm ensures the seeding depth accuracy.

The system uses adjustable-pressure vacuum metering to accurately space crops, regardless of the seed size. Each unit contains a metering disc and a singulator to prevent skips or doubles and is driven by an electric motor which maintains the same seeding distance at variable speeds.

Unlike with conventional precision seeders, the mini hoppers on the Pro-Til Xzact drill are automatically replenished by a bulk fill mechanism on each metering unit directly from the Pro-Til's main tank, thus extending the drilling time and reducing downtime.

Pro-Til Xzact features hydraulic pressure adjustment to each individual

Turning original ideas into practical use

arm and a coulter-following semi-pneumatic wheel to remove air pockets whilst ensuring that the soil is not over-consolidated for compaction-intolerant precision crops.
Precision crops, particularly maize, favour warm, moist, well-structured soil and the Pro-Til Xzact can create these optimum conditions in a single pass.

Seed accuracy

As well as the state-of-the-art Xzact precision metering system, the Pro-Til offers a range of additional benefits awarded by the Mzuri one pass striptill technology.
The Pro-Til only cultivates a narrow strip of soil, leaving the rest of the ground undisturbed, thus not only improving the soil's natural structure and helping beneficial organisms to flourish, but eliminating unnecessary passes and reducing labour and fuel requirement. Less farm traffic, in turn, means reduced compaction, better structured soil and a healthier root system.
Additionally, the drill boasts a unique combination of features which have been engineered to prepare the perfect 'nursery seedbed' and ensure even germination.
With the help of the front cutting discs, the Pro-Til Xzact can drill directly into previous year's stubble, thus preserving valuable soil structure and moisture, both of which are paramount for the successful establishment of precision crops.
Independent leading discs are spring-loaded and pivot side to side to ensure good trash flow.
Next, the leading leg loosens the soil, preparing a strip of friable tilth, and places a band of fertiliser just below the seeding depth to ensure quick access of nutrients for fast root establishment. The band is then gently reconsolidated by a following press wheel to remove pockets.
Seed is accurately placed at a consistent seeding depth by the Pro-Til pivoting seeding arm fitted with the Xzact precision metering system.
Once the soil has been gently reconsolidated by the coulter-following semi-pneumatic wheel, a hydraulically pressurised harrow bar smooths the surface if required, ready for the effective application of pre-emergence chemicals.

MICHELIN Evobib tyre

SMART TREAD PATTERN

Michelin's new '2 in 1' tyre with adapted tread pattern for road or field use

Making it's UK debut at LAMMA ahead of its international release in February, was Michelin's '2 in 1' EvoBib tractor tyre – which features a smart tread pattern that evolves to match the application.
The tyre – which was awarded the prestigious SIMA Innovation Gold Medal last year – was designed to support farmers who increasingly opt for larger machinery to be driven both in the field and on the road.
When set at high pressures for road work, the tyres' central band grips the road providing the flexible fitments with a road-optimised profile. The adapted tread pattern gives a smoother vibration-free ride, while saving farmers fuel and improving safety.
In the field, working at low pressures, the tyres' footprint spreads across a wider and longer surface, helping to boost traction while preventing soil compaction.
The latest in the line of innovative tyre technologies brought to market by Michelin builds on previous products such as Ultraflex technology and the Connected tyre.
The patented technology was developed by Michelin's 6,700-strong team of R&D scientists.

MEMBERSHIP ENQUIRIES
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COUNCIL MEETING 8 FEBRUARY 2018

Warm welcome from Moulton College

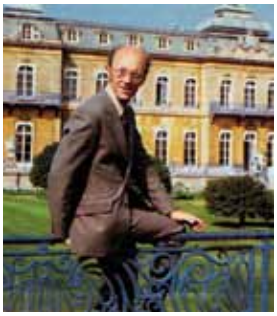
Report by Marion King

February's Council meeting was kindly hosted by Moulton College and members received a very warm welcome from Principal Stephen Davies and Deputy Principal Gerald Davies - no relation.
CEO Alastair Taylor gave a presentation outlining IAgrE's main activities.
This was followed by a discussion about the best way to collect subscriptions the structure of membership grades and their admission criteria, with the majority of council members agreeing that Direct debit payments are to be encouraged and that a break-down of fees, separating IAgrE Membership from Registration fees is valuable but perhaps administration charges need to be included in the registration fee.
Before lunch Claire Donovan, senior professional relationships manager at the Royal Academy of Engineering gave a talk about the structure, work and priorities of the Academy.
After lunch Gerald gave a brief introduction to the college and the new Food & Drink Innovation Centre. Members then toured the college and visited the impressive Chris Moody Centre for sports injury and rehabilitation. The state of the art centre is the first in the UK and aims to become a centre of excellence in providing neuromuscular rehabilitation. Rowers, triathletes, footballers and rugby players are among the athletes being treated at the college.
The centre has a whole-body cryotherapy chamber and thermal suite, a hyperbaric chamber and a rehabilitation suite, as well as a hydrotherapy and water therapy pool. There is also access to a unique 25m swimming pool with a moving floor, which members found fascinating.

Animal Welfare Centre
The tour also took in the Animal Welfare Centre which houses a wide range of animals including small mammals, rodents, goats, llamas and exotic species such as reptiles, sugar gliders, marmosets and meerkats.
There is also an Animal Therapy Centre including canine hydrotherapy pool and water treadmill, where referrals are taken from 80 local vets, it also houses a professional dog grooming parlour which is open to the public. These facilities give a wonderful opportunity for work experience to the students attending the college.

ABOVE: Moulton Animal Welfare

OBITUARY



RONALD BELL CB FREng

Words by Professor Paul Miller

Ron Bell died on Christmas Day 2017 aged 88. Born in Lincoln, he became Director of the National Institute of Agricultural Engineering (NIAE – later to become Silsoe Research Institute) from 1977 to 1984. This was a time when there were growing financial constraints for research Institutes and Ron realised that the future required close links between the Institute and industry.
His policy of attracting extra funding for commercial contract research helped balance the Institutes books at a time when many other research institutes were losing posts.
As well as encouraging staff to be confident and outward looking, Ron Bell was keen that staff at the Institute talked to each other – he initiated a social complex within the mansion building that had a restaurant, bar and games facilities (snooker, pool and darts) and was keen to encourage all internal and external staff events.
In 1984 Ron Bell moved from NIAE to take on the role of Director General of ADAS then the government's agricultural advisory service for England and Wales. He came to this role still with limited agricultural background that added to the challenge of connecting with the farming industry. However he brought a keen intellect and a fresh approach which was needed during this period of rapid change as ADAS attempted to become at least partly commercial after around 40 years of offering a free service.
In both of the above roles, Ron Bell met many challenges in leading change at a time when the government was cutting all forms of support to the industry.
Ron was the husband of the late Eleanor Bell. The funeral took place on Wednesday 17 January at the West Herts Crematorium.

50 YEAR CERTIFICATE

Is it *really* 50 years since I became a member of IAgrE? They say time flies when you are having fun! When I became a member I was lecturing in Agricultural Workstudy at Seale-Hayne but within a few weeks I joined ICI Agricultural Division at the Head Office in Billingham, Teesside.
I later moved to a sales position during which time I continued the advisory role and became involved with the Power farming Conference and eventually was chairman in 1977.
In July 1977 I made a complete change and became the Project Manager for Haradh Agricultural Company in Saudi Arabia. This was right at the beginning of modern agriculture in Saudi and we took over the very large farm with 50 wells, changed the irrigation from flood to centre pivot, grew the first crops of wheat and potatoes plus a range of other crops and introduce a small 300 cow dairy unit.
In 1981 I joined AlKhorayef Agriculture and developed their farms from scratch and over three years introduced 187 centre pivots on seven sites. At the same time I was involved in the introduction of the John Deere agency and was lucky to be in Saudi when the logarithmic growth in agriculture took place which went from essentially nothing in 1977 to 1.5 million ha under intensive irrigation by 1990.
Since 1991 up to today I have run my own agricultural machinery sales company and done consulting work also. We now sell Supreme TMR mixers to all the livestock farms in Saudi and the UAE and increasingly in neighbouring countries such as Sudan, Pakistan and Oman.
Dairy farms have now increased in size dramatically and we now have companies in excess of 100,000 milking cows and single units with 25,000 milking. We also supply Morbark waste processing equipment, Midwest composting, Perry of Oakley for product driers and flaking mills and the Van Aarsen feed mill agency for Saudi. Currently I am based in Riyadh for around nine months of the year and the UK for three, and still having fun after 40 years in Saudi!

John Lawton,
Agricultural Technology Co.
Saudi Arabia / Riyadh.
www.ag-tech.me

EAST MIDLANDS BRANCH
Engineering Excellence - 70 Years of Land Rover
Presentation by John Holland of Jaguar Land Rover
9 January 2018
Report by Peter Leech

The title of this meeting presentation and the fact that John Holland is a senior executive of JLR with the title Head of The Jaguar Land Rover Way was sufficient to generate one of the largest ever gatherings of members and guests at an East Midlands Branch meeting with a total of 32. One esteemed guest and past president came all the way from Wiltshire (Richard Robinson).

We were not to be disappointed as John's presentation was fascinating, we heard about John's meteoric 20 year career (so far) in the automotive industry. Coming from a farm close to Melton Mowbray via a First-Class Honours engineering degree at Loughborough University he took all the practical skills of the farm with him into automotive. He used this to great effect building his career through various component and factory management positions into lead engineer for some significant product launches and into quality engineering and management. He currently leads the JLR Way, the companies integrated management system, which was developed my him and his team and is fully deployed throughout the company globally.

John treated us to some specific situations where critical product issues were compromising a new model launch and where applying the basic sound principles of agricultural engineering he was able to solve the problems and save the day. One example was a telescoping drive shaft, which was a very clever design that experienced some undesirable vibrations in the vehicle that would have caused complaints. This was solved by cutting one open examining what was happening and simply installing some lightweight "Biro" springs to help it self-centre. It was great to see those Ag Eng principles of sound common sense, logic and making do with what's available at hand to solve problems being applied within one of the most successful and prestigious companies in the world.

In the process of these anecdotes about his career and product launches, John was able to give us many insights into the history, culture and success of JLR.

The company is today a combination of two of the UKs greatest automotive brands but with very different origins and products. It is now all one company under Tata ownership since 2008 and prides itself in being the UKs largest automotive producer with 42,000 employees producing over half-a-million luxury vehicles per year and exporting over 80%.

The success of the venture is evident from the numbers, since Tata ownership the company has more than tripled its global turnover to £24 Billion in under 10 years and total production has gone from 200,000 vehicles to over 600,000 in the same period. The split between Jaguar at 25% and Land Rover at 75% has remained fairly constant.

It was also great to see the focus that JLR places on people, education and membership of professional organisations. They currently employ 42,000 worldwide and the business volume supports a supplier and dealer work force of an estimated further 240,000. Of the 42,000 there are 800 current apprentices and no less than 10,000 qualified designers and engineers. IMechE is the chosen professional engineering institution for JLR and they are very keen to have as many engineers as possible in membership and Chartered with the Engineering Council. Many of our large ag engineering companies could learn a lot from JLR about developing their engineers.

We wish John every success in his next 20 years.

History of Stilton Cheese
Held at Ben Craig, Harby
14 November 2017
Report by Richard Trevarthen

The meeting took place at the works headquarters of Ben Craig, Canal Farm, Harby, Leics. Ben is one of the UK's top vintage/classic tractor & machinery restoration specialists, and his HQ also houses a superb social centre.

So, a roaring log fire, fine cheese and a friendly welcome awaited some 30 branch members and guests, who attended the meeting to hear a fascinating talk, entitled "Stilton: Britain's Historic Blue" from Kim Kettle, of Long Clawson Dairy, (sited just a few miles from our Harby meeting point). Kim is the Production and Quality Manager for the Dairy, and has some 40 years experience to draw on.

He led an interactive talk which took us through the history of Stilton Cheese, including its origins, its history, the manufacturing process, and the story of Long Clawson Dairy itself, which is deeply interwoven with the history of the famous Stilton.

It transpires that Stilton, the village, was a major "transport hub" in the days of stagecoaches and some inns there were famous for serving certain quality cheeses. The vast majority of these cheeses were made in Leicestershire, and became widely known as "Stilton" Cheese. To this day Stilton Cheese is protected under EC laws and as such can only be manufactured in Derbyshire, Leicestershire, and Nottinghamshire, and made to strict specifications.

Kim explained how Long Clawson Dairy started in 1911 as a farmers' co operative, to make this famous cheese. It is still a co operative today, but it has grown and prospered, employing 340 people, and is now the largest manufacturer of Stilton in the world, producing approximately 6000 tons of blue cheese per annum. Stilton can be found in all major supermarkets, (except one) and is exported to most countries, where expats and locals alike enjoy its unique flavour.

Then, to what was the highlight for many: Kim had brought along three different types of Stiltons, explaining the difference between them. A white Stilton which has no blue veining, and thus is a great basis for blending with apricot, ginger, or other fruits to create unique dessert cheeses, then Blue Stiltons at two different stages of maturity…..the longer it matures the more blue veining., and finally their aged Red Leicester…. Rutland Red…which is buttered, cloth bound and matured for 6 months to give a fabulous texture and taste. This cheese has recently won some major awards for the Dairy. Then, with biscuits provided we all tucked in with gusto to

taste these delicious cheeses, and put to the test what Kim had told us. Brilliant ! However the eating didn't stop there. At the conclusion of Kim's talk we then tucked into a range of delicious home made cakes, plus tea or coffee, courtesy of Anne Clarke and Vanda Day, (wives of two of our members) who had obviously spent a lot of time and effort on our behalf. Following that we then had an opportunity to have a close look at Ben's superb personal museum, and some of his ongoing restoration projects. Having seen the condition of some awaiting restoration, and comparing them to those completed, I think we were all amazed at the fantastic job Ben does, and can see why he is classed as one of the UK's top restorer.
So an evening with a difference indeed. On behalf of all who attended, a very sincere and huge thank you for a very special evening.

NORTHERN IRELAND BRANCH

Robotics in Agriculture: opportunities and constraints.
Meeting held at AFBI, Hillsborough
14 November 2017

The November meeting featured a presentation by Dr. Debbie McConnell about the application of robotics to livestock husbandry systems. The meeting was at AFBI, Hillsborough where Dr. McConnell is carrying out related research work on the subject of "Digital dairying – increasing the value of precision technologies in the UK dairy sector"
She also recently completed a 16 week world study tour funded by the Nuffield Farming Scholarship Trust to the US, Middle East, India, Australia and New Zealand.
After Dr McConnell summarised the current role of agricultural production, she turned to the use of digital technology in agriculture. The 700% increase in internet data use has revolutionised communications and the storage of large amounts of information. There is now a strong bias to the use of mobile and wearable communication devices. The digital collection and use of data is helping to maximise the utilisation of labour, feed and land resources for livestock enterprises.
Grassland management
Aerial image pictures taken from a UAV or drone are now being used to monitor and manage arable field crops. Using the same technology over grassland offers the potential for rapid collection of useful management data. The analysis of aspects of the images, not all visible to the naked eye, may be able to quantify herbage yield (as a convenient alternative to the existing falling plate or trailed plate methods).
A variety of animal wearable electronic devices are already available to measure activity. A pedometer will record movement patterns to detect heat behaviour, lameness and rest / sleep patterns. On-body devices record heart condition, body temperature and blood pressure. One of the latest is an electronic data logging halter, with a pressure sensor in the nose band, to record grazing and rumination activity throughout the day. It can be worn in the field by an animal for up to 60 days without attention. Improved electronics and build quality mean that reasonably priced, more durable, commercial versions are now available.
In Australia and New Zealand some work has been taking place with robotic programmed herding devices to control cow movement between paddocks.
The concept of virtual fencing using electronic collars (with various frequency sound emissions or mild electric voltage pulses) to steer individual animals to preferred grazing areas, without physical fencing, is also being successfully tested
Robot milking units are now well established and available as single or multiple units.
An example of remote herd management in New Zealand is a 400 cow spring calving unit with employee operators' activity managed electronically on screen by the owner in his farm office 300km away!
Who is buying the technology ?
It is more attractive to a younger generation, with more training and confidence in the technology, seeing it as a way to reduce labour requirement and improve management control. Experienced stockmen may see it as interesting, and in some cases highly desirable , but not ready to take over from the direct application of their time-proven stock person skills and knowledge. A survey of UK dairy farm personnel reports that 45% felt that they would need better ICT skills to make best use of the available technology.
As the technology is so new it is still difficult to assemble enough test data to truly quantify the benefits for its widespread adoption. An International AMS (Automatic Milking Systems) Research project is now under way, including Dr McConnell's research work at AFBI, to co-ordinate and analyse the wide range of available data. A wide ranging technical discussion followed before the chairman thanked Dr. McConnell for her most interesting and informative presentation.

Massey Ferguson: First 60 years and beyond
Presented by Campbell Scott, Sean McAvoy and Chris Todd
2 November 2017

The subject of the first winter meeting was a presentation on the subject of "60 years of Massey Ferguson and beyond", delivered by Mr Campbell Scott, Director of Marketing Service (based at the MF European Operations base, Beauvais, France) and two coleagues.
Almost all of the world's agricultural tractors are now designed around the Ferguson System with its converging 3-point linkage for mounted implements to optimise stability and traction. The system was invented by Co. Down man Harry Ferguson, and his team, with their first patent granted in 1926. The first Ferguson Model A tractor began production, in co-operation with David Brown, in 1936 at Huddersfield. As well as being a talented engineer, Mr. Ferguson was also a skilled and motivated business man steadily pursuing his concept of efficient operation for agricultural mechanisation across the world. He went on to join a succession of other industrial partners to produce Ferguson System tractors. They included Henry Ford in the US from 1939 to 1947 , producing around 300,000 Ford Ferguson tractors up to 1947,and the Standard Motor Company in Banner Lane, Coventry from 1946. A total of 517,651 "little grey fergie" Ferguson TE 20 tractors were produced there, for both home and export markets, up until 1956.
The Massey-Ferguson (MF) brand was established in 1958. For this, the grey Ferguson "gold belly" 35 (which had taken over from the TE 20) changed its colour to the now familiar red / grey and got Perkins diesel power. The larger MF 65 tractor also joined the range along with the famous 735 and 780 combine harvesters which were produced at Kilmarnock from 1949. The 200 series followed at Banner Lane from 1979 to 1985. A high proportion were exported and cab versions were also popular in the UK market. A Massey Ferguson 4345 was the last of 3,307,996 tractors to be produced, since 1946, at Banner Lane when it closed in 2002.
Beauvais factory production
Massey Ferguson tractor production continued at the Beauvais factory, near Paris, which had also been producing tractors since 1960. It is now the biggest AGCO owned site in Europe, as well as the largest tractor factory in France, with 2,300 employees producing 20,000 tractors each year.
In 1984 the European range of Massey Ferguson combines was extended by a supply arrangement with the Danish Dronningborg operation which AGCO went on to purchase it in 1997. During the early 1990s Massey Ferguson combines started using GPS based yield mapping which is now the basis for variable rate precision farming systems. Their combines in Europe are now developed and produced at 2 sites in Denmark and Italy. Using the resources and expertise at both sites (as well as input from AGCO sister companies Hesston, Massey Ferguson, Fendt, Valtra and Challenger) a new high-capacity rotary combine range (known as the Ideal) has been designed, built and tested.
Massey Ferguson and parent company AGCO
During 1994 Massey Ferguson was purchased by US-based AGCO. The same parent company has also since acquired

Fendt (1997), Hesston (2000), Challenger (2002), Valtra and Sisu engines (2004), Sparex (2010), Laverda (2011), Fella (2011), and the forage division of Lely (2017). As one of the largest world manufacturers of farm machinery it now has a wide, intensive and experienced pool of expertise to share across its member companies in the further development of their products.
FUSE is is AGCOs next generation approach to precision agriculture enterprise planning through planting, crop care, harvesting and storage.
Massey Ferguson will continue to develop and provide advanced products to improve efficiency of food production across the world.
The technology for driver-less machines already exists. The concept of a skilled operator using all the available technology to optimise the performance of a combine (or other machine) and using it in the field to lead several other unmanned slave units is now possible for use in the extensive arable areas of the world.
A wide-ranging technical discussion followed before the chairman thanked the Massey Ferguson team for their most informative and enjoyable inter-active presentation.

WREKIN BRANCH

Hands Free Hectare and the Maverick Mechanisation Man!
14 November 2017
Report by John Gough

Kit Franklin, our speaker for the evening, comes from a farm contracting family in the Cotswolds. He commenced his presentation by revisiting our farming history, examining the beginnings of mechanisation, the availability of labour and analysing the arable outputs in the UK since the 1940s, then overlaying that with the mechanisation trends which have taken place during that time. One very revealing slide laid out in graphical form the country's annual cereal output over the last 60 years, the graph showed a steady increase in production until about 1980 which then gradually flattened out around 2000. The question "What do you think has caused the output to plateau?" was posed to the audience. Our attention was then drawn to the tractors and machines which had been used in these past decades and how their size and weight has increased resulting in issues with the soil and compaction.
In more recent times Kit had been involved in Precision Farming and Agricultural Robotics research and development activities at Harper Adams, where he gradually became convinced that this technology presented realistic agricultural advantages and recognised the real potential for downsizing our mechanisation methods.
Upon meeting Jonathan Gill a researcher at Harper Adams, who had considerable experience with robotics in the oil industry and drone technology, and many discussions around the direction in which technology and agriculture was going, the beginnings of an idea began to form. Would it be possible to utilize available technologies both commercial and open source to grow an arable crop without human presence in the field?
Over a period of 18 months this idea matured and discussions with contacts who may be willing to be involved in a project such as this proved positive. Then the matter of funding the idea, finding a suitable piece of ground and sorting out the machinery and technology had to be solved. A funding bid was written and presented to Innovate UK, who agreed to support the project from its Satellites to improve Agri- Food systems budget.
This funding was matched by Clive Blacker at the company Precision Decisions bringing the figure to £200,000. A number of agricultural industry manufacturers were then approached to encourage their involvement and support and suitable flat field was secured at Harper Adams in which to operate. To make the considerable developments feasible Precision Decisions employed Harper Adams Graduate Martin Abell as a development engineer to work on the project finalising the three strong core team.
The Project farming year started in October 2016 and the first few months were spent getting geared up with a small tractor, direct drill, sprayer and the electronics and equipment necessary to operate the various tractor and machine systems in the absence of a driver. The acronym KISS,(keep it simple stupid) was applied to all aspects of the project whenever possible. The RTK GPS guidance system and telemetry were obtained and adapted from existing sources at the cheaper end of the world market, the autopilot from a drone was used for the navigation system being one example given.
The remote-control transmitter used wi-fi signal to communicate with the machines in the field. The first operation in the field was to spray with herbicide, spring barley and fertilizer were then direct drilled on 25th April followed by rolling, fungicide and fertilizer applications and plant and soil sampling. In total 10 separate crop operations were undertaken, combining being the final one which was completed on 6th September. A barley yield of 4.5tons/ hectare was the end result of all this ingenuity and hard work.

Logistics

And so to the details and difficulties which were experienced. The tractor used was a 38hp 4 wheel drive Iseki with hydrostatic transmission which was fitted with 4 safety stop buttons, 2 remote kill switches and a laser scanner safety device with a 2 metre range which would bring the tractor to a halt if things got too close for comfort.
The Sampo plot combine with a 2metre header worked well and the rear steering system enabled the machine to make straighter entry into the crop following headland turns, an issue which was a concern when drilling with the tractor.
Crop and soil sampling was carried out using the remotely controlled adapted mobility scooter and grain sampling for moisture content at harvest was carried out by drone with a small claw suspended beneath on a chord and lowered into the standing barley crop to break off some heads. Jonathan Gill deserves recognition for his piloting skills to have successfully collected the necessary samples!
In conclusion this is a world first for an agricultural crop to have been grown remotely from establishment right through to harvesting, and it should therefore be no surprise that its progress and completion has attracted considerable interest from around the world. Many things have been learnt during the process and it is encouraging to hear that the project will now run for another year enabling the knowledge already gained to be further built upon. The team intend to further develop the low-cost steering and guidance technology software to overcome the tractor steering issues which were identified this year. This approach has already demonstrated what can be achieved with low cost guidance and control equipment and does suggest that we should expect a reduction in price of the current commercial Precision Farming equipment systems in the near future. This project has already shown what can be achieved by a small, highly motivated team working on a fairly tight budget; innovation does not have to cost millions! Many thought that the Hands-Free Hectare wasn't achievable but the Maverick Mechanisation Men were determined to prove them wrong!
And what will happen to the barley which was harvested…….it is rumoured that it might be brewed into beer!
www.handsfreehectare.com

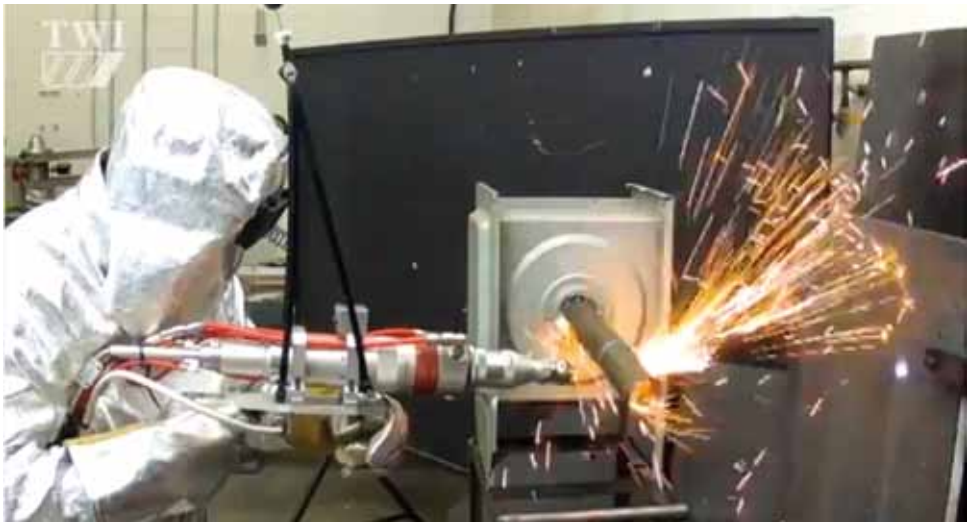
Wrekin Branch Summer Visit
Veolia Energy Recovery Facility, Shrewsbury
30 August 2017
Report by John Gough

A group of eleven visitors from the Wrekin Branch of the IAgrE commenced their visit of the Veolia site at Shrewsbury by being welcomed by Hilary Hanson, signed in on the site and issued with high-vis tabards. We were then escorted to the meeting room situated about sixty feet above ground level in the main incinerator building, with large windows commanding views out over the surrounding countryside to the south east and round to south west. This was followed by a presentation about the French company, its presence in the UK since the1970's and its role in waste management, recycling and energy recovery. The company have 10 Energy Recovery Facilities currently operating in the UK with one further facility planned but having to be re-submitted for approval by Hertfordshire Council. The 25 year residential waste contract with Shropshire Council was signed in 2007 and the £63 million plant, designed to process 90,000 tons / year, was completed and commissioned in 2013. Shropshire covers of an area of 13,000 sq. miles and has a population of 285,000people, there are 135,000 households which produce 165,000 tons of waste/ year which result in 10.5million collections by the Veolia service team.
We watch as waste material is tipped down 3 chutes situated at ground level on the opposite outside wall of the building, the grab operators move and mix the material in 2 ton bites before lifting it up to the high level shredding platform and feed intake moving grate to the incinerator.
We then viewed the control panel and bank of screens which are used to monitor the systems within the plant, all under the watchful eye of one person. One screen showed the fire in the incinerator as seen by an infra-red-camera; another displayed a graph of the burn temperature, while another displayed emissions information.
Moving into the incinerator plant at the top level we were able to follow the process in a logical sequence, the grate takes the waste in at the top, large air fans are situated at this level to provide the air for the burning to take place. 2 levels down we came to the burn inspection windows where the infra -red camera was situated, and at ground level there is an electromagnetic overband separator to remove any ferrous metal before the ash is deposited into a bunker. The lime and carbon treatment material, about 2% of the total intake weight, is packaged up and sent for long term storage underground in the salt mines in Cheshire due to its contamination. The ash, which amounts to 18%, goes for further processing before being used as aggregate for roads and construction.
Crossing into an adjacent building we then walked through the turbine and generator unit. The superheated steam enters the turbine at 400˚C, the generator can produce up to 8.5MW at 11KV which is then transformed up to 33KV and fed into the grid. The plant uses 1.5MW of the generated capacity for its own operating requirements. Exiting the building at the other side we were able to see three large air-cooled condensers and fans used to convert the steam back into water to be reused in the closed loop system.
The Battlefield site also incorporates the household recycling centre and the ethos of Reduce, Reuse, Recycle, Recover, is being promoted throughout the county by the Council and Veolia. Current recycling rates in the county are 53% with the various materials being sold to processors for remanufacturing. The council is charged a Gate fee for each ton of household waste which enters the site and receives an unspecified payment for the electricity generated.
The visit gave an interesting and informative insight into Shropshire's household waste management strategy and operation, our thanks to Veolia Battlefield for enabling us to see behind the scenes!

The Welding Insitute: from Bond to iPhones!
Latest developments by Professor Chris Dungey
12th December 2017.
Report by John Gittins

Chris Dungey, the Director of the Joining Innovation Centre for The Welding Institute (TWI) shared his fascinating technical knowledge in jointing technology at our December Wrekin Branch meeting.
Chris was back on home soil having originated from near Shifnal. Chris opened the meeting with his bibliography, his previous employers had included GKN and Rolls-Royce as well as a Metallurgy and Materials PhD from the University of Birmingham.
Chris began by introducing us to the TWI, and it was soon revealed that it is much more than just welding!
The TWI are concerned with; joining materials, numerical modelling, manufacturing services, materials and testing. Being funded by 700 members worldwide, the institute is focused on meeting the needs of industry, to do this they employ 800 staff in 5 sites across the UK.
He discussed electron beam welding where no filler metal is used with this technique, just a high-powered beam of electrons which can join together 200mm thick steel sections in a single pass.
Rotary friction welding is often used in the manufacture of hydraulic rams and on automotive parts such as turbine shaft assemblies and truck axles, the equipment involved is analogous to a lathe. The biggest challenge with this method is developing methods to hold the workpieces, especially when friction welding delicate turbine blade assemblies to a shaft.
Linear friction welding employs the same jointing process as rotary, but the friction force is developed by a reciprocating action. The machinery involved in friction stir welding can be thought of as being similar in some respects to milling technology where a rotating tool is traversed across a work piece.
This process was another TWI invention. The rotating tool starts at the edge of two clamped plates, the high speed rotation of the tool causes frictional heat which in turn causes a plasticised zone in the metal to be joined. As the tool is traversed the softened material is mechanically mixed and a joint is formed. This technology is used in the Apple iPhone and by the European Space Agency on a Titanium satellite propellant tank.
Laser Processing
TWI has a long history with Lasers, starting in 1967 right up to the present day. Recent project examples have seen TWI design, build and test "LaserPipe" a robot that can travel through the bore of a pipe and make an internal 360 degree weld.
Next in a scene that looked like it was taken straight from a Bond villian lair we saw video of an extremely mobile hand-held laser being used to decommission equipment for the nuclear industry.
We were reminded of laser additive manufacturing's definition and how the consumer market refer to it as '3D printing'. TWI have been involved in this process since the 1990's. It is a process where computer 3D model data is used to join materials, usually in thin layers to build the final component. This can be contrasted to the traditional subtractive processes of machining where material is removed rather than added.
Chris commented that additive manufacturing is rapidly growing, it offers good job prospects as it is an area of

knowledge which is in particular demand in industry today.
Arc based additive manufacturing is a technique which uses hardware we commonly see in many factories; a robotic manipulator arm and a MIG welding set. The part is built up by using layers of weld. It has very high material deposition rates of between 30-50kg/hr, but there is a trade off with accuracy and surface finish.
Overall a very thought-provoking meeting with some interesting examples being shown.
Videos are available on YouTube by searching for "twiltd"



WESTERN BRANCH

Bearing up to precision engineering
Visit to SKF, Clevedon
2 January 2018
Report by Mike Whiting

The Western Branch visit to SKF's manufacturing facilities at Clevedon, North Somerset certainly had a precision theme. We were greeted by Neil Tolson, Business Controller and Bill Makin, senior process engineer who were our guides around the three acre site. From the first engineering drawing we viewed on the machining floor, the word "CRITICAL" reminded the engineers of their responsibilities in getting the component manufactured to tolerances of 5 microns and possibly finer. Neil explained that any failure, during the expected operational life of a large number of the bearings produced would result in a catastrophic failure of the aircraft. No further explanation is really necessary.
As a reminder of technology, SKF Clevedon produces only plain bearings not roller units. The comparison is that plain bearings can produce higher friction forces, although are maintenance free. As any agricultural engineer is aware, roller type units require lubrication to keep them running true. 60% of the output is for helicopters, with a further 20% allocated to other aerospace projects. Although schedules are undertaken for tanks, ships, US railways, even racing cars. Look very carefully next time the Ferrari takes the hairpin bend and you might just catch a glimpse of the SKF logo.
This is where the team at Clevedon apply their skills and product differential to the market requirements. The application of a bespoke composition PTFE woven material to the machined metal provides the barrier to prevent accelerated wear. Once bonded and cured final machining takes place to ensure the final specifications are achieved. As an example the nose landing gear on an A320 requires repeatability of operation across a fixed range of movement. The forces endured by the linkage are very high therefore the application of a plain bearing suits the role well. Preventing the metal to metal contact, a material coating referred to as XL gives an estimated three times the life expectancy of standard steel. Scaling up to the next level, a layer of XLNT provides a reassuringly six times the operational life of the base metal.
Neil Tolson demonstrated his extensive knowledge of the components destination referring to aircraft names such as Merlin, Black Hawk, A380, A320 and Lynx, with the largest unit produced at approximately 800mm diameter. Keeping with the military theme we observed some essential "hardware" bearings in preparation for use in an M777 Howitzer, the US Army's 155mm calibre mobile cannon. This scale of firepower can be carried by helicopters and if you recollect the clouds of dust generated when these craft land in the desert, the requirement for extremely durable transmission systems is clarified, particularly when the welcoming party is a group of "IS" renegades.
The group enjoyed watching some high class engineering practices taking place; the use of rolled threads rather than traditional machining uses extreme forces to embed the profile and prevent the formation of brittle crests. Test rigs were set up to put pitch links for helicopters through repeated loadings, simulating all tangential forces. Data loggers recorded every components reaction, and for completeness destructive testing is performed on site to a predetermined schedule.
SKF Clevedon undertakes its own R&D, using available composition data from the select range of steels sourced from approved aircraft suppliers. The essential fact that the aircraft has to become airborne means titanium is used in preference to steel where weight savings are required, although as expected the overall component costs are higher.
Meticulous assessment is applied in the quality control department with torque measurements undertaken on the assembled components. Given the attention to detail required, the traceability procedures are extensive, with the paperwork trail often weighing more than the product itself. External audits are plentiful, with at least 12 expected on an annual basis. Just to present the teams with some additional challenges, the design office operates to metric with the machining section working on traditional imperial scales.
The visit concluded with Neil Tolson explaining that all the effort and product development results in SKF been considered as the supplier of the highest quality bearings within the aeronautical industry. So next time you go on holiday and glance across at the ailerons adjusting on the wing as you come into land it could well be one of the SKF bearings that is incorporated into the design.
Overall an extremely interesting visit, and certainly enjoyed by the members, with our thanks offered to Neil and his colleagues at SKF. We followed on with lunch overlooking the Clevedon seafront, and a visit to the Concorde exhibition at Aerospace Bristol.

MEMBERSHIP CHANGES

ADMISSIONS
MEMBER
Smyth K J (Ireland)
Anaya Parra P(Western)
Belcher E

Associate Member
Ahioba UV (Western)

Affiliate
Cooper G (Wrekin)
Casey J (Ireland)
Leech D (E Mid)

Technician
McArthur BS (Southern)

STUDENT
Harper Adams University
Armitage G
Ashcroft B
Beddoe WE
Bickerdike O
Billington G
Bird J
Blackburne-Maze GE
Boyle D
Bracken RA
Brookes SG
Brown W
Bryant M
Campbell LA
Churchhouse BAS
Clarke F
Craig AJ
Dvvies JF
Davies SM
Edwards RJ
Evans L
Flittner WG
Fitzpatrick OD
Flood D
Foreman J
Gibson AA
Gillen P
Harvey C
Grimes T
Harvey C
Humbert J
Huston MA
Jones EA
Joynt C
Leeper R
Maclean A
Markmam R
McDonnell C
Mellor TP
Osborne AJ
Philips TEO
Pinn PF
Pollard G
Read G
Roberts DMA
Rundle J
Scales SJ
Sherry M
Sollis RJL
Stanley OJ
Stephen OJ
Taylor T
Thorpe J
Turpin JE
Twigger JI
Van Tienan D
Websdale R
Whiteway SM
Williams AE
Woolf AS

Easton and Otley College
Chapman J
Diver L
Elliott W
Francis C
Freeman L
Hill L
Hubbard J
Game H
Keane O
Lennard H
Marsh K
Read M
Salt M
Sibley-Patman S
Tims M

Cranfield University
Chunga B

Sheffield Hallam University
McAdam J

Newcastle University
Smith J

University of York
Ramjali A
Li X
Mackenzie J

Brooksby Melton
Benner CA
Betts A
Bond A
Cooper G
Cooter J
Featherstone L
Gregory D
Hamore J
Hollis K
Holt J
Knott T
Mayfield H
Moore L
Parry R
Parsons M
Perks A
Pointing S
Pritchitt I
Richardson C
Skinner LHG
Stinson

Coleg Sir Gar
Auid JJW
Carlile CM
Davies I
Davies SW
Eynon D
Francis TR
Grahma MA
Griffiths T
Holt O
Jones JA
Llwellyn TL
Marshall GE
Mason RW
Peach RG
Richards M
Saunders LJL
Stimpson Williams H
Tilling P
Williams RT

Hartpury College
Ackrill H
Benbow H
Compton H
Cross O
Groves M
Joyce H
Manton B
Sayers TJ
Speakman J
Thorley A
Westland O
Williams J
Willison B
Wills J

Greenmount Campus
Anderson W
Bell S
Brady K
Corr S
Donnelly JP
Dowdall L G S
Dunn CL
Griffiths R
Hunter M
Kennedy LRD
Luddy R
McAllister R
McLaughin C
Miller BW
Mortimer D
Neeson P
Nixon JR
Rees RM
Smith S
Stewart R
Tracey C
Trainor N
Walker LT
Winter JD

READMISSION
O'Kane P (Northern Ireland)

TRANSFERS
Fellow
Sayers IJ (East Midlands)
Price D (Wrekin)
Parsons (S E M)

Member
Griffin G (Ireland)
Quigley F (Ireland)

Associate Member

Associate
Marsh B (Wrekin)

ENGINEERING COUNCIL REGISTRATIONS

CEng
Antille DL (Australia)

IEng

EngTech
McArthur BS (Southern)

SOCIETY FOR THE ENVIRONMENT
CEnv
Parsons M (East Midlands)

LONG SERVICE CERTIFICATES (1 JANUARY – 31 MARCH 2018)

IAgrE extend warm congratulations to the following members on reaching significant milestones

Name		*Date of Anniversary*
60 Years		
Thangavelu Toniappa	FIAgrE	14-Jan-18
50 Years		
Nigel Finch	FIAgrE	11-Jan-18
Paul Vernon Hartley	MIAgrE	11-Jan-18
John Noyes Lawton	MIAgrE	11-Jan-18
George Brian Sanders	MIAgrE	11-Jan-18
William Denys Basford	FIAgrE	11-Jan-18
Paul Hamilton Baskerville	MIAgrE	11-Jan-18
Partrick Anthony Inwood	FIAgrE	11-Jan-18
Geoffrey Osborne	MIAgrE	11-Jan-18
John David Shearing	MIAgrE	11-Jan-18
35 Years		
John Anthony Cecil Steel	MIAgrE	11-Jan-18
Roy Trevor Howland	MIAgrE	18-Jan-18
Joseph Osei Darko	MIAgrE	02-Feb-18
Richard John Percival	AMIAgrE	02-Feb-18
Roderick Ewan McGovern	MIAgrE	05-Mar-18
25 Years		
Sule Yakubu Bassi	MIAgrE	11-Jan-18
Stewart Alasdair Paul	FIAgrE	28-Jan-18
Simon Alistair Thomas	MIAgrE	29-Jan-18
Howard Colin Leigh-Firbank	AIAgrE	29-Jan-18
Alexander Lillico Donald	MIAgrE	03-Feb-18
Peter Noel Leech	HonFIAgrE	04-Feb-18
John Anthony Cambridge Clarke	MIAgrE	11-Feb-18
Richard James Brindle	MIAgrE	02-Mar-18
David Alan Yates	MIAgrE	30-Mar-18

ACADEMIC AND COMMERCIAL MEMBERS

ACADEMIC MEMBERS

Bishop Burton College
York Road
Bishop Burton
Beverley HU17 8QG

Brooksby Melton College
Asfordby Road
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Gelli Aur Campus
Llandeilo
Carmarthenshire SA32 8NJ

Cranfield University
Cranfield
Bedfordshire MK43 0AL

Duchy College
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Callington
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Tralee
Co Kerry, Ireland

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Lincoln University
Lincoln LN6 7TS

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Newcastle University
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Co Limerick
Ireland

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Reaseheath,
Nantwich
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Royal Agricultural University
Cirencester
Gloucester, GL7 6JS

Sparsholt College
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Winchester SO21 2NF

SRUC – Auchincruive
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Lacock
Chippenham
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AGCO Ltd
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Alvan Blanch Development Co,
Chelworth,
Malmesbury,
Wiltshire SN16 9SG

Autoguide Equipment Ltd
Stockley Road , Heddington
Calne,
Wiltshire, SN11 0PS

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Middleton House,
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Banbury,
Oxon, OX17 2TN

Bomford Turner Limited
Salford Priors
Evesham,
Worcestershire WR11 5SW

City & Guilds
1 Giltspur Street
London EC1A 9DD

City Farm Systems Ltd
25 Hepplewhite Close
High Wycombe
Bucks HP13 6BZ

David Ritchie (Implements) Ltd
Carseview Road, Suttieside,
Forfar, Angus, DD8 3EE

Douglas Bomford Trust
The Bullock Building
University Way, Cranfield
Bedford, MK43 0GH

DSL Systems
Adbolton Hall
Adbolton Lane
West Bridgford
Nottingham NG2 5AS

FEC Services
Stoneleigh Park
Kenilworth
Warwickshire CV8 2LS

Fullwood
Grange Road
Ellesmere
Cheshire SY12 9DF

HSS Hire
Head Office
25 Willow Lane,
Mitcham, London
CR4 4TS

John Deere Ltd
Harby Road, Langar
Nottinghamshire NG13 9HT

Marks & Clerk LLP
90 Long Acre
LONDON WC2E 9RA

Mastenbroek Limited
83 Swineshead Road
Boston, Lincs, PE21 7JG

Shelbourne Reynolds
Shepherds Grove Ind. Est.
Stanton, Bury St Edmunds
Suffolk, IP31 2AR

SSAB Swedish Steel Ltd
Narrowboat Way
Hurst Business Park
Brierley Hill
West Midlands DY5 1UF

TeeJet London Ltd
Headley House,
Headley Road, Hindhead,
Surrey, GU26 6UK

FORTHCOMING EVENTS

IAgrE EVENTS

Thursday 24 May 2018
IAgrE Annual General Meeting and Awards
Wrest Park, Silsoe

Thursday 18 October 2018
IAgrE Council Meeting
Venue tbc

Tuesday 6 November 2018
IAgrE LANDWARDS CONFERENCE
Royal Academy of Engineering
London

All enquiries regarding IAgrE Events. Contact Sarah McLeod. Tel: 01234 750876
secretary@iagre.org

BRANCH MEETINGS 2018

EAST MIDLANDS
CONTACT: Richard Trevarthen
01509 215109
richard.trevarthen@gmail.com

Tuesday 13 March 2018 7.30pm
Visit to Chandlers Farm Equipment
Main Road, Belton, Grantham, Lincs, NG3 2LX.

Tuesday 20 March 2018 7.30pm
AGM and Annual Dinner (Partners are invited)
Quorn Lodge Hotel, 46 Asfordby Road, Melton Mowbray, LE13 0HR

NORTHERN IRELAND
CONTACT: Ian Duff
028 8673 6977 duffi@iagre.biz

22 March 2018 8.00pm
AGM and CAFRE Landbased engineering courses
CAFRE Greenmount Campus

SOUTH EAST MIDLANDS
CONTACT: John Stafford
01525 402229
john.stafford@silsoe-solutions.co.uk

Monday 9 April 2018 7.30pm
'Electricides': Benefits and commercialisation of electric weed control
Speaker: Dr Mike Diprose, RootWave 'Electricides'
Maulden Church Hall, Church Street, Maulden MK45 2AU

May meeting (tbc)
Visit to PGRO and Sacrewell
Great North Road, Peterborough

WESTERN
Contact: Mike Whiting
07751 345580
mike.whiting@newmac.org.uk

Wednesday 14 March 2018 7.30
Western Branch AGM and Meeting
Talk from Kubota UK, Andrew Wolton and Rob Edwards on "Stage V, living with DPF" and "Kubota's vision for the future of Agri"
Royal Agricultural College, Cirencester

WEST MIDLANDS
Contact: Ian Moore
0121 704 5700 ianm@whale.co.uk

Tuesday 10 April 7.30pm
Annual General Meeting
Friends Meeting House, Stratford upon Avon

WREKIN
Contact: David Clare
01952 815087
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Tuesday 20 March 2018 6.30pm
AGM and Getting the best from agrochemicals
Speaker: James Thomas of Syngenta
Agricultural Engineering Innovation Centre, Harper Adams University

Tuesday 17 April 2018 7.30pm
Technical Meeting
Heico-Lock Tension controlled fasteners
Agricultural Engineering Innovation Centre, Harper Adams University

Tuesday 15 May 2018
Technical meeting (tbc)
Agricultural Engineering Innovation Centre, Harper Adams University

OTHER EVENTS

Thursday 5 March 2018 10.30am-6.30pm
Pix4D Agricultural Workshop
Regional Food Academy, Harper Adams University, Edgmond, Shropshire
Learn how to leverage drone data in agriculture

Sunday 10 June 2018
Open Farm Sunday
Organised by LEAF

13-14 June 2018
Cereals 2018
Chrisnall Grange Duxford Cambridgeshire

21-24 June 2018
Royal Highland Show
Edinburgh

23 June 2018
International Women in Engineering Day (INWED) 2018
The Theme this year is 'Raising the Bar'

8-12 July 2018
AgEng 2018: EurAgEng Conference
Wageningen, Netherlands

23-26 July 2018
Royal Welsh Show
Llanelwedd

Thursday 6 September 2018 9.30-4pm
FEG Symposium 2018
Engineering Forest Access for All
Newton Rigg Campus

Wednesday 26 September 2018
Tillage-Live 2018
Eweford Farm, Dunbar, East Lothian

Institution of Agricultural Engineers

2018
LANDWARDS CONFERENCE

Royal Academy of Engineering
Carlton House Crescent
London
TUESDAY 6 NOVEMBER
10.00am to 4.00pm

CONFERENCE THEME: Engineering Collaboration for Success

Further information and booking details
Sarah McLeod 01234 750876
E: secretary@iagre.org
W: iagre.org

24/7 Out of Hours

A new feature looking at the hobbies and past-times of IAgrE members when not engaged in their day-jobs. CHRIS BIDDLE REPORTS

Pele tower conversion

Former IAgrE President Andy Newbold CEng MIAgrE, who runs Cumbrian events company Farm Smart Ltd, bought Killington Hall with wife Ann in 2003. It was Ann's original family home and came with a derelict pele tower which is being renovated and restored in a near ten-year project by the couple and a willing band of local craftsmen.

The origins of Killington Hall date back to 1266 and was the seat of the Pickering family until the 16th century. Attached to the main building, which is home to Andy and his wife Ann, is a Pele tower (spelt like the Brazilian footballer, but pronounced 'peel') which had lain in ruins for several centuries.

Both the house and the tower are Grade 2 Listed Buildings, but having bought Killington Hall in 2003, it was always the intention that the couple would try and restore the ruin into something inhabitable. It would have made an ideal candidate for a Grand Designs conversion, but as Andy says "They might have stuck with us had we been able to complete the conversion in a couple of years, but that was never feasible"

Pele towers date back to the reign of Edward I who fought a long and bitter campaign to conquer Scotland, and his enemy, Robert the Bruce.

The Scots resisted these actions, and several marches were made with huge armies leaving death and destruction. Farms and churches in the Lake District were destroyed, abbeys plundered and burned, people and cattle slaughtered.

Determined to resist further invasion, the people of Cumberland and Westmorland built defensive structures known as pele towers, usually one to a village. Around 90 were built, and they are quite unique to the north of England. Most were small stone buildings with walls from 3 to 10 feet thick, square or oblong in shape. Designed to withstand short sieges, they usually consisted of three storeys – a tunnel-vaulted ground floor which had no windows which was used as a storage area, and which could accommodate animals.

Listed holiday castle

Hopefully Andy and Ann Newbold will not need to repel marauding masses from the Borders – or anywhere else. Quite the reverse, they intend to convert the Pele tower into a Grade 2 Listed Holiday Castle, unusual and historic accommodation for those wanting to base themselves in the Cumbrian countryside.

Which means of course providing 21st century facilities in a former ancient ruin.

The restoration work started in 2009, and working closely with the local conservation authority to ensure that the conversion conformed with the tower's listed status, Andy enlisted a team of local builders and craftsmen.

First mains water and electricity supply had to be installed in trenches running across Andy's front garden.

The roof had long gone (possibly 200 years ago) and had to be replaced.

Then an immense programme of damp coursing the walls, laying slate stone floor slabs under which would be installed underfloor heating. RSJ steel beams were put in to support an upper floor along with studded partitions to create two storey, 2 bedroom accommodation.

Replacement brass casement windows were sourced from a specialist company in Grantham and made specially to fit the outer walls.

Finally before all the fittings are installed to bring the property up to required standards to attract premium lettings, Andy says the one feature that renters demand these days is a reliable broadband service, so hi-speed broadband fibres have been brought across the parish.

As work progresses, it will have been ten years since the start of the project but Andy and Ann believe they are on course for a formal opening in 2019. It will have been a real labour of love, undertaken by their own hand and a band of local craftsmen.

See photo of the conversion on the Killington Hall Facebook page

2018

Annual General Meeting and Presentation of Awards

Wrest Park, Silsoe, Bedfordshire MK45 4HR

Thursday 24th May 2018

Join members and guests at the iconic venue of Wrest Park, for so many years the home of the Silsoe Research Institute *(formerly the National Institute of Agricultural Engineering)*

Celebrate the 80th Anniversary on the exact day (24 May) of the formation of the Institution of Agricultural Engineering in 1938.

PROGRAMME

Time	Event
10.00	Coffee
10.30	AGM – papers available online at www.iagre.org and at the meeting
11.00	Handover to President Prof Jane Rickson CEnv FIAgrE by Past President Dr Rob Merrall MIAgrE
11.15	Presentation of Awards
12.00	A glance back at the last 80 years and looking to the future – Prof Dick Godwin FREng CEng CEnv Hon FIAgrE and Prof Paul Miller FREng CEng CEnv HonFIAgrE
12.45	Lunch
14.00	Depart

Further details from ***Sarah McLeod***
01234 750876 secretary@iagre.org