Landwards

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In this issue...

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John Deere's GridCON tractor gives a view of what the future without fossil fuels may look like - see p12 for more.

Editors Welcome

Welcome to the winter edition of Landwards. Perhaps by the time you are settling down to read this, it will be the Christmas break, and I'm sure that I'm not the only one who will look back at 2020 in a very different light to past years.

Having finished the annual nip of port, festive mince pie and stared deeply into the flames of the fire, one might be forgiven for thinking that 2020 is a year to write off. Yet we have learnt so much.

Who knew that the car would become so unimportant for work? Unlike a decent internet connection along with Zoom, Webex and Teams which would become vital tools of the trade in our daily lives. Many things have been turned on their heads, but the importance of food has not gone away and the tools to do the job are equally important.

It's been a real pleasure to see how the Institution has reacted to Covid-19 with a strong output of lunchtime lectures and the annual conference heading online alongside the Landwards podcasts. All of which are available and signposted from iagre.org.

Mental health and wellbeing was one of the themes which emerged from the panel discussion at the Landwards conference. It's worth remembering that we are all flesh and blood, so despite the pressures of the day job it's OK to not be OK.

There is lots to get stuck into within this edition, so I wish you all the very best for Christmas and the New Year!

Andy Newbold

Andy Newbold

Editor

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UNIVERSITY OF Southampton

Southampton solution for turning carbon emissions into plastics honoured by Royal Society of Chemistry

Scientists from the University of Southampton have invented a hybrid catalyst platform that can efficiently and sustainably convert carbon dioxide into versatile plastic materials.

The Viridi CO_2 platform, created by Dr Daniel Stewart and Professor Robert Raja, has been recognised by the Royal Society of Chemistry (RSC) as a winner of its prestigious 2020 Emerging Technologies Competition.

The novel chemistry solution could be used to more effectively produce tens of millions of tonnes of plastics used annually in mattresses, clothing and building insulation, while also reducing carbon dioxide emissions.

In future, the technology could be retrofitted to the output streams of petrochemical refineries to close the carbon loop, representing a major step toward the UK's vision to bring all greenhouse gas emissions to net zero by 2050.

New guide seeks to improve the safety of tractor-trailer braking

The Agricultural Engineers Association (AEA) has published an updated edition of the **'Look Behind You'** guide to tractor-trailer braking. The guide is aimed at farmers, tractor drivers, mechanics and technicians - indeed anyone using, purchasing or maintaining tractors and trailers. It seeks to raise user awareness of what is needed from tractor-trailer braking systems, in order to obtain good performance and also to comply with the minimum legal requirements. It will also help users to make informed purchasing decisions and recognise shortfalls in the braking systems of their current vehicles.

Safety is a perennial issue for farming. That applies as much to the use of farm vehicles on the road as it does on farm. A key concern which comes up time and again is the safety of tractor-trailer or tractor-trailed implement combinations. Ten years ago, prompted by a spate of premature tractor brake failures linked to inadequate trailer brakes, the AEA published the first edition of the **'Look Behind You'** guide.

Since then, much has changed. Tractors, trailers and trailed implements are bigger, more tractors can now reach 50 km/h (30 mph) and pneumatic (air) trailer braking systems are more common. Certain UK legislation has changed and new EU Braking Regulations for agricultural vehicles have arrived.

Although tractor-trailer braking in the UK has improved, more still needs to be done - so the AEA Service Managers' Group has revised and updated the **'Look Behind You'** guide. A comprehensive technical overview, the revised guide still provides the basic information but, importantly, it now also covers the increasingly complex braking systems found on modern tractors and trailers. The **'Look Behind You'** guide provides the right level of information to raise awareness and highlight important features which, if addressed, will improve vehicle operation and enhance overall safety. Readers are also advised what maintenance activities may be performed on-farm, following appropriate training, and where it is important to seek specialist help.

As well as bringing the content up to date, the advance of media technology since the first edition was published has allowed new features to be built into the new **'Look Behind You'**. An online version includes several videos to introduce key topics plus animations to help users gain an advanced understanding of some of the most important concepts. This version can be downloaded, so all the features can still be used without an internet connection.

Exports around the world

Knight Farm Machinery, based at South Luffenham, Rutland, is continuing to benefit from an outstanding export trade, notching up over 50 sales to Japan in the past decade, securing new orders from Israel and New Zealand, and opening up a fresh market in Belgium.

Japanese sprayers

The Japanese orders are for high specification vehicles with a fully-equipped Claas cab and rear-mounted engine, to which the Japanese spray manufacturer Kuroda adds a centrally located spray tank and front-mounted boom:

"Over the past decade they have taken 50 vehicles and we have just received the order for a 51st, with more potential orders in the pipeline. This market has become an extremely important part of our business," says David Main, Knight's Sales Manager. The sprayers are used on a wide range of crops including field vegetables.

Knight has also sent its seventh self-propelled sprayer to a major kibbutz operator in Israel, fitted with an air sleeve boom.

It is also expanding its presence in New Zealand, with the latest order being for a 2000 series self-propelled model, for a farmer who is moving up from his previous 1800 series machine.

The company has also delivered two 1800 series self-propelled chassis and spray tanks to a new distributor in Belgium, to which the importer will add their own spray pack. A 2000 series machine is due to be delivered to the country later this year.

Early Knight built self-propelled vehicle fitted with a Kuroda-built sprayer ready to work in Japan

Congratulations to Dr Clare Butler-Ellis

Congratulations to Clare for reaching the finals of the Women's Leader Awards and then winning the category of Science, Engineering and Maths. Excellent news and well deserved!

Clare was nominated for the award by Professor Jane Rickson who wrote: "With an academic background in physics, Clare Butler Ellis is a role model to many young women who may not originally consider engineering as their preferred career path. Successfully balancing research and business, Clare demonstrates that women can make meaningful contributions in sectors traditionally populated by men. "

Women Leaders UK is the brainchild of Jan Flawn CBE, founder of specialist neurological care provider, PJ Care, based in Milton Keynes and in Peterborough. After winning the national CBI First Women of Business Services award in 2013, Jan realised how important it is to celebrate the achievements of women.

Jan set about inspiring a group of activists, passionate to develop the idea and in March 2015, on International Women's Day, the first Women Leaders Awards was launched in Milton Keynes.

DEFRA consultation on N emissions from agriculture underway

Department for Environment Food & Rural Affairs

Ammonia is an air pollutant that is detrimental to our natural environment and is a pre-curser to particulate matter, which is detrimental to human health. The United Kingdom's statutory obligations to restore degraded habitats and reduce ammonia emissions by 8% by 2020 and by 16% by 2030 mean that we must act urgently to tackle ammonia emissions. As ammonia emissions are predominantly from agriculture (87%) and around 8% are from the use of solid urea fertilisers, DEFRA's consultation seeks views on three policy options that provide the greatest reductions in ammonia emissions from regulating the use or sale of solid urea fertilisers. See; https://consult.defra.gov.uk/air-quality-and-industrial-emissions/reducing-ammonia-emissions-from-urea-fertilisers/
for more information.

The consultation closes on

26th January 2021.

JCB launches first ever electric Loadall

The 525-60E uses two electric motors, one for the driveline and the second to power the hydraulic system

It's been over 43 years since JCB first pioneered the concept of telescopic handlers, but now the new electric 525-60E has been unveiled marking another step in the history of this popular telehandler.

Designed to deliver the same performance as the conventional diesel-powered machine, the 525-60E offers a zero-emissions load handling solution for use in agriculture and commercial horticulture, as well as for groundscare, landscaping, construction and industrial applications.

The 525-60E uses two electric motors, one for the driveline and the second to power the hydraulic system. The 17kW traction motor drives through a permanent four-wheel drive dropbox, to proven JCB drive/steer axles.

The 22kW hydraulic system motor powers a fixed displacement gear pump, delivering a maximum 80 litres/min of flow. Flow is proportional to joystick position and the lift end is controlled by an electro-hydraulic valve block, with hydraulic regeneration on boom lower and retract. The electric motors are 85% efficient, which compares well with the 45% efficiency of a diesel engine. Extensive analysis of customer duty cycles, through JCB's LiveLink telematics system and on-site studies, tests and evaluation, has allowed JCB engineers to optimise the machine's battery to meet customer requirements. The 96V Lithium-ion battery, is capable of providing full-shift operation.

Regenerative braking

The traction drive motor utilises regenerative braking, instead of a traditional braking system, topping up the battery in the process. The hydraulic system also regenerates flow whilst lowering the boom, reducing the power requirement and extending operating hours. The brake regen function automatically turns off when the battery is fully charged.

The machine has the same on-board charger as other JCB E-TECH products, capable of recharging the battery in eight hours using a standard 240V, 16A electrical supply. An optional JCB Universal charger can be used for a rapid top-up during breaks, in as little as 35 minutes.

From the CEO's desk

Having been an IAgrE member for 27 years, it's now my great privilege to be appointed as the Chief Executive Officer of this prestigious organisation. Agriculture and engineering have been two constants in my life, so what could be better?

After 24 years in engineering within JCB, my new role is a significant change in career direction , but one I'm keen to get stuck into. It's certainly very odd starting a new role where the first thing you want to do is get out and about and meet people, but like many others, I'm making use of the various on-line video comms platforms instead. As I write this article, we've just entered lockdown two. With schools and colleges open, it seems a little less restrictive, and some would argue pointless, but I shan't comment on that!

I don't know about you, but I'm glad the US elections are over, as we had something far more interesting going on, we held our first on-line Landwards conference. We had an excellent line up of speakers from an array of sectors in our diverse industry. Martin Hamer took us through the challenges and changes Fendt went through to keep the production lines rolling tractors out safely. Richard Halsall gave us the dealer's view on how they managed to keep equipment flowing from factories to customers, whilst still providing that excellent JD Dealer support. John & Henry Shropshire blew many of us away with the immense scale of their global fresh produce operations, along with their professional handling of the Covid-19 pandemic in their significant work force. Mark Cooper gave us some very thought-provoking views of being lean and having a lack of preparedness when unknown unknowns raise their ugly heads! And finally, Simon Pearson gave us a fascinating glimpse of what the future holds in terms of autonomous fruit picking and how we can reduce the risk associated with a very labour-intensive process. For those that have not had chance to view the presentations, I'd urge you to do so via our website.

Registered Environmental Practitioner

At an operational level, team IAgrE has been busy applying for a licence to award the new Registered Environmental Practitioner (REnvP) grade for the Society for the Environment. As some of you know, we've been licensed to award CEnv for some time now and we hope the new REnvP will be a popular choice for graduates working in the environmental industries within our sphere.

In between the latter I've been starting to contact all the colleges and universities that offer land-based and agricultural engineering courses, to get an understanding of education and ensure IAgrE has a relationship with them going forward. One thing that is very clear to me, if we want to attract people and skills to our industry, we must make our industry both visible and attractive to people.

And finally

Despite the pandemic, my passion for match ploughing has been satisfied a little, I've managed about six matches this year (it's usually a lot more!), with a few red and blue prize cards to boot. It was also a timely reminder of how important it is for people to socially interact (or banter as I call it) with each other to benefit their mental health and wellbeing. We're certainly living in uncertain times at the moment, some of the businesses our members work in are very fragile.

The IAgrE prides itself on being a very personable institution, so if you need some help and support, then please get in touch.

Charlie Nicklin C.Eng MIAgrE

ceo@iagre.org

Presidents Musings

Paul Hemingway

A reflection and a call to action

As I write this, we are enjoying a glorious autumn day, the American election has come and gone and the announcement has just been made that key workers may well see a Covid vaccine before Christmas. At the end of what has been a really challenging year there does seem to be light on the horizon with 'just' the Brexit bridge to cross before we get there.

One way or another our arable farmers have had a really difficult 12 months – a sodden autumn 2019 making winter planting impossible for many; drought in early summer and a very catchy harvest – all resulting in wheat yields some 15% down compared to the five year average. Grain quality has also been very mixed – a challenging time all round. Let's hope that the coming season fares better – there's certainly far more planted than this time last year.

Conference reflection

I hope you managed to view some of the 2020 IAgrE Annual Conference presentations even if you weren't able to join us on the day. They are still on-line of course so please do try and view some of them.

Thanks are due to the whole Secretariat team for the effort put into mounting this event which seems to have been very well received. The question and answer session was well attended and provoked some really stimulating discussion. Thanks as well to Andy Newbold for not only recording and editing the presentations, but for also chairing the Q&A.

Dealer business

I read with interest of the expansion of the Chandlers' (Eastern Counties Agco dealers) organisation through takeover of certain of the Lister Wilder (South of England Agco and Kubota dealers) branches and activity. Along with changes in the John Deere dealer network it does seem that the future lies in large, well-capitalised dealer operations able to stock, trade and of course service the large machines of today at the price levels they command. All this is a very far cry from my early days in the industry where most tractor manufacturers limited the scope of dealers for fear of them becoming too powerful.

A call to action

I've been involved, along with our new CEO in a recent meeting of LE-TEC, the cross-industry organisation originally conceived by Chris Whetnall, a previous CEO of IAgrE with the aim of giving our industry a single voice in matters appertaining to training and education, particularly of Technician level Engineers.

The organisation comprises members from IAgrE, AEA, the agricultural machinery manufacturers' association and BAGMA, the agricultural machinery dealers' association.

There is currently a working group being formed to frame the content of the next generation of Landbased Engineering Apprenticeships at Level 2 and 3 (and possibly Level 4). If you work for an organisation that employs this type of engineer and have an interest in training, please do get involved. If you make contact with the Secretariat, they will point you in the right direction.

In the meantime, may I be amongst the first to wish you all a very Peaceful Christmas and a very Happy, Prosperous and Covid-free New Year.

Paul Hemingway.

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.

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Biosystems Engineering
Volume 195, July 2020, Pages 227-241

Managing soil compaction – A choice of low-mass autonomous vehicles or controlled traffic?

John E. McPhee, Diogenes L. Antille, Jeff N. Tullberg, Richard B. Doyle, Mark Boersma

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University of Queensland, St Lucia, Brisbane, Queensland, Australia

Approaches to managing the impacts of soil compaction include minimisation (reduce load), remediation (tillage) and confinement (control traffic). Integrated 'swarms' of low-mass autonomous machinery have recently been suggested as a means of reducing compaction and an alternative to controlled traffic. Combine and potato harvester machinery relationships were used to predict the specifications of potential low-mass harvesters for use in soil compaction modelling. Results suggested that combine harvester gross vehicle mass must be less than 6 Mg to keep the modelled soil bulk density below 1.4 Mg m−3. With this constraint, 6 to 9 small harvesters (~50 kW) would be required to replace one Class 9 (>300 kW) harvester. A fleet of this size would require access to unloading facilities every 2.5 – 3 min for the modelled yield conditions. For root and tuber harvesting, which results in a high degree of soil disturbance, no low-mass harvester option was found that would avoid compacting the soil to unacceptable limits. Avoiding soil compaction while maintaining acceptable productivity will pose considerable design and logistics challenges for low-mass grain, root and tuber vegetable harvest machinery. Integrating controlled traffic farming (CTF) and medium-capacity autonomous machines may be a better solution for both soil compaction and operational logistics than low-mass swarm technology.

Biosystems Engineering
Volume 196, August 2020, Pages 112-126

Measuring soil coverage using image feature descriptors and the decision tree learning algorithm

Dylan C. Owen, Michelle T. Bensi Allen P. Davis Ahmet H. Aydilek

Department of Civil and Environmental Engineering, University of Maryland, USA

Quantification and identification of ground cover plays a key role in erosion modelling, weed measurement, plant disease identification and other environmental applications. Currently, a variety of methods are used to mechanically classify digital images for ground cover. Only a few of these methods can distinguish green vegetation, straw/dormant vegetation, and exposed soil using only the Red-Green-Blue (RGB) spectrum. An approach to classifying ground cover using standard JPEG images was used. Block segmentation, as opposed to pixel-wise or object-based segmentation, was used and compared with multiple machine learning approaches. The most successful classification approach was the decision tree algorithm with a 70-pixel block size and 60% classification acceptance threshold. Images were reduced to three feature descriptors: colour, texture, and oriented gradients to represent the respective RGB spectrum for an image. The produced classifications were compared to manual coverage classifications using a grid-based method, with R-squared values of 0.86 for green vegetation, 0.87 for straw/dormant vegetation, and 0.96 for exposed soil, respectively. This method showed strong performance for images containing exposed soil and either green vegetation or straw/dormant vegetation. The method was less effective for images with large quantities of both green vegetation and straw/dormant vegetation probably because of their similar shape.

Biosystems Engineering
Volume 197, September 2020, Pages 105-121

Analysis of passive downdraught evaporative cooling windcatcher for greenhouses in hot climatic conditions

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In hot climates, greenhouse cooling is essential to provide crops with suitable growth conditions. The combination of natural ventilation strategy such as windcatchers and evaporative cooling has the capability to decrease the energy requirement of greenhouses and provide improved conditions for the cultivation

The Landwards podcast

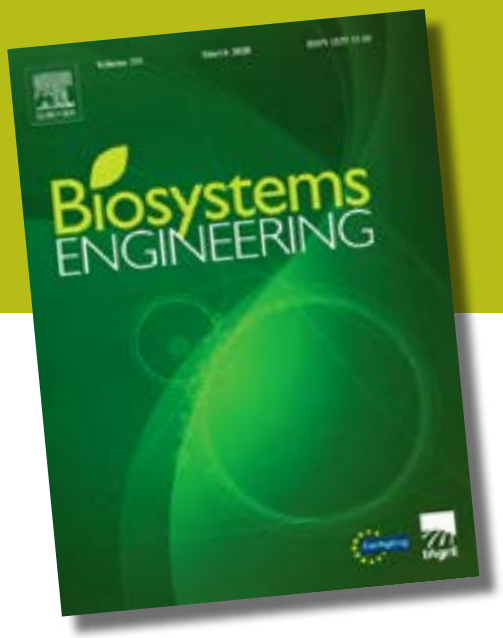
A series of podcasts have been commissioned with a monthly news podcast and a monthly interview with an agricultural engineer or influential person in the land based sector. The Landwards podcast is on iTunes, Spotify or click on

https://www.buzzsprout.com/1067353/episodes

for the latest one.

both paper and electronic versions.

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



of crops. Although the windcatcher is a traditional architectural feature which originated in the Middle East, it has recently gained more attention and is increasingly being employed in buildings as a wind-driven cooling technique. This study aims to investigate the potential of a passive windcatcher and evaporative cooling system integrated into a greenhouse using computational fluid dynamics (CFD), validated with experimental data. Different wind speeds and ambient temperatures and relative humidity were considered. The average error between measured and simulated results was 5.43% for the cross-flow ventilated greenhouse model and 4.55% for the evaporative cooling spray model. The results showed that the windcatcher system could reduce the average indoor air temperature by up to 17.13°C. The study explored the influence of different windcatcher heights and also the potential of fins installed in the windward openings to improve the uniformity of the ventilation airflow.

The study also assessed the influence of neighbouring structures or other greenhouses on the ventilation performance. The results showed that the windcatcher provided higher airflow rates as compared to side openings when other structures surrounded the greenhouse.

A great time for researchers

EurAgEng Secretary-General Ivo Hostens, writes in the latest newsletter:

More importantly this crisis painfully shows us our vulnerability but also shows the gravity of the humanity's impact on our planet in terms of biodiversity and climate change. The resulting higher public acceptance of drastic actions is reflected in the higher limits put in the European climate strategy.

55% reduction of CO_2 compared to reference year 1990 (State of the Union). That will not be reached only with housing insulation and electric cars. Other sectors will have to bring in their fair share. And what about agriculture? The Farm to Fork strategy, as published in May, already put environmental reduction targets for 2030 with:

- a reduction by 50% of the use and risk of pesticides,
- a reduction by at least 50% of nutrient losses in the environment,
- a reduction by at least 20% of the use of fertilizers,
- a reduction by 50% in sales of antimicrobials used for farmed animals and aquaculture,
- reaching 25% of agricultural land under organic farming.
- Also 10 % of agricultural land should be reserved for landscaping.
- and to restore degraded ecosystems and improve the capacity to absorb carbon dioxide, it proposes planting at least 3 billion trees.

But more is in the pipeline. Both farmers and European Commission see agriculture and forestry becoming "the first sector to deliver net zero greenhouse gas emissions" and balancing out greenhouse gas emissions from other more polluting sectors and this by 2035. Soil carbon management is one of the negative emissions technologies that could help to remove greenhouse gases from the air. But there are some angles. The Carbon trading scheme will not be a big driver with the low carbon prices, so subsidies will be necessary from CAP and other sources. It is also not clear how this affects our international trading deals. And finally how can this all be monitored to ensure a level playing field and reward farmers based on results?

Great time for researchers! Old and new ideas will be explored and worked out. New technologies will make their way. Future European research calls will focus on the new challenges. Certainly digital farming will give a boost on smart farming with improved monitoring and with the necessary support tools for farmers to reduce production costs while improving the ecological balance. There was already a first workshop organised from the Directorate General CNECT (unit IoT) and DG AGRI (unit research) to identify the gaps to be solved on creating a common European data space. Hopefully it will help to boost data sharing, including large, high quality data sets for research purposes.

Practice:
Alternative fuel sources

Jonathan Scurlock

Our friend electric?

The future of diesel as farming's fuel of choice is under severe threat, with current and impending legislation expected to curb its use. Jonathan Wheeler investigates

Forward thinking machinery companies realised this some years ago and have been developing alternative power sources.

Work has concentrated on two main systems – one all-electric and the other combining electric power with bio-fuels.

In both cases they offer farmers the chance to generate their own fuel via solar panels and bio-gas reactors. This could cut costs and help improve the industry's environmental profile.

Lack of infrastructure

This is a point emphasised by Dr Jonathan Scurlock, the NFU's chief adviser on renewable energy and climate change:

"Electrification of agricultural machinery could contribute towards the NFU's net zero 2040 goal for farming by helping reduce emissions."

At the moment, he says the supporting infrastructure - notably availability of charging points – is lacking and major improvements are needed if rural businesses and communities are to rely on electric vehicles.

And until that infrastructure is established the NFU supports the use of high bio-fuel blends, such as E10 ethanol and B20 biodiesel.

A 2019 survey of NFU members indicated that many of the 131 respondents thought battery-powered tractors and machines would be available in five to ten years.

Five per cent of them already had an electric car or van:

"Lower running costs and enhanced safety are expected to be selling points. However, higher purchase costs, limited range and recharging down-time were seen as possible drawbacks".

Could farmers soon be generating their own fuel?

EV advocate:

One NFU member, who is already a keen advocate of electric vehicles, is Vice President Stuart Roberts, who uses a Nissan Leaf for his union work.

On a personal level, he says that – having driven an electric car for two years – he will probably never buy another vehicle with a combustion engine.

But he feels the technology needs to be better proven before he would invest in electric tractors, with the current limitations of battery storage being a key issue:

"A farmer could be generating electricity all the time, but not be using the tractor every day. It would be useful to be able to store that energy and use it when needed.

"The real question is can we replace our 200hp tractor with an electric model, or might we have to rely on a fleet of smaller vehicles?"

The answer to that question might lead to a radically different sort of working vehicle appearing on farms, he adds, highlighting the fresh approach being taken by the likes of the Small Robot Company.

And farms that did generate electricity for their own vehicles could achieve a major public good and create an income earning opportunity by selling power to neighbours and visitors.

Practice:
Alternative fuel sources

John Deere's autonomous tractor

Electric company

One company firmly in the electric camp is John Deere, while CNH sees hybrid machines as the way forward.

While Deere has pioneered hybrid machines in the amenity market, it's latest research projects use electric power - the Joker, SESAM and Grid-CON concepts.

The Joker is a fully autonomous electric tractor, while the SESAM is also electric and based on a conventional chassis.

The GridCON is fully electric and autonomous, but powered by a cable, and with a range of up to a kilometre from the connection point.

Nicolai Tarasinski, manager of advanced engineering at the company's Kaiserslauten development centre, is an advocate of electricity as a power source. He believes working models will appear in the next decade:

"Electrically-driven vehicles are very efficient when it comes to energy consumption and the weight to power ratio/power density.

"The drive lines are very easy and fast to control, and that is a requirement for autonomy. The absence of emissions, and of engine/gear oil is a crucial environmental benefit."

Bio-fuels are already coming under pressure, with legislation coming into force in coming years, and hydrogen fuel cells have been displaced because they are too limited:

"You can't carry enough fuel for a day's work, and those fuels will not reduce the CO_2 footprint with the big steps that society wants to see.

"Power from fuel cells is similar to power from batteries."

Hybrid beast

But CNH is taking a different approach, with its work concentrating on hybrid vehicles powered by both electric and bio-fuels.

Machinery consultant Dr Robert Merrall says the key issue is energy density.

Experience from road transport suggests that electric batteries simply don't have the required density to provide enough power for long-distance or heavy-duty work.

"Industry feeling is that long haul and heavy-duty applications will be better served by low carbon-producing fuels

New Holland's T6 - methane powered tractor

like bio-gas," said Dr Merrall.

"Battery power is likely to be more successfully applied for lighter duty tasks.

"The size of batteries needed for today's high-power tractors would weigh so much that the vehicle's carrying capacity would be severely compromised."

He feels gas is a better power source, although not without its own challenges, notably the need for pressurised tanks and pipework.

"By their nature, gas tanks need to be cylindrical to handle the pressure (200 bar), and cannot be fitted or moulded around other engine elements as diesel tanks can".

Farm produced gas

Mark Howell, global product manager for alternative fuels at New Holland Agriculture says much farm-produced gas would need expensive refining to be usable:

"There would be real benefits to making such fuels more widely available and reducing fossil fuel use.

"The power and torque will be the same but running costs will be much lower.
"There are already 65 farm sites producing grid quality gas in the UK. It is a fuel of the here and now rather than of the future."

Mark Howell

He believes re-fuelling would be much faster, removing a key drawback of electric power.

High horsepower hybrid

Christian Huber, vice president global tractor product management for Case IH and Steyr, says hybrid power is the key to higher horsepower:

"If you want 200hp and higher our experience has shown that hybrid power is the only viable solution."

Hybrid tractors could be a real boon to farmers working around the clock and keen not to disturb sleeping neighbours.

The tractor could run on bio-fuels during the day, but switch to near silent and zero emission, electric drive when travelling through villages or working in grain stores.

The higher purchase price should be offset by lower running and maintenance costs, as hybrid vehicles will have fewer moving parts, so would need much less lubrication and servicing:

"There is a clear requirement for a tractor that can run eight to ten hours a day without needing to stop to re-charge. That is something the industry needs to achieve."

Christian Huber

STEYR Kenzept full exterior

Practice:
Dryer control system

Institution member and farmer Andrew Cragg saw an opportunity for the farm when his son Edward came home from the Far East as COVID-19 broke out in March.

After graduating from Leeds with a degree in electronics and music, Edward went on to do a Masters in embedded systems at Leeds. After several years working in Manchester he decided to take a break and go travelling. One year later he had reached Vietnam when Covid-19 prematurely curtailed his plans.

Old school

Brooker Farms has a 43-year-old Wilder RoboMatic 90 batch dryer still in good working order and the farm's mainstay for corn drying. Being analog, the performance is reliable but a little fuzzy and control relies on hardwired logic circuitry. Edward's brief was to digitise and partially automate the controls; as well as capture and record data from each drying cycle; monitor and record drying temperatures; then publish all

The brief was to digitise and partially automate the 'old school' dryer.

this information to a web page for viewing in the office and mobile phone.

The first challenge was to know what the dryer was doing at any time. This was achieved by building an interface unit monitoring the legacy control circuits using optocoupled mains detection circuits.
The user control unit, with a 480×320 graphical LCD and matrix keypad communicates with the dryer interface and temperature sensors using a custom serial protocol over RS485. All operational data – principally input and output moisture readings are entered on the user interface with assisted setting and control of drying time based on expected drying rate. A real

Practice:
Dryer control system

time clock (RTC) allows for accurate timing of all drying stages:, loading, drying, cooling and unloading. This gives predictions and alerts for the next drying cycle time when user intervention may be required. Battery-backed state information, crucially allows for recovery from any power interruption to the whole system without adverse effects. The current process time is maintained even after a power cut.

Data storage

All operational data is stored to a custom content addressed store (CAS) stored on an SD card. The control unit transmits real-time data over MQTT to the web interface service running on Raspberry Pi, as well as historical data on request. Drying temperatures in each of the four corners of the dryer along with

Control Unit

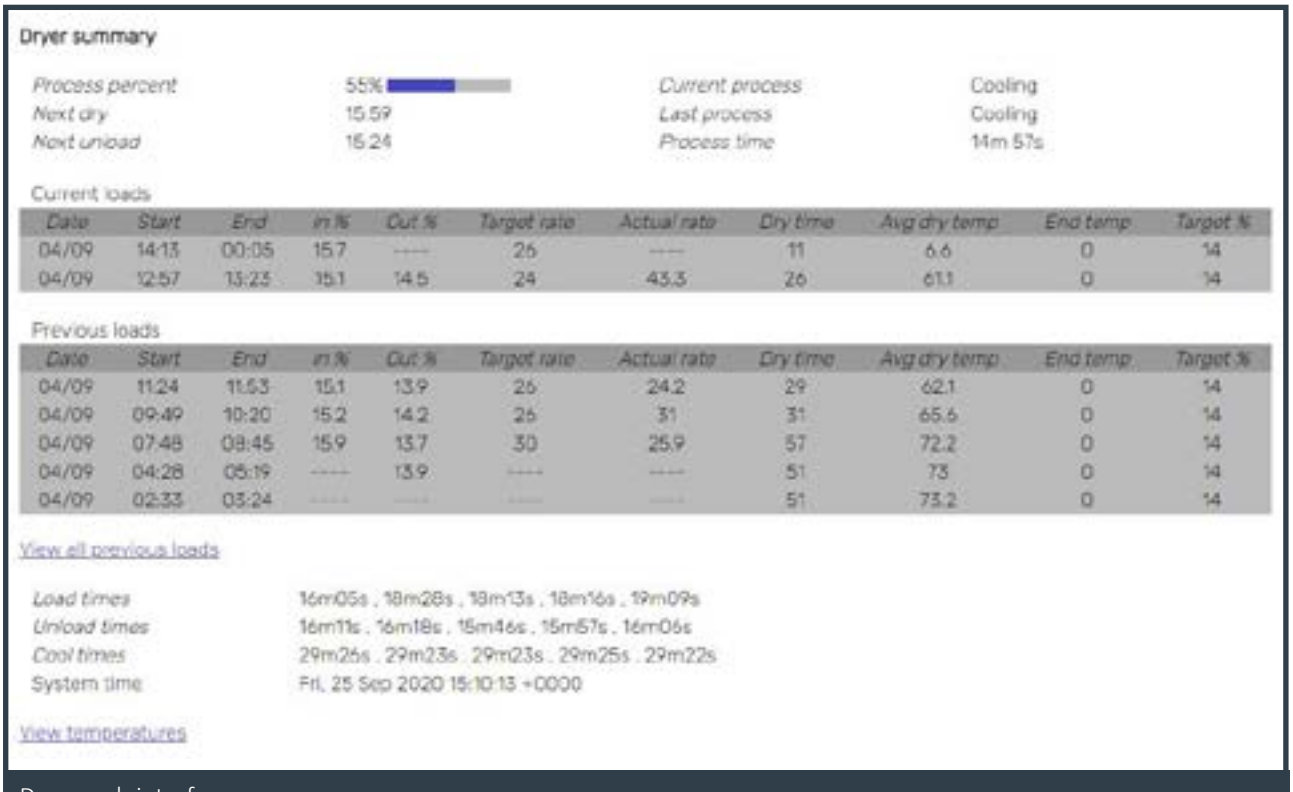
exhaust temperature are measured and logged. Being able to view drying temperatures over the cycle in graphical form has enabled far better balance and control of drying temperature especially as this smooths out the inevitable fluctuation with a high/low flame burner. Of particular interest is the relationship between exhaust temperature and moisture content of dried grain.

Future plans

As drying progresses and grain dries, the exhaust temperature rises as energy used in the latent heat of evaporation of grain moisture decreases. Wilder knew this and fitted a mercury balance thermostat alongside an analogue gas probe temperature gauge with the instruction that after observing a few drying cycles, a relationship could be established between exhaust temperature and desired final grain moisture. This allows drying control as a function of exhaust temperature rather than the more traditional

drying time = [input mc - target mc] x [mins time to dry 1%]

The problem was that the resolution of the temperature gauge and the precision of the thermostat prevented reliable correlation and was rarely used. Next year the aim is to use the new system to accurately determine this correlation and so operate largely automatically.



Dryer summary

Process percent	55%	Current process	Cooling
Next dry	15:59	Last process	Cooling
Next unload	15:24	Process time	14m 57s

Current loads

Date	Start	End	in %	Out %	Target rate	Actual rate	Dry time	Avg dry temp	End temp	Target %
04/09	14:13	00:05	15.7	----	26	----	11	66	0	14
04/09	12:57	13:23	15.1	14.5	24	43.3	26	61.1	0	14

Previous loads

Date	Start	End	in %	Out %	Target rate	Actual rate	Dry time	Avg dry temp	End temp	Target %
04/09	11:24	11:53	15.1	13.9	26	24.2	29	62.1	0	14
04/09	09:49	10:20	15.2	14.2	26	31	31	65.6	0	14
04/09	07:48	08:45	15.9	13.7	30	25.9	57	72.2	0	14
04/09	04:28	05:19	----	13.9	----	----	51	73	0	14
04/09	02:33	03:24	----	----	----	----	51	73.2	0	14

View all previous loads

Load times	16m05s , 18m28s , 18m13s , 18m16s , 19m09s
Unload times	16m11s , 16m18s , 15m46s , 15m57s , 16m06s
Cool times	29m26s , 29m23s , 29m23s , 29m25s , 29m22s
System time	Fri, 25 Sep 2020 15:10:13 +0000

View temperatures

Dryer web interface

For the technically minded

Control unit:

STM32 ARM microcontroller at 180 MHz,

Firmware written in C and C++ using Arduino framework.

Custom graphical LCD user interface (GUI) framework, written from scratch in C

Wireless connectivity provided by an Espressif ESP8266 wireless system on chip

Data in CAS stored on an SD card, serialised and deserialised as JSON and freely synchronisable with the web interface via a simple request-response protocol on top of MQTT, using JSON.

Multi zone digital temperature measurement - 5x K type thermocouples + digital amplifiers

RS485 serial protocol uses efficient MessagePack serialisation and Consistent Overhead Byte Stuffing (COBS) to packetize messages, with CRC32 based integrity checks. Overall, this allows for a resilient addressable network which functions reliably in an electrically noisy environment.

Web interface uses advanced features of the Rust programming language namely type safe and statically checked deserialisation (using Serde) from protocol JSON messages into memory and futures based asynchronous programming techniques, allowing it to handle high loads of input from concurrent sources very efficiently using a threadpool - from web clients, the MQTT protocol and its backing database.

Ideally the firmware would also have been written in Rust for greater determinism, safety and freedom from memory bugs, but time constraints didn't allow for this with the lack of maturity in current embedded Rust.

Practice:
Renewables and net zero

Integrated On-Farm Renewable Energy – Optimisation and the path to net zero.

Removal of the feed in tariff poses a challenge for investment in integrated on-farm renewable energy at a time when the move to net zero is needed. Brian Robinson reports.

The British farming industry was granted access to a major resource to enhance productivity when rural electrification was delivered. The challenge now is to optimise renewables within farm energy use and, in so doing, embrace new control technologies on farm and at the grid edge.

The challenge is to optimise renewables within Farm energy use

The feed-in tariff replacement, the smart export guarantee, pays for export not total generation and payments are typically much more modest.

The challenge is a paradigm shift, from maximising the feed-in tariff, to optimising the choice, size and integration of renewable generation with the farm consumption profile. This article aims to describe an approach to optimising selection of renewable generation, load, import and export tariffs, as well as electricity network connection at a specific location and farm type.

Farmer interest in reducing energy costs, actively engaging towards Net Zero, and increasing resilience, are all ongoing and remain important production factors.

Sources of funding

The network companies, and other organisations, have access to innovation funding with scope to encourage development of enhanced solutions to the issues raised with possible opportunities for the farming industry to take an active part.

Optimisation has the potential to make a real difference to individual farm businesses across the full spectrum of enterprise size and is targeted at on-farm integrated installations, rather than stand-alone large-scale developer projects. It is perhaps at the smaller enterprise where funds are not available for consultancy, but where the benefits of optimisation advice can deliver important savings and are most acutely felt.

There is scope for greater agricultural representation in the innovation initiatives available and it is important for the future that this takes place.

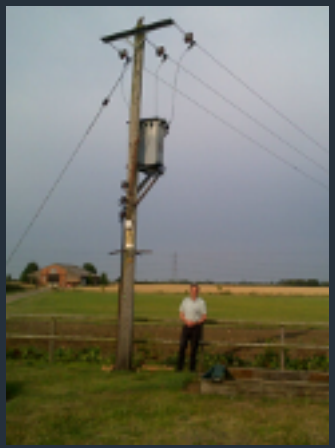
The optimisation problem presented by integrated farm renewables crosses agricultural engineering as well as electricity generation and distribution domains.

Key support not yet fully available to address this challenge are;

- Farmer access to an independent expert/intelligent computer model for supporting informed optimisation decision making from project inception to operation, through the application of systems engineering.
- Comparative data available from the field, on renewable installation key performance metrics as to the actual level of performance achieved, that can be used to provide updated best practice benchmarks, validate models, support decision making, and target operational performance enhancement.
- The need for cross domain innovation projects that target optimisation based on collaboration between agricultural and engineering disciplines utilising new technology.

About Brian Robinson BSc CEng MIAgrE

Brian is an independent chartered engineer with 38 years of experience from the electricity, ICT and agricultural industries. Recent activity included leading an international company's UK smart grid team and its involvement in a portfolio of innovation projects with electricity distribution companies.



Profession:
Conference report

Conference report – Lean and resilience in agricultural engineering.

This year's Landwards conference took a different tack due to Covid-19 with a series of pre-recorded speaker presentations on the IAgrE's YouTube channel, followed by a live virtual panel discussion on 4th November. Jonathan Wheeler reports.

Recovering from COVID

The agricultural engineering sector could play a key role in the country's recovery from the Covid-19 pandemic, suggests Paul Hemingway, IAgrE's president:

"One thing that Covid has done is to focus everybody's minds on the need to put food on the plates of the country.

"You don't need more than a few days of food shortages for people to get quite agitated and start panic buying."

He hopes that focus will lead to an increase in UK food supply, and that the farm machinery sector will benefit.

Covid-19 had displaced Brexit as the primary topic of the year, but he stressed that the latter was still a threat, especially if – as expected - Government support to farmers was reduced.

One thing that Covid-19 has done is to focus everybody's minds on the need to put food on the table.

That made it all the more important for the sector to ensure it meets the demands of its customers:
"Value is what the customer is prepared to pay for. If they are not prepared to pay a little bit more for that thing that you are doing, you probably shouldn't be doing it."

Paul Hemingway

Same problems - different responses

Farm machinery manufacturers faced an oddly contrasting set of circumstances when the Covid-19 pandemic started, Martin Hamer from Fendt told the conference.

The company's manufacturing plants, parts departments and dealer networks all had to respond in slightly different ways to the pandemic:

"It was necessary to close manufacturing plants to deep clean and put social distancing measures in place".

But parts warehouses had to continue working to ensure they continued to dispatch parts every day:

"It was quite a challenge to put social distancing in place to meet local regulations and meet union concerns."

It met PPE requirements by re-deploying procurement staff to source what they could, and

Martin Hamer

Profession:
Conference report

It was quite a challenge to put social distancing in place to meet local regulations and satisfy union concerns.

re-tasking £D printers to produce items like facemasks, both for its staff and the local communities. AGCO has grown by acquisition, which presents the challenge of unifying different operating systems within the new company.

Instead of individual companies buying what they needed, they have built a network including multiple suppliers of the same components, often using different suppliers in different regions.

And rather than seek the cheapest supplier, he says it looks to those that encounter least risk:

"We don't want plants closed for any length of time or lines stopped because we have got component shortages."

AGCO realized how serious the epidemic could become when its Chinese factories started to close down in late January 2020.

Its reaction was to seek out suppliers in safer regions and increase its own parts production so it had a 'bunker stock'.

Where it felt a supplier might not survive, it took one of two routes – one being taking manufacture of the relevant parts back in house.

In other cases, it took a stake in the company - in the form of management input, cash, staffing or other resources – to ensure its survival.

He describes the result as a "lean, flexible centralized system" which made decision-making easier, and meant that factories were closed for shorter periods.

Like many other companies, he said, they had discovered how efficient internet-based communications could be:

"It saved a lot of time on travel and meeting times. I think we will be more efficient as a result".

Machinery matters

Using modern communications has enabled Ripon Farm Services to continue its business during the Covid epidemic.

The company has 12 depots spread across Yorkshire and Lincolnshire, and has adapted to the new circumstances, says Richard Halsall, Group Sales Manager.

In a business seemingly dependent on face-to-face contact,

Richard Hallsall

it has managed to work virtually, and made sales despite not being able to visit farms to demonstrate or install machines.

Internally, activities like monthly inventory reviews are now held virtually.

During lockdown their customers still needed spare parts and the company maintained good stocks. Its existing system enabled staff from each branch to see what was in stock elsewhere and access those parts if needed:

"We have always been on the high side with stock, because we take the view that you can't sell from an empty shelf.

"For the forthcoming season we have enough product available. My financial director might not agree, but high stock levels are actually a positive for us."

The real work of making a machinery sale only starts when the deal is agreed, he added.

Once the deal is complete the machine needs to be installed correctly. And once the customer is working, the company needs to ensure the farmer is getting the best performance from it:

Profession:
Conference report

"If you don't do this, then the customer is not getting best value and will not be 100% satisfied. That means they might not give us a chance the next time they decide to buy a new machine."

Lean principles protect soils

Growing vegetables and root crops for the supermarkets is a complex business, but John Shropshire explained how G's – the company whose UK operations he runs – is seeking to make it simpler. He has introduced two major innovations to the company's operations, based at Barham, Cambridgeshire.

John Shropshire

Laser land levelling

The first was to switch from multiple water tables on the fenland they farm to a single unified level.

The second is a steady progression to using non-inversion tillage and direct drilling. G's had made a significant investment to protect their fen soils:

"Drainage is one of the most important things about managing fen land – because we can't farm in water. It's also important to access all the fields easily," he said.

"A lot of land used to be drained to different levels with a network of dams keeping water at a range of different levels.

"We surveyed the whole farm and decided the best option was to set a single level for the whole unit.

"That meant digging out many ditches. We made many wider and some deeper – some by half a metre; others by a metre."

They are using non-inversion tillage and direct drilling more widely, while keeping the plough in reserve.

The key, he said, is having the right machines on the right rubber:

"We will always have to do some cultivations. But in normal conditions we believe we can farm without the plough.

"In wet conditions it remains an important tool, and if we didn't have one available we might face situations where we could not do anything with the field."

Their aim is to reduce the aggressiveness and amount of tillage and avoid soil compaction.

During harvest it is the tractors and trailers collecting harvested crops that cause compaction, not the harvester itself:

"All vehicles working in the field are fitted with big, flotation tyres or dual wheels. We have a tri-axle trailer on which we can reduce the tyre pressure so it effectively floats on a set of balloons."

Other machines are fitted with tracks to spread their weight as far as possible:

"On a 1.2m wide track you literally cannot see where most machines have travelled."

Dr Mark Cooper

Black swan events

Businesses adopting LEAN principles might benefit for taking a slightly more flexible approach to safeguard their future, suggested Dr Mark Cooper, an independent safety engineer who is a Fellow of the IAgrE.
While adopting full LEAN principles had its merits, he suggested businesses sometimes need a back-stop so they can survive major shocks to their systems.

As an example of the problems that major incidents – dubbed 'Black Swan Effects' – can have, he cited airlines that relied solely on the Boeing 737 Max, a type of plane grounded globally after two major fatal crashes.

While having only one type of aircraft reduced costs because it meant pilots and maintenance staff only had to learn one system, the airline could not operate when the plane was grounded:

"If you have a variety of types of aircraft it gets you a bit more resilience because you can still operate."

The same principles could cause problems in the agricultural engineering section, especially where all manufacturers used the same supplier of a particular component:

"All the software for round balers comes from one source. There is nothing wrong with that, but it has the potential to cause a 'common mode' failure".

'Black Swan events' tend to have three elements; first they are unexpected; second they have a huge impact, and third that some people feel they might have been predicted, he said.

The terrorist attacks of 9/11 were an example, being totally unexpected and having a massive impact.

But the revelation that some of those involved had trained as pilots made people wonder whether the attack might have been predicted.


Simon Pearson

Robots aid resilience

Robots could improve virtually every stage of crop production, says Professor Simon Pearson, head of the Lincoln Institute of Agri-Food Technology (LIAT).

He highlighted three specific areas - plant breeding; disease control and harvesting.

Robots could improve plant breeding by providing highly accurate and comparable data from widely dispersed crop trial plots.

Large plant breeding companies tend to use thousands of replicate plots in their trial work, and collecting data tends to be done by students with clipboards:

"Robots with advanced sensors could play a real role in improving the system, and potentially raise the rate of progress."

LIAT is already working with a UV 'light sprayer', which is a hoop on rails that runs over lines of fruit bushes – usually at night - and projects UV light into them to control problems like mildew.

Further research is needed to assess whether it has any impact on beneficial and predator insects in the crop.

But the system could negate the need for repeated chemical applications – a major environmental and marketing benefit.

Harvesting is another key area for progress, with robots employed in two different roles.

At the moment many pickers spend much of their day carrying picked fruit to the headland or out of the polytunnel.

Instead, the picker can summon a robot to collect the fruit, and resume picking more quickly.

LIAT is also working on automatic pickers for table top strawberries.

These use cameras and sensors to locate strawberries grown on raised tables, and then select and pick the ripe ones.

Prof Pearson suggested that – in time - a machine with multiple cutting heads could replicate the work-rate of human pickers.

But there is still work to do, as the cameras can struggle to locate and pick berries hanging in a cluster or obscured by trailing foliage.

Profession:
Conference report

Key topics of the discussion included the future shape of employee engagement and the machines they might operate.

Be lean but flexible

Businesses that adopt LEAN principles should consider having a back-up plan to which they can switch if things go wrong with their original model. That was a common theme among several in the virtual panel discussion.
Other key topics included the future shape of employee engagement and the machines they might operate. This year's conference was held virtually, with the speakers' presentations being available on the Institutions website.

Many members then joined with the speakers for a discussion session over the internet, during which the future shape of the machines and the care of the people who operate them were keenly discussed.
A clear example of how LEAN principles can go wrong was presented by health and safety consultant Mark Cooper.

He highlighted how airlines that depended solely on the Boeing 737 plane were left unable to operate after two major fatal crashes caused it to be grounded.

While only having one type of plane in the fleet was very 'LEAN' as it meant staff only needed to know how to fly and maintain one type of plane, grounding the plane halted the airline's business.

Martin Hamer from Fendt struck a similar theme, pointing out that rather than rely on 'sole suppliers' AGCO – of which Fendt is a part – uses multiple suppliers for many parts.

In the Covid-19 epidemic it supported suppliers and took a stake in a business if there was a chance it might not survive.

From the dealer's standpoint, Richard Halsall from Ripon Farm Services said his company had deliberately kept larger parts stock than necessary to ensure it could meet customer demand.

Farmer Charles Shropshire, who manages G's UK farms, said the company had made major changes to land management to make its system simpler and more economic to run.

That included unifying the water table across the significant acreage of fenland on which it operates.

And while it has adopted non-inversion tillage across much of its acreage, it still keeps the plough so it can work land that is too damp to be managed by other methods.

In the discussion session the role of staff – what could be expected of them and how they should be managed – were keenly debated.

IAgrE chairman Paul Hemingway pointed out that the level of training in the UK tended to be lower than across other European countries.

Martin Hamer suggested that employers needed to empower their staff to take responsibility for their actions and make decisions for themselves.

But if they were under pressure, they might be more prone to taking risks and having accidents.

Both Richard Halsall and Mark Cooper stressed the importance of ensuring staff were fully involved in the business.

Professor Simon Pearson from the Lincoln Institute of Agri-Food Technology (LIAT) based at Lincoln University, suggested automation could help solve the industry's recruitment issues.

His university has 30 staff and 65 PhD students working on automating many farm operations.

He suggested the farming fleet of the future might combine a number of smaller tractors – potentially electrically powered – working alongside large diesel-powered machines.

Martin Hamer agreed, adding that large machines would be necessary to move bulky and heavy crops like silage and potatoes.

Watch again

YouTube

Don't forget all the speakers presentations and the panel discussion are available to watch on the IAgrE's you tube channel:

https://bit.ly/3kpKVF8

Profession:
Meet Will

Technician IAgrE member Will Hopkins has just completed a year at Kubota (UK) as a placement student, where he grasped the opportunity to become a precision farming specialist.

"I wanted to learn more about how technology can improve on-farm efficiency. My time with Kubota was an ideal opportunity to gain a broader understanding of its precision farming systems," explains Will Hopkins, who is now back at Harper Adams University for his final year.

Will is studying for a BSc in product support engineering, where valuable experience gained with the tractor maker will assist him to complete the course.

Long before leaving school and progressing to higher education,

"My love of the industry, the people, the equipment and the technology, is what motivates me to stay close to farming,"

During his time at Kubota (UK), student Will Hopkins created a quick-start guide to Kubota precision farming systems.

Will knew his future would be spent immersed in agriculture. And that's not just because the 23-year old comes from a family-run farm machinery dealership located near Banbury, Oxfordshire. Farming is also his passion.

Industry passion

"My love of the industry, the people, the equipment and the technology, is what motivates me to stay close to farming," he says. "No two days are the same – the variety in this industry is immense."

And although working in the family business gave him valuable experience at dealership level, he really wanted to see what life was like working for a manufacturer.

"Kubota was the one manufacturer that I really wanted to work with," he says. "As an up-and-coming brand in agriculture, Kubota is a company that I wanted to be involved with. After making initial enquiries, I secured a role as a product specialist, and was encouraged to make it my own," he says.

Precision farming

This freedom unleashed his initiative and saw him create the opportunity to become Kubota (UK)'s precision farming specialist.

"Working with dealers soon identified a need to help further educate customers on the value of Kubota precision farming systems. And to help that process, I produced a quick start guide to operating Kubota precision farming systems, which could be supplied with the tractor and kept in the cab."

This laminated A5 booklet includes topics such as how to create an A-B line with auto-steering systems; how to set-up task control and section control; how to set-up ISOBUS implements; and understanding software licences.

"It was an area where I could add value to the business by helping to support dealers and customers, so that they too could gain a better understanding of precision farming," he says. "It would also become a fundamental element within the final part of my university project."

The future

Will believes farming is now on the cusp of a technological revolution. "We're just scratching the tip of the iceberg with precision farming systems. While the technology is impressive, the applications for it are endless. And I'll always be grateful to Kubota for the opportunity to develop and expand my precision farming knowledge."

Congratulations also to Will for recently gaining his Engineering Technician registration through the Institution of Agricultural Engineers.

People:
Meet the new CEO

Growing up on a farm sparked my interest in all things mechanical.

Landwards interviewed Charlie Nicklin back in October, this article is a brief summary but you can hear the whole thing on the Landwards Podcast.

Tell us a little bit about your background?

Growing up on a farm surrounded by tractors and machinery sparked my interest in all things mechanical. My mother and auntie ran riding stables, so I spent many hours on the back of a pony…but tractors eventually won the attention. I have fond memories of all the busy seasons: silaging, combining and ploughing.

Why agricultural engineering?

My grandad bought me a Fergie diesel tractor and a mower when I was about 10 or 11, so that's when the real tinkering began. I ran it for a few years, then I did the engine up in my teens and dad and I sprayed it up. I still have the tractor today. The little TE20 sparked my interest in vintage and classic tractors which I still have to this day. What really captivated me was when our local mechanic came to do major repair jobs on tractors, I think that was the point when I thought that's what I wanted to do when I left school. Although I was fine at school, I had no intention of doing A levels. I wanted to go and do something like a City & Guilds 015 mechanics course.

How did you become an engineer?

Although my dad was supportive, he persuaded me to do something with a bit more theory. We visited a few ag colleges and I ended up going to Reaseheath in Cheshire to do a National Diploma in Ag Engineering, it was perfect for me and I loved every minute. It was a real good mix of practical and theory, and suddenly things like maths and science became interesting as it was being applied to something that I was hugely interested in. I also met my future wife, who was the sister of one of the lads on the course and I gained many lifelong friends. My time at Reaseheath really sparked my desire to learn more, so that then led me on to Harper Adams where I did my BEng…and again, I loved my time there. I'd have never have guessed at school that I'd end up with an engineering degree! I'd spend the summers either driving or fixing tractors and when I graduated I was in no rush to dive into a career, just get rid of some debts!

What next after qualifications?

I did 2½ years with a company

working on chemical spraying equipment, this involved UK, European and US travel. I was involved in designing and developing the application equipment.

Following that I joined JCB as a design engineer for Loadalls. Within the next couple of years I started leading machine projects and managing people and plans. Over the next nine years I quickly rose up to senior and principal engineer level and eventually Product Manager for the Agricultural Loadall ranges.

At the age of 34 I became Chief Engineer on Fastrac. The range moved on massively in my 11 years there, partnering with Agco on engines and transmissions, developing the non-road side of the product and introducing GPS steering and headland management.

My final role in JCB was as Chief Engineer for Back Hoe Loaders. I spent four years involved in the introduction of new engines/ transmission, range updates and new features, alongside travelling to the company's factories in Brazil, India and China.

I consider myself very lucky that I have worked on the Fastrac and the iconic Backhoe.

What about outside of work?

My uncle was a keen match ploughman and I would travel to matches with him, which sparked my interest, so I now do 20 or more matches a year. I've been in the top three at the British nationals a few times, but not come home with a trophy yet!

Charlie is a keen match ploughman out of hours.

Agricultural engineering has been a life long passion for Charlie.

The Landwards Podcast

You can listen to the whole interview and many others at;

https://bit.ly/3klFt67

Professional:
Douglas Bomford Trust

A busy few months – despite..

Alan Plom, Secretary to The Douglas Bomford Trust teases out some 'academic' positives from

Supporting Students

One noticeable effect of the pandemic has been a significant increase in requests for financial support from students in many countries hoping to study in the UK. Our Trust does not normally fund course fees or stipends, but many students now need our moral as well as fiscal support. We provide a wide range of support for students based or studying in the UK.

The Trust has continued to support students

1. Mentoring

Virtual meetings are now the norm for us all and our Trustees have been able to mentor and conduct interviews or project reviews without visiting students and their supervisors at universities. Whilst this has reduced the risk of infection as well as our carbon footprint, we are aware that many students have been affected (even infected) by Covid-19. Programmes of study and research have suffered directly or indirectly as a result of the pandemic restrictions. The scope of some PhD projects has been revised or deadlines extended, so it was a relief to hear that all our sponsored undergraduate and masters students made it over the line successfully.

2. Travel Grants

The Trust normally provides a number of grants each year for students (and lecturers) to attend international conferences, shows and other events. Whilst events have been cancelled this year, not all opportunities for knowledge transfer have been lost, as most have been deferred or held virtually.

One of our potential recipients of a travel award was doubly disappointed though. Harriet Housam (pictured left) from the Royal Agricultural University (RAU) had originally hoped to present the findings of her MSc research project on 'Calf thermal-imaging systems' to the European Conference on Precision Agriculture in France in July 2019. When that fell through, the Trust agreed to provide a travel grant to enable her to attend the 15th International Conference of Precision Agriculture (ICPA), which should have been held in Minneapolis this July instead.

When that event was cancelled, she was invited to contribute to the International Society's webinar on 'Intensifying Farm Management' held on 3 September. Whilst speaking from home rather than enjoying a trip to USA was a poor substitute, at least it was a chance to publicise her research to a wider audience.

The abstract is available:

https://www.dbt.org.uk/previousresearch-projects

and other papers from the series of ICPA webinars can be viewed at:

https://ispag.org/icpa

Professional:
Douglas Bomford Trust

3. Projects

The Trust co-sponsors more than 10 PhD's each year. These are now listed with links to relevant information on our website at:

www.dbt.org.uk/researchprojects

We also provide sponsorship for other projects, such as Harriet's mentioned above. She needed a thermal camera and associated equipment to develop a monitoring system to measure calf temperature using machine vision software, as part of her MSc in Agricultural Technology and Innovation at RAU. This was funded on the basis that it would be available for use by other students in future. Harriet obtained a Distinction and kindly acknowledged the Trust's support for her project.

Harriet was supervised by Dr Karen Rial-Lovera*, whose Lectureship in Agricultural Engineering at RAU was also sponsored by the Trust.

[*Karen is now a Senior Lecturer at the School of Animal, Rural and Environmental Sciences, Nottingham Trent University.)

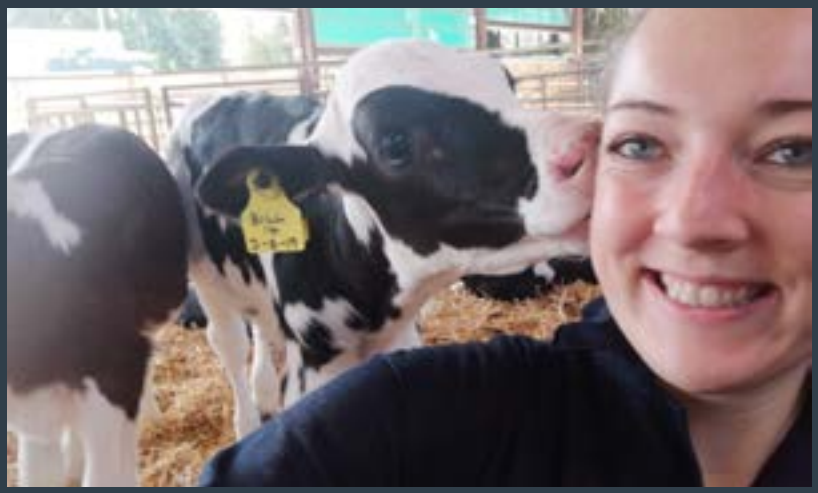
4. Scholarships

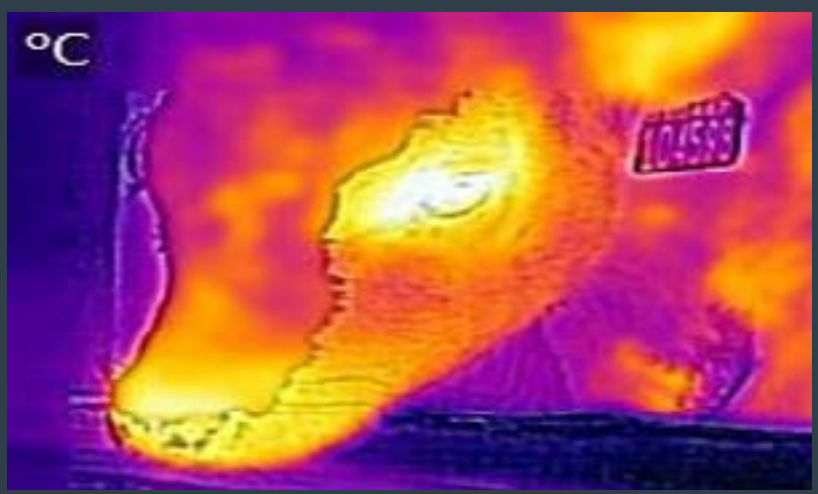
The Trust will again be funding four A-level students under the Arkwright Scholarship Scheme. These are awarded to pupils who show promise and interest in agricultural engineering. We encourage them to attend local IAgrE branch meetings and manufacturers, and we hope we will get to meet them in person soon. We also look forward to receiving and considering applications for scholarships through existing schemes at Haper Adams University and RAU in December. Please note this is an open competition; we are also encouraging students from other universities to apply.

The calf monitoring system

Harriet Housam's innovative calf monitoring system using a thermal camera was installed in the calf shed at Duchy College. It cost less than £1,500 to set up and showed no decline in performance, even in harsh conditions. It allows for more reliable and non-invasive detection of body temperature for unrestrained animals. It could be accessed from a remote computer and the output of the algorithm was suitable for further in-depth analysis. It has great potential as a valuable tool to inform and improve management decisions on commercial farms. It is anticipated that it will be installed in the College's new 'Future Farm' demonstration building. Harriet is now a researcher in the Rural Business School, working on the **'Two Minute Farmer'** project, which aims to break down the big challenges in farming into 'manageable chunks' to inform the farming community.

www.2minutefarmer.co.uk





Prizes - Tom Mead *(Harper Adams)*

Although university award ceremonies have been held virtually or deferred until next year, Tom Mead was the latest student to receive his certificate and monetary prize. Tom achieved the highest mark for an agricultural engineering master's research project at HAU.
His investigation into the feasibility of NRTK being adopted for machine control within a sports stadium environment illustrates the wide reach of agricultural engineering. In thanking the Trust, Tom was very complementary about HAU's engineering lecturers, describing his course as combining two of his passions: innovation and agriculture. He is an active member of IAgrE and follows the latest developments in agri-tech, looking for new and innovative ideas with a mind to developing one of his own projects. It was also good to hear that Tom intends to gain the necessary experience to register as a Chartered Engineer.

Comings and Goings

Mark Kibblewhite

We said goodbye to Mark in the autumn issue of Landwards and gave him a virtual handshake after our AGM on 3 November. However, although Mark has now 'served his time' he has kindly agreed to continue to act as a mentor on a couple of projects until they are completed. Mark now intends to devote his attention to the Dorset Wildlife Trust as its new Chair. [Who better to oversee the re-purposing of a significant area of land for the benefit of wildlife?] Mark also hopes to spend more time sailing.

Keith Hawken

We also said 'bon voyage' to Keith, who is emigrating to Portugal after retiring from AEA in December. Having lived there partially for 15 years, he and his wife feel it is now time to fully immerse themselves in a new way of life, in a warmer climate. With envy, we wish them both well. But just to endorse the saying "Engineers don't retire", Keith couldn't resist undertaking some project work with two universities in Portugal, so this is probably not the last we will hear of him.

If you have relevant experience and expertise within the broad spectrum of agricultural engineering and would like to help the Trust support research and develop young students and others involved in agricultural engineering, please contact the Secretary .

Contact Sarah McLeod
01234 750876
Secretary@iagre.org

Professional:

Douglas Bomford Trust

Welcome addition to our board - John Baines

John is a welcome addition to our Board, having had a long and distinguished career in the dairy industry. Now an independent consultant advising leading companies on milking installations, dairy building layout and design, he has written numerous technical papers and publications and held many key roles. Currently Chair and technical adviser to the Milking Equipment Association, he is also a member of the Dairy Science Forum, dedicated to strengthening the way science contributes to both the well-being of dairy cows and the industry.

John started with ADAS, advising farmers on milking technology, cow management, hygiene, milk processing and retailing. He became the national milking technology specialist, before moving into the private sector as product manager and later technical director of Fullwood (and its Dutch sister company, Fusion Electronics BV). He was responsible for development, support and maintenance of automation, process control and the dairy herd management hardware/software systems used in Fullwood milking machines, including fully automated systems.

John was also involved in setting up an R&D based company owned jointly by Fullwood and DEC; he acts as managing adviser for a company based in New Zealand. His international experience also encompasses dairy farming in a variety of climates and animals (including goats, sheep, buffalo and even camels!).

His representational roles are also impressive, including BSI and ISO Committees for Milking Machines and Cleaning of Milking Installations and the International Dairy Federation's Working Group on Machine Milking. He is also a member of the Milking Equipment Association's Technical Committee and responsible for content and quality of the 'ParlourSafe' Technician Accreditation Scheme.

John will be a great asset to the Trust with his extensive experience in novel R&D, knowledge transfer and training fitting well with the Trust's aims.

Twittering on.....

Please follow us on Twitter

@BomfordTrust

to keep updated, with links to relevant tweets, articles, webinars and other events.

Our website:

www.dbt.org.uk

has been updated with our latest guidance on applications and new 'drop-down' menus to help access information on recent research and other activities. You can also contact the

Secretary by email:

enquiries@dbt.org.uk

or phone:

07951 527051

Professional:
Research round up

The atmospheric water irrigation system uses super-moisture-absorbent gels to capture water from the air.

Self-Watering Soil Could Transform Farming

A new type of soil created by engineers at The University of Texas at Austin can pull water from the air and distribute it to plants, potentially expanding the map of farmable land around the globe to previously inhospitable places and reducing water use in agriculture at a time of growing droughts.

As published in ACS Materials Letters, the team's atmospheric water irrigation system uses super-moisture-absorbent gels to capture water from the air. When the soil is heated to a certain temperature, the gels release the water, making it available to plants. When the soil distributes water, some of it goes back into the air, increasing humidity and making it easier to continue the harvesting cycle.

"Enabling free-standing agriculture in areas where it's hard to build up irrigation and power systems is crucial to liberating crop farming from the complex water supply chain as resources become increasingly scarce," said Guihua Yu, associate professor of materials science in the Walker Department of Mechanical Engineering.

Each gram of soil can extract approximately 3-4 grams of water. Depending on the crops, approximately 0.1 to 1 kilogram of the soil can provide enough water to irrigate about a square meter of farmland. The gels in the soil pull water out of the air during cooler, more humid periods at night. Solar heat during the day activates the water-containing gels to release their contents into soil.

Professional:
Research round up

New tenant companies are all ready to join the thriving ecosystem of agri-tech, agri-food, food tech and innovation businesses

Rothamsted's iconic Russell Building opens for business

- Refurbishment work has been completed on the Russell Building on the Rothamsted campus in Harpenden, Hertfordshire.
- The work was jointly funded by Hertfordshire Local Enterprise Partnership (LEP) and Hertfordshire Innovation Quarter (Herts IQ) – providing a total of £1.7m Local Growth Fund investment.
- The beautiful red-brick Russell Building, steeped in history, has excellent transport links and will house 22 offices and up to 118 people.
- New tenant companies are all ready to join the thriving ecosystem of agri-tech, agri-food, food-tech and innovation businesses.

The Russell Building at Rothamsted, Harpenden, has been newly refurbished to provide much-needed business space for high-growth agri-tech SMEs.

The historic red-brick building, which had lain empty since 2014, has been transformed with the help of a £1.7m Local Growth Fund investment from Hertfordshire Local Enterprise Partnership (LEP) and Herts Innovation Quarter (Herts IQ), which is boosting agri-tech growth in the county.

The investment has breathed new life into the building, bringing forward modern, multi-use spaces, including 22 offices of various sizes, from 200ft^2 to over 1,200ft^2, a hot-desk hub for flexible working, and an open plan innovation space where entrepreneurs can collaborate before prototyping their ideas and testing on-site.

This increase in capacity will enable a greater number of companies to take advantage of the tax breaks, free business support and collaboration opportunities offered by Herts IQ on site at Rothamsted Research.

Rothamsted Research is the world's longest running agricultural research station, delivering cutting-edge science and innovation for 170 years, with strong links to research institutes in Oxford, Cambridge and London.

Reflecting its proud history as the original birthplace of agricultural science in the UK, the Russell Building will once again provide a home for high-tech businesses specialising in agri-tech, food-tech and innovation. The building is ideally situated on Rothamsted's thriving business campus, enabling tenants to tap into a rich ecosystem of agri-science expertise and benefit from opportunities to work with some of the world's leading scientists.

Harper Adams Chancellor, The Princess Royal, makes private visit to the Hands Free Farm

HRH Princess Anne and Kit Franklin at Harper Adams

Her Royal Highness, The Princess Royal, Chancellor of Harper Adams University, has made a private visit to the Hands Free Farm project.

The Chancellor had been due to visit the project and attend a reception on campus in March, but the event was postponed. The University was delighted to be able to welcome Her Royal Highness recently and share progress of its world-leading applied research on autonomous farming.

Vice-Chancellor, Dr David Llewellyn, who hosted the visit alongside HM Lord-Lieutenant of Shropshire, Mrs Anna Turner JP, said: "It was our pleasure to welcome back Her Royal Highness, who has always taken a keen interest in our work to develop sustainable farming methods and technologies. Working with the restrictions required to keep everybody safe, we were able to showcase our work on autonomous farming systems in the field and introduce the Chancellor to key team members and a small number of our students."

Kit Franklin, Hands Free Project Lead, added: "It was unfortunate that we could not hold the bigger reception we had planned back in March with all our Hands Free sponsors and supporters. But we were most grateful that the partners of the research consortium were able to meet Her Royal Highness at this smaller-scale visit and to discuss the technology whilst the autonomous tractor was drilling our first field of winter wheat for harvest 2021. We were able to explain the aims of the work as well as how we had to adapt the project plan to make the most of the resources and activities available to us during the period of restrictions."

The project aims to solve problems such as fleet management and swarm vehicle logistics and navigation, in a real-world environment. The initial hectare was a neat rectangle, but the new farm includes irregular field shapes, obstacles, undulating land and public rights of way.

During her visit, the Chancellor learned how operations had adapted, first to the bad weather of last winter and then to the restrictions of the global pandemic.

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 accomplished in spring.

These hopes were set back with the onset of the coronavirus pandemic and social distancing. However, the team was not deterred. They continued to work on the project from their individual homes, enabling them to be ready to drill when restrictions were relaxed.

They have now successfully drilled two of their fields with a cover crop, while abiding by social distancing guidance. The cover established well before being flail topped and sprayed autonomously to prepare the field ready for drilling winter crops for harvest 2021.

Cranfield University's Dr Jacqueline Hannam has been appointed President-Elect of the British Society of Soil Science.

Dr Hannam was elected at the society's virtual Annual General Meeting and will take up her position as President-Elect on 1 January 2021.

Dr Hannam specialises in soil data, digital soil mapping and soil health. At Cranfield University, Dr Hannam leads the **LandIS 'Land Information System'** team who are responsible for the national soil data for England and Wales. LandIS was a key component of the award of the 2017 Queen's Anniversary Prize which the University won for its work on soil science.

Dr Hannam, Senior Research Fellow in Pedology at Cranfield University and President-Elect of the British Society of Soil Science, said: "I'm deeply honoured to be elected by the members of the British Society of Soil Science to serve as President.

"Soil is getting more attention in the media and this is an exciting time for the society and for soil science with both the World Congress of Soil Science and COP26 scheduled to be held in Glasgow in 2021. As the world looks to the UK, I'm determined that the importance of the world's soils and the role they play in mitigating the effects of climate change and feeding the planet is recognised and acted upon."

Professor Leon Terry, Director of Environment and Agrifood at Cranfield University, said: "All of us at Cranfield are so proud of Jack being elected to this role. She is a true champion of soil science and is a great ambassador for the work we do at Cranfield, whether that is in front of audiences of schoolchildren or Government ministers.

"At Cranfield, she has shown the role technology can play in enabling more informed decision-making and ultimately better outcomes for soils all over the world."

Landwards:

Lunchtime Lectures

Rheality pipe segment (stripped back prototype) and lab setup.

An acoustic fingerprint?

On the back of a very well received lunchtime lecture in September, Daniel Hefft of Rheality Ltd has kindly told us more.

Rheality Ltd

Rheality Ltd is a spin out company from the University of Birmingham. It was officially born in January 2020, but we have been working on our technology since the middle of 2018. The core Rheality team are myself (CTO), Dr Federico Alberini (Scientific Consultant), Dr Francesco Colacino (COO) and Andrea Prisoni (CEO). We have also been expanding our activities in recent months and hired Cyrus Espinoza as our in-field research engineer, allowing us to complement the management team and expand our interaction with clients.

The company is still in start-up stage. We have secured multiple Innovate UK & MICRA grants, won funding for a market exploitation program, and we are currently securing third party investment based on a £3M evaluation. The core idea behind our technology is the ability to fingerprint fluids based on their acoustic signature, which we identify by using a single passive acoustic emission sensor. In order to create these acoustic fingerprints, we had to develop a unique piece of duct, allowing for transient energy releases coming from the fluid and being conveyed to the sensor. This means that unlike many optical probes or technologies such as hydrophones the sensing element will never be in touch with the fluid, since we flange the sensor on the outer pipe wall.

Since these acoustic emission signals have more than 500k data points per probing (and we intend to make use of this technology in large scale settings and allow a regular sampling interval), we also developed a unique algorithm to simplify this output into 10 single values, making the graphical output simple.

The final step of the technology is relating these 10 factors directly

Rheality™ test rig for testing with clients.

with viscosity and rheology by means of machine learning.

Other advantages include, since using a passive probe, we can deal with any size of pipe diameter and do not have problems of signal losses in multiphase flow (i.e. gas-liquid flow) when compared to ultrasound-based techniques.

The whole technology uses a small operational footprint, meaning it would fit into a shoebox. Our technology is in international patent application stage (PCT/GB2020/051548).

Rheality™ technology and agriculture

We see a big potential benefit of bringing our technology from its current FMCG environment into the agricultural sector.

In fact, we are already working towards a full scale and pilot scale project with a major north European company in the agricultural sector producing fertilisers and civil explosives. These trials will take place, assuming COVID restrictions lift, in Q1 2021. The key challenges around manufacture of these fertilisers concern the rheology of slurry at the make-up and crystallisation stages. With raw materials being high in cost to produce fertiliser, the aim is to implement the Rheality™ technology, to allow the client to detect deviations of product rheology early and working towards a PLC system that allows the operator to take actions live and directly (rather than to discard faulty final products as is currently the case). This is due to the offline testing performed with current rheometer (the industry standard) and the inaccuracy of in-line viscometer (i.e. rotational viscometer are reported to be ±10 % inaccurate (Morris & Langari, 2016)). Similar challenges of complex rheology and control measurements are also of interest to waste water and sludge treatment.

We also see value in our technology for the agricultural sector when looking at spraying systems and spray formulations. These formulations are often a complex makeup of expensive ingredients and ingredients in low quantities. Similar to batch processing in the personal care sector we worked with, these mixtures are complex in rheology and faulty products may lead to nozzle blockage or poor spraying. be keen to exploit is animal feed

If you are interested to learn more please visit:

www.rheality.co

to explore business opportunities, or to become part of our industrial advisory board, please contact

d.hefft@rheality.co or **a.prisoni@rheality.co**

Landwards:

Lunchtime Lectures

Another application we would be keen to exploit is animal feed manufacture, with pellet-structured feed often being produced through extrusion. With our measurements each taking a fraction of a second, Rheality™ might unlock key understanding of rheology and flow at the die end, the part of the extrusions process notoriously difficult to take measurements from.
Lastly, we also proved the technology is able to detect blockages and to monitor pressure drop in water supply systems (Hefft & Alberini, 2020).

Industry challenges

One key challenge I see coming from industry is the worrying development of food manufacturing having decayed to a quarterly profit-driven model where very little spend is set for innovation. Pressure on cost savings in this field has only risen with the outbreak of the current global pandemic for an industry that has already been on bottom tier when it comes to innovation spend (Garzón Delvaux, Hockmann, Voigt, Ciaian, & Gomez y Paloma, 2018). This mentality of dealing with food has now led to every US dollar spent on food, costs society two US dollars (Ellen MacArthur Foundation, 2019).

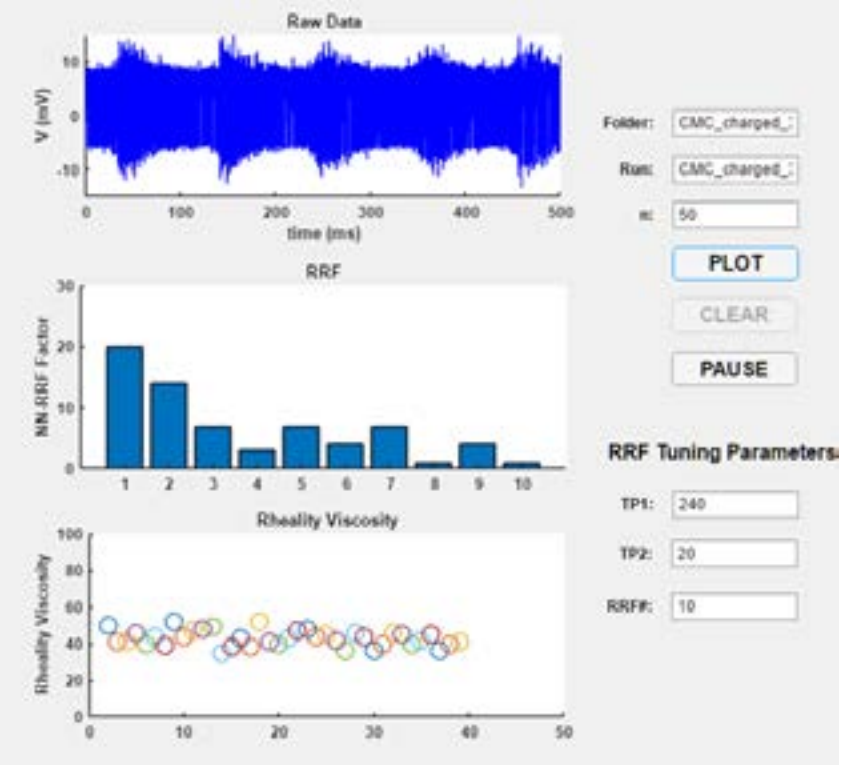
I see the overtaking of lean management tools, such as six sigma, into innovation departments, which restrains the innovator to adhere to a set of templates and not encourage any thinking-outside-the-box. This is partly due to the reign of MBAs at top level and a lack of representation of shop/ factory floor workers and engineers.

About Daniel Hefft

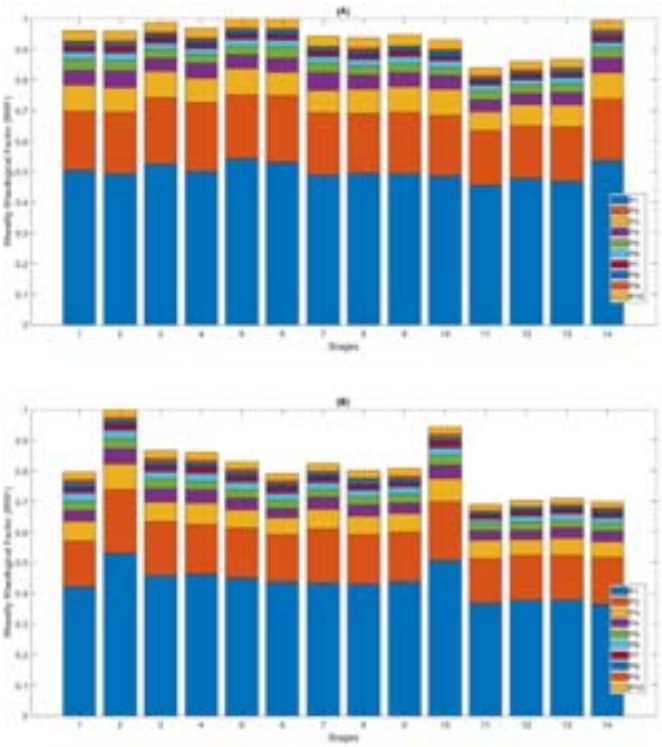
Daniel Hefft is a Chartered Engineer and member of the IAgrE.

He is a food engineer by profession and has worked for food companies within and outside the UK. Daniel is currently doing his final year of a PhD at the University of Birmingham in the field of fluid flow and acoustic emission measurements, which also led to him founding Rheality Ltd, a spin out company delivering a technology for real-time rheology measurements in industrial environments. The technology is his co-invention and shared between two other inventors. It is based on a combination of passive acoustic emission sensing and machine learning mapping tools.

Daniel says “Being a member of the IAgrE means being part of a global community of people of all backgrounds unified in their passion for land-based engineering – covering everything that goes on from farm to fork. What I particularly enjoy about being a member of the IAgrE is its open and welcoming structure, meaning people are truly diverse in their backgrounds unlike other major institutions which are significantly less flexible in their membership acceptance requirements. With this open structure (and our great staff), IAgrE allows its members to express themselves for the cause of land-based engineering, having allowed me to form the Engineering for Food and Drinks SIG and building strong relationships with the University of Nottingham and its food process engineering program.”



Rheality GUI comprising the raw signal, the Rheality Rheological Factor™ and the Rheality viscosity factor.



Rheality 10 factor output the 14 manufacturing stages of a good (A) and a faulty (B) batch of a personal care product (emulsion based).

References

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Watch again

YouTube

Don't forget that the lunchtime lectures are available to watch on the IAgrE's you tube channel :

https://bit.ly/3kpKVF8

Membership Matters

Northern Ireland Branch

Visit to Northway Mushrooms Compost Plant 2020

report by Terence Chambers

Members of the Northern Ireland Branch of IAgrE enjoyed a visit hosted by Northway Mushrooms to hear about their role in the specialist local mushroom industry and to see the new mushroom compost substrate production plant in action.

We were welcomed by Denise Gray who described Northway Mushrooms' formation as a producers' co-operative in 2000 as well as its ethos, rules and general operation. As a Producer Organisation (with its head office at Blackwatertown, Co Armagh) Northway Mushrooms has 20 shareholder members (from farms on both sides of the border) and an annual turnover of around £55 million. It is funded from producer levy payments and the EU's Common Agricultural Policy.

Northway's objectives of maximising business efficiency are supported by a knowledge sharing, support and training programme for its growers in collaboration with the local South West College at Dungannon. All aspects of production, including the possible future use of mechanised automatic harvesting technology, are being investigated. Harvesting work on the farms is currently all carried out by skilled personnel (some of whom can pick 20 -30 mushrooms per minute!) but some mechanised systems, used for secondary harvesting in other European countries, are under consideration.

Growing system

The growing system is now based on the Dutch-style shelf system, yielding mushrooms (in three flushes) within

The IAgrE group enjoying the visit – Pre Covid-19.

Getting hands on with the raw materials.

Compost being loaded into the process

a six-week production cycle. Around 100 tonnes of mushrooms per week are supplied from Northway to customers, across the UK and Ireland, via a cool-chain transport system. After each production cycle, used compost is taken to be recycled by a local processor for horticultural use or by farmers for land spreading. Northway now makes its own mushroom compost substrate (1100 tonnes a week) in its new state of the art £25m stage 3 facility which opened in April 2019.

This impressive process takes place in a large complex of interlinked negative pressure enclosed, environmentally controlled buildings. An internal conveyor system (from specialist Dutch manufacturer GTL) transfers the product to and from the individual process locations. All rain water is harvested off the roof and yard surfaces for bio-filtration and re-use. Ammonia and other exhaust gases are taken out by chemical scrubbing and passing through a high-capacity, activated waste air cleaning biofilter. The compost substrate-making process, which overall normally takes four weeks or more, starts with moist wheat straw being composted and mixed with other ingredients in a three phase process. Each phase is based on a carefully controlled system of heat and humidity management to inactivate unwanted organisms and maximise/fix the organic and inorganic ingredients which favour growth of mushroom mycelium. This produces a higher quality, more homogeneous and better yielding product than was possible with previous uncovered outside yard methods. When ready, the compost substrate is delivered by moving floor trucks directly to the growing tunnels on members' farms.

Our chairman, on behalf of all the visitors from our IAgrE Branch, thanked Northway staff for their warm welcome and very informative, enjoyable presentations. He wished them and their impressive operation every success for the future.

*Please note this was a pre Covid-19 visit which has just made it to the pages of Landwards - Ed

Currently 12 to 14MW turbine models with 220m rotors are typical offshore.

October virtual branch meeting

Developing an offshore wind farm

report by Terence Chambers

Recently the Northern Ireland Branch of IAgrE organised its first web-based presentation on the subject of 'Developing an Offshore Wind Farm' by our member and former Branch Chairman, Gary Connolly, who is now offshore wind development manager for the Electricity Supply Board (ESB) which constructed and maintains Ireland's electricity supply network. It also operates power stations, wind and other renewable power sources. ESB is a well-known engineering consultancy investing in energy and engineering projects globally.

Gary, an agricultural engineering graduate, has been with ESB for 15 years. Before that he was an agricultural engineering specialist, with the College of Agriculture, Food and Rural Enterprise (CAFRE) in Northern Ireland.

Gary Connolly, Offshore wind development manager

He began by describing the initial process of selecting a potential offshore wind power site. Where possible this should be within reasonable (30 km or less) distance from an onshore grid connection for up to 1500 MW. Once chosen and all necessary approvals obtained, the design and construction process begins. The many stages can take up to 10 years. These include:

Environmental surveying and assessment, which considers potential disturbance for marine mammals, fish/shellfish and birds. This process, taking around two years and includes observations from both sea and air.

Surveying wind speeds and patterns. This used to involve placing recording instruments on a temporary rigid platform but now more typically on a marked floating anchored buoy. Like any sea-going vessel this requires consent and registration with the authorities and marking to avoid being a navigation hazard. Data is also sourced from any adjacent shore-based weather data collection sources, such as airports, which assemble long-term records of wind speed and direction.

Stakeholder engagement involving consultation with those who live, work and travel on or close to the proposed site. One example

Membership Matters

includes fishing communities around aspects such as minimising potential conflict between bottom trawling and the cables laid. Proposed visual appearance changes need to be sensitive to land-based tourism interests. Shipping, military and civil aviation navigation must not be compromised. Local archaeology, cultural heritage features and shipwreck sites must be respected.

The overall process of gaining official consent to commence a wind farm project tends to take around four to five years.

The geophysical survey to check the seabed suitability for construction includes geophysical (non-invasive use of ship-based sonar and echo sounder-based) information followed by geotechnical (cone penetration and drilling work) at the proposed turbine locations and along cable routes. Material samples are evaluated in a ship-based offshore laboratory. If this information supports viability the Front End Engineering Design (FEED) process can begin. The promoter must design preferred construction details confirming the likely project cost and decide if the energy yield, less ongoing maintenance costs, can provide an acceptable payback on investment. Finance is vital to support successful large-scale projects. Fortunately, this far, well researched wind farm projects have established a good reputation as viable and ethical ventures worthy of support from large financial institutions.

Choosing appropriate equipment and installation methods.

Offshore wind supports larger turbines than typical onshore 3MW versions. Currently 12 to 14MW models with 220m rotors are typical but it is likely that future versions will be up to 20MW. Turbine construction materials are chosen to minimise the corrosive effects of a marine environment. Physical protection of cables, connecting output from individual turbines to the onshore connection, is vital and involves burying by ploughing, high pressure water jetting or rock covering.

The use of 7-8 metre diameter monopile driven or drilled into the solid seabed, at down to 40m water depth, is common where conditions permit. Where the seabed is less supportive, jacket piles (a structural frame supported on several piles) may be used. Semi-submersible floating structures are suitable for depths greater than 60m and ideally deeper than 100m is preferred. Floating leg platforms, secured to the seabed by anchor cables, are a further option.

Contracts

The total construction contract is normally made up from the integrated work of a range of contractors using their own highly specialist staff and equipment. This can include items such as heavy lift jack-up barges or marine cranes with lift capacities of several thousand tonnes. Working from a floating platform, in a moving sea, to accurately place and secure heavy objects is more difficult and costly than for land-based construction. Keeping floating heavy structures apart during the work is both vital and challenging to avoid damage and the risk of sinking.

Operation and maintenance

It is important to have an onshore service base as close as possible. Some large work platforms can incorporate a helicopter landing pad but without this facility all work personnel (and equipment) have to be winched on and off. Large service operation vessels (SOVs) are available (at a price) to anchor offshore to accommodate construction and service staff as well as workshop facilities, tools and materials.

The presentation was followed by a question and answer session.

Thanks, and best wishes were expressed to Gary for his most enjoyable and informative presentation.

Watch again

YouTube

Don't forget that branch meetings are available to watch on the IAgrE's you tube channel:

https://bit.ly/3kpKVF8

Events and branch meetings

Lunchtime Lecture - Frederick Lanchester - Britain's Leonardo da Vinci

The IAgrE Pioneering Technology Special Interest group recommend the speaker, Paul Henderson, and this fascinating subject.

We hope you can join them for this IAgrE Lunchtime Lecture.

15/12/2020 - 1pm-2pm

Online Technical Talk

Wrekin Branch Online Technical Talk - Environment Agency

Speaker: Jenny Gamble, Environment Agency - topic and details to be confirmed.

For all queries please contact: Dave Clare, Branch Secretary - dclare@harper-adams.ac.uk

15/12/2020 - 7.15pm for 7.30pm

Online via Zoom

South East Midlands Branch Online Technical Talk - Practical arming with the advantage of engineering training

James Hunter, IAgrE member from Tilbrook Farm will show how the City & Guilds Agricultural Engineering Technician course in the 1970s has helped machinery management on the mixed family farm ...

11/01/2021 - 7.30pm

Online Technical Talk

Lunchtime Lecture - HandsFree Hectare

Kit Franklin, lecturer at Harper Adams University and founder member of the Hands-Free Hectare Project brings you up to date with progress.

12/01/2021 - 1pm-2pm

Online Technical Talk

Wrekin Branch Technical Talk - Lawn Mower Racing

Matthew Torok will give a presentation on lawn mower racing. The venue for this meeting remains undecided, it may be online.

For queries please contact Dave Clare, Branch Secretary - dclare@harper-adams.ac.uk

19/01/2021 - 7.15pm for 7.30pm

Wrekin Branch Technical Talk - CLAAS Super Lexion

Speaker Colin Arnold, Topic - CLAAS Super Lexion The venue for this meeting has not been decided and it may be online.

For any queries please contact Dave Clare, Branch Secretary - dclare@harper-adams.ac.uk ...

16/02/2021 - 7.15pm for 7.30pm

Notice

Dr P C J Payne

Members will be saddened to hear that Dr. Peter Payne, the founding Principal of the National College of Agricultural Engineering, Silsoe (from 1962-1975) died in March 2020 in a care home near Salisbury.

He was aged 92.

Prior to his role at NCAE, Dr. Payne had worked at the National Institute of Agricultural Engineering, Wye College and Newcastle University.

A full obituary will follow in the next edition of Landwards.

Membership Change

1/08/20 to 31/10/20

Admissions

Fellow

Dr David K Thaemert (Herts & Essex)

Member

Mr Thomas Rowe (Western)
Mr Andy Tabberer-Catt (West Midlands)

Associate Member

Mr Raymond King (Western) - Re-Admission

Affiliate

Mr Khalid Mahmoud (Yorkshire)
Mr Julian Athawes (Western)
Dr Charles Veys ((Yorkshire)

Technician

Student

Preston College
B Holden

University Of Nottingham
P Bellan

University Of Birmingham
N Taylor

Royal Agricultural University
W A Gibbins

Readmission

Deaths

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

Mr K C Baxter MIAgrE (Southern).
Died peacefully at home.
A member since 1959

Dr Ing Do The Gia (France). CEnv FIAgrE.
Died in February this year.
A Fellow of IAgrE since 1998.

Transfers

Fellow

Member

Mr Niall Pigott (Ireland)

Associate Member

Affiliate

Technician

Engineering Council

Registrations

CEng

IEng

EngTech

Mr William Hopkins (Southern)

Society for the Environment

CEnv

Long Service Certificates - October to December 2020

60 years
None

50 years

Mr RE Robinson CEng HonFIAgrE	15/10/2020

35 years

Mr DJ Roe IEng MIAgrE	01/10/2020
Mr PF Smith AMIAgrE	01/10/2020
Dr GJH Freedman CEng CEnv HonFIAgrE	14/10/2020
Mr J Campbell CEng MIAgrE	21/11/2020
Mr MP Ansell AMIAgrE	26/11/2020
Mr J Livingston CEng MIAgrE	26/11/2020
Mr JR Denton AMIAgrE	12/12/2020
Mr MC Smith CEng MIAgrE	16/12/2020
Mr PT Wyatt AMIAgrE	30/12/2020

25 Years

Mr GP Wardle CEng MIAgrE	15/10/2020
Mr Y Persaud MIAgrE	18/10/2020
Mr ADB Shorten AMIAgrE	18/10/2020
Mr MW Peters AIAgrE	18/10/2020
Mr PW Amos CEng CEnv MIAgrE	13/11/2020
Mr KR Scrivens MIAgrE	29/11/2020
EurIng NJ Handy CEng MIAgrE	12/12/2020

* 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.

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