# Landwards

@IAgrE

The professional journal for the Institution of Agricultural Engineers

IAgrE Professional Journal www.iagre.org
Volume 75, Number 1 - **Spring 2020**

IAgrE

**See iagre.org for the latest information**


## In this issue...



AGRICULTURE HORTICULTURE FORESTRY ENVIRONMENT AMENITY

# TECHNICIAN GRADE
## NEW ROUTE INTO IAgrE FAMILY




### DAIRY EQUIPMENT TECHNICIAN

The Technician grade of IAgrE Membership is for those who are qualified at a vocational or technical level. They may have completed an apprenticeship or extended diploma. Alternatively they may have gathered technical training at work or participation on an IAgrE approved training programme such as Parlour Safe. To qualify, you will be working in industry and will have built up experience and career development in the workplace.
You will be keen to be part of the IAgrE family and seeking a cost effective way of getting involved and benefiting from being part of the community of professional engineers.

The IAgrE Technician Grade for Parlour Safe Technicians.
If you are registered under the Parlour Safe scheme and have attended training courses at Reaseheath or Hartpury Colleges you are eligible to apply for IAgrE membership and use the letters TIAgrE after your name and on your business card as a way of demonstrating your high standards to your customers and colleagues.
If you have completed the training and assessment at Parlour Safe Category 3 and above you can also apply to become a professionally registered engineer. This will permit you to use the title of Engineering Technician and join the growing number of engineers who use the letters EngTech as a demonstration of high standards and professionalism.

ACCREDITATION SCHEME
PARLOUR SAFE

To apply and find out more:
Go to the IAgrE website and complete the Application Form iagre.org/technician. With your completed application form, you will also need to provide a current full and detailed CV which describes in detail your working history and experience. We will need copies of academic certificates and details of education/training.
For further information contact Alison membership@iagre.org or 01234 750 876

# Contents:



Landwards is published on behalf of the IAgrE by FarmSmart Publishing Limited.
Editor – Andy Newbold 01539 620255 andy@farm-smart.co.uk
Design – Kate Mason, Smart Design and Print www.smartdesignprint.co.uk

The views and opinions expressed in individual contributions are not necessarily those of IAgrE or the editor. Landwards is compiled from information received by IAgrE, but no responsibility can be accepted by the Executive, the Publishers or the Editor in respect of errors or omissions. The editor does reserve the right to edit any material submitted for publication. Material from this publication may be quoted or reported on condition that full credit is given to Landwards and to the author together with the date of publication and volume number. In the interest of factual reporting, reference to trade names and proprietary products may be inevitable. No endorsement of the named products or manufacturers is intended and no adverse criticism is implied of similar products which are not mentioned.

© The Institution of Agricultural Engineers (IAgrE) ISSN 1363-8300 Company registration no. 648071, Charity no. 257303

**Book Club - Pages 32-35**
Photo courtesy of **www.farmingphotography.co.uk**

# Editors Welcome

Over the last 27 years or so of IAgrE membership, I have enjoyed receiving and reading the quarterly edition of Landwards. It has been my window into the world of agricultural engineers and engineering outside of my own particular parish.

However, it's quite a different matter mulling over how to take forwards such a strong and respected magazine as rookie editor.

You, the readers are, in the main, members of the IAgrE, and as agricultural engineers are a wide and varied bunch. I often refer to agricultural engineers as the 'swiss army knifes' of the engineering community. Or, to the chattering classes of Cumbrian upland dinner parties, 'the folk you need on a desert island'.

My aim for Landwards is to reflect the many and varied interests of the membership, focus on the profession and your development. I want to showcase how agricultural engineering is a force for good in wider society.

It would be remiss to not mention or credit the great work that Chris Biddle has done, and the fantastic foundation he has left as outgoing editor. I'm grateful for Chris's steer and advice during this period of handover.

I welcome your feedback.

*Andy Newbold*

Editor
andy@farm-smart.co.uk

## A Data Marketplace could solve agriculture's big problem

Agrimetrics
THE CATALYST FOR CHANGE

Agrimetrics, a UK Agri-Tech Centre with public backing, has launched the agri-food sector's first Data Marketplace, which promises to reward data-owners, whilst accelerating innovation.

Agriculture has a big data problem. The sector desperately needs to improve productivity and sustainability. Data-driven technologies promise solutions to these challenges; unfortunately, many of these promises have been hollow.

"The problem is two-pronged," says Dr David Flanders, Agrimetrics CEO. "Agri-businesses are – often justifiably – reluctant to share their data. Meanwhile, organisations lack the information they need to build new solutions. This has prevented meaningful innovation. Data-driven manufacturers have, for example, increased production by 50% and cut waste by 20%."

In response, Agrimetrics, the National Agri-Tech Centre for Innovation in Data Science, is overhauling the way agricultural data is shared and accessed. The Agri-Food Data Marketplace enables data-owners to safely share and monetise their data, whilst making it easier for data-consumers to find the information they need.

This has attracted significant attention. Agrimetrics has close links with AHDB, DEFRA and the NFU, and boasts Microsoft as a strategic partner. Airbus, the aerospace giant, has already made satellite-derived field attributes available through The Data Marketplace; these attributes can be used to calculate irrigation requirements and develop methods for countering lodging. Airbus are joined by The Centre for Ecology and Hydrology (CEH), Soil Grids, The Met Office, Natural England, The Environment Agency and others.

BASF, the world's largest chemical manufacturer, has used the data to develop a water stewardship tool that gives field-specific guidance on when to spray. wHen2gO simplifies a complex regulatory area and is an example of how data-driven tools can improve sustainability and farm profitability. Barfoots, the UK food and farming company, have used the data to create a predictive harvest model to reduce waste and inefficiencies across their international supply chains.

"Robotics, artificial intelligence, carbon farming, predictive models, farm-to-fork traceability and natural capital accounting are often-highlighted when discussing the future of agriculture," concludes Dr Matthew Smith, Agrimetrics Chief Product Officer. "However, they fundamentally depend on the ability to easily exchange data. This requires new linked-data supply-chains that seamlessly connect data-producers and data-consumers throughout the food and farming system. The Agri-food Data Marketplace is the closest yet to making this a reality."

## Members memories

**https://iagre.org/members-memories**

IAgrE realises that the memories of its members form a "living history" of the Agricultural Engineering legacy in the UK. When we send 50- and 60-year certificates to members we ask them to send us their reminiscences and in the last few months Sarah has been adding them to the Members' Memories page of the website. This is a fascinating insight into the history of Agricultural Engineering and if you have memories and photographs to share (selectively) we would love to receive them.

Do take a look at the page and take a walk down Memory Lane – from early careers with Bomford & Evershed Ltd, to a tour of Spain with a Radio Controlled Tractor our members have experience of a broad spectrum of engineering life and it is well worth taking a few minutes to savour our history.

## Advanced engineering centre opens at Reaseheath College

One of the most sophisticated technical education centres of its type in Britain has been officially opened at Reaseheath College in Cheshire.

The £8 million Centre for Advanced Engineering and Agri-Technology has been created specifically to deliver next generation skills in precision engineering, precision farming, service engineering and diagnostic testing.

The initiative, part of a total £80 million investment across campus, was supported by a capital grant from Cheshire and Warrington Local Enterprise Partnership (LEP) and created in partnership with leading agricultural engineering companies, many of which have donated top class machinery and equipment.

The specialist facility is enabling Reaseheath lecturers to deliver technical training on the latest crop production systems and science subjects such as data mapping to agricultural engineering students.

Features include workshops and a technology suite equipped for the teaching of computer controlled automation and high end precision engineering. Equipment includes tractor simulators, GPS and other advanced agricultural engineering systems.

The centre is now fully operational and Reaseheath is looking to expand its agricultural engineering courses to include Level 4 and Continuing Professional Development (CPD) for those already working in the industry.

Additionally, the college plans to cater for Advanced Apprenticeships in agricultural and construction plant engineering through the teaching of advanced farming techniques and management.

Head of Agricultural Engineering Tim Gibbs said: "This ground breaking centre combines all aspects of agricultural innovation, mechanisation and advanced engineering under one roof. It allows us to teach and develop efficient modern farming techniques including precision land management and precision farming. This will enable us to meet increased demand for specialist training from our industry partners, and to equip our students with the skills they will need for their future careers."

Reaseheath Principal Marcus Clinton added: "The funding from our LEP partners emphasises that this government understands the need for specialist technical skills training to meet employer needs and drive productivity. I'd like to thank the LEP for its continued support and indeed all our committed and valued industry partners and our highly skilled staff, all of which enables us to provide a pipeline of talent to service important and increasingly STEM driven sectors who require students with the skills and mindset for tomorrow as well as today."

Ed Hansom, CEO of the Institution of Agricultural Engineers (IAgrE) stated: "This new Centre for Advanced Engineering and Agri-Technology is an excellent example of how academia and industry can work collaboratively to move agricultural engineering well and truly into the 21st Century. These facilities will ensure that Reaseheath students are fully prepared to meet the technological and engineering challenges of a rapidly changing industry."

Also present at the launch were Agricultural Engineers Association council members and technical trainers from leading manufacturers including CLAAS, CaseIH, New Holland, JCB, Kuhn, Manitou, Kverneland, Househam, Krone, Vaderstad and Teagle.

As well as being represented, the companies sent sophisticated machinery which were demonstrated as part of a unique Technical Training Day for full time students and apprentices. These included the world's fastest tractor, built by JCB and driven to a record breaking 150 mph by motorsports personality Guy Martin, and Vaderstad's industry leading superfast seed drill.

## Worlds fastest tractor

**STOP PRESS** [Or perhaps that should be "How do you stop a 5t tractor doing more than 150 mph?"]

Unfortunately, the news that JCB's 'Fastrac One' raised the (tractor) land speed record to 153mph (135mph average) did not get to the Editor fast enough for the last issue.

Congratulations to Project Manager Alex Skittery (HAU and Douglas Bomford Trust alumnus) and his young team again anyway. We hope that his career will continue to be on the fast track too.

## Coronavirus: shortages may be on the way

With financial markets in turmoil, Dr Jonathan Owens, logistics expert from the University of Salford Business School, looks at why the coronavirus is having such a huge impact on business and what can be done to mitigate the risks.

Dr Owens said: "The spread of the Coronavirus to the west means there is a much greater chance of noticeable disruptions in the global supply chain network. Most supply chains continually have disruptions of sorts and these are sometimes factored into their planning, and they survive.

"However, in this instance given that mostly the flow of our manufactured goods is East to West, and although slowly Chinese manufacturing companies are returning, much of the country is still on quarantine lockdown, and after a full production shutdown it will take a while to get up to previous working capacity.

"Also, it is difficult to raise production to the full level when only 50 to 80 per cent of workers are present due to the earlier mass migration because of the Chinese New Year and are unable to return due to China lockdown. With a reduced workforce there are now additional operational sterilising phases to be added for the manufacturers before they ship goods, and these needed to be set up quickly.

"Then, because of the numerous quarantine checkpoints installed regionally, we are seeing a stockpile of empty shipping containers that are not able to get from the ports and load up. Subsequently, the normally balanced flow of shipping containers within the supply chain has been seriously disrupted. As such, we have read reports about vital components such as key fobs being shipped out of China in suitcases.

"We are seeing no big breaks in the supply chains yet, but what is arriving at our ports now may have been ordered five to six weeks ago. So, if we do see shortages this will be in the coming weeks. Looking to alternative sourcing is not the immediate answer, as this is more a medium to long term solution. In addition, it is not clear how long it would take to get an alternative source in place and operating efficiently within the existing supply chain. Also, due to the spread of the Coronavirus, we may find ourselves in a similar situation with this source."

## First Agricultural Engineering Apprentices to undertake end-point assessment (EPA)

Building relationships and driving technology at the cutting edge of the food production and agricultural engineering sector is the cornerstone for a successful career in one of the most important industries in the world, the latest graduates of the renowned AGCO Apprenticeship Scheme were told during a lavish awards ceremony at the Forest of Arden Hotel, near Birmingham.

As the first agricultural engineering apprentices in the country to have completed the recently introduced and rigorous end-point assessment (EPA), 14 AGCO engineering apprentices passed through the tough new national apprenticeship standards in 2019, and were recognised during an awards ceremony that saw joint-winners named for the overall Apprentice of the Year Award.

Matthew Read of Brian Robinson Machinery in Northallerton, North Yorkshire, and William Ogg of Peacock & Binnington (P&B) were named joint winners of the Apprentice of the Year title, receiving their awards from AGCO Director of Distribution Management UK & Ireland, Mark Casement.

Addressing the guests and graduates during the presentation, Mr Casement explained that AGCO is focused on growing its markets. "One-in-four tractors sold in the UK and Ireland is currently an AGCO brand, but the next step is to make that one-in-three," he said.

"It is essential we continue to build confidence in our dealerships, and you are now at the start of that route in your careers," Mr Casement told the newly qualified apprentices. "The level of technology is at the cutting edge, and that transformation will continue over the next 10 to 20 years, and you are the lifeblood of that progression," he explained.

Mr Casement spoke of AGCO's commitment to performance and service being key to delivering the ambitious sales objectives. "We have fantastic dealerships and partners, and building relationships at all levels is crucial to the integrity of the industry. We always want to create long-term bonds with our customers," he added.

Martin Hamer, Manager, National Sales Fendt UK & Ireland added, "We can't sell a second tractor to a customer if the first has not been serviced and maintained to the highest standards. I would like to thank you, for making my life as a salesman much easier!"


Matthew Read & Mark Casement


William Ogg & Mark Casement

In its 21st-year, AGCO's industry recognised dealer apprenticeship scheme, in partnership with WCG, combines classroom and workshop-based training at WCG's Moreton Morrell campus, with practical on-going training at the apprentices' dealership.

Also collecting awards during the ceremony were Ryan Thorne of CJ Cox, Dominic Pender of Wilfred Scruton, Andrew Ford of TNS and Kyle MacBain of Chandlers Farm Equipment.

# Presidents Musings

**Agriculture Bill 2019/20:** https://publications.parliament.uk/pa/bills/cbill/58-01/0007/20007.pdf

**Health and Harmony:** the future for food, farming and the environment in a Green Brexit: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/684003/future-farming-environment-consult-document.pdf

**25 Year Environment Plan:** https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

## The new Agriculture Bill: what's in it for agricultural engineers?

The new Agriculture Bill will replace the Common Agricultural Policy (CAP) as the country leaves the EU. The new Bill has been described as "a historic opportunity to radically reshape domestic agricultural policy", comparing it with the 1947 Agricultural Act, which sought to dramatically increase food production after the Second World War. The main difference is that farmers will be paid for 'public goods', such as environmental or animal welfare improvements, rather than receive payments largely on the area of land farmed.

So how will the Bill affect UK agricultural engineering? Will it bring new opportunities for our industry? How can agricultural engineers help implement the Bill successfully?

Agricultural engineers are best placed to develop innovative ways of delivering environmental benefits and 'public goods' under the legislation. We will need to design innovative systems (including technological advances in farm machinery, field agronomy and soil management) to deliver "clean air and water, resilience to climate change, abundant and diverse wildlife, and attractive landscapes". According to the Bill, these innovations should also "prevent, reduce or protect from environmental hazards". You only have to see the devastation caused by Storms Ciara and Dennis this year to realise the importance of soil and water engineering in upper catchments.

A number of targets mentioned in the Bill can only be met by more R&D in applied agricultural engineering. For example, the Bill calls for lower ammonia emissions, protection of sensitive habitats and controlled nitrogen deposition. In forestry and horticulture, the introduction and spread of harmful plant pests and disease needs to be addressed. In livestock production, better rearing of rare and native breeds or species is needed, because these genetic resources "could sustainably increase food production or improve capacity to adapt to climate change or new diseases". The Bill promises more financial support for soil protection and improvement, by using innovative products (such as soil conditioner/improvers, plant bio-stimulants, fertiliser inhibitor/additives, growing medium and blended fertiliser) to have less reliance on non-renewable materials…but are these emerging products cost-effective? All of these ideas sound promising, but whether they can bring the expected benefits will require more robust evidence from agricultural engineers.

The agricultural machinery industry is supported by the Bill. Funds will be provided to "invest in equipment, technology, and infrastructure….in the form of grants, loans, loan-guarantees, or capital allowances". This support could be used by a farmer to invest in equipment that both increases productivity and delivers environmental benefits. For example, finance could be used to purchase precision equipment for slurry application to reduce use of chemical fertilisers, lower costs and lower ammonia emissions.

The Bill recognises that agricultural productivity has risen dramatically since the 1940s, reflecting the technological advances in agricultural engineering, including mechanisation and agronomic practices. Given the present need for food security and environmental protection, the contributions of agricultural engineers are as important now as they have ever been.

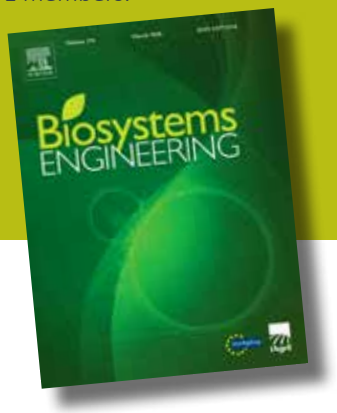
# Biosystems Engineering

Biosystems Engineering, owned by the IAgrE, and the official scientific journal of EurAgEng, is published monthly with occasional special issues.

Head to https://www.sciencedirect.com/journal/biosystems-engineering to view the full article list of the latest edition and to find out more about depth and breadth of articles accepted for publication.

Reduced subscriptions are available to IAgrE members. Go to https://iagre.org/biosystemsinformation for details of the preferential rates for both paper and electronic versions.

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




**Biosystems Engineering**

Volume 186, October 2019, Pages 156-167

**Fluorescence imaging for rapid monitoring of translocation behaviour of systemic markers in snap beans for automated crop/weed discrimination**

Wen-Hao Su, Steven A. Fennimore, David C. Slaughter

University of California, Davis, USA

Investigating the translocation behaviour of fluorescent markers is significant for the effective application of the markers in weed and crop differentiation. Snap bean was used as a model plant to study the systemic movement of Rhodamine B (Rh-B) in specialty crops for weed control. A fluorescence imaging system was developed to monitor the uptake and translocation of Rh-B from dyed snap bean seeds to bean plants. The proposed crop signalling approach based on Rh-B emission was able to classify snap bean plants from different weeds (e.g. burning nettle, groundsel, and barley). The results demonstrate that fluorescence imaging technology is a rapid and effective approach to studying the real-time translocation behaviour of a signalling marker in a crop system. Based on the unique fluorescence property, visualisation of the marker in vivo specialty crops grown from Rh-B treated seeds provides potential for their successful application in early season weed discrimination.

**Biosystems Engineering**

Volume 186, October 2019, Pages 214-227

**A theoretical study of the parameters affecting the power delivery efficiency of an agricultural tractor**

Nicolò Regazzi, Mirko Maraldi, Giovanni Molari

University of Bologna, Italy

The aim was to identify the key design parameters affecting the power delivery efficiency of an agricultural tractor and to quantify their effect on the tractive performance. To this end, numerical simulations were performed varying several tractor design parameters. The results of the simulations were then analysed using a gradient-based method which allowed to identify the most influential design parameters. Within the range of variation of the design parameters explored in this study, the maximum power delivery efficiency was found for a tractor having equal kinetic rolling radii of front and rear tyres, no lead of the front wheels and the centre of mass shifted towards the front axle. However, if the front tyres kinetic rolling radius becomes smaller than that of rear tyres and if there is lead of the front wheels, the tractor centre of mass has to be shifted towards the rear axle to attain the maximum overall traction efficiency.

**Biosystems Engineering**

Volume 187, November 2019, Pages 278-291

**Crop signalling: A novel crop recognition technique for robotic weed control**

Rekha Raja, David C. Slaughter, Steven A. Fennimore, Thuy T. Nguyen, Vivian L. Vuong,

Neelima Sinha, Laura Tourte, Richard F. Smith, Mark C. Siemens

University of California, Davis, CA, USA
University of California Cooperative Extension, Watsonville, CA, USA
University of California Cooperative Extension, Salinas, CA, USA
University of Arizona, Tucson, AZ, USA

Automatically distinguishing weeds from the crop plant is a complex problem since weeds come in a wide variety of colours, shapes, and sizes, and crop foliage is often overlapped or occluded by weeds. Current technology, cannot reliably and effectively perform the differentiation task in such complex scenarios in real-time. A technology to make crop plants machine readable and reliably distinguishable from weeds for automatic weed control has been developed. Four different techniques have been investigated and developed to make smart crop marking systems such as a) systemic markers, b) fluorescent proteins, c) plant labels and d) topical markers. Indoor experiments have been conducted for each method. Field experiments, using plant labels and the topical markers methods, have been successfully conducted for real-time weed control in tomato and lettuce. The results demonstrated that robots could automatically detect and distinguish 99.7% of the crop plants with no false positive errors in dense complex outdoor scenes with high weed densities.

**Biosystems Engineering**

Volume 188, December 2019, Pages 320-330

**Abatement of ammonia emissions from dairy cow house concrete floor surfaces through additive application**

John P. McIlroy Karen L. McGeough Ronnie J. Laughlin Rachael Carolan

Agri-Food and Biosciences Institute, Belfast, Northern Ireland, UK

Winter housing of dairy cows and beef cattle is common practise in north-western European countries such as the UK and Ireland. In cattle housing, urine and dung are deposited over a large floor surface area from which ammonia (NH3) emissions may rapidly occur. The application of additives to this emitting layer has the potential to significantly reduce NH3 volatilisation from cattle housing surfaces. A dynamic flow-through chamber based study was carried out to determine the NH3 abatement potential of 10 additives applied to dairy cow slurry covered concrete surfaces under simulated northwest European winter housing conditions. Experimental data suggests that targeting a slurry pH of 6 at the housing floor stage can significantly reduce NH3 emissions from fresh excreta. Of the tested additives, alum was the most successful at abating NH3 emissions from slurry; particularly after 6 h (76% NH3 abatement), where the efficacy of alum was greatest relative to the other acidifiers. Alum was followed by calcium chloride (69%) and sulphuric acid (41%). Actisan, a commercially available bedding disinfectant was another successful NH3 abatement option (59% after 6 h).

# CEO's Reflections

As I write this article the New Year, and indeed the new decade, is already over one month old. January 2020 was quite a busy month kicking off with my first visit to the (very impressive) LAMMA show at the NEC in Birmingham on the 7th and 8th.

This show was a great platform for the IAgrE as we presented the Ivel Award to JC Machinery for their Vredo CDS System. The President and I were also treated to a glimpse into the future when we were shown the new, all-electric tractor offered by Reesink. Apart from its zero emissions, this small but powerful tractor was much quieter than those powered by an internal combustion engine and, therefore, could operate well in livestock housing or confined spaces where fumes are a safety issue.

**New strategic plan**

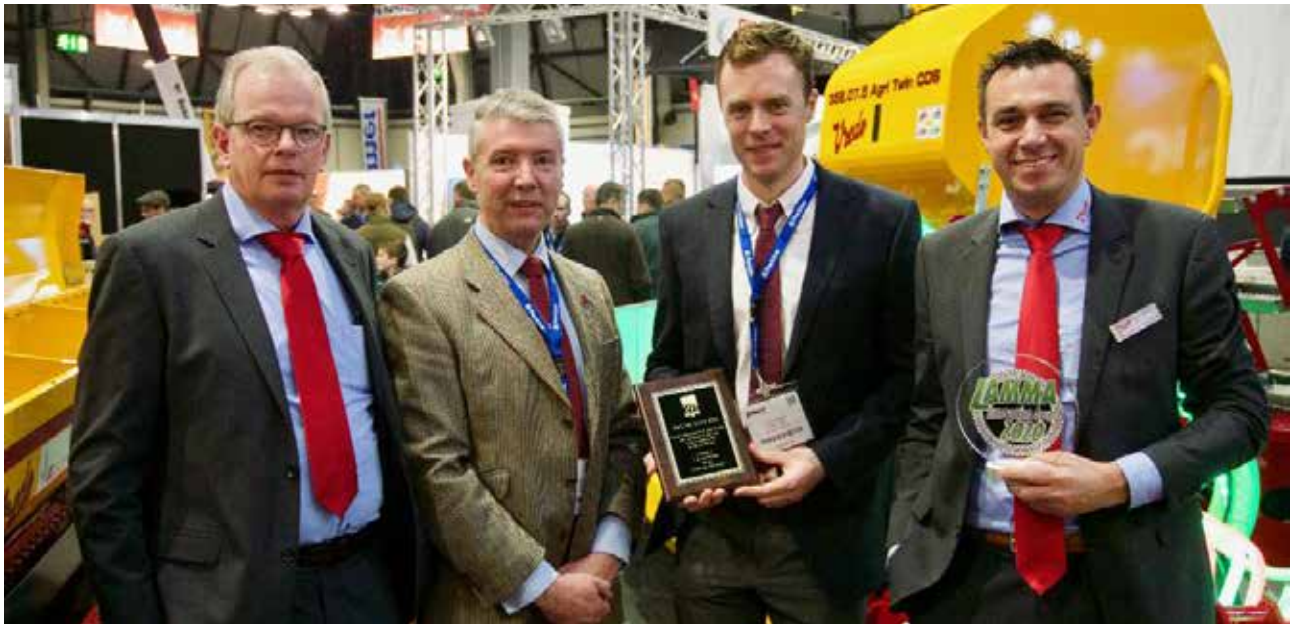
The first Executive Committee meeting of 2020 took place on the 15th January and our new strategic plan for the next three years was approved. Members will start to see some of the output from this plan later on in the year when we hope to roll out our new mobile App, which is currently under development. Looking more long term, I am very keen to engage with companies and organisations over the next three years to see how we can best serve young agricultural engineers and environmentalists at the start of their careers in this exciting and diverse industry. I also want to meet those mid-career agricultural engineers and environmentalists who have just "never got round to joining" – a phrase I have heard many times in my travels.

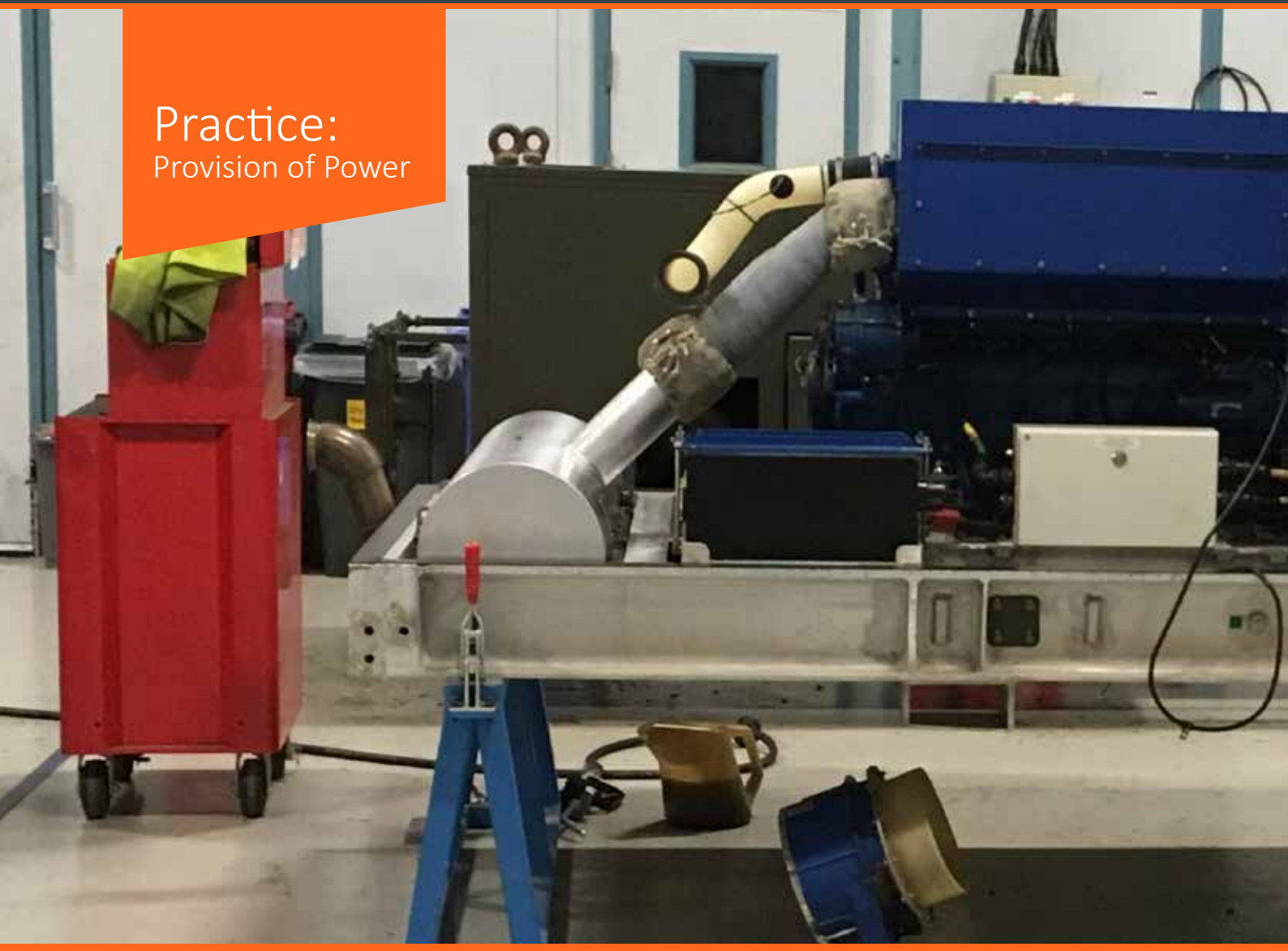
In the office we have also been busy preparing all of the documentation necessary for our forthcoming visit by the Engineering Council on 17th March to renew (hopefully) our licence to award EngTech, IEng and CEng registration to those of our members who meet the appropriate registration criteria. Thankfully these visits are 5-years apart because the work required in preparation can be quite arduous. We did have a similar visit from the Society for the Environment in December last year and whilst it was a nerve-wracking experience (being my first licence review by this eminent body) we received a 'Satisfactory' (the highest level of recognition they award) across every one of the categories they reviewed.

**Future members**

I have recently returned from Reaseheath College where I spent the day talking to cohorts of students studying on various courses offered by the College. These young men and women are the future of the Institution and as such we must learn to engage with them in ways that best appeal to them (hopefully the new IAgrE App will help). Our message, however, is still the same, namely that the IAgrE is their professional 'home' and that we can support them throughout their career by providing information, facilitating networking opportunities and recognising their professionalism. I was also delighted to accept the invitation from the College to open their impressive, new Centre for Advanced Engineering and Agri—Technology on behalf of the Institution.

2020 has started with a 'bang' and looks as though it will continue apace for the rest of the year. We are 'living in interesting times' but increasing our membership will be my mantra. Leaving the EU will bring with it challenges but I am determined to ensure that your Institution continues to give you what you need to move your career forward. I hope the new decade has started well for all of our members.





# Practice:
## Provision of Power

## Provision of Power on rail, land and air

*Recently Landwards was invited for a look around Rolls-Royce Distributed Generation Systems (DGS) in Winsford, Cheshire. Not only did we get to peer under the bonnet of a fascinating engineering undertaking, but there are lots of lessons for agricultural engineers.*

### Who are Rolls-Royce DGS?

- A wholly owned subsidiary of Rolls-Royce plc, which is split into three business divisions, Civil, Defence and Power Systems. Rolls-Royce Distributed Generation Systems is a part of Rolls-Royce Defence.
- Based on a single site at Winsford, Cheshire.
- C 50 employees
- 5000 square metres of workshop, test environment and a small area of offices.

**At Winsford they offer three specific services:**

1) **Land power**, the development, maintenance and ensuring availability for service of approx 33,000 pieces of mobile power generation and associated hardware for the MOD.
2) **Rail** - maintenance and routine overhaul of MTU train engines with UK regional rail companies.
3) **Historic aero works** – production of spare parts and overhaul/ rebuilding to OEM spec of Merlin and Griffon engines.

**What's under the hood of a mobile generating unit, with the air cooled Deutz diesel engine in blue.**

## Mobile power assets

A range of distribution and generation equipment made and managed by Rolls-Royce DGS.

Rolls-Royce DGS develop, manufacture and maintain a broad range of distributed power generation equipment including:

- A large fleet of mobile power generators;
- The auxiliary power units for the Ajax armoured fighting units;
- Diesel generator sets for navy vessels – auxiliary power, not propulsion;
- 25kW variable speed power units for the Watchkeeper UAV system;

# Practice:
## Provision of Power


## Land power

The traditional core business of Rolls-Royce DGS involves looking after c 33,000 specific assets, ranging from a large fleet of mobile power generators, down to the interconnecting cables to distribute the power, and everything in between. These assets are wholly owned and maintained on long term contracts by Rolls-Royce DGS.

These solutions are designed to operate off-grid, be mobile and in a military environment, and for military customers.

Consequently, Rolls-Royce DGS design the equipment to meet harsh environmental, climatic, noise and Electromagnetic Compatibility (EMC) standards.

As a supplier to the Ministry of Defence (MOD) for some 20 years or so, there are long term hardware supply, lease and maintenance contracts in place to look after these assets.

There is a long tail of support in place with these contacts to ensure that the provision of power is maintained with these assets. The equipment will be in service, or at least available for use, for perhaps 20-30 years in these contracts and the onus is on Rolls-Royce DGS to maintain it accordingly.

### Generation game

Diesel engines are the prime mover for the generator sets, which produce DC power as standard and can convert to AC as required.

The generators use permanent magnet alternators as a way of ensuring power density (i.e. the smallest footprint for a given power


**‘Rolls-Royce DGS are looking at ways on non-invasively testing tyre integrity as a way of extending the service period’**

output), which aids transport and manoeuvrability.

Using a variable speed generator to hit the required output also enables fuel efficiencies, that the generator can be ‘wound’ up and down depending on load. Remember transporting fuel in a conflict zone can be a dangerous occupation, so reducing the need is all to the good.

## Maintenance challenges

In round terms, about a third of the generating equipment is in active service at any one time, another third is available for deployment at short notice and the final third is awaiting, or in the cycle of maintenance and overhaul.

Given the length of some contracts this cycle of overhaul and maintenance creates some interesting challenges, particularly for some items one might routinely overlook, such as the tyres on the generator sets. Tyres generally do not wear out, but over time the wires inside the carcase can break and the rubber can deteriorate. Historically the only way to check the condition of carcase wires was to cut open a tyre, instead they were routinely replaced on a time basis. Rolls-Royce DGS are looking at ways of non-invasively testing tyre integrity as a way of lengthening the service period.

# Practice:
## Provision of Power

## Rail

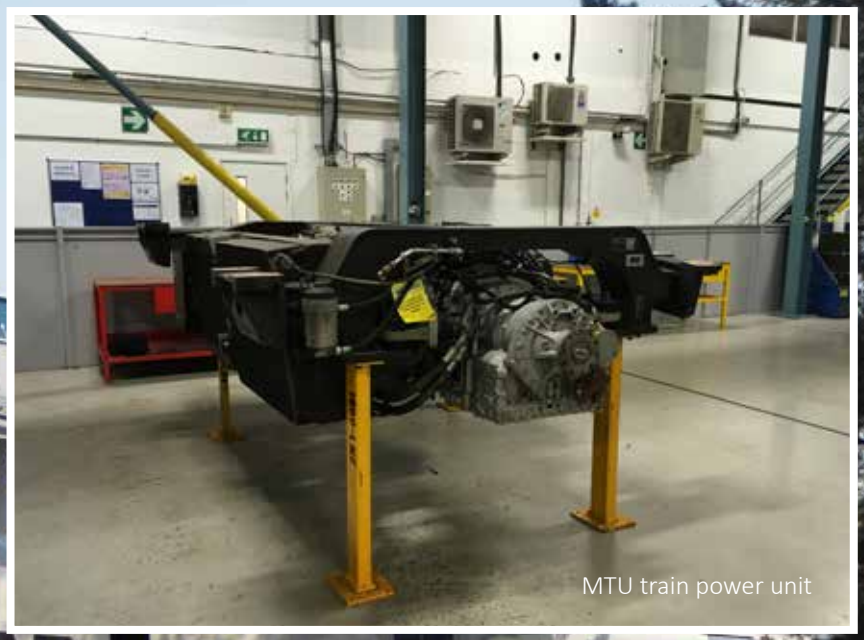
As a result of the success of Rolls-Royce Power Systems selling train power packs (some hybrid) into train manufacturing companies, a new market for engine overhaul and routine maintenance has been stimulated.

Rolls-Royce DGS have partnered with Rolls-Royce Power Systems - who supply new power packs for trains using MTU engines (also owned by Rolls-Royce), to go after service, repair and overhaul work for rail power packs in the UK and Eire.

Northern Rail (now being run by the Department for Transport DfT under Northern Trains name) ordered £500m of the class 195 trains in October 2018, which have the MTU rail power packs, so there is a long term future maintaining and overhauling these units.

Being located equidistant between Northern Trains in Manchester, Wales and West in Chester and West Midlands Trains in Birmingham provides a great opportunity to become the partner of choice for these rail companies.

**Editors note:** Thanks to Andrew Biggs of Rolls-Royce DGS for kindly taking the time to show us around and explain about the business.



MTU train power unit

**Northern Rail Class 195 train powered by MTU engine units, approximately 58 units are in operation now (of a total of 98 units ordered) , with an expected working lifespan of 35 years.**

## Electromagnetic compatibility testing

As all of the distributed generation products are designed and developed in-house, Rolls-Royce DGS have invested in their own EMC testing facility.

**This has:**

- Reduced development lead times;
- Maintained in-house control of EMC testing;
- Ensures compatibility of components without the time and expense of third party testing;
- Become a resource available across the whole Rolls-Royce group.

# Practice:
## Provision of Power


## Historic aero works

This is a new area with Rolls-Royce DGS. Rolls-Royce piston aero engines (the Griffon and Merlins) are still in-service globally, and need routine service, repair and overhaul.

There are companies, organisations and charities still flying historic planes (ie Lancasters, Hurricanes, P51 Mustangs, and Spitfires) and putting several hundred engine hours on the engines annually. The Griffon was the last in a line of v12 aero engines produced by Rolls-Royce, from November 1939 with production ceasing in 1955.

Third party aero engine maintenance specialists are keeping these engines airworthy, but are running out of decent replacement parts (either old 'new' stock, or workable part worn).

This opportunity enables Rolls-Royce DGS to get back into the piston aero engine business. Rolls-Royce originally built the engines, own the plans and IP, so they can produce new parts and commence service and overhaul work on these engines.


Photo courtesy of **Tim Felce**

**Rolls-Royce still own an airworthy Spitfire powered by the 2050 hp Griffon engine.**

Rolls-Royce still own an airworthy Spitfire powered by the 2050hp Griffon engine, alongside two spare engines. They have a requirement to look after the 3 engines which support the company Spitfire. The company's IP includes all the drawings, the test schedules and technical documentation to be able to maintain, overhaul and produce parts to original manufacturers specifications.

It made commercial sense to use the existing investment as a new business venture. Rolls-Royce can go to the market to offer service and overhaul of engines alongside the manufacture of spare parts to original specification.

The opportunity exists for Rolls-Royce DGS to raise the bar and offer something other third party specialists can't deliver with genuine spare parts, and overhauled engines built and tested to the manufacturer's original specifications.

The aero engine area of the workshop was behind a locked barrier in a 'No FOD' (Foreign Object Debris) zone, which was scrupulously clean, with the engine suspended on a jig. By this point the author was breathless with excitement about being in the presence of a Griffon engine and was even allowed to touch it!

**Key learning** - Rolls-Royce DGS have identified opportunities to exploit their existing capacity in a different part of the business. This helps them to have a more balanced portfolio across land, air and rail. As engineers are we exploiting our full capability and competence? What else can we do?

Profession
Natural Partners

# Back to school

*Natural Partners is an established programme for training STEM teachers about the importance of forestry and forest products within the context of the Scottish Curriculum. At the end of September, Andy Newbold donned his walking boots and went for a walk in the woods.*

**First some background, the programme consists of three elements:**

1 A 1-day field trip to students to Glentress Forest (which the author took part in).

2 An assessed piece of work, which takes a different form depending on the subjects. This forms a major part of the Design and Technology (D & T) and General Science students assessment.

3 An event at the Royal Botanic Garden Edinburgh coordinated by Forest Research but run by the D & T students to demonstrate their assessed work from 2 above.

Thus, on a slightly overcast day, I find myself at the Glentress Forest Park in the Tweed Valley in the Scottish Borders. Just myself, waterproofs, sandwiches and about 100 student teachers from the Moray House School of Education (a part of Edinburgh University).

First up, Sally York from Scottish Forestry, framed why the Natural Partners programme existed and explained to the group that we were there to understand how trees fit in to the key teaching themes of sustainability and global citizenship. The day was intended to help the students as new teachers to 'think outside the subject box' and recognise how the themes and subject matter work across the curriculum.

Whilst the context of the day was forestry and forest products, the lessons learnt can be applied to any situation the future teachers are working within.

**‘The issue is that teaching works in subject boxes, but the real world does not’**

Sally York, programme coordinator

## Shelter building

Each group were given a pet ‘stone’ to keep warm and dry with the watering can being used to ‘proof’ the shelter design.

We all headed off up into the woods, broke into small groups of 5 or 6 people which were interdisciplinary, ie maths, geographers and DT teachers. Then tasked with building a shelter for each groups stone, using only the materials available, whilst taking account of the slope, prevailing weather and available resources.

It was interesting to note the differing approaches of the different student teachers, between getting stuck in, discussing options, foraging for likely building materials etc..

At this point we were taught the ‘rule of threes of survival’

You can only survive for:

- 3 minutes without air
- 3 hours without shelter
- 3 days without water
- 3 weeks without food
- 3 weeks without company, as we are social animals.
- 3 seconds without wifi ( for some!)

**Each group were given a pet ‘stone’ to keep warm and dry with the watering can being used to ‘proof’ the shelter design.**

# Profession
## Natural Partners

Next the teachers were split into groups and rotated around the following activities:

### 1. Exploring - not all who wander (wonder?) are lost

Steve McLeister from Moray House launched this by explaining that this was experiential learning at its best. As individuals, we were to head to a quiet area of the forest and either continue walking or sit to think for about an hour and see what came up.


Steve McLeister

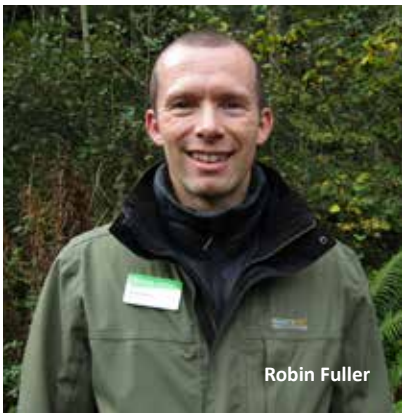
This opportunity for self-reflection was intended to embed the thinking of cross disciplinary learning and how forests fit into teaching. We were encouraged to consider the advantages and disadvantages of interdisciplinary learning and see other perspectives. We also noted down our thoughts on what had impacted from the programme and how it could be used within teaching going forwards.

### 2. Decision Making

Robin Fuller, a planning forester from Forestry and Land Scotland, took us through the potentially conflicting interests at work in the forest environment.

This was a role-playing task where the students were split into smaller groups, to consider one aspect from the environment, economy, timber, recreation and society.

The aim was to identify the tensions and the common ground between the differing needs in and of a forest environment. Each group had to agree their approach and present how they would meet their responsibilities whilst managing these tensions.


Robin Fuller

### 3. Bridge building

Led by FEG members Steve Penny, Forest Research and Graeme White, Forestry and Land Scotland, this task was about appreciating the versatility of wood as a building product and working within the constraints of the supplied kit to produce a bridge.

After a brief introduction Graeme demonstrated a timber arch made from lollipop sticks and how much load it could take as an example of practical engineering with basic materials.

Again as multi disciplinary groups, the students were issued with some lollypop sticks, clothes pegs, scissors, string, a tape measure and a lego car along with a briefing about the need to build a bridge to carry the car. At this point the author had to restrain his enthusiasm for getting involved.

Needless to say there was a tight time deadline and limited resources (does that sound familiar?) and it was fascinating to watch the groups working to identify options, (copy other groups ideas!) and get stuck in with the materials available.

Steve Penny

The task was about appreciating the versatility of wood as a building product and working within the constraints of the supplied kit to produce a bridge.

Graeme White

# Profession
## Natural Partners

**Some very different results from the same materials.**

## About the Natural Partners Programme

The Natural Partners Programme focuses on the Professional Graduate Diploma in Education (PGDE) STEM students from the University of Edinburgh Moray House School of Education.

The programme started in 2012 with Design and Technology students, but now encompasses other STEM students and Geography.

The aim is to demonstrate how trees and sustainable forest management can be used in teaching and learning. Particularly within the context of sustainability.

The programme is organised by the Natural Partners collaboration: the University of Edinburgh Moray House School of Education, Forest Research, Forestry Engineering Group and Scottish Forestry.

## The history of the Natural Partners programme

The IAgrE Forestry Engineering Group (FEG) wanted to do something in forest education. Alongside this Forest Research (who Steve Penny works for) needed to run a couple of events a year. Steve discovered in 2009-10 that working with student teachers was a great way of doing this. Initially this involved going into schools, but this was very resource intense.

By 2012 they were working with teachers and recognised:

- the need to educate on forestry and forest products;
- The lack of knowledge of the wider use of trees, woods and forests;
- The need to work within the curriculum but 'out of silos'

This all combined into the Natural Partners programme.

The model is to reach as many school age children as possible through teachers. The best way to reach teachers is through the curriculum, their training and by showing that trees, woods and forests can meet their curriculum objectives.

## The teacher trainers view

We spoke with Russell White, Strand Leader for Design and Technology for initial teacher education at Moray House, and asked what does the Natural Partners programme mean to Moray House?

'It brings together all the elements of the STEM agenda into a practical working context' Russell said. 'This enables the students to integrate trees, woods and forests into the curriculum, whilst learning about sustainability. The programme addresses the big themes of society.'


Russell White

## What does this mean to me as an agricultural engineer?

- Knowledge crosses disciplines and skills can be applied in many situations.
- We do not (& should not) work in silos.
- Sustainability should be at the heart of an engineer's activities.
- There can be potentially conflicting priorities on a project. These tensions need to be managed to get the best outcomes.
- How do we and our work engage with wider communities?
- We have transferrable skills which are valuable to society.

**Summary**

It was very encouraging to be a part of a successful embedded method of STEM training which incorporates elements of forestry engineering with the next generation of teachers.

The challenge is how we can replicate this, or support activities to deliver similar outcomes across wider agricultural engineering.

**Key fact** - Did you know that 100 years ago 4% of Scotland was covered in trees, that figure is now 19%.

Practice:
Soils

Photo courtesy of **Andrew Ward**

**Soil effectively acts as a sponge to take in these extreme rainfall events**

# Soils: the first line of defence against flooding

We have witnessed some of the worst flooding on record in the UK, with damage costing the country up to £1.2 billion a year because of erosion, compaction and loss of organic matter.

Jane Rickson Professor of Soil Science at Cranfield University and President of the Institution of Agricultural Engineers takes a look at what's happening in our fields and why healthy soils can help in the fight against flooding.

Professor Jane Rickson

"Soil is so important because it effectively acts as a sponge to take in these extreme rainfall events that we are seeing across the country at the moment. But for soils to be really effective they have to be healthy, able to receive the rainfall, retain it and release it gently and slowly over a longer time span," says Professor Rickson.

## What is healthy soil?

There is a lot of debate about what we mean by a healthy soil. Soils have physical, biological and chemical properties and these interact to ensure the soil is well structured.

Some soils types will be very effective at absorbing and draining rainfall such as sandy soils and others such as clay or compacted soils, which have small pore sizes, may not be able to cope and that's when we get surface run-off that gathers in the valleys and can cause some of the flooding we are seeing at the moment.

We can change the pore structure by how we manage soils. For example, if we put very heavy machines onto soils while they are wet this will compress the soil leading to compaction, meaning you have got rid of the air spaces that could otherwise be filled with water. So it's very important to avoid compaction by trying not to go onto the land if it's too wet. But the 'window of workability' (when the soils are not too wet to traffic) may be shortened by more frequent rainfall events that are predicted, especially in winter.

Cover crops can really help too

because their roots grow down into the soil and help bring in structures such as root canals which act as conduits for the water.

## Impact of Flooding

Flooding can cause huge impacts on agricultural land. For example, if you have a saturated soil profile you haven't got any air space and roots can suffer if they are not able to get oxygen. Wet soils are also going to affect your soil biology and nutrient cycling because the microbes can't break down nutrients. Soil surface structure is affected by sediment being deposited on top of existing soil, which can lead to sealing of the soil surface, leading to more surface flow and flooding.

The flooding is having a real impact on farmers who may have to re-sow some of their crops because of flood damage. Here is the irony because you can't use machinery on wet soils to alleviate the damage: you have to wait until they dry out. Ponds of water remaining on the surface for weeks mean farmers won't actually be able to manage their land for some time to come.

Some of these issues are likely to become 'the norm' according to future climate change predictions for the UK.

Agricultural engineers are well placed to identify ways to mitigate and adapt to the effects of increasing rainfall, through innovate machinery design and better field engineering.

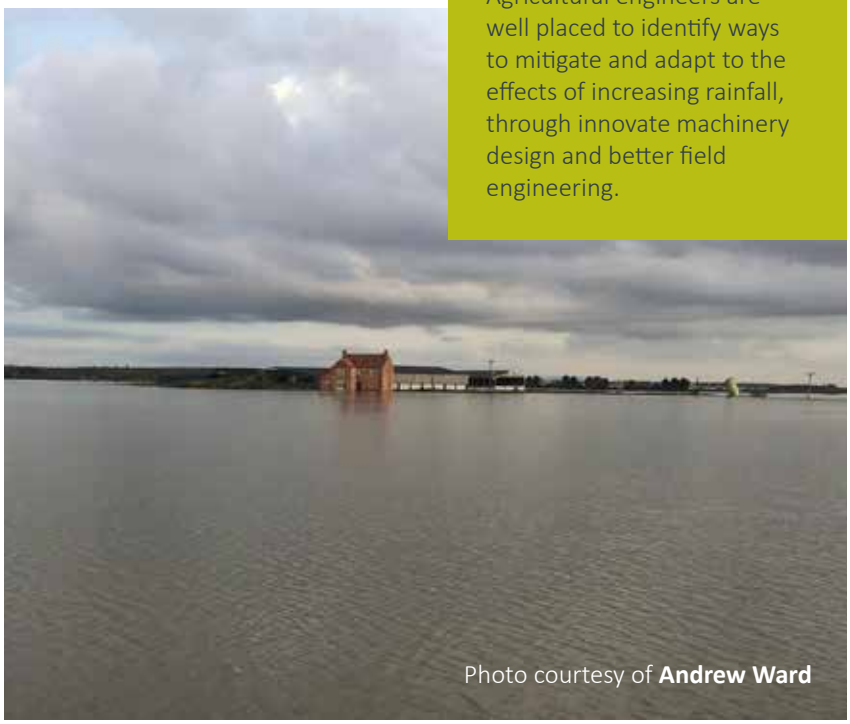


Photo courtesy of **Andrew Ward**

Cranfield
Environment
and Agrifood

# Enrich your career with a Cranfield MSc in Environment or Agrifood

By studying for a postgraduate qualification at Cranfield you will learn from industry leading academics through research informed teaching.

- Exclusively postgraduate university,
- Full and part-time MSc and CPD study options available,
- Exceptional near-industrial scale facilities,
- A selection of our Environment and Agrifood courses are accredited by the Institution of Agricultural Engineers.

**To find out more about our Environment and Agrifood courses visit:**

**E: study@cranfield.ac.uk**
**T: +44 (0)1234 758082**
**www.cranfield.ac.uk/environmentandagrifood**

# Practice:
## How to build a plough

**Pottingers Vodnany plough factory in Southern Bohemia, Czech Republic**

## A very modern plough factory

Austrian machinery manufacturer Pottinger have been building ploughs for over 40 years. Andy Newbold was fortunate to be able to spend a couple of days last year at their Vodnany, Czech Republic, plough and cultivation equipment factory.

Forget anything you may think about the idea of 'beating metal' into ploughshares for a start. This business is very serious about applying the best possible technology and techniques to plough production.

First the history lesson. In April 2000, Pottinger rented a factory in Vodnany, and began building ploughs, shortly thereafter they acquired an 11Ha site and started their current factory development.

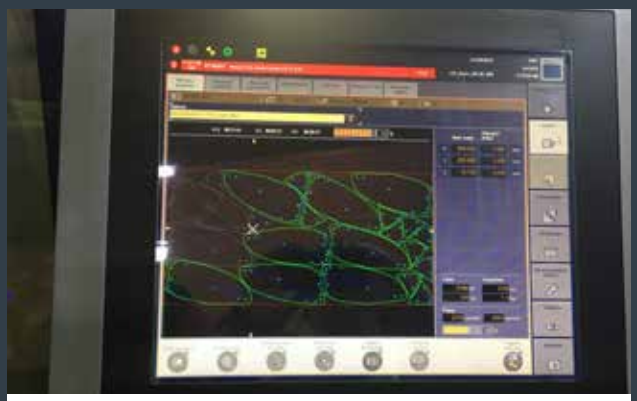
Some 41M Euro's later there are 35,000 sq m of buildings on site, including dedicated assembly lines, a logistics centre (for just in time sub-assembly deliveries to their Austrian factories at Grieskirchen), machine testing and final dispatch.

Pottinger make around 1700 ploughs annually at Vodnany from two to nine furrows, with 600 variants of the Servo plough being available.

## About Pottinger

Pottinger are an Austrian family owned and run manufacturer of agricultural machinery, both for grassland and arable farmers. Founded in 1817, They have 1892 employees, operate in 32 countries worldwide with a turnover of nearly 400m Euro's.

Ready and waiting, this German steel is racked and waiting to head off down the production line.



The laser cutter works out the best arrangement for the mouldboards on screen prior to cutting.

The robot laser cutter works though each sheet of steel, then vacuum lifts and stacks the flat mouldboards before the next stage.

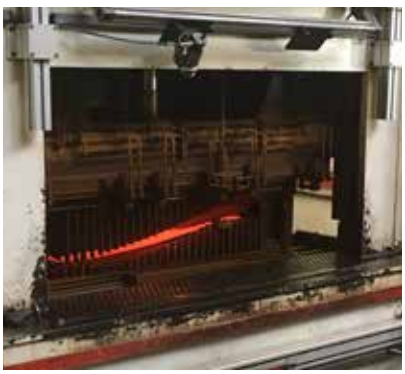

Since 2013, Vodnany has been the first plough factory in the world to use the ALD Vacuum Technologies GmbH high temperature, low pressure carburizing system. The mouldboards are heated to 1050 $^{0}$C for 9 hours to open the steel structure and allow the carbon to enter this structure to a depth of 2.2-2.4mm. These mouldboards have a hard and resistant surface whilst still maintaining a ductile and flexible core.

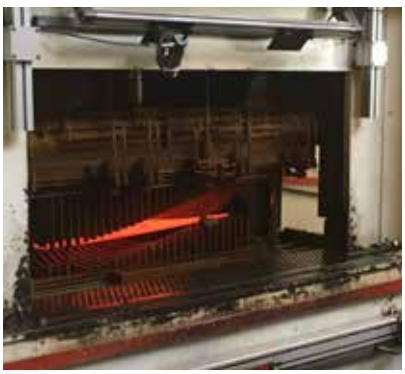
# Practice:
## How to build a plough

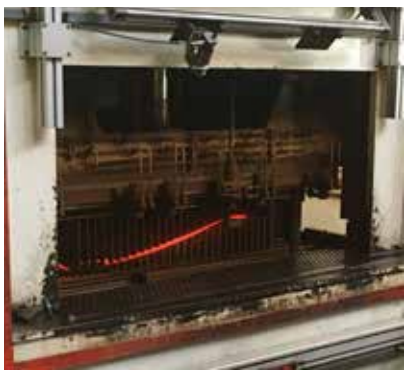
**The purpose built logistics centre despatches both completed products and subassemblies for their Austrian factory at Grieskirchen.**

Next the mouldboards are heated in a furnace to approx 9200C for over 30 minutes.

Every year 1700 ploughs leave Pottingers Vodnany plant in the Czech Republic.







The pressing process - From the furnace they are pressed into the final shape.

The finished mouldboard.

Large – mouldboards are routinely subject to rigorous checks to ensure consistent quality.

In a separate area the headstocks are cut and welded, prior to painting.

Plough legs heading into the powder paint system.

Here a 7-furrow reversible auto reset servo plough is on the assembly jig awaiting legs and mouldboards.

The finished articles awaiting dispatch.

# Profession:
## CPD


### Maintaining your core competence

Continuing Professional Development (CPD) should be a familiar phrase for all engineers. It can, however, conjure up images of a bureaucratic institution policing its membership for any indication of non-compliance. Ed Hansom, IAgrE CEO deals with some myths.

It is a pity that CPD has such a 'bad press' in some quarters. Maintaining one's competence through a process of CPD has always been a requirement of IAgrE membership as well as a registration requirement with both the Engineering Council and the Society for the Environment. What's more, it is what professionals do. Surgeons, for example, are mandated to complete a minimum amount of Continuing Professional Education (CPE) each year if they wish to remain employed by the NHS. (I hope that comes as a relief to our members!) CPD is becoming ever more important to IAgrE members as the vehicle to demonstrate an individual's ongoing professional competence and commitment to the profession. Members are encouraged to send their CPD records to the IAgrE for review and comment.

### Good news

The good news is that CPD covers a wide range of activities which enhance one's professional competence. Most people think of CPD being restricted to attendance at conferences, courses and seminars; organised visits; writing articles or technical papers and further education, distance or open learning. However, CPD is much broader than that and can, additionally, include involvement in IAgrE committee work, attending IAgrE technical meetings, work-related secondments and exchanges, reading or private study as well as on-the-job learning.

### Increasing emphasis

All Professional Engineering Institutions licensed by the Engineering Council and all professional bodies licensed by the Society for the Environment (the IAgrE is licensed by both) have steadily increased the emphasis on CPD in recent years.

We are now obliged to monitor a randomly-selected sample of our members' CPD records each year to ensure that they comply with the registration requirements.

This sounds like an onerous task but Institutions have been given freedom to interpret this obligation that best suits their members. Thus, the IAgrE promotes CPD to all its members and has adopted what it considers to be a pragmatic approach to the registering and recording of members' CPD.

The IAgrE has decided to see this as a great opportunity to add real value to the CPD 'cycle' of planning, doing, recording and reflecting. IAgrE members who are asked to submit their CPD record will, in turn, receive valuable feedback on what they have done and what they are planning to do.

### IAgrE committment

Additionally, the IAgrE is committed to providing a wide range of CPD activities to its members as well as a system for all members to register their CPD (so that we can provide feedback and support). The IAgrE does not use a monitored points or hours system as this is considered a rather mechanistic approach. Instead we believe that the quality of one's CPD is much more important than the quantity. However, we will recommend (if pushed) that IAgrE members should aim to complete a minimum of approximately 30 hours of CPD per year. This, however, is very much offered as a guide to assist our members.

### Straightforward approach

The IAgrE already uses the Engineering Council's online CPD planning and recording tool 'mycareerpath' as a member benefit and a simple way for members to record their CPD. The Engineering Council has also developed an auditing facility for Institutions to work alongside the recording area of mycareerpath. The IAgrE has, therefore, chosen mycareerpath to collect members' CPD records.

### How do I record my CPD?

You can record CPD through the Members 'log in area' of the IAgrE website. Members who wish to use this as their CPD planning and recording tool should contact Sarah at HQ for details about how to set up an account and to log on (email **Secretary@iagre.org**); more information is also available on the IAgrE website: **iagre.org/cpd.**

## Key areas of CPD

The three key areas of CPD which are generally considered appropriate cover:

**A.** activities which develop technical expertise and knowledge relevant to one's profession.

**B.** activities which extend the technical and managerial skills beyond one's normal field.

**C.** activities which develop professional life skills and knowledge such as languages, finance, law etc.

Most importantly we are all doing CPD regularly in order to remain competent in our jobs. Equally a sound record of CPD has been proved to enhance career prospects, contribute to business performance, help to support job satisfaction, improve employability and ensure employees deliver a high-quality service.

**IAgrE members who submit their CPD record will receive valuable feedback on what they have done and what they are planning to do.**

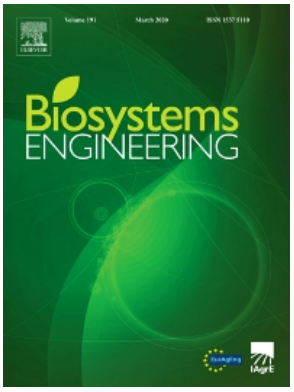
## Managing Editor required for Biosystems Engineering

Biosystems Engineering is a peer reviewed journal owned by the Institution of Agricultural Engineers (IAgrE) and published by Elsevier. It is an international journal and the official scientific journal of the European Society of Agricultural Engineers (EurAgEng).

IAgrE is looking to contract a Managing Editor in the team of two Editors (Editor-in-Chief and Managing Editor) and three Associate Editors that operate the journal. The Managing Editor will work with the Editor-in-Chief (who will then be Steve Parkin), taking responsibility for aspects of the management and strategic direction of the Journal, and editorial responsibility for about 600 submissions p.a., some of which will be handled by the Associate Editors.

The successful candidate will need:

- A high degree of proficiency in written English, either as first language or high fluency as second language
- To be technically experienced in significant aspects of the engineering or physical sciences associated with agricultural or other related biological systems
- To have a history of publication in international peer-reviewed journals
- Have significant experience as a reviewer for such journals
- Be experienced in decision-making in relation to scientific research.




As much of the work related to this position will be internet based, access to a good internet connection is essential.

Expressions of interest (with a CV) should be submitted to the Chief Executive of the IAgrE, in the first instance, by Friday 3rd April 2020.

Email: ceo@iagre.org

Postal Address: The Chief Executive, IAgrE, The Bullock Building (Building 53), University Way, CRANFIELD, Bedfordshire MK43 0GH. United Kingdom.

# Book Club


**Good ag engineering books are like buses, none for ages and then two in short order. Whether you have a professional interest in tractors or farm building design, or just fancy flicking through to remind yourself of the principles, both of these books are a worthwhile read.**

## Fundamentals of Tractor Design by Karl Theodor Renius

This explains the level of engineering detail applied in delivering the optimum tractor, and the journey the tractor has been on to become the machine it is today. Mike Whiting engaged the diff lock and hit the throttle…

As with many other agricultural engineers, I'm sure there have been many instances when you think you've taken a tractor to its working limits. Have you ever considered how the design team pre-empted your exploits in the field amongst all the cost, performance, adaptability and safety constraints?

German born Karl has worked at the highest levels of agricultural mechanisation for over thirty years. With roles such as Manager of Advanced Engineering and also Tractor Development at Deutz tractors all underpinning his high "horse power" bracket Curriculum Vitae.

### Working from first principles

Using his engineering principles Karl takes us through milestones in tractor history including Harry Fergusons 1925 patent referring to depth control for implements. We gain an insight into how the global manufacturers manage multi-million dollar budgets to develop a new range. Useful facts on the cost allocation across the specification highlight the pecking order of engine, transmission, cab and quality control.

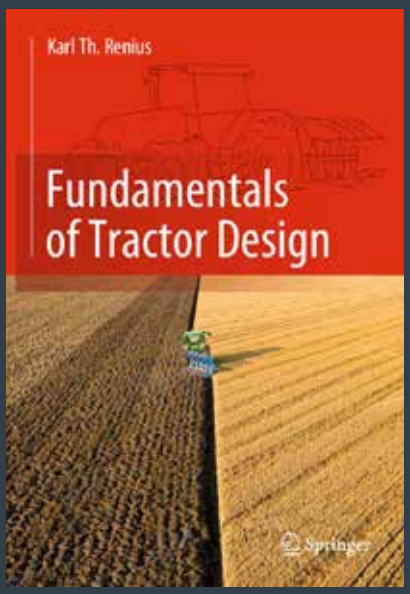
Getting down to the fundamentals, the book provides a detailed understanding of a tractors interaction with the soil. A combination of diagrams and example calculations gives us the "cook's tour" of wheel slip and tyre technology. Information is provided on how soil compaction testing is undertaken with tractors, and importantly reference to both wheeled and tracked machines. The high exposure to road use is also factored in with the effect of inflationary pressures and braking specifications.

### Running gear

We all take four-wheel drive as the default option when selecting

Photo courtesy of **John Deere**

**If you have read (or written a new or recent book) which members will benefit from, please let the editor know.**




a power source, however Karl explains the impact on overall tractor performance. Bringing the reader into the early 2000's, the book exposes us to newer technology such as front axle suspension. In-between the maths and formulae there are some timely reminders on basic tractor design. Such as the engineers need to consider the implications of fitting a front-end loader.

The auxiliary services such as power take off (PTO) and hydraulics receive full attention detailing the various configurations available. A move to economy specification PTO speeds is a logical progression, although the limited room at the rear of the tractor presents a challenge. The book uses table formats throughout to explain comparisons such as closed and open centre hydraulic transmissions.

### ISOBUS and CVT

Complex subjects such as ISOBUS connectivity and constantly variable transmissions (CVT's) receive detailed explanation by Karl. The depth of knowledge and understanding continues through to the tractor-implement management (TIM) relationship. Utilising the front linkage with a cultivator to prepare the topsoil for the drill mounted on the rear maximises the stress loading capabilities of the tractor chassis frame. Although beneath the cab fascia there are potentially twenty nine operational functions that a combination of manual and automatic control, needs to consider with one headland turn.

### Operator comfort

As the operator still plays a big part in the tractors efficiency, the designer's considerations and requirements for ensuring safety and ease of use are referred to in both text and illustrations.

There are a wide range of people who should be selecting the "add to cart" button with this publication. From students and engineers to lecturers and manufacturers of any mounted or towed implement, all would find the almost 300 pages of detail most useful. With very senior executives from both Deere & Co – Illinois US, and the AGCO Global Corporation personally endorsing Karl and the book, there is little need for any further recommendations.

# Book Club

Photo courtesy of **www.farmingphotography.co.uk**

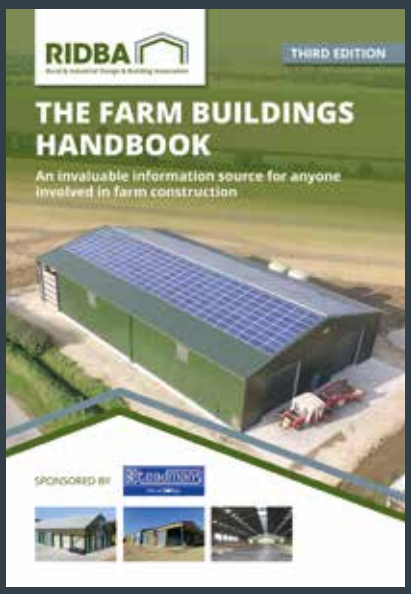
## The Farm Buildings Handbook. Third edition. 2019

***An invaluable information source for anyone involved in farm construction. Reviewed by Jamie Robertson.***

If there was a short list of books that contain enough hard data and guidance to save the UK agricultural industry £ millions per annum, this 192 page volume would be on it. The Farm Buildings Handbook, in its third edition edited by Jim Loynes BSc, CEng, MIAgrE, is a reference volume that guides us through the preparations of a build project, the law and regulations, and into construction technology. Thereafter the book tackles specific building design details for livestock and crop storage and finishes with a comprehensive source list of useful information.

Whilst the introduction states that the information in the handbook does not seek to replace the advice from specialist advisers, the current situation in UK agriculture is that independent advice on buildings is very hard to find. The attraction of this guide is that all the information contained is provided by individuals who have contributed to British Standards over the years and / or have years of experience from the now defunct R&D sector that supported the evolution of design for farm buildings.

The Farms Buildings Handbook is sufficiently clipped in its language to be suitable for producers who require to know what questions to ask the planners and builders before they




**A reference volume that guides us through the preparations of a building project, the law and regulations and into construction technology.**

The Farm Buildings Handbook is a £20 investment that is good for the next decade.

The Farm Buildings Handbook. 3rd Edition (2019) Rural & Industrial Design & Building Association (RIDBA), 6-8 Bonhill St., London. EC2A 4BX. ISBN: 978-1-5272-4508-2.

start a project. There is also a myriad of design details, including 78 tables, that are useful to the generalist at all levels from adviser, builder, planner, architect, QA assessor and finance manager. The handbook should be on the shelf of every large animal veterinary practice in the country, so that they can compare the built environment on clients' farms with how the target building "should" be if constructed and maintained according to good practice.

### The impact of building design

The impact of poor building design, construction and maintenance on the efficiency of crop storage and livestock production is massive. Engineering technology has advanced so that, for example, remote sensors in buildings can pass live information on the CO2 content of a store, ambient temperature alarms, data on feed intakes from individual animals, and hormone concentrations of milk from individual cows. On the other hand a ball-park of 50% of all new livestock buildings do not have sufficient ventilation capacity due to ignorance of design guidance published over 30 years and accepted around the world. Respiratory disease in UK livestock inflicts £m's losses per annum. Similar associations can be made between the contribution of poor flooring and the cost of foot problems.

### Generational investment

An agricultural building is an investment for a generation of use. It will often be the single largest investment a producer has to decide upon. But, unlike the purchase of a piece of field machinery where all the technology is put together by experts before purchase, the producer is often left to choose elements of building design with minimal or conflicting guidance.

# Professional:
## The Douglas Bomford Trust

Photo courtesy of **www.farmingphotography.co.uk**

**See www.dbt.org.uk for more information**

# Looking back to the future?

*Douglas Bomford Trust Secretary **Alan Plom** looks back over the winter months and forwards to the New Year and the next decade:*

The end of the year is not a quiet time for the Trust, being a period of evaluation and reflection for our Trustees. We traditionally hold our AGM in mid-November, when we welcome new trustees, discuss our strategy and review completed, ongoing and potential new projects for funding.

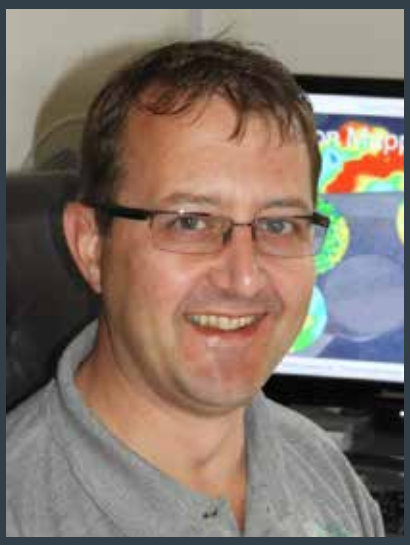
We traditionally allocate around two thirds (approx. £100k) of our total income (arising from around £5million invested by the Trust) to PhD research projects each year. These are usually co-sponsored with other charities, organisations or businesses. However, applications relevant to our core objective to develop and promote agricultural engineering have been declining.

As a result, the Trust will be taking a wider perspective and consider supporting more Masters' degree-related projects.

Reflecting the increasing breadth and interest in developing agricultural technology, we have recently sponsored projects at a wider range of academic institutions than those offering agricultural engineering courses - provided they are within scope of our broad aim, ie "to help advance the application of engineering and technology to achieve sustainable agricultural, food and biological systems for the benefit of the environment and mankind". [See www.dbt.org.uk for more information and application form.]

### By Royal Appointment?

Our Board meeting in November was kindly hosted by the Royal Agricultural University (RAU), where we have sponsored a chair of Applied Farm Mechanisation and Management/lecturer in agricultural engineering, to encourage the integration of agricultural engineering into RAU's courses and research. Karen Rial-Lovera has been very effective in this role over the past two years and we are pleased that RAU will be retaining the post and continue working closely with the Trust after she moves on to pastures new, at Nottingham Trent University.



## Meet a trustee...

Clive Blacker is our latest Trustee, having joined the board in November. He is looking forward to helping the Trust identify and mentor the next generation of engineers to shape our future and is obviously well-placed to do so. He is a Fellow of both IAgrE and the Council of the UK's Royal Agricultural Societies and is well-known as an advocate of precision farming. Clive was an early convert, instrumental in his family farm adopting the technology in 1998 and he has continued to promote the benefits and explore the boundaries of what new technology can offer.

Following an Agriculture HND at Harper, Clive received a Nuffield Farming Scholarship to study precision farming in America and Australia in 2004. Through his own company Precision Decisions and in his role as the Department of International Trade's 'UK Precision Farming Specialist', Clive has supported UK businesses developing technologies and solutions to manage crops more profitably and has encouraged international investment into the UK.

Clive had the vision to support the development of 'Hands Free Hectare' and his advice to Kit Franklin that "there is no such thing as a daft question" and "you don't learn until you try" were the foundations for their successful research, now evolving into 'Hands Free Farm'. Now working for Map of Ag, Clive is keen to see what can be achieved with data to unlock the real potential of machines and crops.

### Awards and Scholarships

In addition to sponsoring an Award for 'Best Agricultural Engineering Dissertation' at RAU, this year sees our first scholarships awarded to RAU students. The Trust's Scholarship Scheme is intended to help develop individuals and encourage them into a career in agricultural engineering. We have awarded scholarships for many years to students at Harper Adams, but the competition is open to students studying a relevant subject, at any university.

It is always a pleasure to meet the applicants and explore their diverse ideas for projects and we look forward to meeting the 'chosen few' again at their forthcoming Scholarship/Award Presentation ceremonies. (More about them next time.) This is a competitive process and we can't sponsor everyone, although we have helped some in other ways. Even those who are not successful find the experience helpful in preparing them for future interviews. We wish them all well with their career progression.

Some of the interesting projects funded by the Trust will be described in future editions of Landwards. A selection reflecting the diverse range of topics and projects funded by the Trust are also available on our website: www.dbt.org.uk .

## About The Douglas Bomford Trust

The objective of the Trust is to advance knowledge, understanding, practice, and competence in the application of engineering and technology to achieve sustainable agricultural, food and biological systems for the benefit of the environment and mankind.

**Contact us:**
The Bullock Building
(Bldg 53)
University Way
Cranfield
Bedford

MK43 0GH
Tel:+44 (0)1234 750876

**www.dbt.org.uk**
**enquiries@dbt.org.uk**

# Council Report

**Cranfield Universities state-of-the-art, agri-tech facilities, purpose built for the study of soil dynamics, soil management and soil conservation techniques.**

## Council tour the Agri-Food facilities at Cranfield

*Cranfield University was the venue for the February Council meeting. After reviewing the minutes of the last meeting and a summary of IAgrE activities, members were divided into groups to discuss how IAgrE can offer better career support with regards to mentoring, Continuing Professional Development (CPD) and improvements to the overall registration process.*

### CPD comments:

The break-out groups agreed that the CPD 30 hour threshold is nothing to fear as it is just a guide. It's all about quality not quantity, plus adequate planning is key to a successful CPD record.

It was also felt that the new IAgrE App (currently being developed) would make the gathering of data much easier for members. CPD is not just about listing a series of events. What is more important is the impact of the event or activity on an individual, which needs to be reflected in the CPD record. The importance of reflecting on what the learning has meant and the benefits was also emphasised.

The Western branch is trialling a scheme that logs members attending branch events. This data is forwarded to the Secretariat who log the event under the individual's CPD record. All the member has to do is add a reflection about the event. If this scheme is successful, other branches will have the opportunity to take part.

### Membership drive

Increasing the membership was a hot topic. How do we attract new members by demonstrating it will help develop their career and open the door to professional development opportunities.

Membership through the Engineering Technician level was seen as having huge growth potential. We should be building stronger relationships with colleges, selling ourselves as a marketing tool to attract more students onto landbased engineering courses and making membership more attractive to college lecturers.

We should also work with colleges to approve more of their courses through accreditation, which will also help to build new and stronger relationships.

### The technical route

It was also suggested that we need to re-examine the Technician grade to open up career progression and offer mentoring to guide people through the process. The guidelines for registration need to be examined and the process described in simple steps with support readily available throughout the journey.

# Purpose built soil research facilities

After lunch President Jane Rickson led a tour of Cranfield's state-of-the-art, agri-tech facilities, purpose built for the study of soil dynamics, soil management and soil conservation techniques.

The Agricultural Engineering Precision Innovation Centre – Agri-EPI is a world-leading centre for excellence in engineering and precision agriculture covering livestock, arable, aquaculture and horticulture. Cranfield houses a main hub of the Centre.

The first stop on the tour was a new glasshouse, built as part of the CHAP (Crop Health and Protection) AgriTech Centre. It houses a phenotyping sensor platform and offers real-time, pilot-scale growth trials, simulating soil-plant water interactions in controllable test conditions.

The facility can demonstrate how soil quality can change with different tillage techniques and test the effects of soil condition on crop establishment, root and canopy development, crop yield, soil health and degradation, soil-borne diseases, weed control and crop phenotype. This will help inform on-farm decision making and the development of more efficient and sustainable methods of food production.

The glasshouse allows crop growth trials to be conducted in 24 containers (lysimeters), large enough to simulate full-scale, controlled field conditions, including drainage. Soil can be packed to manipulate real field conditions, including bulk density, soil strength and surface properties.

The tour then moved onto the soil bin and erosion laboratory. The 45m long, 5m wide and 2m deep soil lane is renowned internationally for its work in off-road vehicle dynamics. The soil lane can simulate a variety of conditions such as hard compact dirt roads and airstrips, as well as agricultural fields. Simulating extreme off-road environments helps to evaluate machines that interact with the soil from rally cars and agricultural machines to tillage trains and tyres.

The soil erosion laboratory simulates temperate and tropical rainfall with drop size, intensities and kinetic energy conditions recorded over a range of conditions. The laboratory

can be used to test the erodibility of slope forming materials including soil, waste-rock and ores, and evaluate a range of erosion control technologies including mulches, soil conditioners and geotextiles.

Following the visit Council members were left in no doubt that Cranfield is a leading University, well on the way to developing solutions to the challenges facing world agriculture. The work brings together the best expertise, knowledge and insight from leading research organisations, making sure that the knowledge and insight learnt is translated into benefits for farmers, growers and the food industry in the UK and overseas.

# Membership Matters

## East Midlands Branch

**Evening visit to Bifrangi UK Lincoln An Italian owned company, specialising in Forging and Precision Engineering, 12th December 2019**
Report by Phil Spencer

Less than a quarter of a mile from the centre of Lincoln is a piece of Lincolnshire's agricultural engineering history; There has been "engineering" taking place for over 170 years. Clayton and Shuttleworth built threshing machines there in 1840. Other activities included the manufacture of railway wagons, Handley Page bombers and military equipment during World War 1 and then various drive shafts for Rolls-Royce to go into Merlin engines fitted to Spitfires and Hurricanes in World War 2. Many parts for the mining industry have also been manufactured there. Over the past fifty years various owners have continued this type of work and in 2001 the site was purchased by Bifrangi.

Since then Bifrangi has invested £50m, upgrading and developing buildings and specialised forging equipment, along with R and D facilities for new forging techniques.

On the evening of our visit, 28 branch members and guests were welcomed with a delicious buffet by the Finance Director and the Managing Director, Francesca, the daughter of the owner. Our hosts also explained the reasons for their continued investment and plans for the site regarding its capability and capacity of production.

The forging presses were the real "stars" of the visit and Bifrangi UK are noted for having the largest screw type press in Europe. Designed by the company owner, it is about the same size as a house and has a 16,000t capability! You need to see it, stand by it and hear it to appreciate its scale. Bifrangi UK are installing a new 32,000t press & plant, to produce a wider range of forgings.

**Bifrangi UK produce high quality forgings,** mainly for the agricultural, plant and mining industries and their customers include:

**Caterpillar** – engine crankshafts and soil engaging parts

**Cummins Engines** – engine crankshafts up to 3 metres in length

**John Deere** – engine crankshafts

**Yan Mov** – engine crankshafts

**Thysson Krupp company** – mining conveyor belts

Bifrangi UK produces 35 crankshafts per hour, 24 hours a day. (Last year with 90k for one customer).

We saw the full process of pressing a large crankshaft. Cold steel bar, measuring 2m x 150mm x 150mm was passed through the induction heater, coming off the conveyor almost white hot! Skilled operators, sat in a heat resistant cab, drove a robot style handling system to lift the length of steel, transferring it into the press dies. The press thunders down, the floor shakes and there is a spooky noise like something from Star Wars. The press lifts and there lies one very large crankshaft. (see picture).

Once removed and cooled each crankshaft is checked for straightness, subjected to vertical heat treatment, crack testing and balancing, and then centre point machined and drilled, before being despatched to their sister factory in Sheffield for full machine grinding. It was stressed that every process is carried out "in house".

The visit continued with a tour of all the rest of the processes, followed by a final Q&A session, and ended with a vote of thanks for a remarkable evening by Nigel Penlington.

(The photographs do not give the visit justice, however there are some excellent videos/pictures on the Bifrangi web site).

**Evening meeting - The Welding Institute (TWI) at the Quorn Lodge Hotel Melton Mowbray - 10th Dec 2019** - Report by Richard Clarke

Derek Oliver spoke and he is the senior project leader for the Electron Beam Section in the Joint Technologies Group from TWI. Derek did a sterling job as our speaker from TWI, quickly getting us up to speed on a range of welding/ joining processes either currently on the market or in their experimental pioneering days.
We were shown the advances in Electron Beam welding, using an excellent Power Point with video clips. A number of material examples were handed round for inspection.

Electron Beam Welding is Derek's specialist area of knowledge and this type of welding produces some amazing work. To remove oxidation from the Electron Beam welding process a vacuum chamber is used. The edges of the material to be welded are brought close together and the electron beam is placed on this joint, a molten pool is created which can join material up to 200mm thick in a single pass. No additional filler is required, the material from both parts being close enough together and molten pool produces the welded join. As the energy is concentrated into a small area, an added benefit is that very little distortion is created.

Friction Welding, although has been around a long time, has been drastically improved by automation. A combination of force exerted by a rotating machine tool head is applied to the pieces of material to be joined together. Heat is generated in this localised area due to friction, this makes the two parts soft and malleable and are joined in a rapid process. Avoiding the liquid pool typically associated with welding, yet making an extremely strong joint. Examples of this joining are, engine valve heads to valve stems, turbocharger turbine vanes to the turbine shaft.

A spin off from Friction Welding is Friction Stir Welding, this uses the principles of the Friction Welding but having a moving platform or moving head. This allows two pieces of material to be joined continuously together at speeds of up to 6 metres a minute, again with very little distortion. This same process can be used for a different form of Spot Welding, where the rotating head is pressed at intervals along the work piece joining the two parts together. Typically, this would be used for sheet metal of various kinds. Friction Welding has one more trick up its sleeve and that is Linear Friction Welding. Linear Friction Welding uses the principle of oscillating one of the two parts of material against the other with force, producing enough heat to join them together.

Laser Welding and cutting has been around since the late '60s, but with the evolution of time and the use of robots is much more efficient and timely. It is both a single sided and a non-contact welding process which focuses the energy in a small area to perform the weld. An inert gas is required for more reactive materials, but it can be performed without a vacuum being applied.

Laser Cutting, is generally carried out on a moving table or moving laser head, but Derek showed a demonstration video of high powered hand held Laser Cutting being performed by a suitably safety attired technician.

This concluded an excellent evening which for many of us was a real eye opener to the latest welding techniques and many thanks to Derek Oliver of TWI.

**Evening meeting – Tuesday 14th January 2020**
**Equipment used in Sustainable Demolition**
Report by Phil Spencer

On Tuesday 14th January, first meeting of 2020 approximately 20 members meet at the Quorn Lodge Hotel Melton Mowbray, our regular venue when its not a visit.

Our Guest speakers representing A R Demolition Ltd were Richard Dolman MD and co-founder, assisted by Patricia Sloneczny CSR Director (Trish).

AR Demolition operate from Central Leicestershire and are one of the UK's Award -winning progressive Specialist demolition contractors.

The presentation started with the company history and how it had developed to what they do today. From originally training as a car mechanic, Richard borrowed money to purchase a JCB digger for carrying out groundwork and was asked by a friend to help demolish an old petrol station to build new homes. Seeing potential in this type of work started bidding for contracts to demolish disused factories in the Leicester area.

Examples of work carried out were given, coming up to the present day, and in particular how the equipment had evolved for different tasks. No jobs are the same, with different customer requirements time scales and site issues.

Examples of these jobs included the demolition of the Nottingham BroadMarsh shopping centre. Notts Council set limitations on the task and Richard explained how they overcame each issue.

They were not allowed to close any roads! Existing shops were to remain open. No dust! Limits to how much wastes could be taken off site. The balance of which was later recycled on site.

All this needed new innovative special equipment. Modified 360 excavators with extended booms, high lift cranes, high lift tele-handling equipment, with special attachments to cut through concrete, steel. Attachments for dust suppression cannons, equipment to lift large metal structures, as well as equipment to crush concrete, separate wood and other materials.

Through a series of photographs and time lapse video, they showed other examples of major demolition jobs:

- Demolition and site clearance of a

fire damaged public house. Site to be clear to ground in 24 hours!

- Major roundabout and flyover demolition. Leicester city centre.
- Work on Kings Cross Underground station, Central London, without restricting rail or passenger movement.
- One particular contract required all the equipment to be transported by ferry to an Island off the Scottish coast to demolition and remove a quarry plant.

There was a number of humorous stories too. The demolition of two factory chimneys. To make it more interesting, tickets were raffled for a prize to press the button! a spectator area and local news coverage. Big bang, lots of smoke but the chimneys didn't fall!

Health and safety is also a top priority. With all the staff having qualifications in demolition technology.

In conclusion they also demonstrated examples of sustainability and recycling. AR demolition suggested that if you demolish a 200-year-old building, almost all of the materials are reusable. Bricks, wood, stone and roof tiles, could all be used to build another house. However a modern building may have a life span of 25 years! And at the moment some of our modern materials/ insulation produced are not recyclable.

Our speakers were truly professional, enthusiastic and skilled in what they do. They were able to demonstrate that knocking buildings down is a specialist area requiring the most modern equipment and know how.

NB: Time lapse films of some of their contracts can be seen on YouTube, search for AR Demolition.

# IAgrE Republic of Ireland Branch

## AGM - New Committee Appointed

New committee appointed to IAgrE Republic of Ireland branch. Chris O Donoghue chairperson, Robert Shine vice chairperson, Niamh Foley secretary, Francis Quigley PRO, and Colm Egan treasurer.

ACGO's Sean Gorman and Craig England from Topcon with Chris O Donoghue chairperson at the recent IAgrE meeting held in Limerick.

There was a good attendance at the recent AGM meeting of the Republic of Ireland branch of IAgrE. It was held in the Woodlands hotel in Adare Co. Limerick in late 2019. The existing committee of Michael Moroney, David Frizelle and Michael Ryan opened the meeting and delivered their reports to the attendees. The committee members announced their retirement and were thanked for their long and generous service to the IAgrE branch.

An election of new committee members saw the appointment of Chris O Donoghue to role of chairperson, Robert Shine as vice chairperson, Niamh Foley as secretary, Francis Quigley as PRO, and Colm Egan took over the role of treasurer.

The meeting was followed by two technician presentations by ACGO's Sean Gorman and Craig England from Topcon.

Sean Gorman, the area sales manager for Fendt, spoke about how they are becoming a full line agricultural brand. The company have introduced their new grassland range of equipment, formerly Lely, to the Irish market, they can offer silage harvesters, balers, silage wagons as well as mowers, rakes and tedders.

Fendt tractor sales globally have been on the rise for the last number of years with production hitting 16,800 units last year and the company's production is back at its peak. Germany is still the company's most important market and about a third of the company's production stays within the home market.

Sean pointed out that from an engineering perspective Fendt have always aimed to be market leaders from breaking the 200hp bracket in 1970's, introducing a 40km/h tractor in 1980's, and leading the field with the introduction of technologies such as their turbomatic clutch and vario transmission. Research and development are keys parts of the company. The R&D budget for 2019 was €73 million, and they have been fortunate to win numerous awards for their innovations over the years.

With the environmental challenges facing us all Sean spoke about the Fendt e100 Vario a fully electric tractor. The tractor is proving popular with the councils, utilities and some stock farmers. It has a 650V high capacity battery and can be charged to 80% in 40 mins. Sean said that Fendt recognise the challenges facing the agricultural sector and are looking at a wide range of engineering solutions although a fully electric large horsepower tractor is not something he can see on the market in the short term.

Craig England from Topcon gave an overview of the company's agricultural division. He explained the range of Topcon products available and spoke about how they can offer a wide range of technology from controlled traffic

to boom levelling control. Their real time nutrient sensing system, which uses laser diodes to measure plant reflectance and give nitrogen concentration levels in the leafs, has the largest sensor footprint in the industry.

He spoke about how the company are trying to bring all the data and information available from yields, to nitrogen levels, fertiliser applications etc. into one source using the Topcon TAP system. The aim is to make better use of the information by creating a single Digital Ag Ecosystem.

The meeting was closed by Chris O Donoghue, who thanked everyone for their attendance.

# Northern Ireland Branch

## Safer use of farm machinery - Past, Present and Future

Brendan Digney, Peter Frost and Malcolm Downey at IAgrE

The recent Northern Ireland Branch of IAgrE meeting, held at the Agri Food and Biosciences Institute (AFBI) Hillsborough featured integrated presentations by both Malcolm Downey (HSENI) and Brendan Digney (Machine Eye) around the technology aspects of the safer use of tractors and farm machinery.

### The statistics

Mr Downey is well known to farming audiences in Northern Ireland through his role as Principal Inspector leading the Health and Safety Executive for Northern Ireland's agriculture team. He started his presentation by summarising the grim statistic of 519 human lives (103 of them children) lost in Northern Ireland farm incidents since 1968. During the last 10 years, 66 people (including 2 children) died in farm incidents here. Of these, 21 involved animals,19 vehicles or machinery, 12 falls from a height, 8 during work with slurry, 4 when cutting up fallen trees, 1 when trimming a hedge with a chain saw and 1 suffocated in a silo.

Engineering innovation (and the legislation to require its use) has had a beneficial effect in reducing farm fatalities. For example, the enforced legal requirement for tractor safety cabs / frames from the 1970s quickly reduced the number of overturning incident fatalities by around 5 per year. At the same time, the introduction of any new design needs to be monitored and corrected, if necessary, to avoid the unintended creation of new hazards. One example was the "push down" door handle, on some popular rear-hinged tractor cab doors, which was too easy to open unintentionally. Inadequate basic maintenance of tractors and machinery can be lethal. Examples include the by-passing, rather than replacing, of safety devices (such as the engine safety starter switch) and incomplete PTO guarding. There have been many fatalities, involving entanglement with PTO shaft drives, when using machines such as grain rollers and slurry tankers. The available option, on the latter, of hydraulic drive now offers a safer alternative.

Fatal incidents still occur, with a driver being run over, when their vehicle moves off without warning. This tends to occur when attempting, whilst standing on the ground, to start a tractor or because the parking brake is defective or has not been applied firmly. In some cases this may have been due to lack of strength or dexterity by older drivers. The development of automated systems for secure parking on some of the most recent tractor models is welcome.

### On-farm maintenance

If access for work at height is needed any personnel cage platform must be designed for the job and very securely attached to the lifting vehicle. During on-farm maintenance of machinery, items raised to gain access underneath must also be mechanically propped up. It was stated that the rapid-response Northern Ireland Air Ambulance Service, with its ability to provide emergency stabilisation treatment of serious injury, is now an important advance for the survival chances of people injured in remote rural areas.

People, including children, being run over after getting into working farmyard areas, where tractors and telehandlers are manoeuvring, is a major concern. The ability of the driver, within the confined cab, to see people close to the vehicle is often limited. Mirrors, if well positioned, are a useful aid but their coverage is limited depending on vehicle size and shape. The addition of cameras and monitors significantly improve visibility which is especially important where it is poor. HSENI recently carried out a test demonstrating that as many as 28 people could hide close to a modern tractor and remain unseen by the seated driver! More information about health and safety matters can be viewed at www.hseni.gov.uk

### The future

Given the current risks and the need to improve driver visibility, the future for improving health and safety standards now needs to embrace the application of advanced observation technology in managing human and machine behaviour. Brendan Digney, our second guest speaker, who graduated in December 2019 from Queens University Belfast with his Master's Degree in Electrical and Electronic Engineering, has already done just this by developing his Machine Eye system. Growing up on the family farm in Co Down, his recognition of the need to reduce the risk of injury around machinery operation has inspired him to use his skills and experience to develop the concept. Machine Eye is now patented and has already won numerous innovation awards throughout the UK and Ireland. It has taken him, as part of a trade delegation with Enterprise Ireland, to New Zealand. A suite of sensors

are fitted (or retrofitted) within the structure of the machine, as well as processing units internally. It can monitor and protect people close to working machinery by measuring their movement against safe working limits. Based upon Machine Learning principles, it learns from both its previous and ongoing observations to continuously refine the process.

Many field work operations are carried out using tractors with auto-guidance GPS steering. An actual example was described of how over-reliance on it, without due regard to constant driver supervision, could lead to disaster such as contacting a high voltage electricity pylon with risk to life and massive damage to the network. Machine Eye can be used to sense when such objects are close and take corrective action.

Modern tractors now increasingly incorporate protective safety features to control a wide range of performance features through their central electronic management system. This is known as the Bosch based CANbus (Controller Area Network) system which (depending on the vehicle specification) controls all critical communications in the machine, more-so on those with autonomous aspects such as GPS guidance. Machine Eye can integrate to this system, providing another layer of data on the machine. In the human farm-safety context real-time situational analysis can establish if someone has entered, or is approaching, a critical danger area.

The latest technology can view images in conditions which would otherwise not be visible to the human eye. The systems can monitor and log routine human movements around machines and learn their normal routines. It can also recognise and alert different practices to assess if they may result in an unacceptable contact with moving components and take appropriate actions (such as PTO drive shut-off, applying brakes, sounding an alarm ). Complete shut down may not always be required if the system recognises the role of an experienced operator. Within other industries where a continuous process is involved , such as on a production line, the system can slow it down to permit checking without the need for an expensive and inconvenient complete shut down. The concept very much closes the boundary of human and machine by building a co-operative environment between the two.

### The next steps

With the system now patented, the job of certification (demonstrating that it works in the everyday practical world) is well under way. Fund raising to take it to the next stage of general commercial acceptance is now a priority. The small specialist team, now working to apply and refine the latest technology at Machine Eye, have Invest NI support and have established a Belfast office base. More detail can be viewed at www.machine-eye.com and Brendan can be contacted at brendan@machine-eye.com or 07588 197395

.

A lively interactive discussion followed ranging through the following topics:

- Could the system be copied? - patent protection is now in place.
- How much will the system cost? -TBA.
- How long until the first available commercial version will be available? -soon.
- The potential to transform safety standards and process efficiencies in other industries.
- Extension to herd management by monitoring individual animal behaviours and interactions?
- Local quality control and sourcing of the electronic components.
- Ownership of the collected data.

In conclusion, Peter Frost (Branch Chairman) thanked both speakers for their excellent presentations and wished the Machine Eye team every success in this most important, exciting and pioneering venture.

## West Midlands Branch Meetings - **William Waddilove reports**

### JCB Fastrac its history and development - Wednesday 23 October 2019

JCB Fastrac 4220 Stage V 01a

In the JCB factory written very conspicuously on a wall is a saying 'Our customers can get along without us. We can't get along without them'.

Well it must be delivering a clear message. The JCB Company is huge! The first speaker Ed Strawson, an Agricultural territory sales manager, took us through the history and development of JCB from its first days when Joseph Cyril Bamford bought a second hand welder for £1 and in a rented garage, started building trailers from ex WW2 parts. There is a replica of that garage at the factory. He then went onto building their first tractor mounted front end loader. The big breakthrough came when Joseph Bamford saw a backhoe on a tractor and decided to add it to a tractor with his front end loader.

From then on the company developed at a relentless pace. We are all familiar with the JCB brand but do we know the range? I certainly didn't. It extends right up to battery powered diggers suitable for use in areas where there are clean air zones and there might be a problem with exhaust emissions and where noise could be a problem.

Robin Carter, Fastrac Engineering Manager, took us through the design stages of a new model from the initial sitting around a table

to produce a one page outline specification though to release for volume production. During this talk he illustrated it with the various models of Fastrac and other equipment and showed how the Fastrac had evolved through many versions over time. We were even told a little about their 'world's fastest tractor' having achieved over 135 mph (with a little modification) and yes it did look a little like the latest model.

He was supported by Clive Ellard a sales representative from the local JCB distributer LQG Agri.

We came away from the meeting with an enhanced respect for the JCB manufacturing and design system and an appreciation of them coming to give us the company story.

### Speaker – Professor James Brighton, Senior Lecturer

### On the subject of 'Round Vehicle Engineering Research' - Tuesday 3rd December 2019

James Brighton gave an enthusiastic talk about the work he and his university were doing.

He started off by giving us a history of the organisation. Silsoe College was established in 1960 (Keep an eye out for the celebrations in 2020!) and from the beginning was a centre of learning for agricultural engineering and as I knew took many students from the OND course at Rycotewood College (I didn't take that route). Silsoe College gained university status and became a detached campus of Cranfield University. It is now absorbed into the Cranfield campus.

The agricultural aspect is also absorbed into a branch of automotive research and development. In national terms it is a very small university but it takes no students below graduate level and so maintains it role at the peak of research and development.
It has a new and developed soil laboratory and he spoke about some of the work that was being done there with wheeled and track laying vehicles for example assessing the grip on very loose and unstructured surfaces such as sand. This naturally extends into the testing of developed designs.

All this is related to the areas of advanced vehicle engineering designs. In relation to automotive work he spoke about the test facilities they had for self-guiding vehicles both on roads with 'obstructions' as well as using roadside guidance systems. These are all very exciting developments. The discussion afterwards covered subjects like the move to electric vehicles and how in some ways it may be seen as over enthusiastic and with concern about the future problems that would occur when trying to work out how to reclaim some of the rare metals and components within batteries and electronic components. This even extended to speculation about how we would manage with shortages of cobalt, lithium and other elements.

The talk concluded with some films of some of the TV work he had been involved in and telling us about some of the behind the scenes design work and calculations that had been done.

## Western Branch

### - Richard Robinson reports

### Visit to the Roy Fedden Heritage Centre, October 2019

Western Branch

This collection of Piston, Turbo prop and Jet engines is located within the Rolls-Royce engine facility in Filton, Bristol.

We were welcomed by members of the Rolls-Royce Heritage Trust who used to work on the site and now work on the collection`s exhibits which are of huge historical importance. Ten Institution members were divided into two groups and my group started with jet engines first.

The collection starts with a Whittle W2 jet engine, featuring the tortuous route followed by the air necessary to keep the engine compact whilst using a centrifugal compressor.
Later Rolls-Royce jets followed but Bristol concentrated on the Pegasus Turbo Prop engine intended for the Brabazon, but which actually found applications in the Britannia aircraft, fast naval craft, Hovercraft and as stand-by power generators. Versions of the mighty Olympus, used in the Vulcan and, with afterburners Concorde are mixed with various experimental axial flow jets. The world beating Pegasus is shown, both complete and broken into its components to better appreciate the genius which went into its design and construction of the engine which powered the Harrier. Whilst walking to the exhibition we passed the engine test installations, identified by the models they could test, which occupy a fair portion of the extensive site, still actively manufacturing and designing power plants.

We then turned to the piston engine collection which was a special tribute to the engineering (although lacking formal qualification) genius that was Roy Fedden.

He started by designing a very successful car the Shamrock whilst at Basil Straker and his insistence on continuous improvement in design and quality resulted in the company being allowed to produce Rolls-Royce Hawk and Falcon engines together with parts of the Eagle. So as not to compete with Rolls he and Leonard Butler designed the radial Mercury and Jupiter air cooled engines. War ending brought about a significantly turbulent time for the business, but the Air Ministry encouraged Bristol to purchase the assets of Cosmos who had taken over the aircraft engine business of Basil Straker.

An interesting aside here is that one of our past Presidents Theo Sherwin worked for Basil Straker who produced a V4 sleeve valve engine used as the auxiliary power unit in the Sunderland flying boat.

There is an example of the well-respected Bristol Jupiter engine together with a crankshaft and connecting rod set showing the master and slave rod arrangement common to most radial engines. This set new benchmarks for reliability and interchangeability and formed the basis for the Mercury and Pegasus engines with four valves per cylinder. The dead end development of a diesel radial is on display, but produced insufficient power for its weight.

Fedden could not find a way to make a good two row radial with four valves per cylinder, so commenced development of the Sleeve Valve engine. We were able to see various engines and actually hold a Bristol Sleeve valve, the better to appreciate the exquisite development which went into the development of the next, and final, generation of Bristol piston engines.

The Sleeve Valve proved to be a nightmare to develop for production, hand built engines were wonderful, but producing perfect sleeves from a very special steel was only solved after spending huge sums. Nevertheless these challenges were overcome and one should note that in the late 1930`s about 55% of the world`s aircraft used Bristol built or licence built engines.

The display includes a Taurus and pride of place to the Mighty Centaurus, in two forms. One is a case with the gear train from Propeller through the two throw crankshaft to the supercharger drive including the gears to operate the sleeve valves. The other display is a tribute to the Rolls-Royce Heritage Trust Volunteers who have sectioned and motorised a complete Centaurus. The detail is stunning and of huge complexity – well worth the visit on its own!

## Wrekin Branch

### - Bill Basford reports

### Deep Sea Drilling, Colin Atkinson, Master Mariner

One of the benefits of IAgrE meetings is that occasionally we go ‘off piste’ into spheres of engineering not normally linked to agriculture. From the very first slide and words Colin had us all in his grasp with descriptions of his career from general cargo ships through dive boats to semi-submersible and an array of deep-water drilling rigs. His large audience included everyone from 1st year students to long serving members representing the whole range of IAgrE interests. Most were aware of the many changes in our industry however Colin mapped changes in the undersea drilling industry from 1980 when the norm was a rig displacing 18000 tonnes and drilling to 660m to 2001 when this had moved to 53000 tonnes capable of drilling to 3000m! Later developments being even deeper, heavier and faster. Who really thought that a Master Mariner was in overall charge of the rig anyway?

The evening then followed extreme after extreme, in both statistics and measurements. Highlighted were stepped drill bits from 42” diameter (back to units later) reducing at depth to 8” when almost at 4 km depth. Steerable drill bits with small offset angles allowing that function associated with system pressures of 15,000 psi were all shown and described. Taking some 45 days to 6 months to drill a well astounded most listening as did the speed of getting a bit down to 3000m in just 3 hours with very modern control room conditions and auto assembly of well pipe lengths.

The need for a sophisticated Blow Out Preventer on the sea bed was described and the past failings of inadequate or earlier designs were made known when one uncontrolled well flowed for 565 days! Critical understanding of the ‘Mud’ fed down to the drill bit to extract the spoil mean that on board all rigs there was one person at least whose specialism was ‘Mud’, actually a carefully controlled fluid both physically and chemically enhanced to suit the geology involved. In fact on all ‘rigs’ there are engineers of various specialisms continually monitoring both function and well parameters / condition.

The ability now to have semi submerged unit rigs on a pontoon base held by 8 anchors, each weighing 20 tonne capable of holding accuracy to within 2-3 cm in water depths of 30 + m and winds of above 100 knots barely compared to agriculture now with RTK and 2 cm accuracy in our ‘arduous’ conditions. The rigs now use 4 or 10 sea bed transponders, controlling systems sensing from those and GPS to give the accuracy, licences costing $18,000 per rig per year!

Considerable attention was reported to safety and training for the 120 staff on board including Catering (vital!) and Geologists, Oil or Gas company representatives, Climatologists, Mud engineers, ROV pilots as well as all engineers involved in rig function.

Far Eastern yards (Korea) building the rigs and drill ships were described where modular builds were made, with associated townships built up, even with a Tesco! Each drill ship taking about 18 months to complete, at a cost around $850 million.

Oh yes, those units. Questions ran thick and fast after Colin's amazing talk. The one which brought out the smiles was 'What units are involved?' Well, drilling being basically an American development, inches, feet, US gallons etc. but with North Sea, African and European industries now involved using imperial and metric units some strange hybrids have evolved, kilopounds?, a foot divided into 10??. So ended a brilliant evening, one which held all present spellbound with engineering achievements.

## How do we embrace Automation in Agriculture?

Jonathan Gill, a researcher on the Hands-Free Farm Project and a Nuffield Scholar addressed a packed audience identifying the many challenges to automation adoption.

Describing his early studies involving a robotic shark whilst at university and his later career in sub-sea exploration was at the time far away from agricultural engineering he outlined how many of the lessons learnt entirely suited him for his current work.

Moving back into agricultural activity his studies with bale handling through to lettuce harvesting all raised robotic and automatic issues to be solved. He questioned the trend of many years of 'bigger is best' looking at the potential of autonomous small vehicles and drones as providing many answers to a wide range of remote sensing and functional activity.

Having visited many countries during his Nuffield scholarship he described and showed examples of a wide range of crop sprayers, seeders and harvesters. Reporting that 20 million hectares have been sprayed so far by autonomous sprayers he recorded that technology can currently answer the need though regulation and other issues limit adoption in many areas of the world.

The evening closed by demonstrating a programmed mini drone safely manoeuvring around in the front of the lecture theatre with his personal 'Thank you' notice!

## Notice of Meeting

Notice is hereby given that the Seventy-fourth Annual General Meeting of the Institution will be held at Amazone Ltd, Orchard Farm, Hurst Lane, Auckley, DN9 3NW on Thursday 30th April 2020 at 11.00am.

**Agenda**

1. To receive and confirm the minutes of the seventy-third AGM held on 2nd May 2019.
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 2021".
3. To consider and adopt the Annual Report for the year ending 31 December 2019.
4. To receive and adopt the Accounts for the year ending 31 December 2019.
5. To announce nominations for election to Council for the 2020/21 Session.
6. To re-appoint Landers Accountants Ltd, registered auditors, as reporting accountants and to authorise the Executive to fix their remuneration.

By Order of the Trustees

Ed Hansom, Chief Executive & Secretary
20 February 2020

NB: all papers are available on www.iagre.org

# Events & Branch Meetings

## IAgrE Events:

**Thursday 30th April 2020. 11am – tbc**

**IAgrE AGM & Awards Presentation**

Orchard Farm, Hurst Lane, Auckley, DN9 3NW

We are delighted to be hosted by Amazone Ltd at their farm just outside Doncaster. The morning will begin with the IAgrE AGM and this will be followed by our awards presentation and a buffet lunch.

All enquiries regarding IAgrE events, please contact Sarah McLeod on 01234 750876 or email secretary@iagre.org

## Branch Events

### East Anglian

**Contact: David Seccombe**
**07766 206208**

**Tuesday 7th April 2020, 7-9pm**

**Branch visit – JF Temple & Sons**

JF Temple & Sons, Copys Green Farm, Wighton, Wells-next-the-Sea, Norfolk
NR23 1NY

Following an introduction to the business, there will be a walking tour of the farmyard incorporating the cheese making section, farm workshop, anaerobic digester, and dairy herd. We would then adjourn to our meeting room for cheese tasting, tea and coffee, questions and discussion.

### East Midlands

**Contact: Richard Trevarthen**
**01509 215109**
**richard.trevarthen@gmail.com**

No events listed yet

### Northern Ireland

**Contact: Ian Duff**
**028 8673 6977**
**duffi@iagre.biz**

No events listed yet

### South East Midlands

**Contact: John Stafford**
**01525 402229**

**john.stafford@silsoe-solutions.co.uk**

**Tuesday 28th April 2020 7.30pm**

**Technical meeting : Reducing food loss and waste through postharvest technology**

Speaker Marie-Carmen Alamar Gavidia from Cranfield University

The Upstairs Room, The George, 6 George Street, Maulden, Beds MK45 2DF

**May 2020 – date, venue and time to be confirmed**

**Branch visit: Ben Burgess, John Deere dealer**

### Western

**Contact: Mike Whiting**
**mike.whiting@newmac.org.uk**

No events listed yet

### West Midlands

**Contact: Ian Moore**
**westmids@iagre.biz**

**Tuesday 14th April 2020**

**Branch AGM - details and time to be confirmed ...**

Friends (Quaker) Meeting House, 37 Maidenhead Road, Stratford on Avon CV37 6XT

### Wrekin

**Contact: Dave Clare 01952 815097**
**dclare@harper-adams.ac.uk**

**Tuesday 28th April 2020 7.30pm**

**Technical meeting – Flood and drainage**

Jenny Gamble of the Environment Agency will give a presentation on the issues surrounding the drainage of agricultural land, flood water storage capacity and flood risk management.

AEIC, Harper Adams University, Newport, Shropshire, TF10 8NB

**Tuesday 23rd June 2020 time and venue to be confirmed**

**Summer visit – Middleton Engineering – to be confirmed**

## Industry Events

**TOTAL FOOD 2020**

Total Food 2020 will be a gathering of industrialists, academics, policy-makers and charities with the common goal of protecting the environment and promoting human and animal health through waste ...

**15/04/2020 to 17/04/2020 - All Day**

East Midlands Conference Centre, University Park Campus, University of Nottingham

**Tuesday 12 - Weds 13th May 2020**

**THE PIG AND POULTRY FAIR**

Stoneleigh Park, Warks.

**Weds and Thursday 20-21 May 2020**

**GRASSLAND AND MUCK** – working forage conservation and muck demonstration.

Grassland & Muck is the leading demonstration event for farmers, focusing on grass, forage, muck and soils at the new venue for 2020, Ragley Estate, Warwickshire.

Ragley Estate, Alcester, Warwickshire.

**Sunday 7th June 2020**

**OPEN FARM SUNDAY**

LEAFs Open Farm Sunday is farming's annual open day, a chance for farmers to open their gates to the public, publicising farming and creating a lasting positive impact to all those who visit.

Locations across the UK

---

**Weds and Thursday 10-11th June 2020**

**CEREALS** – the arable event.

Europe's leading technical event for the arable industry.

Chrishall Grange, Duxford, Cambridge, SG8 7NT

---

**Saturday 13th June 2020**

**ROBOT DAY COVENTRY 2020**

IET Coventry and Warwickshire Network together with Coventry University and Culture Coventry plan to hold a Robot Day.

Engineering Faculty, Coventry University

---

**Wednesday 17th June 2020**

**THE ARABLE EVENT**

Weston-under-Lizard, Staffs

---

**Thursday 18th - Saturday 21st June 2020**

**THE ROYAL HIGHLAND SHOW**

Ingliston, Edinburgh

---

**Wednesday 24th – Thursday 25th June 2020**

**GROUNDSWELL 2020**

Lannock Manor Farm, Hertfordshire

---

**18TH INTERNATIONAL RAMIRAN CONFERENCE - MANAGING ORGANIC RESOURCES IN A CHANGING ENVIRONMENT**

Registration is now open for this Conference.

**14/09/2020 to 17/09/2020 - All Day**

Cambridge UK

---

# Obituaries

**Michael (Mike) John O'Dogherty PhD, DSc, FIAgrE, Member ASABE**

Mike, who sadly died on the 16th of January 2020, the son of a policeman, was born in Bideford, Devon on 13th March 1931. After attending Bideford Grammar School, he obtained a degree in Maths and Physics from London University (1952) and a degree in Engineering from Nottingham University (1955) followed by a post-graduate Diploma in Applied Mechanics from Sheffield University (1958). Mike established his early career as a research engineer/scientist with the National Coal Board (Mining Research Establishment) and the Building Research Establishment (Fire Research Station). Working respectively on improved techniques for the cutting of coal and the detection and extinction of fires.

Mike joined the National Institute of Agricultural Engineering (Silsoe Research Institute) in 1969 as the Head of the Row Crop Department. At that time the Department was focused mainly on work for the sugar beet crop and had projects concerned with the design and performance of precision drills, selective thinning machines and the harvesting of root crops. Mike contributed to projects in all these topic areas and encouraged approaches that developed an understanding of the processes involved as well as the development of new machines. His major contribution related to the analysis and design of a new sugar beet topper that formed the basis of designs that were developed commercially, for which he was awarded a PhD in 1977. In the early 1980's, the Row Crop Department was disbanded, and Mike moved to work on improving cutting mechanisms for plant stems as part of grass and grain harvesting machinery, a topic for which he was to be awarded a DSc degree by Reading University.

Upon retirement from the NIAE/SRI he approached Silsoe College of Cranfield University to see if he could be useful? This established a new phase in his career by teaching engineering mathematics, instrumentation, research methods and the physical properties of agricultural materials. In addition to his classroom activities as a Visiting Professor he worked closely with colleagues in the co-supervision of over 30 PhD students in soil dynamics, instrumentation and precision farming. The following comment, from a former student, is evidence of his positive student focused mentoring:

"These were good times when I was studying at Silsoe and whenever Mike was around he would pop into all PhD student offices to catch up, listen and give some positive encouragement, which was often very much needed!"

As a result of the above he received the IAgrE "Contribution to the Land Based Industries Sector" Award in 2010, for his 40 years of distinguished service to agricultural engineering.

In later life he bought a mobile home in Blue Anchor, Somerset so that he could spend weekends and holidays walking on Exmoor. He finally sold his house in Bedfordshire to live permanently in his beloved West Country. His son John, to whom we send our condolences, survives him. John shares Mike's love of the West Country and plans to continue living in Blue Anchor.

*Dick Godwin and Paul Miller*

**Mr David William Tilbury IEng MIAgrE - died suddenly - a member since 1992**

# Membership Changes

1/11/19 to 31/01/20

## Admissions

### Member

Flynn D J (Yorkshire)
Jungbadoor A P (Mauritius)
Manasseh S A (Berkshire)

### Affiliate

Walker A (East Anglia)
Hanglin G (Cambridgeshire)

### Technician

Heffernan P (Ireland)

### Students

***Royal Agricultural University***

Mugford J

***University of Birmingham***

Burlace L G

***University of East London***

Florius K N

***Reaseheath College***

Evans T

***Greenmount College***

Acheson S
Armstrong J W
Blackburn M
Byrne C
Cairns C P
Clements K J
Cunningham S
Dickson J T G
Dornan J
Drain J
Duggan L
Hamilton C J
Hammond R S
Henderson D
Jackson W G
McCorry P
McFetridge J
McKee J J
McKinney B
Nesbitt N
O'Hagan O
Simpson Z
Telford L C

***Cranfield University***

Sambu M S
Jepkosgel G
Adamu A
Agbonghae L V

***Harper Adams University***

Acquah C
Akaran R
Austin-Davies F G
Bagley W J S
Beech A E
Billington K M
Boyle E
Brinkley T M
Cooper C
Crawley S
Dakin R
Dempsey M
Doolley S J E
Douglas D E F
Farrell C
Finch M
Flanagan R J
Galbraith W G
Gildersleeves J E
Gleghorn A W
Hans D
Hawkes A
Hewitt M A J
Higgs R
Hood G J
Hopper R
Hughes B L
Huges T C
Hutchinson T N
Jackson C
Jasper W
Johnson A B
Johnson J P
Johnston E A
Kimber R L
Korzeniewski R
Lapworth H
Latham B L
Leney T J B
Lenharth C T
Lester J
Longman R
Lowe A C G
Lunkevich D
Maguire M
Mason G S
McCrea M
Middleton A G
Moxham O
Neal D J G
Nelson C
Nieto S J
Page O J
Penlington A
Perry A
Pickard W
Pindoria E
Ransford F P A
Rawbone J
Rendell H M
Rigby H A
Rietdyk J A
Rogers J A
Smyth R A
Simpkin B
Steel R
Steyn N B
Stretch E JBJ
Sun L Y
Swinnerton J
Thomas H
Todd C
Todd H
Treadgold J W
Waldram L G
Webb H R
Williams K K
Williams R T
Windus J
Withers- Lewis S J

## Readmission

**Member**
Fletcher R T (Western)
Manasseh S A (Southern)

## Deaths

*We have recently learned of the death of the following members and we send our condolences to their family and friends:*

**Tilbury, David William MIAgrE**
a member since 1992
(East Midlands)

## Transfers

**Fellow**
Birch R (Trinidad & Tobago)

**Member**
McAdam J A (Staffordshire)

**Associate Member**
Hayes I (Cambridgeshire)
Affiliate

## Long Service Certificates - Jan to March 2020

**60 years**

| | |
|---|---|
| EurIngProf BD Witney FIAgrE | 22/11/2020 |

**50 years**

| | |
|---|---|
| Mr RT Pringle MIAgrE | 09/01/2020 |
| Dr DWM Pullen MIAgrE | 09/01/2020 |
| EurIngProf J Matthews FIAgrE | 27/01/2020 |
| Mr W Hancox MIAgrE | 27/01/2020 |
| Mr AE Moore MIAgrE | 27/01/2020 |
| Mr CM Blackbrough MIAgrE | 27/01/2020 |
| Mr MJ Taylor MIAgrE | 27/01/2020 |

**35 years**

| | |
|---|---|
| Mr AR Kneeshaw MIAgrE | 01/01/2020 |
| Mr MBH Daud MIAgrE | 07/01/2020 |
| Mr PJ Baumber AMIAgrE | 01/02/2020 |
| EurIngProf BS Blackmore FIAgrE | 01/02/2020 |
| Mr MA Brown AMIAgrE | 01/02/2020 |
| Dr AJ Scarlett MIAgrE | 01/02/2020 |
| Mr AR Scott AIAgrE | 29/03/2020 |
| Mrs JL Smith AMIAgrE | 29/03/2020 |

**25 Years**

| | |
|---|---|
| Mr CJ Richter AMIAgrE | 05/01/2020 |
| Mr DW Jenkins FIAgrE | 25/01/2020 |
| Mr PB Davies-Cooke MIAgrE | 27/01/2020 |
| Mr SE Cooper IEng CEnv MIAgrE | 27/01/2020 |
| Mr L Kailondo CEng MIAgrE | 13/02/2020 |
| Dr TW Waine AMIAgrE | 20/02/2020 |
| Mr RL Grantham EngTech MIAgrE | 03/03/2020 |
| Mr K Gardiner CEng MIAgrE | 16/03/2020 |

# Academic Members

**Berkshire College of Agriculture**
Hall Place, Burchetts Green, Maidenhead, Berks, SL6 6QR

**Bishop Burton College**
York Road, Bishop Burton, Beverley, HU17 8QG

**Brooksby Melton College**
Asfordby Road, Melton Mowbray, Leics, LE13 0HJ

**Coleg sir Gar**
Gelli Aur Campus, Llandeilo, Carmarthenshire, SA32 8NJ

**Cranfield University**
Cranfield, Bedfordshire, MK43 0AL

**Duchy College**
Stoke Climsland, Callington, Cornwall, PL17 8PB

**Easton & Otley College**
Easton, Norwich, Norfolk, NR9 5DX

**Greenmount College**
CAFRE, 22 Greenmount Road, Antrim, Northern Ireland, BT41 4PU

**Harper Adams University**
Newport, Shropshire, TF10 8NB

**Hartpury College and University**
Gloucester, GL19 3BE

**Institute of Technology**
Tralee Clash, Tralee, Co Kerry, Ireland

**Lincoln Institute of Agri-Food**
Technology, Lincoln University, Lincoln, LN6 7TS

**Manchester University**
School of Electrical and Electronic Engineering, C39, Sackville Street Building, Sackville Street, Manchester, M1 3WE

**Myerscough College**
Bilsbarrow, Preston, Lancashire, PR3 0RY

**Newcastle University**
King's Gate, Newcastle Upon Tyne, NE1 7RU

**Pallaskenry Agricultural College**
Co Limerick, Ireland

**Plumpton College**
Ditchling Road, Lewes, East Sussex, BN7 3AE

**Reaseheath College**
Reaseheath, Nantwich, Cheshire, CW5 6DF

**Royal Agricultural University**
Cirencester, Gloucester, GL7 6JS

**Sparsholt College**
Sparsholt, Winchester, SO21 2NF

**SRUC – Auchincruive**
Auchincruive Estate, Ayr, KA6 5HW

**University of Manitoba**
Winnipeg, Canada, MB R3T 2N2

**Warwickshire College Group**
Warwick New Road, Leamington Spa, CV32 5JE

**Wiltshire College Lackham**
Lacock, Chippenham, Wiltshire, SN15 2NY

# Commercial Members

**Ace Aquatec Ltd**
16B City Quay, Camperdown Street, Dundee, DD1 3JA

**Agri-EPI Centre**
1-4 Bush House Cottages, Edinburgh, Technopole, EH26 0BA

**Agricultural Engineers Association (AEA)**
Samuelson House, 62 Forder Way, Hampton, Peterborough, PE7 8JB

**AGCO Ltd**
Stoneleigh, Abbey Park, Kenilworth, Warwickshire, CV8 2TQ

**Alvan Blanch Development Co**
Chelworth, Malmesbury, Wiltshire, SN16 9SG

**Autoguide Equipment Ltd**
Stockley Road, Hedington, Calne, Wiltshire, SN11 0PS

**BAGMA**
225 Bristol Road, Birmingham, B5 7UB

**Briggs Irrigation**
Boyle Road, Corby, Northants, NN17 5XU

**City and 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, MK34 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

**Household Sprayers**
Roughton Moor, Woodhall Spa, Lincs, LN10 6YQ

**HSS Hire**
25 Willow Lane, Mitcham, London, CR4 4TS

**JCB**
Rocester, Staffs, ST14 5JR

**John Deere Ltd**
Harby Road, Langar, Nottinghamshire, NG13 9HT

**Marks & Clerk LLP**
90 Long Acre, London, WC2E 9RA

**Mastenbroek Ltd**
83 Swineshead Road, Boston, Lincs, PE21 7JG

**National Fluid Power Centre**
Carlton Road, Worksop, Notts, S81 7HP

**Orby Engineering**
Craigmore Road, Newry, BT35 6JR

**Reesink Turfcare UK**
1-3 Station Road, St Neots, Huntingdon, PE19 1QH

**PlantTech Research Institute**
Bay of Plenty, New Zealand

**Shelbourne Reynolds**
Shepherds Grove Ind Estate, Stanton, Bury St Edmunds, Suffolk, IP31 2AR

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

**Teagle Ltd**
Blackwater,Truro, Cornwall, TR4 8HQ

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

**Witham Oil and Paint Ltd**
Outer Circle Road, Lincoln, LN10 6YQ

SocEnv
Society for the Environment

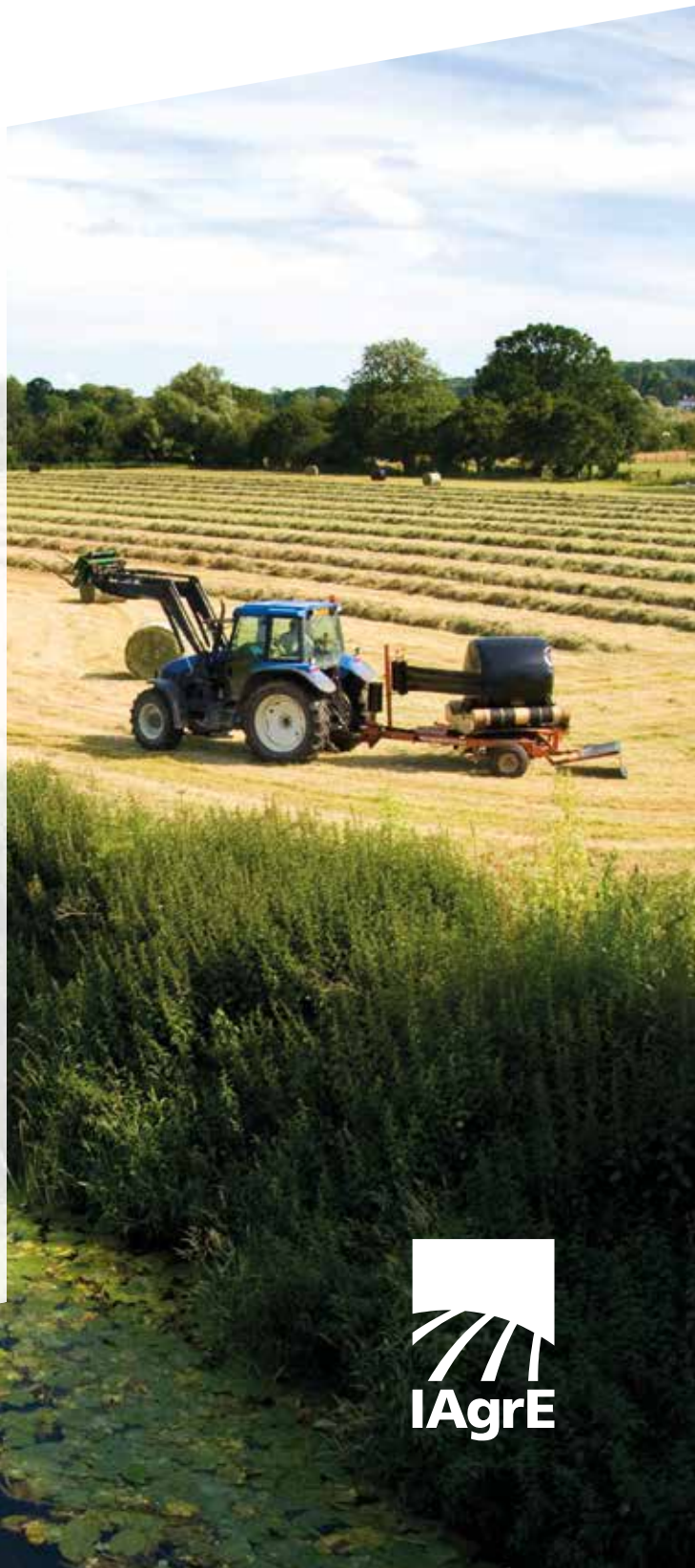
*"Being CEnv keeps me ahead of the game for professional standards and sharing of best practice"*

**Dr Alexandra Cooke CEnv MIAgrE**
Severn Trent Water

# Progress in your Career with CEnv

Chartered Environmentalists are professionals who work across industry, government, education and the public sector, share a commitment to environmental best practice and have a high degree of expertise in their field.

The Chartered Environmentalist status shows the highest level of professional qualification for individuals working in environmental engineering.



## Why should I register?

- Improve career and salary prospects
- Join a network of nearly 7500 dedicated professionals
- Demonstrate your competence and skills

## Register through IAgrE now:

**t:** + 44 (0) 1234 750876
**e:** membership@iagre.org
**w:** www.iagre.org

Although the standards are high, IAgrE makes the process simple

IAgrE