

Landwards ^{@IAgrE}

The professional journal for the Institution of Agricultural Engineers

IAgrE Professional Journal www.iagre.org
Volume 75, Number 2 - **Summer 2020**

See iagre.org
for the latest
information



In this issue...

- Keeping the taps running
- Profession - how engineers are managing with COVID-19
- Recommended reading
- Meet the President
- Membership matters



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, 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.

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 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:

Agricultural engineering news and views	4-6	Profession: Coping with COVID-19	16-23	The Douglas Bomford Trust	32-35
Perspectives from the people and profession		Some encouraging engineers rising to the challenges of a new normal		How the DBT is supporting the profession	
The Presidents musings	7	Members profile	24-25	Opinion	36-37
New President Paul Hemingway makes his case		Dr Alex Cooke talks about her agricultural engineering journey		Alastair Tulloch gets stuck into the new Agriculture Bill	
Biosystems engineering	8	Meet the President	26-27	Membership matters	38-49
A review of some of the latest papers		An interview with the incoming President		The latest movements, and branch reports	
COVID-19 – how the IAgRE can help	9	50 years membership	28-29	Out of hours	50-51
Ways the institution is supporting you		A reflection		One members dedication to the hills	
Practice: Waste water treatment	10-15	Book Club	30-31		
A technical visit with Severn Trent Water		Recommended reading on soils and cultivation			

Landwards is published on behalf of the IAgRE by FarmSmart Publishing Limited.

Editor – Andy Newbold 01539 620255 andy@farm-smart.co.uk

Design – Ann Newbold, 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



Editors Welcome



What a change a few months makes, the world has turned on its head and may never be the same again.

A whole new vocabulary has become the norm, from key workers, to self-isolation and social distancing. We are living in very different ways and have quickly adapted to new habits and routines.

I can't help feeling that, although this situation has been forced upon us, there are many positives, the renewed focus on local and accountable food chains, communities drawing together to support each other and a simpler life for many.

Engineers are resourceful and resilient creatures, from a career built on problem solving, we are used to tackling what's thrown at us, with the tools to hand (if not to hand, we can make them too). I do apologise that

we mention COVID-19 in this edition, but it's refreshing to reflect on the positive examples in Profession from p16 of members and how they and their businesses have adapted to the current situation.

If you find yourself self-isolating, or even choosing social distancing I hope this summer's edition of Landwards will help take you away from the current situation into the world of agricultural engineering.

I wish you well for the summer and hope that you stay safe!

Andy Newbold

Editor
andy@farm-smart.co.uk

Employers urged to take 'Skills Pledge' to protect pipeline of apprentices



One of the UK's leading training providers has launched a new campaign to ensure apprenticeships are protected as companies seek to find ways of coping with the COVID-19 pandemic.

In-Comm Training, which operates three academies at Aldridge, Bridgnorth and Shrewsbury, is asking firms in the West Midlands to sign-up to its 'Skills Pledge', which will see them commit to supporting apprentices, raising the profile of vocational learning and 'upskilling' their workforces.

'Powering the Engine' will last for over a year and will ensure the business

world does not sacrifice the investment and time it has channelled into developing the talent they are going to desperately need to help reignite the economy now that lockdown is starting to ease.

The three pledges for the 'Powering the Engine' campaign include:

- Apprenticeship Ambassadors – the company and an apprentice will give up one hour of their time to participate in promoting the benefits of apprenticeships.
- Skills Support for the Workforce – a commitment to put some of its staff through upskilling courses

over the next 12 months.

- Apprenticeship Recruitment – to recruit one or more apprentices every year.

Companies taking part will receive a specific incentive depending on the pledge they take and these range from a free skills audit and report, to free Learning Mentor courses and 5% off the cost of upskilling courses (when they cost over £500).

In-Comm Training has delivered in excess of 40 different trailblazer apprenticeships to 800 apprentices over the last 12 months.

All of these apprenticeships have been written in partnership with world-class industrial partners to ensure the technical content is right for their current and future requirements, whilst all individuals apply their learning on machinery and equipment that will futureproof them for years to come.

The company has recently been named as one of the training providers for a new skills fund run by the West Midlands Combined Authority (WMCA), which means firms do not have to pay the 5% contribution to take on an apprenticeship, saving up to £1350.

Hands Free Farm drills first fields



The Hands Free Farm (HFF) team has successfully drilled a cover crop as the first major operation for the project.

The HFF launched in May 2019 following the end of the award winning Hands Free Hectare (HFHa) feasibility study which was the first in the world to plant, tend and harvest a crop without a driver in the seat or an agronomist on the ground.

The HFF is a three-year project which scales up to 35 hectares and is run by Harper Adams University, Precision Decisions (a Map of Ag company), FarmScan AG and Agri-EPI Centre. By the end of the project, the team hopes to have a fleet of autonomous small vehicles working in swarms which can be operated from the farm office, ready for commercialisation.

When the project started, the original plan for year one, had been to drill two winter crops and a spring crop across its five fields. However, due to the poor winter weather

experienced by the UK, winter drilling was postponed in the hope that it would all be done in spring. These hopes were dashed with the onset of the coronavirus pandemic and social distancing. The team had prepared to start drilling before March 27, the day Her Royal Highness The Princess Royal was due to visit the project, but on March 23, Prime Minister Boris Johnson announced the lockdown of the United Kingdom.

However, the team were not deterred. They continued to work on the project from their individual homes, enabling them to be ready to drill when restrictions were relaxed.

The team has successfully drilled two of their fields with the cover crop, while abiding by social distancing guidance.

Kit Franklin, Senior Agricultural Engineering Lecturer, said: "Although drilling a cover crop wasn't the original plan, nor even plan B or C, it will be good for the soils. It should

also help the fields be flatter and more forgiving next year.

"This drilling has still provided a useful learning process; we've seen that the system is better than ever before and that we'll be able to analyse the drilling performance when the crop emerges. This will enable us to improve the mapping ahead of working on combinable crops next year."

The team hopes to complete a harvesting operation later this year, on a field that has been drilled with a spring barley crop by the Harper Adams University Farm using conventionally-sized manned machines.

"This option allows the testing of the combine harvester in a year when it would otherwise be impossible to work on a combinable crop within the Hands Free Farm," said Mike Gutteridge, Mechatronics Senior Graduate Research Assistant. "The potential learnings from this are an opportunity that couldn't be missed.

"However, for us to be able to harvest, we are heavily reliant on specialist components being delivered from international suppliers which may not be possible this year due to the current situation."



Registration costs cut to encourage registration during lockdown

Following the Society for the Environment's decision to reduce the cost of registration as a Chartered Environmentalist until the end of September 2020, the IAgRE has passed the reduction on to members and reduced the Registration fee from £140 to only £95. IAgRE has decided to reduce the costs of registration with Engineering Council to match this and Chartered Engineering registration is now available for the same price £95, Incorporated Engineer reduced from £100 to £75 and Engineering Technician registration is now only £35.

If you have been thinking about applying now is a great time to do so – contact Alison membership@iagre.org to find out more.

AGM, Annual Awards and approval of IAgRE Accounts 2019

We have been advised to postpone the AGM and Annual Awards and have a tentative date of Thursday 15 October for the rescheduled event at Amazone Ltd near Doncaster. We are watching events carefully and will update the Membership as soon as we can.

The Annual Report and Accounts for 2019 are now on the website so please look at them and let us know if you have any objections.

The Accounts were approved by the Executive Committee on 21 April and have been approved by the auditor.

We would ask for objections to secretary@iagre.org by Tuesday 30 June 2020 and after this date will assume consent and they will be uploaded to Companies House.

Thank you for your help.

Newton Rigg to close



Askam Bryan College's Newton Rigg Campus in Cumbria is earmarked for closure in July 2021 after an independent review found the site is not financially viable.

The College's governing body has decided to propose the closure of Newton Rigg after considering the findings of a Further Education Commissioner review of educational provision at the campus and in the wider area.

The closure proposal is subject to the outcome of a 45-day consultation process with 117 staff (79 full time equivalent roles) and the trade unions, which started in May.

A final decision on whether or not the campus closes in July 2021 will be made following the completion of the statutory consultation in respect of college staff.

Learning planned for the next academic year, from September 2020 to July 2021, will commence as intended. Student recruitment and enrolment will also continue. All current and prospective students will be informed of the closure proposal.

Apprenticeships for 2020/2021 will continue as planned at the Newton Rigg Campus until July 2021. In the event of campus closure, the college would seek to identify an alternative location for 'off the job' training provision in Cumbria.

Around 888 learners are based at Newton Rigg in Penrith. They include 667 further education students, the majority of whom are enrolled on one-year programmes, and 221 apprentices.

The Further Education Commissioner's review, which started in March 2020 and concluded in May 2020, involved a wide range of stakeholders and identified the following challenges:

- Demographic challenges: The College faces low population density in the rural location of Cumbria, and future low demographic growth of 16 to 18-year-olds.
- Student recruitment: Over the longer term, this is falling with insufficient local demand for specialist land-based provision, compounded by the declining demographics.
- Financial losses: As a result of the above factors, Newton Rigg has an annual operating deficit of around £1 million and lacks a sustainable business model due to declining student numbers and demographics.
- Estates reinvestment: In order to keep pace with the latest land-based sector skills needs, the estate needs around £20 million capital investment.

The timing of the proposed closure for next July 2021 gives a window of opportunity for an alternative group or organisation to provide a potential solution.

During discussions with various groups from Cumbria over the past few weeks, there has been a

high level of support expressed for Newton Rigg from various Cumbrian organisations and groups.

Askham Bryan College would welcome working with these groups, over the next couple of months, if they wish to explore how they could deliver a Cumbrian-based solution for Cumbrian students should the campus close next summer, pending the outcome of the staff and trade union consultation process.

The importance of the uplands farm at Low Beckside is recognised and the college would look at the viability of transferring it to an appropriate body or group, on the basis they continue to preserve it for educational and potential applied research relevance.

Newton Rigg was established in 1896 to serve the needs of agricultural and rural industries in Cumbria. Since incorporation in 1992, Newton Rigg has been owned or governed by four different corporations including two universities.

During this 28-year period it has not been possible to develop a sustainable business model that would enable Newton Rigg to maintain the necessary investment in its infrastructure and resources to compete successfully with other specialist land-based and general further education colleges.

Courses currently provided include agriculture, gamekeeping, animal and equine management, forestry, horticulture and agricultural engineering.

In terms of new students starting in September 2020, the College would work in partnership with other FE colleges to map progression routes beyond 2021.

Presidents Musings

Paul Hemingway



Engineering expertise needed, close to home

May I start by thanking on your behalf my predecessor Prof. Jane Rickson, our first female President, for the work she has done for and on behalf of the IAgRE. Her work over the past two years has left the organisation in good heart. Hopefully in due course we will be able to convene a proper AGM at which we can properly acknowledge her work.

The world finds itself in the midst of a crisis not seen in our lifetime and the only certainty seems to be that little will stay the same in the future. In the midst of this and just as I took over the President's role, Ed Hansom, our IAgRE CEO left the organisation after a relatively short time with us. I thank him for the work he did and wish him well for the future.

In the interregnum the Secretariat team and a number of experienced members are assisting in progressing the work and development of the IAgRE in a number of areas and I thank them all for this.

As I write this the drone of a self propelled forager can be heard across the fields, reminding me that farm work is ongoing and with that of course is the good news that our

machinery manufacturers and dealers are still in business.

As Agricultural Engineers or Environmental Scientists we need to take heart from the fact that the crisis has brought home to the population in a way not seen for a couple of generations firstly the importance of food production and secondly the importance of having Engineering expertise and capability close to home.

For the first time since WW2 the country had a desperate need for certain commodities ranging from face visors to intensive care ventilators. If you had told engineers at Maclaren or Dyson last Christmas what they would be designing or the JCB Cab factory team that they would be making casings for hospital ventilators they may not have believed you.

The fact was we had both capable food supply chains and innovative engineering design and manufacturing expertise to hand and a fantastic focus to deploy these quickly and effectively. It seems to me that as Agricultural Engineers we have found ourselves in a 'sweet spot'

of interest and it is crucial that we maximise the opportunity to develop our profile.

Not everyone will be unaffected by the crisis however and at this time membership of a professional engineering institution and particularly professional registration at EngTech, IEng or CEng level could prove a key differentiator on a CV in support of a job application.

I am determined that we will continue to develop the offering of the IAgRE to our members in line with current constraints. You will have read that the IAgRE Annual Conference will this year take a 'virtual' form focussing on 'Lean' as it relates to agriculture, machinery and the supply chain. I very much hope that you will engage with this as for the first time our conference will truly become accessible to all members.

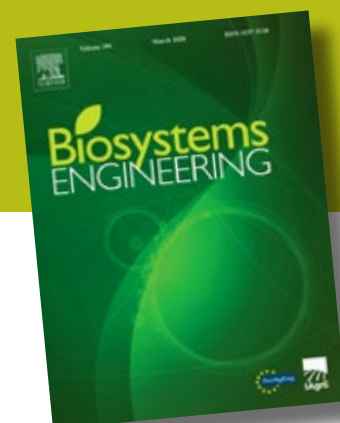
Biosystems Engineering

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 189, January 2020, Pages 60-83

Review

Machine learning applications to non-destructive defect detection in horticultural products

Jean Frederic Isingizwe Nturambirwe, Umezuruike Linus Opara

Stellenbosch University, South Africa

Machine learning (ML) methods have become useful tools that, in conjunction with sensing devices for quality evaluation, allow for quick and effective evaluation of the quality of food commodities based on empirical data. This review presents the recent advances in machine learning methods and their use with various sensing devices to detect defects in horticultural products. There are technical hurdles in tackling major issues around defect detection in fruit and vegetables as well as various other food items, such as achieving fast, early and quantitative assessments. The role that ML methods have played towards addressing such issues are reviewed, the present limitations highlighted, and future prospects identified.

Biosystems Engineering

Research Paper

Simulation of tillage forces and furrow profile during soil-mouldboard plough interaction using discrete element modelling

Mustafa Ucgul, Chris Saunders

University of South Australia, Mawson Lakes, Australia

The mouldboard plough has a complex shape and its development has mainly relied on resource intensive and time consuming empirical or semi empirical methods. However, if the mouldboard plough to soil interaction can be simulated, improved and more energy efficient mouldboard ploughs can be designed without performing field tests which may only be undertaken at certain times of the year. The interaction between the soil and a mouldboard plough was simulated using discrete

element method (DEM) and results were compared to experimental test and analytical draught force results and furrow profile measurement. It was found that draught and vertical tillage forces can be predicted within 1.9–16.6% and 0.3–21.5% of the total cutting forces, respectively. This shows that DEM can predict draught forces better than analytical methods which predicted draught forces within 3.6–44.4% of the total cutting forces. Results of the study proved that DEM has the potential to predict soil-mouldboard plough interaction with a reasonable accuracy.

Biosystems Engineering

Volume 191, March 2020, Pages 60-84

Review

Internet of Things in arable farming: Implementation, applications, challenges and potential

Andrés Villa-Henriksen, Gareth T.C. Edwards, Liisa A. Pesonen, Ole Green, Claus Aage Grøn Sørensen

Aarhus University, Denmark

Agro Intelligence, Aarhus, Denmark

Natural Resources Institute, Helsinki, Finland

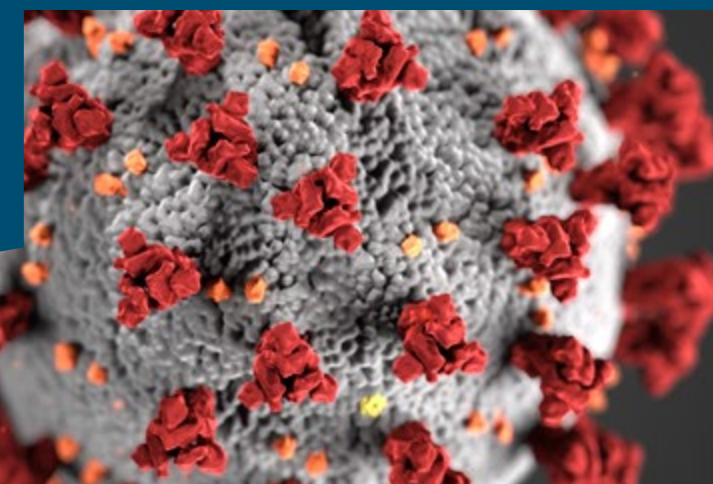
The Internet of Things is allowing agriculture, to become data-driven, leading to more timely and cost-effective production and management of farms, and at the same time reducing their environmental impact. This review is an analytical survey of the current and potential application of Internet of Things in arable farming, where spatial data, highly varying environments, task diversity and mobile devices pose unique challenges to be overcome compared to other agricultural systems. It contributes an overview of the state of the art of technologies deployed and provides an outline of the current and potential applications. It discusses the challenges and possible solutions and implementations. It presents some future directions for the Internet of Things in arable farming. Current issues such as smart phones, intelligent management of Wireless Sensor Networks, middleware platforms, integrated Farm Management

Information Systems across the supply chain, or autonomous vehicles and robotics stand out because of their potential to lead arable farming to smart arable farming.

During the implementation, different challenges are encountered, and here interoperability is a key major hurdle throughout all the layers in the architecture of an Internet of Things system, which can be addressed by shared standards and protocols. Challenges such as affordability, device power consumption, network latency, Big Data analysis, data privacy and security, among others, have been identified by the articles reviewed and are discussed in detail. Different solutions to all identified challenges are presented addressing technologies such as machine learning, middleware platforms, or intelligent data management.



COVID-19 Support



IAgRE supporting members through COVID-19

The Coronavirus pandemic has affected us all; work and business, home life, income, and the Institution has had to make changes to its working practices and reviewed what we can do to support our members.

We have concentrated on providing you with information, improving our signposting and provision of CPD and sharing stories from members.

The Corona Virus COVID-19 information page summarises much of the Government advice as well as listing information provided by other relevant bodies; helping members access information about supporting employees, businesses, mental health, health and safety and most recently with updates on getting back to work and how to operate business safely both for staff and customers. Take a look on the website [https://iagre.org/covid-19-\(coronavirus\)](https://iagre.org/covid-19-(coronavirus))

There is a signposting page to help you access online content for CPD. We know that many of our members have been furloughed and this is an ideal opportunity to spend some time improving your skills and knowledge. We have been assisted by several organisations and institutions who have been pleased to share their content with our members. We would like to thank the IMI, the IMechE, the CIPD, AHDB and many others for their help. See the full list of available content on the logged in Members page <https://iagre.org/cpd-resources-and-ideas>

Other items of interest may include the recent South East Midlands Branch Meeting, held on Zoom, on Postharvest storage, and last year's Conference on Big Data, to which retired CEO Alastair Taylor has kindly added the audio recordings we made to the speakers' presentations.

You can watch the videos via our website <https://iagre.org/conference-2019-presentation-recordings> or on YouTube IAgRE Videos.

We have compiled some stories from our members about how they have coped during the lockdown and you can read the series Coping during the Covid-19 Pandemic <https://iagre.org/coping-during-the-covid-19-pandemic>

Landwards - 2020 Virtual Conference

IAgRE is planning the 2020 Conference, Applications of Lean Principles in Agricultural Engineering, this will be a virtual event with speakers' presentations online as the year progresses, culminating in a live Q&A with all speakers in November, watch out for more information as plans develop.

The Landwards podcast

A series of podcasts have been commissioned with a monthly news podcast and a monthly interview with an agricultural engineer or influential person in the land based sector. The Landwards podcast is on iTunes, Spotify or click on <https://www.buzzsprout.com/1067353/> episodes for the latest one.



Practice: Waste water treatment

SEVERN
TRENT
WATER



pic copyright Severn Trent Water

Multiple machines keep water flowing

Supplying water to eight million customers occupying 4.3 million homes – and dealing with the effluent they send back – necessitates a huge and complex system populated with many machines and staff.

It also means working closely with all those who manage the land within the catchment areas.

Severn Trent Water presented some of those many figures to IAgRE members, and they are huge.

Every day the company cleans 1.8

billion litres of water to make it fit to drink and cleans up 2.5 billion litres of sewage so it can be safely returned to the environment.

Their water comes from 181 boreholes, seven reservoirs and nine river abstraction sites, and

is prepared for human use by a network of 16 major water treatment works.

And disposing of used water – in all the forms in which it is returned to them - requires 1,017 sets of sewage works!

Key steps to improving water quality

Severn Trent Water works closely with farmers and landowners to control emissions from farmland that might damage water quality.

And that includes offering grants to help with projects that will reduce the pollution risks created by some of the water coming from farmland.

Those costs can be significant, says Dr Jodie Rettino, Catchment and Biodiversity lead, who heads a team of scientists and advisors who work with farmers and landowners to minimize problematic discharges:

“In one recent incident we found the pesticide quinmerac in a water works and had to shut it down for 14 days. The value of the pesticide was around

£40, but the operation cost the company £150,000.”

Their work is aided by highly sensitive detection equipment, which will alert them to a single droplet of pollutant in an Olympic sized swimming pool.

But prevention is better – and less expensive – than cure, and help is offered via the Severn Trent Environmental Protection 0.3Scheme (STEPS).

The company also offers its “Farm to Tap” scheme, which encourages groups of farmers in particular areas to work together to address issues. This approach – called “Catchment Management” - is reckoned to produce between £2 and £20 worth

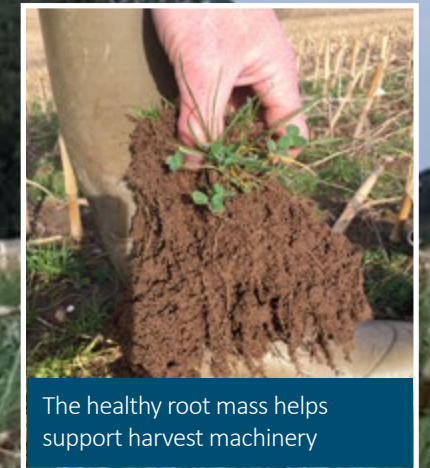


Dr Jodie Rettino, Catchment and Biodiversity lead

Practice: Waste water treatment



Phil Billings, agricultural catchment adviser for Severn Trent Water



The healthy root mass helps support harvest machinery



Undersown grass protects the soil during harvest and warms up the soil earlier in the spring for subsequent crops

of benefit for every £1 invested in terms of reducing or avoiding the costs of cleaning water to drinking standards.

It is also estimated to offer an additional £4 in environmental benefits.

STW's field staff aim to work with farmers and landowners where they believe they may be able to avoid a pollution risk:

"If there is a risk in the catchment we work with farmers and landowners to mitigate it," says Dr Rettino: "So we might make suggestions on future use of inputs or suggest practical ways to disrupt pathways through which pollutants might make their way into water courses". That could include suggesting that farmers

install features like headland strips or bio-beds that can help protect watercourses by filtering out potential pollutants.

This kind of work helps reduce clean-up costs and keep customers' bills down.

Under STEPS the company can make grants of up to £5,000/year for work that addresses water quality issues:

"Farmers choose what is best for their farm and we pay for work that achieves water quality improvements.

"We would urge farmers to come and talk to us. If they have a project that achieves a water quality benefit, we can fund up to half of the cost." The "Farm to Tap" scheme helps mitigate problems in areas

where the source might be from a group of farms, with the success of schemes being aided by the peer pressure of working together.

As an example of these schemes at work, she cited work in the Derwent valley which had seen a 70% reduction in peat erosion with farmers helping plant some 700,000 trees, and a further 1.3 million due to be planted over the next decade.

Cover crops key to soil protection

A major field trial examining different techniques for

establishing forage maize has shown the value of sowing grass as a cover crop between the rows of maize.

The study was on a sandy soil site at Thoresby in North Nottinghamshire, with 49 plots being sown, half with a cover crop sown between the rows of maize and half without.

Phil Billings, agricultural catchment adviser for STW, said the trial was established to address key concerns of farmers and contractors.

The farmers feared that sowing the gaps between the crop might 'rob yield', while contractors were worried that it would make harvest harder and slower.

In fact, the topography of the field had a greater influence on yields than whether it was under-sown or not, and the grass growth was not tall enough to inhibit harvesting.

And grass growing between the crop rows kept the wheels of harvesting machinery cleaner, so they didn't need to employ a road sweeper.

The maize was drilled in April, with the grass being sown 49 days later when the crop was a seven/eight leaf stage.

While grass growth above the ground appeared limited, it was supported by a very healthy root mass.

And the grass did an efficient job of capturing the available sunlight, especially after maize harvest. They noticed a clear difference in soil

structure between the two halves of the field, especially in soil porosity after rainfall:

"Those parts that had been under-sown looked drier, while the other parts were glistening because the water remained on the surface".

That would have benefits in the spring when the under-sown part of the field could be expected to warm up and be drillable earlier than the other half.

For 2020 STW will expand the trial to test sowing dates and seed rates, with grass being sown as soon as the maize emerges or when it is at four to six leaf growth stage.

Practice:
Waste water
treatment



IAgRE member Dr Alex Cooke CEnv MIAgRE led the technical visit

Technical visit

The IAgRE ran a technical visit to Severn Trent Water's Stoke Bardolph site near Nottingham on 5th March 2020, the visit included a tour of the facility and information on agricultural and environmental engineering and its impact. This was led by IAgRE member Dr Alex Cooke CEnv MIAgRE.



John Jackson, farm manager for Severn Trent Water's Stoke Bardolph farm

Crop power

John Jackson admits being an unusual farmer: he has just one stomach to feed but needs 80,000 tonnes of forage maize to do the job.

John manages Severn Trent's Stoke Bardolph farm, which includes a major anaerobic digestion plant fed

entirely by crops – mainly maize with some rye and other cereals.

The plant produces 46 gigawatt hours of electricity – enough to power 13,000 homes: "Every trailer load of maize that arrives could keep a single house going for two years in gas and/or electricity."

Most of the crops are grown on other farmers' land, and any damage to the land or roads would pose a risk to STW's public profile and reputation.

2019's harvest – which John refers to as "the harvest from hell" – meant he had to get innovative:

"In a normal harvest we receive 65,000 tonnes of forage maize in six to seven weeks during October and November.

"When IAgRE members visited us in March 2020 we still had 80 acres of 2019's crop to harvest near Newark!"

So, he had to think creatively and

make some changes to the system: "We needed to get the crops harvested and moved but also need to protect the credibility we have spent 10 years building up with 42 suppliers.

"We would have been a very easy target if we had left mud on the road."

The machines that used to run on wheels were switched to tracks if possible. The forage harvester was switched to dual wheels and trailers

fitted with top quality low ground pressure tyres.

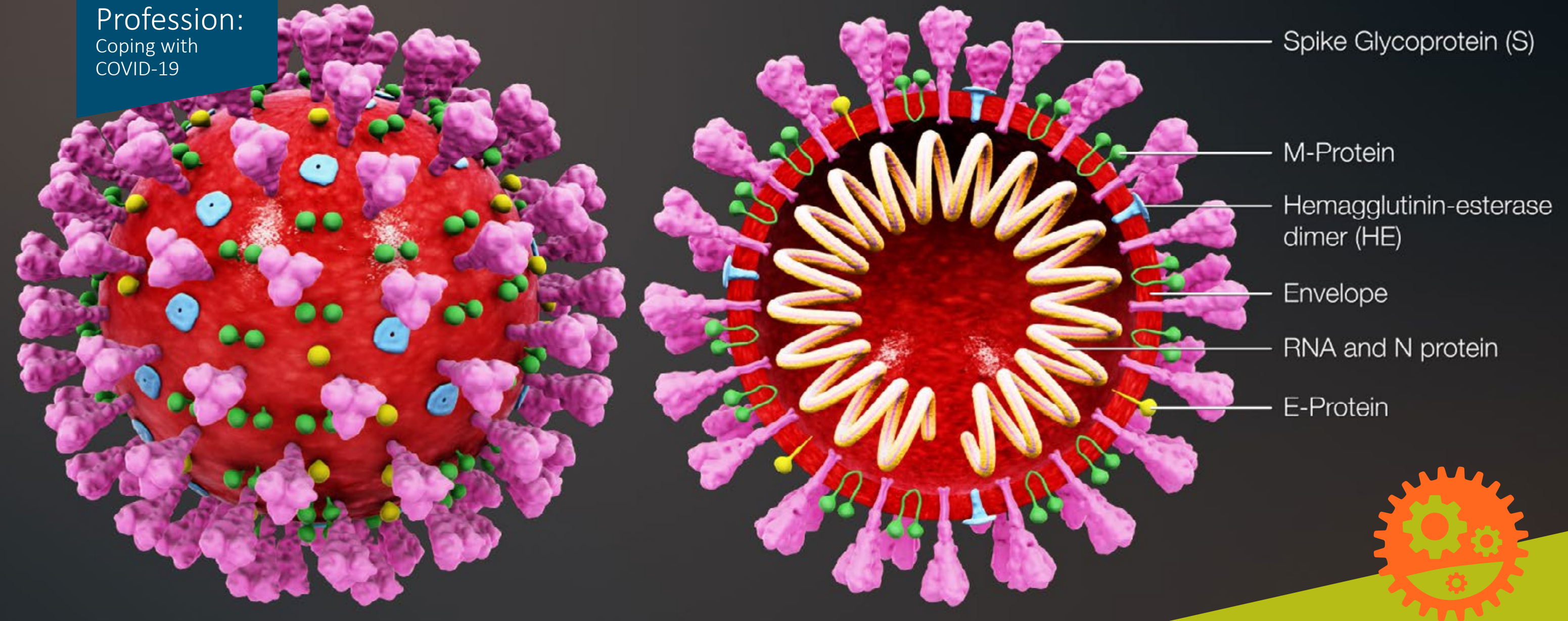
At the same time, they installed a clean side/dirty side system that meant machines that travelled in the field didn't routinely travel on the road.

He expects fitting tracks to big machines like harvesters that work late into the autumn to become common practice in future. One field of maize growing near

Newark had been flooded to a depth of one metre four or five times over the winter but was successfully harvested in the early spring:

"The machines barely made a mark. We gained a lot of credibility from our supplying farmers for using tracked vehicles on their fields."

Profession: Coping with COVID-19



Engineering a safe and healthy supply chain

The development of a medical ventilator in less than 100 hours demonstrates how industry professionals have applied their ingenuity and determination. This has delivered life-saving equipment to medical practitioners and their patients. With contribution from seven Formula one teams, 'Project Pitlane' responded to the UK Governments call to ramp up

availability of respiratory support equipment. Delivering to critical specification requirements, the Continuous Positive Airway Pressure (CPAP) ventilator has been approved by the UK's Medicines and Healthcare Products Regulatory Agency. Such developments have only been possible with business leaders making decisions on how their manufacturing divisions can

continue working whilst applying social distancing.

We take a look at 'Project Pitlane' and have taken the opportunity to understand first-hand how the COVID-19 UK Government guidance has changed working practices for IAgRE members.

F1 and UCL rapidly develop life-saving breathing aids for the NHS

The breathing aid, known as Continuous Positive Airway Pressure (CPAP), has been used extensively in hospitals in Italy and China to help Covid-19 patients with serious lung infections to breathe more easily, when oxygen alone is insufficient.

Since Wednesday 18th March,

engineers at UCL and HPP and clinicians at UCLH have been working round the clock at UCL's engineering hub MechSpace to reverse engineer a device that can be produced rapidly by the thousands. This has now been recommended for use by the Medicines and Healthcare products Regulatory Agency (MHRA).

This breathing aid was produced within a rapid timeframe – it took fewer than 100 hours from the initial meeting to production of the first device. One hundred devices are to be delivered to UCLH for clinical trials, with rapid roll-out to hospitals around the country ahead of the predicted surge in Covid-19 hospital admissions.

Profession: Coping with COVID-19



A team of doctors and engineers rapidly developed the Continuous Positive Airway Pressure (CPAP) ventilator

The collaboration, supported by the National Institute for Health Research UCLH Biomedical Research Centre, demonstrates the way that universities, the NHS and industry are coming together to help the national response to the Covid-19 coronavirus outbreak, by providing vital technologies to the NHS which can enable them to care for patients who require respiratory support.

Reports from Italy indicate that approximately 50% of patients given CPAP have avoided the need for invasive mechanical ventilation. However, such devices were in short supply in UK hospitals.

UCLH critical care consultant Professor Mervyn Singer (UCL Medicine) said: "These devices will help to save lives

by ensuring that ventilators, a limited resource, are used only for the most severely ill.

"While they will be tested at UCLH first, we hope they will make a real difference to hospitals across the UK by reducing demand on intensive care staff and beds, as well as helping patients recover without the need for more invasive ventilation."

Professor Rebecca Shipley, Director of UCL Institute of Healthcare Engineering, said: "At UCL, we have an established ecosystem of partnerships spanning engineers, healthcare and industry ready to be mobilised in times of need. It's been a privilege to work closely with our clinical colleagues and with doctors leading the COVID-19 response in China and

Italy. This close contact has helped us to define the need and respond with technology that we hope will support the NHS in the weeks and months to come."

Professor Tim Baker (UCL Mechanical Engineering) said: "Given the urgent need, we are thankful that we were able to reduce a process that could take years down to a matter of days.

"From being given the brief, we worked all hours of the day, disassembling and analysing an off-patent device. Using computer simulations, we improved the device further to create a state-of-the-art version suited to mass production.

"We were privileged to be able to call on the capability of Formula One – a

collaboration made possible by the close links between UCL Mechanical Engineering and HPP."

Andy Cowell, Managing Director of Mercedes-AMG High Performance Powertrains, said: "The Formula One community has shown an impressive response to the call for support, coming together in 'Project Pitlane' to support the national need at this time across a number of different projects. We have been proud to put our resources at the service of UCL to deliver the CPAP project to the highest standards and in the fastest possible timeframe."

Andy Obeid, Chief Executive of Oxford Optronix, a small business that will manufacture the oxygen monitors for the CPAP devices, said: "By working

flat out and mobilising the support of every individual in my company as well as other small companies across the UK, we have accomplished something in five days that would normally take two years.

"I am delighted we have been able to design, develop, test and manufacture a bedside monitor that will continuously measure the concentration of oxygen being delivered to the patient and is ready for clinical trials."

CPAP machines are routinely used by the NHS to support patients in hospital or at home with breathing difficulties. They work by pushing an air-oxygen mix into the mouth and nose at a continuous rate, keeping airways open and increasing the

amount of oxygen entering the lungs. Invasive ventilators deliver breaths directly into the lungs, but require heavy sedation and connection to a tube placed into the patient's trachea (windpipe).

"*Project Pitlane' is a collective of UK-based Formula 1 teams and their respective technology arms coordinating a response to the UK government's call for assistance with the manufacture of medical devices. It will pool the resources and capabilities of its member teams, focusing on the core skills of the F1 industry: rapid design, prototype manufacture, test and skilled assembly. F1's ability to respond rapidly to engineering and technological challenges allows the group to add value to the wider engineering industry's response.

Profession: Coping with COVID-19



Nick Handy, MAN Truck and
Bus UK Limited



Rapid decision-making resulted in the placement of large orders for fast moving HGV spare parts from global suppliers.

Keeping the wheels turning

The responsibility of keeping the supermarket shelves stocked has landed firmly at the door of heavy goods vehicle drivers, logistics schedulers and warehouse managers. As Head of Product Management at MAN Truck and Bus UK Ltd, Nick Handy CEng MIAgrE, explained from his temporary home office.

MAN trucks are in use across all sectors affecting daily life including medical supplies, agriculture, food processing, waste removal, construction, emergency services and

forestry. With 69 dealers based across the UK, product service is essential in keeping planned downtime of vehicles to a minimum. To facilitate inspection and maintenance schedules, technicians have been split across two shifts to reduce the risk of potential contamination on site and maintain social distancing. This has provided flexible routines allowing employees to have additional time with their families.

Nick explained that MAN Truck and Bus monitored the development

of COVID-19 in early January. Rapid decision-making resulted in the placement of large orders for fast moving HGV spare parts from global suppliers. This initiative ensured that their principal European distribution hub in Germany has remained operational throughout the crisis.

A review of the MAN corporate website illustrates the commitment to employee safety regarding the response to COVID-19. Operational changes have been made at the manufacturing plant. These include

additional distancing between assembly operators, reviewing system routing and where necessary the provision of personal protective equipment.

Early action

In the UK the redeployment of all 150 MAN office staff in Swindon to home working was enabled ahead of the UK Government lockdown. This demonstrates MAN's commitment to its employees' health and safety with robust social distancing measures and remote

working practices.

Nick's role within MAN incorporates product development, type approval, overseeing technical sales literature and liaising with bodybuilders. He frequently visits Europe with a conference planned for Munich in late spring 2020. To maintain the impetus with product development, the event was delivered using live camera filming at the factory location. With supporting promotional material, the streaming was facilitated via

Skype. Such online communication methods are in use across the business with Nick referring to its benefits regarding time management and cost reduction. The question was posed to Nick on how the reduction in traffic on the roads is helping the drivers with regards to their daily tasks. The reports are that routing schedules are being regularly achieved well within the planned timings. Further analysis will be needed to establish how vehicle efficiency levels have in turn been influenced.

Profession: Coping with COVID-19



Pressure relief

Moving onto the core engineering sector, a call was made to Rupert Caplat CEng MIAgrE, Head of Engineering & Technical Sales at Linde Hydraulics UK Ltd. Located at Abingdon near Oxford, the business provides support to many industries employing hydraulic applications across the UK. Just ahead of the edict from the UK Government on 23rd March, the office administration and engineers were reassigned to home working.

By applying the UK Government's guidance on remaining operational, a core team of locally based engineers have kept the workshop facilities open. Strict control measures have been put in place regarding goods inwards and despatch to protect both staff and haulage drivers. The result has been that existing and potential new customers can arrange for repairs to their precision oil powered transmission systems.

Continuing the logistics theme, Rupert explained that the site undertakes repairs for hydraulic pumps and motors for all Linde IC-engine powered forklift trucks (via UK dealers). Their specification is focused on the requirements of high capacity food warehouses and distribution hubs. Another essential cog in the 24 hour, 7 days a week cycle which ensures our online purchases are delivered on time.

An opportunity to reflect

Asked how the pandemic control measures had affected business, Rupert referred to the increased number of discussions regarding their customers' previously dormant projects. The time away from the constant pressures of project

deadlines and support of production lines has allowed engineers to review concepts which have long been on the 'pending' list. Hopefully these will develop into confirmed orders for Linde Hydraulics UK Ltd as industry and manufacturing restart over the next few months.

IAgrE support for members

The secretariat regularly updates the website with relevant information to help members at this time see;

[*https://iagre.org/covid-19-\(coronavirus\)*](https://iagre.org/covid-19-(coronavirus))

for more information.

There are some case studies on the Institutions website explaining how IAgrE members are adjusting to a different way of working during COVID-19. see;

[*https://iagre.org/coping-during-the-covid-19-pandemic*](https://iagre.org/coping-during-the-covid-19-pandemic)



A diverse approach

The engineering sector consists of both multinational organisations through to the small and medium enterprises. Positioned at the top end of the well-established family business bracket is Autoguide Equipment Ltd, based near Devizes in Wiltshire. Founded in 1977 by Richard Robinson CEng Hon FIAgrE, and his wife Peggy, their extensive range of products apply the full range of engineering disciplines. From cricket ground rollers to high capacity screw pile anchors, Autoguide Equipment provides service to many industries.

Into the cloud

Home working has been implemented effectively following an investment in 2019 to a cloud-based intranet system. Following a short cessation of production, manufacturing has resumed with social distancing procedures in place. This steady increase of production is matched with the availability of spare parts.

The downtime has provided the opportunity to review business practices and efficiencies. As a result Richard and the team are continuing to seek ways of becoming less reliant on external suppliers. The support of the accounts team has been essential in navigating their way through the various UK Government financial support schemes. Their role in rapidly interpreting the guidance and completing online documentation has been vital for planning work schedules. Whilst ensuring the workforce is both safe and healthy, Richard explained that technological advancements at Autoguide Equipment Ltd remain active. A massive 34 tonne /metre torque motor is under construction which is matching world records for the biggest and certainly the fastest operational unit entering the market.

Summary

It's encouraging to hear the consistent message from the contributors on

maintaining production and supply within the COVID-19 control measures. The profession faces many challenges as plans for restarting the economy are put into place. Engineering success relies on effective communication, often only achieved through face to face meetings.

We therefore need to remember how we've rapidly adapted to new working systems over the past few months. In addition, what our true potential is, as opportunities for social re-engagement are permitted. Landwards would like to send their thanks and best wishes to all employees within the engineering and food-based sectors during these unsettling times.



What does this mean to me as an engineer?

It's worth reflecting on how quickly individuals and businesses have come together to solve a common problem. Key themes which emerge from all these examples are of resilience, rapidly developing and implementing plans and solutions all with the overarching imperative of keeping all involved safe whilst the work gets done.

Member Profile:



Alexandra Cooke

Alex gained a degree in Environmental Geoscience from Cardiff University before doing a Masters in Land Reclamation and Restoration at Cranfield University.

She then spent a few years working as an environmental soil scientist for Wardell Armstrong, a Newcastle-based environmental and engineering consultancy, before returning to Cranfield to complete a PhD developing a tool that farmers can use to help stop soil and phosphate from leaving farm land.

She has worked with Severn Trent Water for two years and has recently been promoted to Principal Catchment Scientist.

Day to day work

Her day to day work comprises identifying and assessing risks to water quality from diffuse pollution, seeking to prevent incidents and looking for ways to increase and enhance biodiversity in the Severn Trent region. That includes engaging in innovative trials and working with farmers and their advisers.

Background

I was born and bred in Wantage, Oxfordshire and spent my youth walking the Ridgeway hills or exploring the woods and fields of West Berkshire where my grandparents lived. Family and school friends still live there, and my younger sister has recently returned to the area. I return often (at least I did before COVID-19!).

Current location

I moved to Northamptonshire with my partner Ewan in 2014. He works locally for a consultancy as an Energy Strategy Consultant. Severn Trent's HQ in Coventry is a bit of a commute, but I work flexibly so I don't have to go in every day, and I am frequently on site.

Education

My background is in science and I 'fell into' engineering. I was always encouraged to do what I enjoy and I always enjoyed environmental sciences. Having spent so much of my youth in the countryside, it was natural

to combine that with engineering.

I chose my university course because I thought I would enjoy it and because it gave me options. I always wanted to travel and felt working in the environmental sector would do that, although that hasn't quite worked out.

My undergraduate course gave me an interest in soil and water; hence my choice of a Masters course. That was the best thing I could have done – it opened so many doors for me and I'll ever be grateful to Cranfield for that.

PhD

Filter socks are a US-developed device for sediment control; my role was to develop them into a tool that UK farmers could use easily to prevent both soil and phosphate from leaving their land, and so prevent either causing water quality issues.

It was three great years and I'm lucky that in my current role Severn Trent has encouraged me to continue looking at these issues and developing tools for farmers.

Sediment and phosphates are emerging issues for water companies as they can block treatment works and cause algal blooms in reservoirs. Working with farmers on 'at source' solutions helps reduce both treatment costs and customer bills!

Best part of the job

The Team! It's great to work with people who tackle every challenge with gusto and enthusiasm. We're all striving for the same outcomes and we have so much fun along the way.

Worst part of the job

Dealing with incidents – it is hard to explain to customers that they don't have water!

Current research projects

I've got my hands full with a number at the moment. The three most interesting are:

Filter socks: I am continuing my work where my PhD left off, to build an understanding of how they might

work in different agricultural systems and weather situations. The ultimate aim is to be able to offer them to farmers throughout the region under the Severn Trent Environmental Protection Scheme (STEPS).

Reverse auctions: I am part way through a three-year study into whether these are a suitable way of engaging with farmers, and whether they would achieve the water quality benefits we need. They may form part of the Environmental Land Management (ELM) scheme, but trials suggest they may not deliver as many benefits as traditional environmental schemes, and farmers are nervous about them.

Nature based solutions: Using Catchment Nutrient Balancing, within a natural capital approach, as an alternative way to meet our phosphate commitments in wastewater catchments. This is a new technique to the UK and we are one of two water companies currently testing the method.

Advice to young engineers

My experience suggests to me that there will be more blurring of lines between disciplines – particularly engineering, environment, social and financial. Having an understanding or appreciation of two or more of these will set you up for a great career. Also, do what you enjoy!

Out of my suit

My partner and I have an allotment which I love to fill with vegetables and cut flowers.

Like many people, I am sure the lockdown due to COVID-19 has caused some re-evaluation of our lives. We have loved having a better work/life balance, allowing us to get outdoors during the week. It has been great for exploring local footpaths and we've found some gorgeous places. Access to the countryside is something we definitely want more of in future – a house move to achieve that might be on the cards!

Meet the President

Right place, right time, right man.

*In conversation with the incoming IAgRE President.
Paul Hemingway*

Tell us your background and how you became an ag engineer?

I was brought up in West Wales within a farming community although my father wasn't a farmer – he was a municipal engineer who married a farmer's daughter – so I spent a lot of my youth on typical farms in the area of 80 - 100 acres, milking 40 - 50 cows or so, very much a family affair – there was always work for a keen young boy. Machinery was small scale by modern standards and simple to operate.

The lure of a 'full university' experience in an urban setting meant that I spent three very happy years in the north east at Newcastle University studying Agricultural Engineering and ended up with I suppose what you'd call a classical science based degree.

Talk us through your career progression

Following graduation, I decided that it would be a good idea to find out a bit more about the practicalities of farm machinery and got a job as a trainee service manager in a machinery dealership in Cornwall which had five or six branches throughout the south west. Within about six or eight months I was made branch Service Manager and the contrast between managing a team of 10 or dozen service engineers in west Cornwall and the halcyon days of university life less than a year earlier were stark to say the least. I learned lessons then that have stuck with me throughout my professional life.

After two years I saw that Harper Adams were advertising for a lecturer in Ag Engineering to support their new (HND) course. I knew a bit about Harper because several of my West Wales friends and family had been there and the job appealed, so I applied.

It was at this stage that I also applied to be a student member of IAgRE to strengthen my job application.

I was appointed by Harper and for the first time in my career I found myself part of a small team at the outset of a brand new project. I spent 11 very happy years at Harper Adams including a one-year lecturing exchange at Lincoln University in New Zealand. Over the years I helped the course develop from HND into the degree level offering which still runs today, some 40 years on!

In the late 1980's I was approached by JCB to do some consultancy work on a project to develop a high-speed tractor. It was clear to them that tractor design had some shortcomings for modern farming – tractors were slow, had no suspension. They weren't designed for road work or in higher speed field applications.

The project progressed and I was invited by the team to test drive an early prototype alongside other radical machines of the day – MBTrac and Unimog – in a side by side comparison - which for a college lecturer was a fairly privileged experience.



When the project 'became a runner' the team was expanded and I was asked to apply for the role of Service Manager. They didn't have to ask twice! My two years in a dealer service role in Cornwall had stood me in good stead. Again I found myself part of a small, highly dedicated team in the early stages of development of a brand new concept vehicle. I spent the next 11 years with the Fastrac team becoming responsible for service, product marketing and export sales functions.

In 2000 I moved across to the construction machine side of the JCB business and spent the next 18 years in a variety of functions, all of them on the 'customer facing' side of the company – field service, technical service, dealer training, parts marketing and so on. This has given me the opportunity to work with the JCB dealer network on a global basis both from the office and on territory around the world.

In 2012 I was asked to move with my wife to Delhi to take up an appointment as Vice President – Service with JCB India responsible for a team of about 120 staff based both within the JCB factories and throughout India in the regional offices. This was to me a most rewarding position although also very hard work! The culture shock of moving from the UK to a developing country like India not to mention the climate, the language, the traffic and so on was massive. What I did find though was a country that places real value on their engineers and

also on the experience that older people can bring to a business.

I retired from JCB in 2018 and am now involved as a Visiting Lecturer at Harper Adams University as it now is – a very different establishment from that which I left 30 years ago – but I'm pleased to say really flourishing!

What advice do you have to younger engineers or potential engineers?

- Engineering is a critical and extremely rewarding profession and engineers should be immensely proud of the careers they have chosen. The experience we have just been through with COVID-19 illustrates just how important it is to have design, development and manufacturing capability in our country. None of this happens without engineers.
- COVID-19 has reminded society about the importance of home-grown food in a crisis. Food production today needs machinery and hence the Agricultural Engineering profession is in a 'sweet spot'.
- Develop excellent communication skills – both written and verbal – without question those with good communications skills progress their careers.
- Set yourself goals for your career development by all means but also realise that this is not an exact science... ..there is a lot of luck in life; the right opportunity comes up at the right time or the person whose job you want moves on to create an opportunity for you. I've had an amount of luck in this respect but also believe that the harder you work the luckier you get...you can definitely make your own success.
- Be professional in everything you do – the way you act, the way you interact with and treat people – you will be thought better of and be a better person for it.
- Oh, and don't expect life to be fair – it isn't, nobody said it had to be, life as the saying goes 'is what you make it'.

How has IAgRE membership helped?

Networking at both a local and national level. Getting CEng registration was a valuable professional development exercise and it is a recognition that I still value 30 years on.

The fact that we have a specific Professional Engineering Institution for Ag Eng is a real bonus. It gives us a sense of identity and a common

interest. It also helps that our institution is one of the smaller ones, so it is a lot more approachable and flexible than some others.

In short, I've got a lot out of membership of IAgRE but have also put a fair bit back. These two factors are definitely related.

What is your vision for Agricultural Engineering going forwards?

I think that we will always work in close harmony with the needs of the farming industry. Over my career it has really all been about production maximisation, bigger, faster more efficient machines and production systems. The global population still continues to grow fast – 7.8bn people today is forecast to grow to 10bn by 2050 - and they will need feeding but there is also so much focus on environmental issues and sustainability and these too will have to be addressed.

It does seem that for UK farmers particularly post Brexit farm support payments are going to be based heavily on these areas. Inevitably this will throw up engineering challenges which the ag engineering industry will have to rise to.

This is a brief summary of the full interview conducted with Paul. You can hear the full interview on the Landwards Podcast including Paul's take on ag engineers during lockdown, AI and big data.

The Landwards podcast

A series of podcasts have been commissioned with a monthly news podcast and a monthly interview with an Agricultural Engineer or influential person in the land based sector. The Landwards podcast is on iTunes, Spotify or click on <https://www.buzzsprout.com/1067353/> episodes for the latest one.



Membership: 50 years reflection



A half century – not out!

Richard Robinson, recently retired from running his own company Autoguide Equipment (See p23) reflects on the past 50 years of IAgRE membership.

John Patterson, Engineering Manager at New Holland Aylesbury, blustered, as usual, into the drawing office, said “about time you joined the Institution” and handed me an application form. I duly completed it and not too long after, went, at New Holland’s expense, to my first IAgRE conference.

One speaker was Dr Ing Gego from Deutz who introduced the Intrac system tractor concept, which, much later I would be demonstrating. This is an idea others have pursued to this day with generally great enthusiasm, but frequently, poor returns.

The report I wrote got me noticed and I progressed through many of the departments until my arrival at Field Test with particular responsibility for balers. (I started

driving a McCormick B50 and then NH Super 68 at home in my eleventh year).

In reminiscing over my membership years, I thought I should just describe a few significant contacts or events which have got me here.

Bush engineering

My travels, particularly in Africa and New Zealand taught me to respect ‘bush engineering’ which has served me well over the years. The sort of things included straightening a shaft with a stick welder (that got me a job offer in Germany), a quick method for removing the broken end of a Land Rover half shaft, (yet another built in failure), dropping tyre pressure to unstick the car on a beach (at midnight) with the tide coming in and how to remove

bearings when you haven’t got a press or puller. I salute those Engineers sent out to the far corners of the world to reassemble, repair, modify or simply train users of new equipment. Fowlers, for instance, would ship a consignment of ploughing engines in crates to Africa, accompanied by a fitter who had to train locals, initially to assemble the first one and then to use it to build the rest. Following that he had to instruct all and sundry in the techniques of engine driving and cable ploughing.

A move to sales

Attempting to be an engineer, one has a natural wariness when in the company of a salesperson, my change from design and development at NH to a sales company Watveare Overseas was



quite startling, particularly regarding my pay, which, for complicated reasons became dramatically better.

My transition from Service Manager with emphasis on haymaking and harvest progressed rapidly from tiny chain saw engine issues to looking after Deutz tractors and introducing Rabe ploughs to England. At one stage it was reckoned that Watveare had products on every stand at the Royal Show, so wide was the range of imported components.

Deutz tractors needed both pick-up

hitches and quiet cabs, so we had to design, test and get these manufactured. Hitches became a big thing in my life and formed the basis for our present business.

In those days there were just a few rough terrain forklifts and ICI wanted to supply fertiliser, initially in one tonne and later heavier pallets. David Spence from the Isle of Wight started making tractor mounted forklifts and we began to sell them. Fortunately, we got on really well and succeeded in adding wheels to the frame to stop the tractor falling over! Gradually quality improved and new ideas were offered, even winning an RASE gold medal. Whenever I visited David, I knew that there was a ‘golden’ period of never more than 40 minutes to get your message across, after that he would be thinking about some other project, be it ship models, classic cars, playground equipment or food and drink!

David was instrumental in the founding of what is now Autoguide Equipment, but sadly died in a horrible boating accident in 1984. I’m sure he will be remembered as a great innovator but usually a little too far ahead of his time!

Faith in the company

I have been lucky enough to benefit from friendship with a few salespeople who have had faith in my company. One was a great guy John Dunn who, when we first met worked for Volvo hydraulics. John introduced me to a very expensive and clever hydraulic motor. After some calculations we agreed that this could be the answer to fitting auger drives to lorry loader cranes. This solved triple problems of poor flow, low auger spin off speed and boiling oil, whilst using the available high pressure to give excellent torque.

Unfortunately, we just didn’t have the money to pay for one of these, so John suggested we take one on ninety days credit, if it worked, we could pay the £100 plus price or return it. That level of trust turned into one of our most successful products, still in production today.

Another example involved a similar offer for Planetary Gearboxes from Michael Marsh of Comer. At our last ever Smithfield Show, Mike visited our stand and suggested we try his products, once again showing trust in our little company, eventually becoming their biggest customer for a while. One of our most recent projects utilises six of the above motors and six gearboxes, building on past trust in their excellent reliability.

Customers have also shown faith in us, even when our initial offering came up short. Our first tracked vibrating post driver didn’t work, yet Jim Hurley gave us the time to turn it into a fantastic bit of kit, allowing one driver to install nearly two hundred posts an hour, with unparalleled accuracy. That has led to a range of post drivers in use around the world, performing work way beyond our original objectives.

The privilege of professional friends

As well as salespeople and customers, I have been privileged to meet a huge number of colleagues, from academia to commerce, principally as a result of my Institution membership. Local branch meetings, always informative, led to Council membership and then the honour of President, even as I write, way beyond my dreams. Charged with introducing something to interest younger members, the Young Engineers Competition, with huge support from the Secretariat, (especially Sylvia and Sarah) Richard Trevarthen and Peter Leech, had some excellent years and memorable welcomes from our host venues.

I am particularly proud to be a Chartered Engineer, Honorary Fellow and now a member of the Douglas Bomford Trust, with particular responsibility for the Arkwright Scholars, all entirely due to that short conversation with John Patterson.

I intend to maintain my involvement in our great Institution for many more years, it is care of the land that feeds the world and we will always need committed, enthusiastic and dedicated Agricultural Engineers.

Book Club

Overground and underground with AHDB guidance

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

Soil can easily be taken for granted when farming land. However scientific reports have warned us that without careful management, the capability of the natural brown matter to produce high yielding crops will be lost for ever. The Agricultural and Horticultural Development Boards (AHDB's) arable soil management guidance provides farmers with a cultivations and crop establishment roadmap. Referring to soil type, the opening paragraphs focus on where your land sits between the common benchmarks of clay and sandy profiles. From there on the document is providing greater detail on how to engage metal with soil to promote seed germination and maximise harvest potential.

Sticking with the principle that a cold damp soil prevents rapid germination, the importance of good drainage is highlighted. Moving back above the surface, the pros and cons of either chopping the straw for reincorporation or baling and carting away is discussed. Keeping with the 'simple but informative' approach, three photographs illustrate the full range of textures from too wet through to insufficient moisture. The term 'friable' is introduced, and it doesn't have any resemblance to a Friday night takeaway. It refers to when the tractor depth control can be lowered, allowing the implement to break down clods to form a seedbed. You can imagine the arable foreman stood in the middle of the field with the guide and a fistful of soil.

It might not give them the specific answer, but the guide can certainly focus the decision making. The 35 pages of knowledge will also help to determine which tractor and implement to bring into the field. It won't matter whether your machinery fleet is 20 years or 20 days old, the same principles apply. Often tyres get overlooked when setting up equipment, resulting in soil degradation and additional fuel cost. Flick to page seven where the paragraphs will provide enough information for all those from novice to professional operator. The combination of well thought out explanations and clear images is used throughout the document to guide the reader through the subject. Examples of this include 'top

tips' for machinery specifications, such as adjacent tine clearance should be 1.5-2 times the chop length when drilling into residues. A profile schematic of a deep surface loosening tine illustrates how rake angle and lift height of the wing maximise disturbance to break up compaction. Often soil compression is the result of poorly planned cultivations and multiple references are given to avoiding this scenario. It's evident that the writers have put a lot of effort into giving enough detail without overcomplicating and losing the reader's attention. Where further information is relevant, a clearly identified text box provides links to other AHDB publications. There is a natural method of cultivating soil, via the plant roots.

The soil management guidance covers the benefits of cover crops and how retaining organic matter content is essential to aid mechanical intervention. Moving the earth's crust, whilst keeping weed seeds in a dormant state is covered with an appropriate level of detail. All aspects of cultivation techniques are referred to from ploughing through to minimum tillage and controlled traffic farming. The guide culminates with a 'ready reckoner' score chart where farmers can select variables across all aspects of soil management. The resultant value is cross referenced to a summary detailing the appropriate tillage practices for the soil type. Available free to download from

<https://ahdb.org.uk/arablesoils>, the AHDB's publication needs to be referred to when planning crop rotations and setting farm budgets. It will be interesting to see how further developments in precision farming and availability of data can influence future updates.



Professional: The Douglas Bomford Trust



We applaud all of our sponsored students and their supervisors for their fortitude, positivity, continued commitment and pragmatic response to get done whatever they can.

Zoom and the new normal

Alan Plom, Secretary to the Douglas Bomford Trust, ponders on the 'new normal' and the role of the Trust in encouraging students into 'agricultural engineering'.

Zoomed Out?

This article is very different to our usual review of recent events and successful projects. In the last issue we looked forward to the future, but none of us anticipated the profound changes to our lives and ways of working that were about to hit us. Our days now revolve around Zoom meetings and webinars (other on-line meeting platforms are available) and

this enforced glimpse of the future is likely to become the new norm.

Our Trustees and I have obviously been unable to attend meetings or carry out project reviews and mentoring face-to-face. However, we have kept in touch on-line. Even our half-yearly Board meeting due to be hosted by Trustee Keith Hawken at the AEA in April was held 'virtually' for

the first time in 48 years. More significantly, the worldwide lockdown and social distancing has had a major impact on many of our funded students' research projects and developmental opportunities in ways we could not have foreseen. With research and teaching facilities closed and international events and conferences cancelled or postponed, many planned activities cannot be

completed. However, universities have risen to the challenge to help students achieve their academic goals and enable them to graduate, eg by communicating, working remotely and extending deadlines (at zero cost), but the position on use of our travel grants is less certain.

Coincidentally, over recent weeks we have been working 'closely' (via Webex) with a group of Cranfield MSc students who have been 'horizon scanning' for us. They have developed a tool to help identify and prioritise emerging issues and technologies for projects that should attract funding over the next 5-15 years. Instead of holding a workshop the team had to interview a wide

range of selected experts in academia and industry by telephone and we thank the many IAgRE members who shared their knowledge and vision of the future.

On a personal level, we applaud all of our sponsored students and their supervisors for their fortitude, positivity, continued commitment and pragmatic response to get done whatever they can. Many come from around the world and for those far from home and separated from their families and friends (internationally and locally) it is a very worrying and stressful time. We hope to be able to congratulate them all at their Graduation Ceremonies later in the year, face-to-face (and within two metres).

Zooming Forward (and Back)

It is the Trust's 50th anniversary in 2022 and we are planning a special event to reflect on what our sponsorship and support has achieved over the past five decades, in terms of helping to develop and promote agricultural engineering as well as the many individuals who have gone on to play a leading part in the industry worldwide and those who will undoubtedly influence it in the future. If you would like to be involved, or are an alumni of the Trust, please contact me via enquiries@dbt.org.uk. [Due to GDPR we hold no past records and people have moved on anyway.]

Professional: The Douglas Bomford Trust



Meet a trustee...

John V Fox (Hon FIAGrE)

Douglas Bomford himself (then President of IAGrE) invited John to work with him in 1957 and during his long career with Bomford & Evershed (later to become Bomford Turner Ltd), John served as Technical and Production Manager, Managing Director and Chairman (from 1982-91). Like Douglas Bomford, he is also dedicated to the industry and a strong advocate of education and training, he served on IAGrE's Council for many years and became President and Honorary Fellow.

The Trust was set up in 1972 after Douglas died in 1969, and John joined our Board in 1977 as the Company's representative when he was MD. John has been involved continuously since and has served as Chair and Vice Chair. John was given the unique status of Emeritus Trustee when he formally 'retired' from the Board in 2011 and he is still keeping an eye on us and providing sound advice at 88!

As an innovator with a keen understanding of commercial reality and having developed many market leading-machines, John has been well-placed to assess projects. More than 20,000 of Bomford's signature product - the 'Superflow' cultivator - were sold over 25 years of production. John is also particularly proud of his 'Dynadrive' design, and a string of other innovative products led to the company receiving the Royal Agricultural Society's Gold Medal for outstanding contribution to agriculture in 1976. After John retired in 1991, he continued to work as a consultant for another 25 years or so, advising a wide range of clients in agriculture, manufacturing and the legal profession, including acting as an expert witness.

Dr Geoffrey Davies

We were saddened to hear about the death of ex-Trustee, Geoffrey Davies, in December aged 71. A past-President of the AEA, Geoffrey was Vice President of the Alamo Group when he joined our Board of Trustees. His portfolio of businesses included agricultural engineering components that operated across the globe. He also promoted education and entrepreneurship through the wider community and his formidable business expertise combined well with his commitment to enhance the capability and success of others. His experience was therefore invaluable to the Trust and, by a strange

coincidence, the Bomford company became part of the Alamo Group.

Zooming In - on students and IAGrE

The Trust endeavours to encourage 'new blood' into the profession and supports IAGrE by sponsoring the annual membership of around 300 students studying a relevant course or carrying out research within scope of our objectives. Some of these are not from an agricultural engineering background (and hadn't considered themselves as such) but we hope that by encouraging them to join IAGrE whilst students, they will remain affiliated long after graduation.

Zooming off

We have increased the maximum funding limit for 'Minor' projects to £5,000. This will allow more applications to be fast-tracked, rather than wait for the six monthly Trustees' meetings. New guidance and check lists have also been agreed for initial assessment and monitoring progress of projects. The guidance on our website has been updated to reflect this and it is emphasised that applicants are expected to identify clear deliverables in their submissions. We also regularly review the case studies posted on our website and new 'drop-down' menus will help searching the content.



Our Trustees are keen to maintain a cross-section of experience, expertise (and contacts) on the Board and are always willing to receive expressions of interest (and a CV) at any time. Please contact the Secretary or any Trustee for further information.

Opinion

Alastair Tulloch MIAgrE graduated from college with two engineering diplomas at the end of the 1960's, which is when he joined the IAGrE - hence this is his 50th membership year!

His whole career was spent with Claas UK Ltd. Starting in 1972 as a Demonstrator and Training Instructor, he gradually progressed to acquire all the 'After -Sales' responsibilities and became a Director in 2000.

Since retiring in 2017, he retains a continued interest in the industry and has an involvement with the Claas International Scholarship Scheme and the LAMMA Innovations Awards. He has also written a few articles for industry publications.



There is something of an assumption that future innovation ideas will be accepted with the same enthusiasm as the innovator had with its development.

Agricultural Engineering support for end users with the new Agriculture Bill

Engineers include a lot of bright, forward-looking innovative people and those in the IAGrE are of course no exception. In their pursuit of future technological developments, however, how much consideration is given to the plight of the target customer? No doubt the obvious answer would be that is the objective, to improve the future efficiency of agriculture and horticulture for the benefit of all. How much consideration is given to the business situation of these customers? It could be suggested that there is something of an assumption that future innovation ideas will be accepted with the same enthusiasm as the innovator had with its development. Should this aspect be given more thought? Should the IAGrE give more support?

If we consider the current target market, we obviously have a mixture of type, size, age, wealth and opinion, but perhaps the one aspect which is common is the operational margins of their business. Many growers would accept they have a good lifestyle, but they are also trying to run a business and that is very challenging. It is also important to separate the wealth of an individual, with the margins generated in the business, because that is what drives the ability to invest in future technological proposals.

Little opportunity, more concern Agriculture and horticulture have long been struggling with margins, from the downward pressures on farm gate prices, combined with the upward pressures on all inputs,

both of which are largely out of their control. Now we have a new Agriculture Bill to contend with and that seems to bring a little in the way of opportunity, but also much in the way of concern.

The accepted current situation is that the UK is only 60% self sufficient and could so easily be at least 75%. Subsidies pay about 50% of agricultural income and 85% of agricultural profit. Many do not like the idea of subsidies, but what do these figures say about the business model without them?

The new Agriculture Bill makes much of the environmental issues and many would say that is absolutely right, but surely its function is to produce food! All growers would support environmental aspects more

than many would give them credit for, after all, they are closer to the countryside environment, but their business is also trying to make a margin from food production. The more these margins are squeezed the greater the incentives are for intensifying production in order to try to achieve some margin, which can be counterproductive for the environment!

For those who managed to actually read the 'Health & Harmony' document produced by DEFRA, the word 'environment' was mentioned on every page, the words 'food production' were hardly mentioned at all! At the same time there is a good easy to read graphic government document called 'The Future Farming & Environment Evidence

Compendium' which adequately demonstrates the current reliance on support from direct payments.

Now we all face an uncertain future, with the outcome of future post Brexit trade negotiations. Could the temptation of a deal hinge on the acceptance of more food imports? Could these imports include environmental and animal welfare aspects which we would not approve of, and might also be rightly forbidden in the UK?

An opportunity to invest?

The new Agriculture Bill might offer funds to invest in new technology, but surely any business investment decisions are likely to hinge on confidence in future prospects. Investments made from business

margins, which look like they can be sustained, are much more likely to drive such decisions than short term grants or loans, especially from a slightly sceptical grower.

Ironically, the current Coronavirus crisis just might have something of a 'silver lining' for agriculture, in raising the awareness of quality home grown food production, which is more dependable and will have the added advantage of a lower environmental impact than any which is imported.

In any event, there is perhaps food for thought within the work of engineers to support the plight of their target market, otherwise engineers and academics might be looking at their own margins more closely!

Membership Matters



The next generation Tom design incorporates factors such as weather-proofing, speed, camera capacity and extended battery life.

East Anglia Branch

Evening meeting – The Small Robot Company at the Claas UK training centre at Saxham.

11th February 2020

Report by Paul Baskerville.

The renaissance of the East Anglia Branch continues, with an audience of 30+ members, attending an excellent and very informative presentation by Tom Jewers, on the activities and objectives of the Small Robot Company.

Tom is a graduate from Harper Adams University and is now a conservation arable farmer and contractor with a keen interest in zero tillage and robotic farming.

He is an investor in the Small Robot Company (SRC) and is part of a farmer advisory group working with SRC to develop technology through hosting field trials for robot prototypes.

So, what does the Small Robot Company do?

They were founded in July 2017 by Sam Watson Jones a 4th generation farmer from Shropshire and Ben Scott Robinson an experienced entrepreneur, both of whom were inspired by the work being carried out on farming robotics by Harper Adams University and also had support from Matt Jones, Principal Designer at Google AI. They concluded that the traditional method of food production by the

use of heavy tractors and tillage machinery combined with the use of chemicals was destroying agriculture's precious asset – the soil. Change was needed and fast!

So, a new British Agritech start-up company was born involving farmers, engineers and scientists with the objective of offering farmers a commercial non-chemical method of food production provided by sustainable and reliable robots. The immediate goal was to provide an Artificial Intelligence (AI) generated field mapping service for wheat which identifies the exact location of every plant and weed and then to kill the weed autonomously without use of chemicals. The mapping service can also be used to predict

crop yields and the measurement of herbicide efficacies. The next step is to eradicate the weeds, and then in the medium term also offer a service to include seeding and applying precise levels fertiliser.

The plan is to have the 'Weed map and zapping' service up and running by early 2021 to be followed by the seeding and fertiliser mapping service.

All this to be carried out by light weight, low cost robots. This the company claims will increase farmer revenues by 40%, reduce costs by 60% and reduce chemical use by 95%.

Funding for this new start-up company has been exceptional, with crowd funding of £2.1 million including a £200k investment from a venture capital company. Also,

financial support from the UK Government Innovation scheme is now in excess of £1million. Goldman Sachs estimate that the market for digital agricultural technology will exceed \$240 billion by 2050.

The SRC task force consist of four robots. Tom for mapping, Dick the weed terminator, Harry under development for seeding and fertiliser application and finally Wilma (AI) the brains of the outfit.

Tom, like his robot colleagues, is electrically powered, light weight and with the aid of GPS can move around the field by himself. He carries out the field mapping and is equipped with a bank of cameras and other sensory equipment. Working in wheat he

can collect about six terabytes of data, distinguish plant details at sub-millimetre resolution with less than one millimetre pixel resolution. He has now learnt to distinguish the wheat crop from broad leaf weeds. He can cover around 20 ha per day, is weatherproof and can be used all year round. With the help of Wilma all this data produces the field map.

Weed killer

This data is then used by Dick the executioner who uses an electrical zapping system supplied by Rootwave (another small British company). Dick's wheels work like an electrode to make contact with the ground while another electrode is moved to touch the weed. This makes a circuit through the plant creates a heat build-up in the plant's cells, and kills the weed from stem to root instantly. Mission accomplished!

Harry the third robot is still under development for tasks such as seeding and applying precise levels of fertiliser to each plant. In practice the plan is to have Tom live in the kennel on the farm where he will 'download' data to the farmer and recharge his batteries. Dick and Harry will be delivered to the farm as and when necessary. Very much like a contracting service and very price competitive vs our current crop protection methods.

In the past 12 months SRC has moved from prototype development to commercial development and have recently entered into an agreement with Tharsus (a British manufacturer of robots based near Newcastle) to produce an initial fleet of 10 robots commencing in August 2020.

Early versions are already on farm including Waitrose's Leckford Estate.

Looking to the future robots will still have to compete with systems towed by smart tractors and combines, that can steer themselves, using satellite position systems and can produce much greater work rates. To compete you will need a swarm of light weight robots but for sure farmers will not invest unless they can do the job!

Membership Matters



The Househam Harrier at the recent National Sprayer Demo

East Midlands Branch

Visit to Househam Sprayers Ltd.
February 11th, 2020

Report by Richard Trevarthen

Some 28 members and guests thoroughly enjoyed an outstanding visit to the home of Househam Sprayers Ltd. at Woodhall Spa, Lincoln LN10 6YQ, one of the world's leading manufacturers and the UK's largest manufacturer and supplier of top quality self-propelled and trailed agricultural sprayers, selling machines world-wide.

Our visit focused on their very high-tech range of self-propelled sprayers both new and refurbished second-hand machines. On arrival there were numerous members of their staff present who all gave us a very warm welcome and invited us to join them for a delicious buffet supper.

Following that we gathered for two presentations, the first given by the Managing Director Robert Willey, focused on the company history and development. Founded in 1970 they now employ a workforce of some 60 plus highly skilled employees, and

over the years have concentrated on developing the best in their class with a big focus on reliability and efficiency, with an integrated design team and state of the art manufacturing and assembly areas.

Sprayer technology

The second presentation was given by Phil James, Engineering and Quality Director, whose presentation included information on the four self-propelled sprayer range namely, 'The Spirit' 'The Air Ride', 'The Harrier' and 'Predator'. All are known for having the lowest soil compaction in their class by weight. The outstanding advanced technology includes, amongst a range of other things, individual nozzle control, boom height control, precision spraying with total machine control (TMC) which integrates many functions onto one touch screen control, a high tech computer system which will link with any other computer the customer may have, a new hydraulic suspension system, which features anti-roll and self-levelling, and of course GPS.

Bespoke machines

However, another aspect which Househam pride themselves on

is the fact they are one of the few manufacturers capable of building bespoke machines for world-wide and individual customer requirements, as not everyone wants a highly sophisticated machine.

Following the presentations we were split into three groups and had a conducted tour of the factory and design offices. The two main workshops are set out with one to build the new machines and the other to refurbish the second-hand ones. The tour was excellent, and we had time to ask questions and have a good look at the machines in place. Depending on market demand, currently some 60 new machines are being manufactured per annum and similarly some 60 second-hand machines are being refurbished to 'as new' specification.

After the tour we reassembled for a final Q&A session.

A very sincere thanks to all the team at Househam for a brilliant evening, and we all wish you every success in the future.

East Midlands Branch

Evening meeting with Heico Fasteners at the Quorn Lodge Hotel, Melton Mowbray
March 10th, 2020

Report by Peter Leech.

We take them for granted and generally forget they are even there, but pretty much everything we use on a daily basis is held together with nuts and bolts. As engineers we probably handle nuts and bolts on a regular basis and understand the importance of correct torque, but do we really understand what's happening and how to ensure those nuts and bolts stay tight?

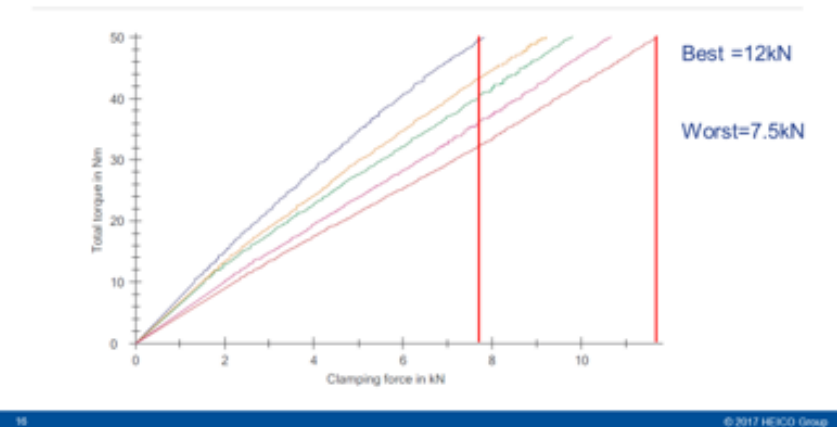
On Tuesday 10th March 19 members of the East Midlands branch gathered to listen to a fascinating presentation and demonstration given by Paul Ryder and Paul Windsor of Heico Fasteners. Just like we take fasteners for granted none of us had ever heard of Heico but they are an integral part of our everyday lives and are present in most motor vehicles particularly German made ones and employ over 400 people.

Not just nuts and bolts

The key things we learnt about joints held together with nuts and bolts is that it's all about the clamp load, and lubrication. The torque applied to tighten the nut and bolt has to compensate for the friction within the threaded assembly, the friction on the joint face or washer if fitted and the all-important stretch of the bolt which is the crucial factor in applying the clamp load to fix the parts in the intended position. With so many variables it is therefore quite difficult to state that for a given tightening torque a specified clamp load will be applied. See the following graphs which show 4 different bolts of the same size all tightened to 50Nm and resulting in clamping loads from 7.5 to 12 kN. These nuts and bolts were installed dry and had different frictional properties as can be expected within a normal batch of standard nuts and bolts.

Therefore, lubrication of bolt threads

Dry Bolted Connection



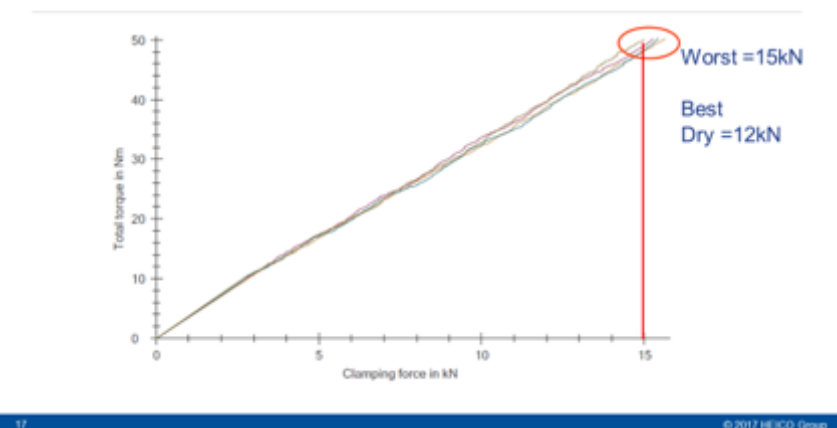
is strongly recommended by Heico as equalizing much of these frictional properties and differences. See the next graph which shows a similar selection of nuts and bolts also torqued to 50Nm but lubricated with engine oil. Now there is virtually no difference between the four results and the final clamping force achieved is 30% higher than the best dry bolt.

Correct torque and lubrication are required to achieve the specified clamping force. When that correct clamping load has been applied it is vital that it is maintained over time regardless of vibrations, temperature changes and other forces working on the parts.

Locking method

Thus, the method of locking nuts and bolts is paramount, and this is where Heico really stand out with their specialized Wedge locking systems. This ingenious system comprises two washers which have serrations on the outer sides which engage with the nut or bolt face and the surface being clamped, between these two washers is a ramp face with different angles in the tightening and loosening directions, when tightened up it means the initial torque required to loosen the nut is actually higher than the final tightening torque as the nut has to turn the washers against each other and up the shallow angle wedge thus forcing the two washers apart.

Lubricated (Engine Oil)



Membership Matters

To demonstrate the effectiveness of this clever locking system the two Pauls brought along a very neat little demonstration device called the 'Junker vibration test rig' where a nut and bolt could be installed to clamp two parts of the device together and the clamping load actually measured

and shown on a graph.

The machine is then run which applies a 40 hertz vibration cycle to the parts and tries to shake them loose. We were shown a nut and bolt with no washer, a nut and bolt with spring washer, then a nut and bolt with a nyloc nut and finally with a Heico locking system washer all torqued to the same clamp load. On all but the Heico joint the clamping load was lost almost immediately down to a very low level however in the case of the nyloc nut the nut and bolt still appeared to be tight. What was also impressive was

that when the Heico fastener was undone we could see the clamping load increase during the initial part of the turn as the washers turned against each other and up the shallow angle wedge forcing the two washers apart.

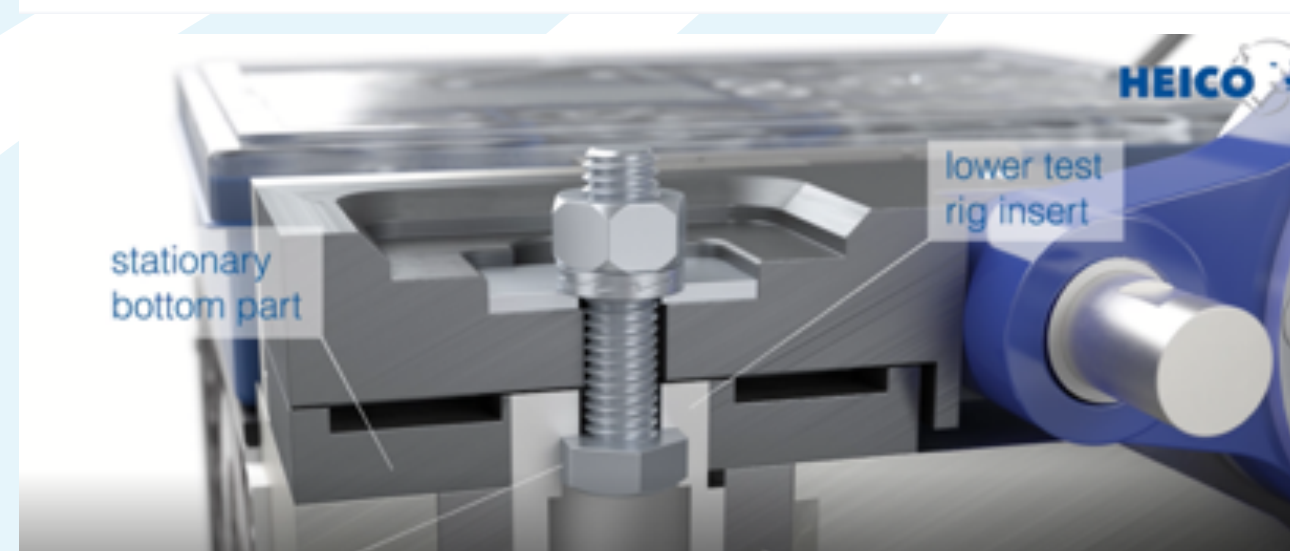
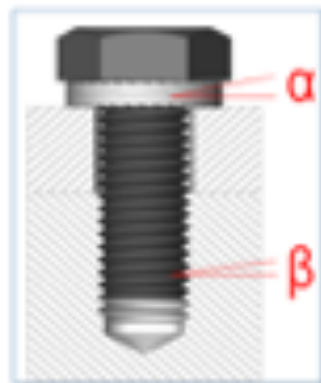
Seeing is believing and this simple demonstration made us all think twice about nuts and bolts holding everything in this engineered world together.

Thanks to Heico and the two Pauls for an excellent evening.



FUNCTIONAL PRINCIPLES HEICO-LOCK® WEDGE LOCKING SYSTEMS

Angle difference: $\alpha > \beta$



South East Midlands Branch

**Evening Zoom meeting –
Reducing food loss and waste
through post-harvest technology.
Marie-Carmen Alamar from
Cranfield University
28th April 2020**

Report by Tim Chamen.

The SEM Branch had a 'first' on the evening of 28th April 2020! We held the last in our series of winter technical meetings using Zoom, a cloud-based video conferencing service. Access to this was kindly supplied by the Institution and technically supported by Sarah from the Secretariat with Jane Rickson in the chair. Participants were asked to mute their microphones before the session started but could choose whether their image was displayed to the right of the screen by switching their camera on or off. Other than a teething issue with the speaker getting her slides to move on (solved by her leaving and joining the meeting again), the meeting went swimmingly well!

Marie-Carmen Alamar from Cranfield University spoke on the subject of 'Reducing food loss and waste through post-harvest technology'. This was a fascinating insight into what happens to crops after they have left the field. Globally there is an

enormous amount of food waste in store and Marie-Carmen spoke about the novel means by which they are tackling the issue.

One means is having sensors dotted around within stores that can detect levels of such things as ethylene, ethanol, acetaldehyde, ethane and methanol which are associated with ripening, fermentation and damage of one sort or another.

Potato storage

In any one year there are over 4 Mt of potatoes in stores and 310 kt of onions, so a sizeable amount of produce to keep fresh and healthy. Keeping potatoes healthy is mostly about preventing them from sprouting, which degrades their quality significantly, leading to a dark colour and unpleasant taste in crisps for example. As growers will not be able to use chlorpropham (CIPC) from October of this year, alternative means of sprout suppressant for the approximate 2 Mt of potatoes treated in this way is being sought. Cranfield is currently looking at ultraviolet-C irradiance as a non-chemical means of treatment but also at ethylene supplementation and induced hydrolysis. To understand the mechanisms involved they are carrying out fundamental studies to determine what controls dormancy and its break.

Novel packaging

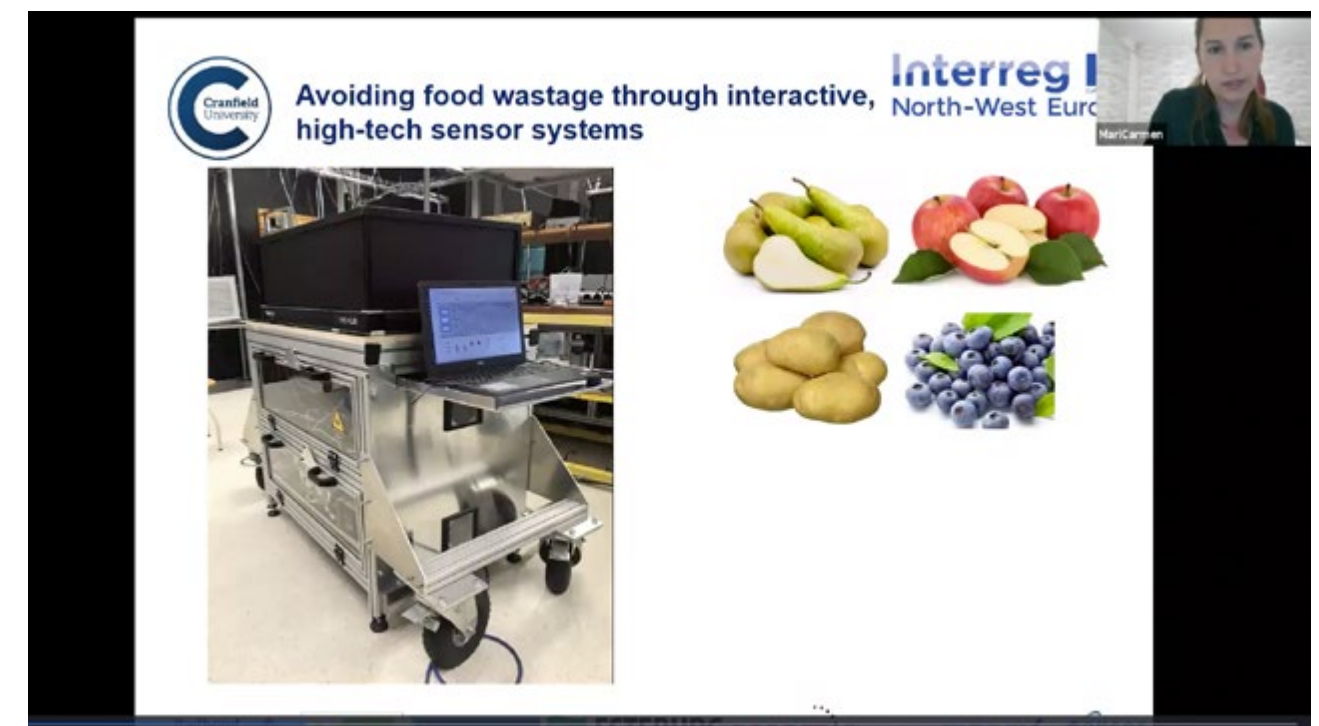
Amongst numerous other things,

Marie-Carmen spoke about novel packaging that for example could respond to the changing nature of produce contained within it. Also, of particular importance was keeping UK apples full of flavour when in store while maintaining their texture.

One of the other advantages of Zoom was that the audience could pose questions during the presentation by typing them in a 'chat' box in the lower section of one's screen. These could be displayed to all, individual participants or just to the chairperson. Several questions could be asked as the talk progressed, but it wasn't obvious that one had to press the enter key for them to be delivered and that was only learnt by chance rather than instruction!

When it came to asking questions to the speaker at the end, this worked really well - providing you remembered to switch your audio back on if you wished to ask the question in person. You could also be seen if you wished by turning on your own video.

Although one was only participating electronically, one did get a sense of camaraderie from the fact that one could see everyone, and they could respond to any quips or remarks directed at them! Overall, a good experience if we need to do it again, but it does not replace meeting up in person to socialise and network.



Membership Matters

Western Branch

Visit to Rexquote, Bishops Lydeard, Taunton, Somerset
20th November 2019

Report by Rupert Caplat, Western Branch Chairman.

A grey day in late November saw a cohort of nine members and guests visit Rexquote at Bishops Lydeard near Taunton.

Rexquote is renowned for their range of road-rail conversions allowing standard excavators, cranes, access platforms and tractors, to name but

a few, operate on both road-ground and rail track to carry out their various duties. The location was a fitting one as they occupy a site next door to the West Somerset Steam Railway's southern terminus and the platform was clearly visible from the meeting room.

The visit was hosted by Engineering Director, Roger Soper who was ably assisted by both Development engineer Jeremy Soper (Roger's son) and Design engineer Isaac Anderson. Roger gave an informative presentation on the history and current business of the company followed by a tour of the production facility and a further presentation by Jeremy.

Originally Rexquote was set up by Stephen Morris in 1988 as a general engineering company providing problem solving solutions

for companies including adding additional functions and hydraulic circuits on construction equipment.

Road rail conversions

A conversion on a Case excavator in 1991 gave them the opportunity to become the first UK company to specialise in road-rail conversions. Road-rail versions of excavators and site dumpers soon became the mainstay of this business. Roger did much of the early mechanical hydraulic and electrical design work on a contract basis. In 1995 the business moved to its current location in Bishops Lydeard and Roger became Engineering Director in 2000.

Direction of travel

When transitioning to rail drive most machines use a system to hydraulically push down rail wheel/ axles front and rear which lift the

road wheels clear of the ground but at the same time contact the now suspended road wheels to provide drive by friction alone. This results in the normal forward driving direction becoming reverse and vice versa. In other cases such as on tracked machines a separate hydrostatic drive of the rail wheels can be provided by radial, axial piston or gerotor motors fitted in the rail axles driving the wheels. The motors are driven by additional hydraulic circuits fitted to the machine.

A question was asked as to what was the maximum load an excavator can put on a single rail when lifting or excavating at 90degrees to the track. The weight of a train was more evenly spread across its bogeys, but maintenance operations differ greatly. Roger explained there were limits which have to be adhered to and that a larger diameter wheel can

allow the point load to be increased. The additional hydraulic circuitry and electrical functions on an excavator sometimes require the centre joint to be replaced for one with additional connections.

Backup power

As rail maintenance work is carried out under very strict rules and regulations with substantial penalty clauses for works overrunning, all machines have to have emergency backup powerpacks fitted to allow the machine to be recovered after a breakdown in the main systems. Rexquote tend to use small petrol and diesel engine driven or battery powered hydraulic powerpacks for this.

Rexquote work with the OEM machine manufacturer as closely as possible to ensure that the machine is not operated outside of the OEMs

guidelines and parameters and as such the OEM will warrant the base machine parts the same as they would the un-converted version. The converted machines have to be individually approved by appointed vehicle acceptance bodies before they can be operated on the rail network. All of the designs comply with the Machinery Directive and have the necessary CE marking as well as certification to mandatory rail specific standards.

Workshop tour

The presentation was followed by a tour of the workshop where we were shown work in progress on a Komatsu wheeled excavator, articulated site transport vehicles and two machines for vegetation control: one for bunching tree branches into transportable bales – the other a large capacity crawler mounted chipper; the inevitable result of maintenance work to cut back tree growth along the railway to avoid "Leaves on the Line".

Stability system development

A final presentation was given by Jeremy Soper on the work he had been doing in developing a control system which prevented machines being operated outside of their stability limits. This used a Parker iQAN electronic system programmed by Rexquote to accept inputs from sensors such as inclinometers, angle sensors, linear encoders (on the hydraulic cylinder) and pressure transducers and use the information to calculate the position of the attachment and load condition. Limitations on the movement could be made accordingly to override operator inputs and ensure safe operation at all times. The same system could be used to set virtual "walls" and "ceilings" to prevent the machine contacting overhead power lines and also reaching across adjacent live rail lines where trains would be passing.

It was a fascinating visit and thoroughly enjoyed by all who attended. Our thanks go again to Roger and his team for their much-appreciated hospitality.



Membership Matters

Direct drilling specialist appoints new agricultural engineer - Tom Carnell



Horizon Agriculture (formerly Sly Agri), Lincs based strip tillage and conservation ag machinery company, has appointed agricultural engineer and IAgRE member Tom Carnell as technical sales manager covering the south and west of the UK.

Commenting on his appointment Tom says, "It's a very exciting time for UK farming with the first real shift in support towards environmental matters in living memory. He continues "This will focus growers minds on cropping practices, carbon sequestration and soil health. Horizon's background and pedigree in strip tillage and minimum disturbance drilling ideally places them to work alongside growers through this step change in the business."

George Sly, managing director of Horizon Agriculture said: "Tom really strengthens Horizons approach to working alongside growers, with his background in technology implementation and practical agriculture, he's a great fit to help us

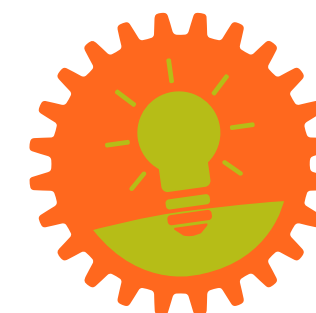
take the business forward."

Tom has a huge interest in agriculture which has come from an early age working on various different types and sizes of farms. This interest is still current today and Tom keeps hands on by helping at a friend's farm over harvest and seeding times in order to keep up to date with current practises and methods. Toms former job role at DICKEY-john took him all over the world working with major OEM's in order to support their business and develop products to meet the needs of modern farmers.

Tom's early career following Cranfield University began working for RDS Technology developing crop protection and seed application controllers and was involved with the development of early yield mapping systems.

For the past five years Tom has been with Dickey-John supporting precision farming technology in the UK.

Events and branch meetings



The current programme of IAgRE events and branch meetings is suspended due to COVID-19, pending changes in government advice regarding meetings.

The IAgRE is working hard to develop a programme of online resources and virtual meetings to help fill this gap. If you have any suggestions or would like to help please contact Sarah McLeod Secretary@iagre.org .

Update to CPD Requirements

As an active professional member of the IAgRE you will be aware that we expect you to complete CPD in order to maintain your membership and your professional registration and/or standing. Suitable CPD activities include courses, conferences, fieldtrips, online learning, webinars and relevant reading etc.

Of course, in these challenging times and with the current restrictions on commercial and social interaction, many of the events you would usually attend have been cancelled. This may impact the CPD activities you had planned for the year. We have been working with our licensing bodies, the Engineering Council and the Society for the Environment, who have agreed that the current situation will be taken into account when the CPD records are reviewed for 2020.

However, we have been taking steps to ensure that you will still have a variety of online options for CPD available to you. We have created a member page CPD Resources & Ideas <https://iagre.org/cpd-resources-and-ideas> that pulls together a variety of online resources we have made available to members including recordings of the 2019 IAgRE Landwards Conference, webinars from the Society for the Environment as well as training resources generously shared by IMI and IMechE. We are also launching a series of podcasts and intend to host online Branch Meetings and Technical Talks so do look out for eNews and contact us if you are not receiving it.

Landwards, as you are reading, is still in production so do make sure your online details are correct so that our publications reach you even when you are working at home! If you need any support with your CPD please do contact Sarah – secretary@iagre.org – who will be pleased to help and for Membership queries please get in touch with Alison – membership@iagre.org – who is on hand to assist.

Membership Changes

1/02/20 to 30/04/20

Admissions

Member

Mr Oliver Wood (East Midlands)
Mr Richard Larke (South East Midlands)
Mr Stuart Harper (Wrekin)

Associate Member

Associate

Affiliate

Mr Christopher Hortor (East Midlands)
Mr Marcus Bailey (Herts & Essex)
Mr Thomas Fielder-Shaw (West Midlands)
Mr Robert Shine (Southern Ireland)
Mr Nick Smith (Wrekin)
Mr Henry Partridge (Western)

Technician

Miss Poppy Burrough (East Midlands)

Academic & Commercial Members

Students

Harper Adams University

Woolley S

John Deere Training Centre

Sagrott F

Reaseheath College

Swain J
Ridout S
Hadingham M
Lee-Bott R

University of Reading

Gawai A

Easton College

Barrett N
Blackshaw D W
Burrough G A J
Chapman E
Hendry L
Lloyd T H
Mitchell Z
Nicholson A
Stimson O
Wright D

Readmission

Deaths

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

Mr P W Haw EngTech MIAgrE

(Yorkshire) a member since 1972

Mr D A Telford MIAgrE (Yorkshire)

a members since 1959, died peacefully aged 101.

Transfers

Fellow

Member

Mr Stephen Constable
(East Midlands)

Mr Benjamin Turner
(Herts & Essex)

Associate Member

Mr Tom Mead (South East Midlands)

Affiliate

Technician

Engineering council registrations

CEng

IEng

Mr William Tuer (Scottish)

Mr Declan Flynn (Yorkshire)

EngTech

Mr John F McAdam (Wrekin)

Mr Tom Mead (South East Midlands)

Society for the environment

CEnv

Mr Ackshay P Jungbadoor (Mauritius)

Academic Members

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
ORY

Newcastle University

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

Pallaskerry 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

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

Househam 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,
DYS 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

Long Service Certificates - April to June 2020

60 years

None

50 years

Mr JM Swanson MIAgrE 16/04/2020
Mr AJH Tulloch MIAgrE 16/04/2020

35 years

Mr AR Scott AIAgrE 29/03/2020
Mrs JL Smith AMIAgrE 29/03/2020
Mr CW Day AMIAgrE 28/04/2020
Mr RR Taylor AMIAgrE 23/05/2020

Mr MR Oldham AMIAgrE 01/06/2020
Mr S Peirson CEng Cenv MIAgrE 01/06/2020
Mr BP Weston Ieng MIAgrE 01/06/2020
Mr MS Tatlow AMIAgrE 06/06/2020
Mr RT Roadnight MIAgrE 06/06/2020
Mr RC Piper AIAgrE 20/06/2020
Mr RG Cole MIAgrE 20/06/2020

25 Years

Mr MT Cresswell EngTech MIAgrE 10/04/2020
Mr PR Earl AMIAgrE 04/05/2020
Mr AI Olorunfemi MIAgrE 15/05/2020

* Please note due to the Secretariat home working there is a delay in sending out Long Service Certificates, once the team are back in the office, this will be dealt with.

Out of hours

The call of the wild



Background

Steve grew up in Crieff, Perthshire, with three younger siblings (one brother and two sisters). He studied Civil Engineering at Edinburgh University, began work with consultants in Dundee and then moved to Tarmac National Construction before joining the Forestry Commission as a civil engineer. Steve then studied for a Masters in Forest Engineering at the University of New Brunswick in Canada, joined Forestry Commission Forest Districts as Area Engineer and Forest Manager for 18 years before joining Forest Research in 2007. Steve is still with Forest Research as Senior Communications Officer.

When did the interest start?

In 1991, Steve was invited by a work colleague to an emergency services open day with the idea of learning more about the retained Fire Services. However, an estate car with a stretcher in the boot stopped him on his way; chatting with the MR volunteers by the stand, Steve ended up joining Galloway Mountain Rescue team there and then.

Mountain Rescue roles

Steve has been an operational member of Tweed Valley Mountain Rescue for nearly 30 years. He started training with Search & Rescue Dog Association (SARDA) Scotland in 1992, with his search and rescue dog Tarah, and volunteered as a dog handler until 1997 and then as a 'body' for a number of years after that. "it's very much a hands-on role, getting out and doing the job."

Steve's first role in the national body, the Mountain Rescue Committee of Scotland (now Scottish Mountain Rescue), was as secretary, a post he held for six years. He says this allowed him to meet a lot of the teams around the country "it was good to know people all around." Steve said. Since being secretary, Steve has been vice chair, acting chair and for the past couple of years as Wellbeing Officer.

Steve Penny MBE *Tweed Valley Mountain Rescue*

Many will know Steve Penny as a friendly face at the FEG Symposium or through his work with Forest Research. When he's not professionally out in the woods he is often to be found in the hills of the borders as a very active volunteer with Mountain Rescue. Steve is a C.Eng and IAgRE member.

A family connection



In November 2019 Steve recalls "I got a letter informing me that I had been recommended by the honours committee for the New Year's Honours list. It took a long time to sink in, it was a real surprise. The challenge was keeping it quiet; you're not allowed to tell anyone until the 27th December, when it's announced to the press, and then on the 28th a list of names is published. The family wanted to celebrate and open a bottle of champagne, but I thought; 'I wish I could have done that 6 weeks ago!'"

The award of the MBE is particularly significant for Steve;

"my grandfather got an MBE in 1959 for services overseeing fuel rationing in Dundee during and after the war. He was also a special constable for over 20 years. I have a photo of him, my Granny, and my Dad. His [grandfather's] brother got an OBE for his work in the Dundee jute industry and spent his whole working life in India and Pakistan. My Dad was a GP and a police surgeon, so he was heavily involved in the community too. That service for community has passed down to us, and is embedded in who I am. So, one of the most valuable things in receiving the MBE was knowing my Grandpa had one too. Sadly,

my Dad passed away suddenly last August and he would have loved to have seen this; there was a sadness that tainted it but being able to celebrate the award at New Year gave us a lift."

Transferrable skills

When asked what skills from his career are applied to his Mountain Rescue volunteering Steve replied "I think it is probably more about the skills that can be transferred from Mountain Rescue into the workplace and this is a message we would wish to keep pushing to employers."

Landwards Conference 2020



LEAN AGRICULTURAL ENGINEERING AND RESILIENCE IN THE SUPPLY CHAIN



We are delighted to announce that the IAgrE will still host an annual conference this year. The topic will be the Application of Lean Principles in Agricultural Engineering, with expert speakers covering the supply chain, dealers, the farming perspective as well as exploring the principles of Lean Manufacturing.

A virtual conference delivered during 2020 culminating in live Q & A with all the speakers on a date to be announced in November.

Further details will be shared as plans progress.

For further details:

• www.iagre.org • secretary@iagre.org • 01234 750876

