Landwards

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In this issue...

AGRICULTURE HORTICULTURE FORESTRY ENVIRONMENT AMENITY

Forthcoming Events

How to crash an efficient lightweight structure thousands of times and survive

Date: 1st December 2022
Time: 1pm
Venue: Online

The Engineering Integrity Society Young Forum invite you to attend their webinar led by Jamie Shenton from JCB. Read more about the event here:

https://iagre.org/upload/1668087840.pdf and email info@e-i-s.org.uk to register.

Lunchtime Lecture - How to build a robot

Date: 13th December 2022
Time: 1pm-2pm
Venue: Online via Zoom

The financial and environmental pressures on arable crop producers are increasing all the time. The team from Small Robot Company are seeking to use robotics and artificial intelligence to help farmers reduce inputs, save money and reduce their impact on the environment. To deliver these state of the art robots, the team has been on a journey of development and discovery.

Ray King, Lead Mechanical Engineer at Small Robot Company, will talk through the processes that the team followed and give some insights into the learnings that the team made as the project progressed.

Wrekin branch technical talk - Kuhn electric autonomous diet feeder

Date: 13th December 2022
Time: 7.30pm
Venue: AEIC Lecture Theatre, Harper Adams University / online via Zoom

Rhodri Jenkins is Product Specialist for Forage, Livestock and Landscape maintenance at KUHN UK, and will be giving a presentation on the AURA diet feeder, which can load, mix and deliver rations autonomously.

Please contact Dave Clare: dclare@harper-adams.ac.uk for an invitation if you would like to join via Zoom.

UK Irrigation Association (UKIA) - online masterclass - Are proposed changes in legislation 'over the top' for farm reservoirs?

Date: 19th December 2022
Time: 10am
Venue: Online via Zoom

*Event **FREE** for UKIA members – a small charge for non-members.*
To register click here: https://www.eventbrite.co.uk/e/are-proposed-changes-in-legislation-over-the-top-for-farm-reservoirs-registration-464940839567

If you own a farm reservoir or are planning on storing more than 10,000 m3 above ground level, then proposed changes in legislation announced by Defrain July 2022 will affect you. The proposals are designed to improve reservoir safety following the Toddbrook Reservoir incident in 2019 and are well-intended to protect communities from flooding if an embankment breaks. But they draw little distinction between large on-stream reservoirs for public water supply and small irrigation reservoirs that mostly store water off-stream and are usually far from urban developments. Clearly the proposals are 'over the top' for farm reservoirs.Reservoir panel engineer Neil Harding will explain the proposed changes and how it will affect farm reservoirs, the additional legal implications and responsibilities, and the charging system to be levied by the Environment Agency. This Master Class will prepare you to engage in the consultation process and to offer constructive criticism of the proposed legislation. Please tell your colleagues and others who are not members about this important event.

Contents:

farmsmart publishing

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Find out why the West Midlands Branch were messing with steam engines from p32

Editors Welcome

In Keats' Ode to Autumn is the immortal line 'Seasons of mists and mellow fruitfulness', and whilst by the time this is read, I expect the currently unseasonably mild autumn will doubtless have passed, it's still a great time for reflection.

This edition is simultaneously sustaining two opposing positions, that of looking forward through the lens of this year's excellent conference (the first face to face since 2019 see p18) whilst also being mindful of what has gone before to bring agricultural engineering to where it is now (see Practice p24).

Elsewhere, we hear from a dynamic young engineer (People p12) and which effective robotics need good people (Profession p14).

As ever the Institution's regions are cracking on with a selection of fascinating meetings which does feel a little like trains, planes and automobiles, turn to p32 for more film analogies.

We have much to be grateful for, with full stomachs, however the challenges of the wider world are never far away and agricultural engineers are better placed than most to tackle these, so read on to get some inspiration.

Andy Newbold

Andy Newbold

Editor

andy@farm-smart.co.uk

Building farm resilience - Soil 22 Conference

This year's Soil and Water Management Centres Soil 22 conference is focussed on bringing efficiency, nature and farm profitability into harmony and takes place at Harper Adams University and on-line on Wednesday 7th December 2022.

The speakers Dr Philippa Mansfield (Natural England) will present 'Improving soil and farm resilience with the Sustainable Farming Incentive' and Dr Marie Kirby (Harper Adams University) will speak on the removal of contaminants from Anaerobic Digestion and other wastewater using electrocoagulation. Dr Kirby will also lead a tour to show the installation of this technology at Harper Adams. Ian Rudge (Agrii Sustainability Trials Manager and former Farm Manager, Bedfordia Farms) will share his experience of managing digestate and slurries in a reduced tillage environment. Neil Furniss (local farmer) will be presenting his experiences of under-storey sowing of crops in maize. Alison Karley (James Hutton Institute) will talk on 'the practicalities and benefits of mixed species cropping'.

The Soil and Water 22 conference has been awarded the following CPD points:

BASIS – 5 points, 3 Environmental and 2 Integrated Pest Management
NRoSO – 1 point

Event pricing:

- In-person attendance only £46 + VAT members, £61 + VAT non-members (includes lunch)
- Online only delegate fee £25 + VAT members, £40 + VAT non-members

NOTE: 12-month SWMC membership only £45 + VAT when purchased at the same time as your conference ticket (normally £65 + VAT)

Link to registration page available from early November at: **https://soilandwater.org.uk/home/events/**

Soil 22 Conference - Programme

Soil&Water Management Centre

When: Wednesday 7th December 2022
Where: Harper Adams University / on-line
How to Book: Register on-line at: https://soilandwater.org.uk/home/events/

09.15 Registration opens - hot beverages available

09.50 Introduction - Guy Smith, Essex farmer and past Deputy President, NFU

10.00 Pathways to sustainable agriculture - Chloe Maclaren - Rothamsted Research

10.30 Improving Nutrient Use Efficiency - Andrew Riche - Rothamsted Research

11.00 Umbilical spreading of digestate - Ian Rudge - Agrii / former Farm Manager, Bedfordia Farms

11.30 Refreshment break

11.50 Improving farm and soil resilience with the Sustainable Farming Incentive (SFI) Philippa Mansfield - Catchment Sensitive Farming, Natural England

12.20 Electrocoagulation - Marie Kirby - Harper Adams University

12.50 Lunch, videos, short tour of the electrocoagulation plant, posters

14.10 Intercropping - Alison Karley - James Hutton Institute

14.40 Growing clover as a companion crop - Mark Lea, farmer case study - Green Acres Farm

15.00 Regen vs conventional - a systems study - Joe Collins, PhD student - Harper Adams

15.30 Under-storey sowing of crops - Neil Furniss, farmer case study - ME Furniss & Sons

15.50 Panel discussion

16.15 Close

Wraps come off hydrogen refueller as JCB unveils industry first

JCB, unveiled another world first for the industry - a mobile hydrogen refueller. JCB is investing £100 million in a project to produce super-efficient hydrogen engines and has already showcased working prototypes of a backhoe loader and a Loadall telescopic handler powered by hydrogen.

The company recently announced another industry first: a mobile hydrogen refueller, providing a quick and easy way for customers to refuel their machines on site. Around 97 per cent of construction machines have fuel delivered to them while working on site. This means customers are already used to a transportable fuel, allowing refuelling to take place in a matter of minutes.

JCB Chairman Lord Bamford, who is leading JCB's hydrogen project, said: "Since we became the first construction equipment company to unveil machines powered by hydrogen, many have asked how they can be refuelled.

"Well today we have an answer with our new mobile hydrogen refuelling system, which allows

hydrogen to be taken from on-site tube trailers and distributed to machines by our refueller as they work on the job site. This is no different to today when diesel is taken in bowsers to refuel machines. “Fossil fuels are not the future and hydrogen is the practical solution to powering our machines in the decades to come. Our British engineers are doing a fantastic job in developing this technology and there are many more exciting developments to come.”

A team of 100 engineers is working on the project. The first hydrogen-powered machine to be unveiled was a JCB backhoe loader followed, a year ago, by a Loadall telescopic handler.

Agriculture and the Armed Forces: Growing Social Value in British Agriculture

Improving the lives of those affected by service while adding value to the agricultural industry through access to land.

FORCES INTO AGRICULTURE CIC

The Community Interest Company of

FORCES FARMING

Forces Farming represent the link between agriculture and the armed forces. Offering a bridge for veterans and service leavers who want to pursue a career in agriculture or associated industries. AGCO UK has supported Forces Farming for the past 12 months to create the ReTrain Career Pathway for armed forces engineers. Service leavers are being connected directly to the dealer network. This leads on to an informal interview for both the service leaver and potential employer. Forces Farming supports a company or business investment in their Social Value through Armed Forces Engagement initiatives.

Forces into Agriculture has been launched as a Community Interest Company to support wider sector initiatives that help more people access agriculture as a career choice. Founder Jeremy Gibbs explained that Forces into Agriculture is not for profit; “This is where we grow Social Value and can launch sector specific initiatives that add value to the industry and make a difference to someone’s life.” The CIC is where employability skills and training is delivered.

The mission statement of Forces into Agriculture CIC is to ‘improve the lives of those affected by service while adding value to the agricultural industry through access to land. We are looking forward to launching an exciting engineering focussed initiative in January 2023.

The IAgrE Lunchtime Lectures

For more details on future lectures head to the upcoming events page at:

https://iagre.org/events

Don’t forget that the Lunchtime Lectures are available to watch on the IAgrE’s YouTube channel: https://bit

YouTube

From the CEO's desk

I do like the autumn months, up until the point where the clocks go back, then the days just feel very damp and dark. However, a few nice frosty mornings with a bit of sun do make things more pleasant.

The UK weather is certainly never boring, in fact to the detriment of the planet, extreme weather events are becoming increasingly common as the climate around the world continues to change. Agriculture always comes in for criticism regarding climate change, which I often find difficult to comprehend when you compare us to transport, residential and industry. However, my view in the first instance is a UK-centric one, but from a global perspective it's obvious that agriculture and land use needs to change.

The Institution's annual conference in Peterborough was aimed at understanding what engineers and environmentalists can and are doing to tackle this very subject, specifically sustainability in agriculture. I wanted the conference to be a mix of practical design, scientific and future thinking plus a reality check on what's happening on UK farms.

With my members hat on I think the conference hit the spot. I certainly enjoyed it. George Sly from Horizon Agriculture started the day by giving us a detailed look at the innovation going into no-till seed drilling. Dr Paula Misiewicz looked at various research projects and experiments at Harper Adams with regard to soil compaction, such as low tyre pressure, controlled traffic, etc. Ole Green, founder of Agrointelli gave us an in depth look at their Robotti product along with the future thinking and vision behind it. Finally, Ben Taylor-Davies, otherwise known as "RegenBen" gave us an entertaining informative view of how his farm in Ross-on-Wye operates in harmony with the environment, whilst remaining a profitable enterprise and having some fun along the way! All the delegates I spoke to really enjoyed the day, it's covered in more detail from page 18.

Hands free wrap up

With research in mind, I was invited to the concluding event of the Hands Free Farm project at Harper Adams in Shropshire. It's incredible to think it's been six years since the project started out to prove what can be done. Although I have followed the project over the years, I've never actually seen it first hand, so it was interesting to see and discuss the technology involved. My question now is where does this take us? Farmers and growers need to clearly understand the benefits of autonomous vehicles, given the investment and complexity that comes with them. I suspect the future will be a blend of systems, some robots, some autonomous conventional tractors, plus the highly automated equipment we have today.

Apprenticeships

Back in October I attended John Deere's apprenticeship open day at their recently opened technician training centre in Nottingham. The event had a fabulous line up and offered the attendees a detailed view on what it's like to start your career journey with a global company like Deere in their dealerships. IAgrE had a booth at the event, and I spoke with a number of young people, parents and teachers about the industry and where their careers could take them. It's great to see the enthusiasm of the attendees and staff proactively promoting the industry to the next generation of technicians and engineers.

Continuing on the education theme I visited Myerscough College in Lancashire, which is one of the very few colleges where you can do a Level 2 technician qualification up to a BSc (Hons) in Agricultural Engineering. The college has great facilities and enthusiastic staff, but recruitment and retention of lecturers continues to plague education nationally. Given the economic situation, public money is unlikely to be hugely forthcoming, so it is important that industry offers as much support as it can; whether it's with guest lecturers, loaned equipment or other means.

The cost-of-living crisis continues to be a regular feature in the media. I am sure it is being felt by all of us in our daily lives. We fully recognise this in IAgrE so we have kept our membership fee increase to well below inflation at around 2% in most cases. To ease membership for those just starting their careers we have not increased the fee now for several years. Those of us that are registered will see an increase of 5.1% and 6.7% from our friends in the Engineering Council and the Society for the Environment respectively. We do continue to offer great value professional membership for those in the sector with an excellent range of content.

Charlie Nicklin CEng FIAgrE

ceo@iagre.org

President's Musings

Steve Constable

Autumn is passing and we will soon be in winter which could be considered a suitable time to reflect on the past year's events.

The year began as it meant to with New Year's Day being the warmest on record. Since then every month has been warmer than average through 2022 bringing the UK, the warmest first nine months of the year in a series that goes back to 1884. This coupled with the driest year since 1976 in the UK and on average 115% of the normal sunshine plus record temperature of 40.3ºC degrees recorded at Coningsby, Lincolnshire you might be wondering what challenges the climate will bring next for the land-based industries.

It is no secret that the climate is changing and many people who are far more knowledgeable than myself are currently meeting in Egypt to discuss the future initiatives for tackling climate change at the COP 27.

In every situation there are going to be winners and losers. It was interesting to read about some of the upsides for climate change such as it being one of the best years for the UK wine industry and a good year for apple production. However, unfortunately it is not all positive. Farmers are custodians of the countryside and will play a vital part in the goal of reaching net zero greenhouse gas emissions across the whole of agriculture in England and Wales by 2040, a target ambitiously set by the NFU. Agriculture is a net contributor and an important sink so management and research is the key.

The Landwards Conference

On the 1st of November we held the 2022 Landwards Conference at the East of England Showground in Peterborough on Engineering Sustainability in Agriculture which was an enormous success. I would like to thank the whole of the Secretariat for the huge effort in organising venue, speakers, and administrating the attendees for what was our first face to face in three years so thank you. Also, a big thank you to Andy Newbold and his daughter Izzy for chairing the Q and A and recording the presentations respectively. Finally, a big thank you to our speakers and sponsors who helped make it happen.

On that day we focussed on various areas of soil management from the use of min/no till drill design and processes, ongoing research, adoption of robotics for ongoing processes, effects of compaction through to regenerative farming techniques. I must admit that up to then I was unaware of the scope for regenerative farming until Ben Taylor-Davis gave his presentation, he really has put the fun back into farming. I am going to visit his farm in Ross on Wye as soon as possible!

Overall, the day was extremely interesting, prompting some lively discussions. If you could not join us and have an interest in soil management, then please take some time to view the recordings when you are able.

Finally, I would like to wish you all a Happy Christmas and safe and prosperous New Year.

Biosystems Engineering

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

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

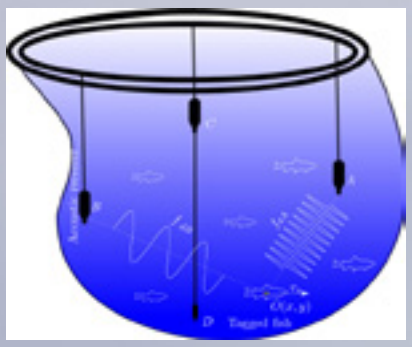
Reduced subscriptions are available to IAgrE members. Go to **https://iagre.org/biosystemsinformation** for details of the preferential rates for

Biosystems Engineering

Volume 220, August 2022, Pages 103-113

New concept for measuring swimming speed of free-ranging fish using acoustic telemetry and Doppler analysis

Waseem Hassan, Martin Føre, Henning A. Urke, John B. Ulvund, Eskil Bendiksen, Jo A. Alfredsen
NTNU, Trondheim, Norway; INAQ AS, Trondheim, Norway;
Nord University, Bodø, Norway; Bjørøya AS, Flatanger, Norway



A novel technique for measuring individual fish swimming speed based on conventional acoustic telemetry and Doppler analysis was tested with live tagged fish in a field experiment at a fish farm. The aim was to evaluate the feasibility of measuring instantaneous swimming speeds over time for individual fish under commercial farming conditions. Measurements were obtained from two acoustically tagged specimen of farmed Atlantic salmon and results showed realistic speed spectra and average swimming speeds (880 mm s−1 std. 590 mm s−1 and 1080 mm s−1 std. 560 mm s−1, corresponding to 1.4 and 1.6 body lengths per second, respectively). A reference tag moored in a stationary position in the same sea cage was simultaneously measured as having a mean speed of 110 mm s−1 (std. 80 mm s−1), confirming that the method was able to distinguish between moving and stationary tags. The technique could potentially become a useful in-situ research tool with applications within both general fish behavioural biology and the study of fish performance and welfare.

Biosystems Engineering

Volume 221, September 2022, Pages 283-292

Controlling idling: a ready-made solution for reducing exhaust emissions from agricultural tractors

Massimiliano Varani, Manuel A. Perez Estevez, Massimiliano Renzi, Luigi Alberti, Michele Mattetti

Mechanised agriculture accounts for nearly 70 million tonnes of CO_2 emissions annually. To mitigate these CO_2 emissions, powertrains running on alternative fuels and hybrid powertrains are under development. However, such solutions have not yet reached the technical maturity required for the marketplace. One solution is to reduce unnecessary engine idling. The duration of idling stops, the energy required for starting the engine, and the time at which the engine should be turned off to avoid higher emissions from continued idling was investigated. Four tractors with different engine displacements were used in experiments. The energy required for engine start-up was measured and real-world data were collected over several months. It was found that shutting off the engines for idling stops longer than 4.4 s resulted in lower emissions. The four tractors showed different idling patterns; turning off the engine during unnecessary idling stops led to fuel savings of 1.1%–5.1%. Based on these results, 770,000 tonnes of CO_2 annually could be saved by using proper technology for turning off the engine during unnecessary idling stops.

Biosystems Engineering

Volume 222, October 2022, Pages 106-116

On the rate of cooling of aerated food grains

Graham R. Thorpe
Victoria University, Melbourne, VIC 8001, Australia

Aeration is one of the most powerful tools available to the managers and handlers of stored grains. Irrespective of the initial temperature and moisture content of the grains, the biological and chemical phenomena that occur in the stored grains are significantly influenced by the wet bulb temperature of the air entering the grain. Several authors have developed mathematical expressions to estimate the rate at which aerated stored grains and other hygroscopic materials cool. They refer to 'difficulties in comprehension', remark

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.

that 'results are difficult to interpret' and 'necessarily complicated'. The principal objective of this work is to clarify and quantify the factors that determine the rate of cooling aerated food grains. This is achieved by deriving an equation that arises as a direct consequence of the conservation of energy and moisture in aerated grains. It is found that the rate of cooling of aerated grains depends strongly on the sorption isotherm, a mathematical function that relates grain moisture content to the equilibrium relative humidity and temperature of their surrounding atmosphere. Its effects are typically neglected in analyses of the rate at which aerated grain cools because published sorption isotherms are insufficiently accurate. It is proposed that a multidisciplinary approach be taken to measuring the psychrometric properties of food grains.

People

Early Career Insight

Harper Adams MEng student Rhodri Williams

Members insight – Rhodri Williams

As a budding agricultural engineer, I have a great passion for the future of agriculture and engineering. Where both industries work jointly to ensure the future of the planet is as sustainable as possible.

Studying an MEng Agricultural Engineering course at Harper Adams University, we grasp knowledge on the industry's biggest strengths and challenges. I have recently returned from Germany, where I completed my year in industry placement for CLAAS as a research and development engineer for combine harvesters. These are the experiences we can seek at Harper Adams, which are more difficult to achieve elsewhere. The reputation we can use and contribute to is a great asset to Harper Adams' students.

Along with the Harper Adams Engineering Society of which I am

"I find it fascinating meeting experienced engineers as well as those only just venturing out into engineering careers."

proud chairman this year, the engineering department has excellent relationships with industrial companies. These relationships can provide placements, graduate roles and sponsorships for events at university.

Support

I am thankful for the continued support from the CLAAS Scholarship and the Douglas Bomford Trust. Numerous scholarship opportunities are available for students of all ages. I am proud to be a scholar of both CLAAS and the DBT. I have gained financial benefit, confidence in myself and networking opportunities through the scholarships.

The IAgrE is a brilliant institution for all involved in the industry. I find it fascinating meeting experienced engineers as well as those like myself only just venturing into our engineering careers. To be able to draw on their experience and discuss the industry and its future needs is nothing short of interesting.

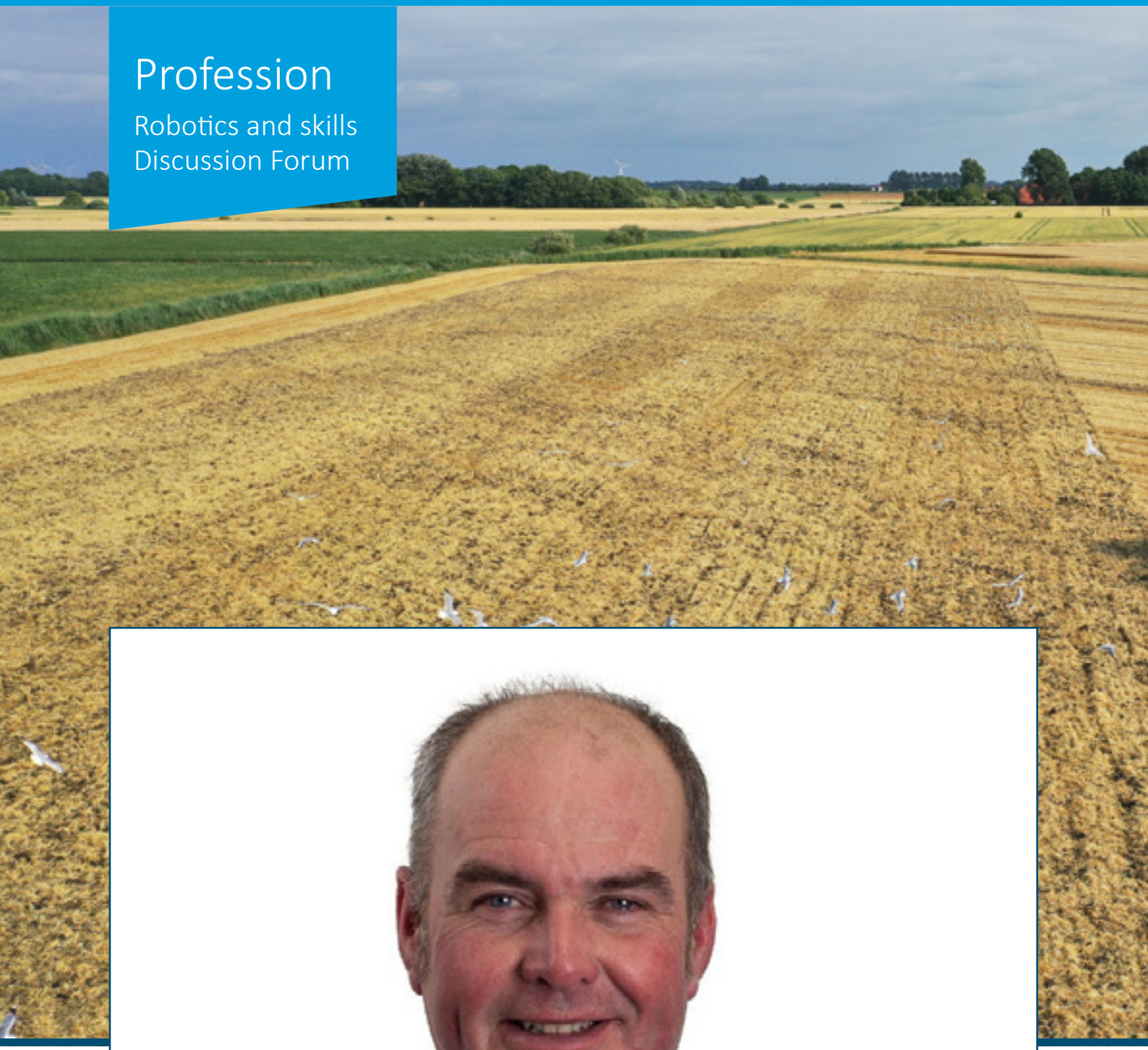
The future

Working in Germany has broadened my horizons. I will be seeking working travel opportunities post university, looking at the Southern Hemisphere as well as USA and Canada. I think the future is exciting with autonomous machines, live data gathering systems, agricultural practises will be adapted to accommodate many changes. After all, we are aiming to hit Net Zero targets soon, not only in the UK but globally.

I'd love to see more young engineers in the industry and engaging with the IAgrE. After all, the events on offer for us are focused on the future. Why not build such relationships now. I can't wait for the next opportunity to arrive!

Profession

Robotics and skills Discussion Forum



Charlie Rollason - After Sales Training Business Development Manager for AGCO

"We have to be ready for the robotic revolution before machines take over the world."

New skills needed

A range of labour issues will need to be resolved if the agricultural industry is to harness the full potential benefits that the robotics currently being developed might offer.

That was a theme followed by several contributors to an IAgrE Robotics Special Interest Group webinar considering whether the industry is ready for the robotics revolution.

Both manufacturers and dealers have a 'desperate need' for staff with the right skills, Charlie Rollason, After Sales Training Business Development Manager for AGCO, said.

For new recruits those skills need to be taught alongside a sound apprenticeship.

Speed of change

Existing employees will also face fresh challenges:

"We may struggle to keep many dealer staff up to speed because of

Profession

Robotics and skills Discussion Forum

the march of technology. We are currently struggling to get them up to date with what we have already, regardless of what is coming next!"

He is working with industry advisory bodies to determine which sections of existing courses might need to be discontinued to make room for training in the new technologies. But they should still be able to cut and weld and adjust the skimmers on a plough, he added.

A sideways shift

Some of AGCO's training staff had transferred to agricultural engineering from automotive and similar roles: "There is a huge gap between the people who design it and the people who would be expected to mend it in the field. We have got to get these teams talking to each other".

A systems level approach

Parmjit Chima, head of the Engineering Department at Harper Adams University, said the UK had a great opportunity to be at the leading edge of the technology. The University's strategy is based on a 'systems level approach' to ensure students gain transferable skills so they can work with any system. Course content needs to change as fast as the industry itself, he suggests, which is why HAU constantly reviews course content so it can drop obsolete elements to release teaching time for newer subjects.

But he queried whether teaching the skills needed to run robotic and similar systems could be comfortably accommodated in existing course structures.

While most students complete a four-year course which includes a year's work placement, many opt to study further on an MEng/MSc to learn further about advanced engineering systems.

Parmjit Chima - Head of the Engineering Department at Harper Adams University

Even then, he says, it can still be a challenge to include the plethora of relevant emerging technologies. For instance, cyber security will be pivotal in the design of new machinery and equipment that relies on data connectivity and communications if hacking is to be prevented.

Maintaining a balance

Dr Marcello Calisti, Associate Professor in Agri-Robotics at the University of Lincoln, said it can be

Dr Marcello Calisti - Associate Professor in Agri-Robotics at the University of Lincoln

difficult to find a proper balance between specialization of knowledge against broad exposure to different domains:

"This is especially true of robotics, which is an inter-disciplinary subject by definition.

"Students need to understand robotics but they need a wider knowledge to understand the whole picture.

"It is very important that students are flexible and adaptable so they have knowledge that can be used across different sectors and the ability to change".

Charlie Rollason added:

"We have to be ready for the robotic revolution before machines take over the world. The role of the engineer has grown significantly from the days where we were either mechanical or electrical engineers.

While robotics use is not widespread yet, he suggested it would not be long until they were:

"We are certainly not there yet, but keep an eye on the rear-view mirror because it's coming fast. One of the large manufacturers will launch a swarm robot or something similar and the flood gates will open".

Future branch meetings

For the winter programme, head over to:

https://iagre.org/events

The IAgrE's YouTube channel has recordings of all the previous years branch meetings, alongside lunchtime lectures and some of the specialist groups presentations too.

https://www.youtube.com/channel/UCCiJwRVjGiz-SE3EZ-KQ3uVg

YouTube

Watch again

Practice
Conference
Write up

Conference report – Engineering sustainability in agriculture

How can we use soil management techniques to feed the world?

How can today's engineers help ensure humanity has enough food to eat, and that farmers have the right tools and knowledge to supply it?

Practice
Conference
Write up

George Sly - Horizon

A range of new ideas and research were showcased at the IAgrE Landwards conference on 1st November.

A crop well sown

Achieving an even crop stand is key to George Sly, whose company Horizon makes a range of direct drills suited to regenerative and conservation-friendly farming.

Maintaining even seed depth when direct drilling is essential but can be difficult to achieve.

His company's solution is an angled double disc opener, a system thoroughly tested on the family's 300 hectare farm – all heavy silty clay within a metre of sea level – at Holbeach, South Lincolnshire.

The result of that testing is a drilling coulter designed to compensate for the natural variations of an un-tilled seedbed, including an uneven surface and variations in soil moisture and hardness.

The depth wheel is positioned alongside the double disc opener, rather than ahead or behind it, so the seed is always accurately placed no matter how uneven the soil surface might be.

The coulter itself is on a parallelogram mounting, which enables it to move through 32 centimetres vertically, so it will remain level on uneven ground.

It also ensures the coulter maintains a consistent working angle:

"If you didn't have that parallelogram mounting, the angle of the disc would alter as the coulter rides up and down on the surface."

Angling the coulter has other advantages: "It requires some force to get a vertical disc into the ground, in the form of weight and we don't want to make the machine any heavier than necessary.

"With the vertical disc you also have the issue of effectively closing the slot.

"You have got to remove the air and achieve good seed to soil contact. If you squeeze and pinch from both sides you risk leaving an air pocket in the trench."

By contrast, the angled trench can be closed by running a press wheel on the overhanging side, which collapses it into the trench and efficiently covers the seed.

The company's drills already offer liquid fertiliser placement and may soon feature an enhanced range of sensors to give operators more information on which to base management decisions.

The liquid application system is well suited to the needs of regenerative farmers.

It can place one line of product beneath and separated from the seed and two others either side of it, with two different products being able to be applied simultaneously:

"We can basically pass soup into the ground. A lot more people are home-brewing compost tea and other liquid treatments. It's a niche and it's a premium which is what we are all about".

Paula Misiewicz - Senior Lecturer in Soil and Water Management at Harper Adams University

For the future, he sees the introduction of new sensors, which will send information back from more parts of the drill, to help change how farmers work.

And autonomous systems will be significant too. Although he says removing the human from the driving seat would place greater onus on computers to manage the machine.

He sees the distinction between conventional seed drills and precision planters eroding, as conventional drills become better equipped. This will enable them to achieve seed placement that is more akin to a precision planter.

Time proven trials

The benefits of zero tillage and controlled traffic take time to accrue, says Paula Misiewicz, Senior Lecturer in Soil and Water Management at Harper Adams University.

She oversees the University's long-term trial on the subject which has been running for around a decade.

While this has highlighted the yield advantages of controlled traffic, it also suggests some environmental advantages. As has been reported in previous IAgrE sessions, these include higher worm populations, better water infiltration rates and raised organic matter levels.

As well as being an agronomic advantage, she points out that this third achievement also raises carbon sequestration levels by an estimated five tonnes a hectare: "That is important in our attempts to become carbon neutral."

Farmers need to protect their soils because they take time to build, she says – about one centimetre every 300 years:

"You can lose a centimetre of soil in an hour or a day if you have significant erosion problems on a specific site."

Controlled traffic helped reduce soil damage, cutting the proportion of the field receiving a wheeling to 45% compared to 85% (conventional cultivations) and 65% (minimal tillage):

"Matching machine widths and sticking to permanent traffic lanes means the rest of the field suffers no compaction at all."

The trial has also showed that using reduced tyre pressures cuts compaction and helps raise yields over conventional pressures.

For the future she suggests the industry needs to work out how to generate the tilth that crops need with less operator input.

And the current performance of crawler tracks needs to be improved, with the higher ground pressure exerted by the bogeys at the front and back than those in the middle being cause for concern:

"Some better load distribution would be worth investigating."

Robotic capabilities

Farming needs to exploit the capabilities of robots, Ole Green from Agrointelli – developer of the Robotti system – told delegates:

Practice
Conference Write up

Ole Green from Agrointelli – developer of the Robotti system

"We can benefit from what robots do well – which is working consistently.

"They don't get lazy; their foot doesn't get heavy on the accelerator and they don't want to finish the job and get home."

Switching from human control to robotics would also enable developers to remove the cab and all the systems associated with it. And the ever-growing range of sensors available made real-time management of tasks available, he added.

As an example, he showed a film of a sprayer on a trials unit in the Netherlands spot spraying volunteer

Credit: Martin Rickartson

Robotti

potatoes growing in sugar beet beds.

Cameras mounted at the front of the machine take pictures that are transmitted to the company's base in Eindhoven for analysis via a 5G connection.

The application data is returned to the sprayer, which - travelling at 2kph - has moved some 80 cms between the photo being taken and the application based on that information to be applied.

Information management is becoming a major issue, with the cameras capturing three terrabytes of images in an eight hour shift.

Useful data

But sensors capture lots of useful data: "We can show the amount of energy used to work each square metre of soil and complete carbon footprint calculations.

"We know precisely what inputs have been used and the farmer can sell that data when he is selling his produce."

Some of the early robots were orchard sprayers, developed by the orchard owners themselves to solve the issue they had obtaining sufficient labour.

And staff working with these machines would have to be very different from the conventional workers they replace: "For a multi-disciplinary system we need multi-skilled staff."

A holistic approach

Herefordshire farmer Ben Taylor-Davies (nicknamed RegenBen) believes his life should be about much more than just the farm, the soil and profit.

"Regenerating communities is as important as regenerating the farm."

He brings the village onto the farm with a farm shop, a brewery, farm walks and tours and an art trail. He aims to respect and farm in harmony

Ben Taylor-Davies (nicknamed RegenBen)

with the environment, which often means copying it.
And he aims to protect the soil, suggesting that his children will not thank him if all he leaves them is bed-rock".

So he uses cover crops rather than leaving the soil bare to keep harvesting the sun's energy and keep a living root in the soil. And he avoids killing pests and weeds in case it creates a vacuum which the target species can then recolonize, although he will use them if problems risk serious yield loss.

Mixtures of different arable and livestock species feature strongly in his cropping:

"Disease doesn't jump about anything like as much as when you plant a full field of clones. We don't use insecticides simply because we don't need to."

And combinations of two crops – such as beans and oats – can produce 126% of the yield if the two crops were grown separately. He suggests farmers should work with open eyes. If they did that last summer, they would have noticed that the multi species hedgerows and field margins were often far greener than the fields they surround.

He admits to not being a livestock farmer by nature and the farm's animals – cattle, sheep and goats – are run as one large mixed herd too that moves every day to avoid over-grazing.

And his Dorset sheep lamb in the autumn because that is when they have the most feed available:

"The science behind regenerative farming is so complex. We need to try and nail down these multiple

Practice

Pioneering Technology

A day at the mill

The IAgrE's Pioneering Technology Specialist Interest Group enjoyed a combined visit with the Midlands Mill Group http://www.midlandmills.org.uk/ to Wickhamford Water Mill in the Cotswolds at the end of the summer. William Waddilove reports.

The water mill is privately owned on a working farm and over the years a number of people, mainly through the Midlands Mills Group have been working on it and all very much encouraged by the owner John Poulter and his son, who now lives in the mill house.

John Poulter bought the farm in 1964 as it was adjacent to their existing farm. At that time the mill was almost derelict with the wheel pit full of sediment and the weir in poor repair.

Gone to sleep

It had effectively 'gone to sleep' in the 1930's. Since then, the sediment has been dug out of the wheel pit, it has been re-paddled, the weir rebuilt, and the water ways cleared.

John Bedington has led the project and put in a lot of time to progress it. The pit wheel had just been re-cogged with 94 hornbeam teeth inserted into the cast iron wheel. It is common to run wooden

“ When it was purchased in 1964 the mill was almost derelict, the wheel pit was full of sediment and the weir was in poor repair.”

teeth against cast iron gear teeth although the mechanism was still quite noisy and wet if you were near the water wheel.

Back in action

On the day, visitors saw the mill pond full and the running wheel turning the machinery and flour being milled by the kibbler. They also saw the sack hoist working with its noisy trap doors on each floor.

Reconstructing the drive to the two stones is still too much of a job. In addition to being able to eat biscuits made with flour milled the previous Tuesday, there was also bread made with a proportion of the flour. The first flour milled for 80 years had been done only on the 3rd of August!

Other attractions were two Austin Sevens, as well as refreshments supplied by John Poulter. We think John was delighted to see so many people coming and appreciating the restoration work on his water mill.

The next work unit in the project is to rebuild the mill pond sluice gates. They do leak rather a lot!

Are you tired of working on complicated modern equipment, join the volunteers, there is not a computer in sight!

William Waddilove feeding the kibbler

Technical

New electric plug-in version of rotating telehandlers

IAgrE corporate member and Italian telehandler manufacturer Merlo has announced its entire range of Roto rotating telehandlers are now available as electric plug-in versions. Chris McCullough visited in the summer.

With the main goals of reducing emissions, noise and fuel in the working environment, Merlo has added an electric motor to the Roto range that can control all its movements, except for forward and reverse.

Following on from the introduction of the eWorker all-electric telehandler, the new plug-in Roto, available as an option on the Roto models, is also part of the Merlo Generation Zero range.

How it works

A plug-in power supply system will allow the rotating telescopic handler to be operated at full capacity without using the diesel engine once the machine is positioned for work.

All of the telehandler's hydraulic functions are powered by an on-board electric motor, with operation of the Roto available from the cab, the aerial work platform, or by controls used remotely by the operator.

"The performance of the plug-in model is identical to the standard diesel powered machine."

Merlo says the performance of the plug-in Roto is identical to the standard diesel-powered machine, but it has the added benefits of reduced pollution, minimal noise and less fuel consumption without compromising on the power of the machine.

The plug-in Roto is also able to operate indoors, in confined spaces and in areas where only zero-emission machines are permitted. It can operate in diesel mode when travelling on the road, and for positioning of the machine.

Once in position, the Roto can then be switched to plug-in mode simply by connecting the supplied 50 metre cable to a compatible power source, 400V, 32A or 64A.

At this point, the machine's stabilisers can be positioned, and all of its hydraulic functions can be activated in electric mode, with the exception of frame shifting. With the 32A version, the machine's movements are a bit slower, while the 64A version guarantees movement speeds that are more consistent with those of the diesel machine.

Tech spec

The Merlo plug-in system consists of four elements: control unit, electric motor, hydraulic pump and the 50-metre-long power cable. The control unit is positioned at the front of the machine's frame. It contains the electrical system's indicator lights, start, and stop buttons, including emergency stop button, and the power supply type selector to choose between diesel engine or the electric motor. The three-phase electric motor powers a variable displacement hydraulic pump capable of delivering a flow rate of 70 l/min. This allows for boom extension and retraction as well as lowering and raising, carriage rotation and engagement of auxiliary services, turret rotation and stabiliser positioning.

Technical

Expansion and production goals

With this target unveiled, Merlo is currently undergoing significant expansion in several areas through its plant in Cuneo, where the company story began.

Merlo enjoys a 15% market share in Europe and a 10.5% market share worldwide while it has higher market shares in Italy, Germany and Canada.

Inspired by his own father's engineering business, back in 1964 Amilcare Merlo established Merlo Spa and began producing mobile construction equipment. The first telehandler arrived in 1981 with the SM series, which was essentially a concept offering both the performance of a forklift and a hydraulic telescopic boom crane.

Today, Merlo, which still maintains its family run structure, produces several product lines of telehandlers for agriculture and construction, attachments, and other products for the waste industry under its Merlo, TreEmme and Tecno brands.

The company's Cuneo site extends to 330,000 square metres and provides work for almost 1,600 employees.

The factory features 38 robots, 16 machining centres, 11 automatic steel cutting lines, and three high-tech powder coating lines.

Covid challenges

During 2021, when other manufacturing facilities stopped production, Merlo continued non-stop throughout the year, albeit with some changes in its supply chains. Even though Merlo manufactures a high percentage of its components in-house, it relies on outside companies for more specialist parts.

Merlo has set itself a goal of producing 10,000 telehandlers and 25,000 attachments per year by 2025.

Paolo Merlo

Technical

Amilcare's son, Paolo Merlo, managing director of Merlo Spa, said production went on, but not without its challenges.

"The Covid-19 crisis hurt the availability of components severely affecting all companies in the industry. The Merlo Group tried to counter it with strategic interventions at all levels, by expanding the number of suppliers and trying to diversify our supply channels.

"We continue to fight daily for parts, mostly small electro components only around ten euros each. It's an everyday struggle. However, when those parts arrive the machines are ready to go, and that's why we decided to continue our main production throughout the pandemic."

Indeed, there were scores of telehandlers parked in every available space outdoors at the Merlo factory each awaiting a simple component to be completed and sent to a customer.

Production

During 2021 Merlo produced 7,200 telehandlers, 80% of which were exported to the company's main markets, with 19% going to France, 17% to Germany and 8% to the UK.

Merlo operates branches in the UK, France, Spain, Germany, Poland and Australia. It has invested heavily in these outlets over the years.

The key products that Merlo manufactures fall into a number of categories including compact telehandlers with a load capacity from 2,700-3,300kg and lifting height from 6m to over 8m.

Medium capacity telehandlers, which includes the popular Turbofarmer range, have a load capacity from 3,300-4,200kg, and a lifting height from 7m - 10m.

A range of telehandlers with stabilisers has a load capacity from 3,000-5,000kg and a lifting height from 10m - 18m.

High-capacity telehandlers have a load capacity from 4,500-12,000kgs with a lifting height from 8m - 18m.

The Multifarmer telehandler, which Merlo calls its 'tractor' has a load capacity from 3,400-4,000kg and a lifting height from 7m - 9m.

And finally, the rotating telehandler, known as the Roto range, can handle loads from 4,000-7,000kg and a lifting height from 16m - 35m.

The latest Merlo compact telehandler to come to the market is the Merlo TF27.6 with load capacity of 2,700kgs and a lift height of 6m. And in the Multifarmer range, the latest models are the MF44.7CS and the MF44.9CS with load capacities of 4,400kgs and respective lifting heights of 6.8m - 8.8m.

During 2021 Merlo produced 7,200 telehandlers

Sustainability

Merlo has also entered the electric telehandler market with its two eWorker models; the EW25.5-60 and the EW25.5-90. Both have a lifting capacity of 2,500kgs and a lift height of 4.8m. The main difference is the latter model is 4WD.

The news from the factory is that Merlo will launch new lithium-ion batteries (41kWh, 850Ah) for their electric machines. These lithium batteries will come with an automatic battery cut-off, which functions after two hours. When the battery is disconnected, the operator will have to reactivate the circuit by pressing a key in the cab.

Merlo says lithium batteries charge faster, last longer and hold more energy compared to lead batteries. However, they are more expensive and must be completely replaced if they get damaged. The other current issue is the availability of lithium is under pressure.

Another new product arrival, on the construction side, that is also battery operated is the latest Cingo M600TD-e tracked carrier with a 600kgs load capacity. There is also a petrol-powered Cingo M700TD with a 700kgs capacity.

Merlo enjoys a 15% market share in Europe and a 10.5% market share worldwide while it has higher market shares in Italy, Germany and Canada.

The company's Cuneo site extends to 330,000 square metres and provides work for almost 1,600 employees.

Membership Matters

Gloucester & Warwickshire Steam Railway

West Midlands Branch

Summer Visit 2022 - **Gloucester & Warwickshire Steam Railway**

Report by John Pedley

The branch members were treated to a tour of the workshops of the Gloucester and Warwickshire Steam Railway at Toddington lead by branch member John Pedley.

Members were invited to meet at the exit from the station platform just in time to see the 1:45 from Cheltenham pull into the station. Our host for the afternoon John Pedley, was training a new volunteer fireman on the footplate on that service. After a brief introduction and welcome John departed for a quick 'wash and brush-up' and the party reconvened near the workshops 15 minutes later.

John started by introducing the railway – which is a registered charity and operates largely thanks to a strong team of almost 1000 volunteers. John has had an interest in steam since his childhood and has been involved in the railway since he retired – initially in the workshops and more recently driving and driver training. As we stood by the heap of coal alongside the track, John told us that the steam locomotives – which pull a 7-carriage train – consume 30 gallons of water per mile and 1.5 tonnes of coal per day. Interestingly, GWSR do not own most of the locomotives – they are each owned by restoration groups or enthusiasts. GWSR make the workshops available to the loco owners and they do the maintenance and restoration work themselves. GWSR then pay for the use of the locomotive once it is in service. The major restoration of the steam locomotives is mandated by a compulsory re-certification of the boiler which must be carried out every 10 years. For a group of enthusiasts who own a steam locomotive it is not surprising to learn that the 'down time' driven by the need for boiler re-builds forms a major part of the locomotive's life.

In the steam workshops we were shown several restoration projects – in various stages of development.

It was fascinating to get so close to the locomotives and to see the scale of the engineering work being undertaken – both in terms of quantity – and size… with 5-foot and 6-foot diameter wheels on some of the locomotives. Interesting also to see the installation of new cast white metal bearings in the rebuilds.

We were to see similar bearings being manufactured in the machine shop later. Worthy of a particular mention in the steam workshops was Merchant Navy Class 35006 'Peninsular and Oriental S.N. Co'. This 4-6-2 configuration locomotive was restored to operational condition at Toddington in 2015.

'Royal Highland Fusilier' - one of the old British Rail fleet of 23 Deltic locomotives.

Membership Matters

The locomotive had been retired in 1964 after completing over 1.1 million miles in 25 years of service.

Diesel too

Parked up outside the workshops was 55019 'Royal Highland Fusilier' - one of the old British Rail fleet of 23 Deltic locomotives. The Deltic was visiting GWSR for the summer Diesel Weekend. There is no direct rail link from GWSR onto the main network and so all visiting locomotives must arrive by road. For this 99 ton load that must have been quite an operation!!

Having seen the engine workshops, we were able to see the machine shop where some of the volunteers work on fabrication and repair of components. Outside the machine shop was a set of wheels which had recently returned from having new "Tyres" fitted. In this case it was not a job for a "Quick fit fitter" .... The steel tyres are the wearing surface of the wheel and, like a pneumatic tyre, can be changed from time to time.

The visit was rounded off by a visit to the Toddington signal box where members were able to chat with the signalman and learn about the traditional operating methods employed on the railway.

In all this was a fascinating visit and it was a true privilege to see inside the 'backstage operation' which enable the railway to operate.

The West Midlands branch would like to extend their thanks to John Pedley for hosting this visit and also to John Cruxon – the Chairman of the GWSR Steam Department for his support for the workshop visit.

September meeting -

How do you describe a development in vehicle suspension?

Our speaker Colin Smith, Chief Technical Officer, Freedm Ltd started by describing suspension taking a traditional tractor with a pivoted front axle. This is defined as a 'zero warp suspension' where no torsion is fed into the vehicle chassis until the limit of the front axle pivot is reached when the other front wheel starts to lift. However, the driver follows the articulation of the rear axle with the only compliance from within the rear tyres. He is thrown from side to side and shaken.

He next brought out a radio-controlled light weight racing car chassis. Many improvements included independent suspension on all four wheels however, as one wheel is raised there is a load transfer to the diagonal opposite wheel. Also, when that gets too high beyond the design limit of 1/3rd wheel diameter you have non-driving wheels in the air.

So looking at these shortcomings, with a conventional tractor, it can cope with small irregularities but large irregularities result in the driver being thrown around. Tractors maintain traction by retaining rear wheel ground contact, even if this means front wheels are in the air. An ideal arrangement would be if all four wheels could remain on the ground, maintaining a reasonably even weight distribution for traction.

He then showed us his model with the new Freedm suspension and described how it accommodated these needs. To emphasise he had four small weigh scales and we could experiment and see the result. Very impressive.

With a wheel raised on a block over half the actual wheel height there was barely a load change on the wheel loading.

This would allow excellent traction on varying ground conditions and reduce the need for differential locks and other means of overcoming low ground weight and wheel slippage. No damping is needed over small irregularities but only some damping towards extreme movement. And yes, it is covered by worldwide patents!

We were able to experiment with the models. All very interesting.

A first observation was that it appeared to be like a 2CV suspension with front back linkage. The reply yes but – and a big but – this system links all four wheels and has no spring connections to the vehicle chassis. The system retained excellent accommodation of both small and large ground irregularities using its very large suspension travel.

Simple and robust

One of the vehicle manufacturers they spoke to said that they could already accommodate all this using their electronic and active linked hydraulics. All very well and good but this is entirely mechanical over most of its range and could be more robust, simpler, easily repairable and, dare we say, cheaper.

It was admitted that this system was much more suited to off road and multi-purpose vehicles rather than a high speed use were there was a completely different design criteria.

We were invited to come to their demonstration ground to experience the difference by driving two golf buggies. There they have two basically similar vehicles but one modified to their system although it is not always easy to upgrade an existing vehicle as the suspension travel is a lot greater!

The key question is: "Is a vehicle which significantly reduces driver G forces, improves traction and improves body stability of interest to the agricultural and off-road vehicle market?"

Is there anyone out there designing a new vehicle and starting to think about the suspension? Come and have a drive?

The traditional tractor, look what happens when one front wheel goes beyond maximum height?

This model has independent suspension on all four wheels. However, when one wheel is raised there is a big weight transfer to the diagonally opposite wheel.

A group discussion around the models; the front one is with the new suspension on a model of the same size as the standard radio controlled one on the right. The far model is the system built into a platform as would be in an automotive application with a central space for a battery.

Membership Matters

The T6.160 methane tractor in action recently at Tillage-Live.

Western Branch

Branch meeting -

New Holland ignites success with methane-powered tractor

Report by Mike Whiting

As sequels go, Alistair Walshaw delivered a blockbuster at the Western Branch AGM in March. A refreshed presentation from the IAgrE conference in November 2021 gave an update on delivery of New Holland's methane tractor into the market.

Alistair explained how methane became the selected fuel source for the new venture. Investigations on the use of purely electric would have required a battery mass of 3500kg, a recharge time of 12 hours, and coupled with £100,000 cost. This is all before any considerations for the necessary supporting fuel infrastructure. Although electrification still remains in the mix due to its benefits in controlling implement functions such as spot spraying.

The challenge was to get as near as possible to the energy density value of diesel fuel, methane ticked the boxes and project development got underway. Sales colleagues submitted their 'wish list' onto the agenda stipulating that performance

had to match that of current units. This included in the field, on the road and operator comfort. The operations team weren't expecting to make any changes to the current tractor production build and assembly lines. Alistair summarised the four main technical issues for engineers to solve. These were driveability, gas tank development, variability of fuel quality and high exhaust temperatures. As an indication of variables, residual vapours from a gas-powered unit can exceed 800ºC compared with 550ºC for diesel systems. The move to a spark ignition engine for burning a gaseous material required the application of a knock sensor. Failing to keep this phenomenon in check causes damage, primarily to the head gasket and ultimately the cylinder head. Regarding performance, the sensor maximises energy yield whilst reducing fuel consumption and increasing torque. All achieved via a signal transmitted to the engine control unit (ECU), starting ignition as soon as possible.

The design of the methane powered engine block retained only three original elements of the traditional diesel unit. These were oil sump, crankshaft, and structural cylinder block. A new cylinder head, pistons, ignition system were all required to ensure the tractor's performance was maintained. Achieving the all-important Stage V compliance with the methane fuelled unit is much simpler, requiring only a three-way catalyst with sensor monitoring. This declutters the current requirements for Selective Catalytic Reduction (SCR) plus the injection and monitoring of AdBlue.

The natural characteristic of methane prefers a long, straight large diameter vessel for storage. Not the easiest design to accommodate within the road dimensions for legal use on the public highway. A three-million-pound slice of the development budget resulted in four tanks totalling 193 litres situated within the main frame. An optional front mounted range extender comprising three cylinders holding 270 litres. With a mass of 853kg when empty this assembly provides useful front counterbalance. Running time in the field is approximately seven hours with a rapid refill procedure.

With the tractor specification agreed and tested across worldwide locations, New Holland's attention has turned to the fuel source. A map detailed where dairy farms dominate the UK's western regions which coincidentally matches higher concentrations of methane levels in the atmosphere. The business model recognises the value, both financially and environmentally, from harnessing emissions from cattle to fuel tractors. Alistair concluded that fuel sales generated from livestock effluent may be considered as equal to revenue from marketing their produce.

Membership Matters

Branch meeting -
Take the pressure out of soil compaction

Report by Mike Whiting

Establishing the effect of tyre pressure on soil's long-term health and productivity is the topic which the Western Branch explored at the Royal Agricultural University in September. With over 20 years' experience in the agricultural sector Bridgestone's VT Sales Manager Stephen Lamb provided the tutorial. The logical and detailed presentation used both graphical images and calculations to demonstrate that creating a lighter footprint on the land increases profitability. Although achieving optimum performance of the tractor and machine combination requires a much greater depth of understanding.

Creating a balanced tractor scenario is how Stephen started the journey with the tractor stood in the yard. This is achievied by placing weigh scales under the axles and inputting data into Bridgestone's readily available app. The important factor is that safety trumps performance. The tyres' ability to maintain safe travel on the road must be considered before opening the valve and watching the pressure gauge needle descend. Cross referencing with industry guidance quickly provides the operator with a ratio of load between front and rear axles, not forgetting that implement tyres must also be set correctly.

Richard Robinson went early with the technical questions, querying the relationship between radial circumference and rotational speed of front and rear tyres. Stephen referred to first principles of the rim size which typically provide for a range of rubber boots currently available on the market.

Many will remember the classic flotation tyre from the 1980's which has now been superseded with technological developments. Stephen explained that we should bring our thinking towards the length of soil and rubber contact, rather than width. Put simply, previously we would have three lugs of contact, whereas now we've moving up to four or five.

Morphing tyres into a track scenario is now possible. Bridgestone's VT range of tyres provides maximum flexibility without permanent degradation of the cross-sectional profile. The icing on the cake is their patented involute lug design which minimises slip and reduces the potential for compaction. Those with central tyre inflation systems (CTIS) can fine tune field activities in accordance with soil mapping results and the field's topography. Consider a wet harvest with a tractor and trailer combination entering the field to await the combine's unloading auger. Those with CTIS can minimise their footprint whilst undertaking

L-R Stephen Lamb and Stephen Day of Bridgestone.

an activity which can contribute to degradation of soil structure. Keeping with this theme, matching tyre pressure accurately to the task reduces residual build-up on the radial surface and the potential to deposit dirt on the public highway.

Facts and figures drive decision making, and the datum of a square inch is used to tabulate the impact of tyre load across a field. Multiply the force applied across every wheeling area made throughout the tractor's movements provides an overall value. What does this tell us? Stephen explained that a typical optimum pressure setting for Bridgestone's mainline tyre specification is 8psi (0.55 bar). Running at this level rather than 12psi (0.8 bar) can reduce overall loading by 33%. Extrapolating this to yield loss, the calculations kept to a simple principle. Land untouched by wheeling's is interpreted to produce maximum returns. Operating at 1.0 bar compared with 0.6 bar across 12 hectares reduces income by approximately £675, at today's market prices. Although the 'iceberg' effect must also be considered. Farmers must factor in the costs for reducing compaction by additional passes, machine wear and subsequent depreciation of high value kit.

A relative newcomer to the agricultural tyre market, Bridgestone is planning to be a long term supplier. With a 10-year guarantee and a new generation compound using vegetable oils to replace traditional hydrocarbon sources.

The Western branch expresses thanks to the Bridgestone duo of Stephen Lamb and Stephen Day for their contribution to our autumn speaker programme. The relationship between tyre pressure and soil health needs to remain in sync to ensure farming remains profitable, and environmental targets can be met.

Wrekin Branch

June visit to -

Millington Racing Engines

Report by Dave Clare

Branch members were hosted by Roy and Julian Millington, owners of Millington Racing Engines, at their engineering premises just south of Bridgnorth. Roy is the son of a farmer and started repairing tractor engines in the mid 1970s. He also did Autograss car racing so started to get requests to rebuild racing engines. The Cosworth YB as used in the Ford Sierra/Escort became a popular power unit, but it's cast-iron block was heavy so Roy decided to produce his own aluminium block which became the start of the Millington Diamond engine. As time progressed, the supply of Cosworth cylinder heads started to dry up. This is when Roy decided to design and produce his own cylinder head as well. The Diamond engines are popular with many forms of car racing from track to rallying to hill climbs.

Millington Series II Engine

Membership Matters

The tour started in the machine shop by one of his original hand operated milling machines. Roy has invested in technology as and when appropriate, buying a Cincinnati/Siemens CNC milling machine as his first step in automation (still used today), noting that at the time it cost the equivalent of a combine harvester. His son Julian has just invested in a 5 axis machining centre, which incidentally cost the equivalent of a combine harvester. This is able to machine inlet manifolds in one go, first machining from one end, then rotating the bed 180º, before finishing from the other end. Through some clever manipulation, they are also able to machine complex components from solid aluminium block in one go, finishing with a 'trophy' like item that just needs cutting from its stem and a little fettling.

The tour then continued to the assembly area where there was a line of engines being built and refurbished. Each engine is built to customer requirements depending on the type of racing. Roy explained that what makes their engines so popular is not their peak power, but the high flat torque curve, and ability to easily rev up to over 8,500rpm. All the engines are naturally aspirated and have a built-in roller barrel throttle with individual inlets for each cylinder. This gets around having to balance a combined inlet manifold. The attention to detail is exceptional with cylinder head inlet/exhaust ports being finished by hand, a process that typically takes a full day. The tour of the workshop finished with an engine being tested on their water brake dynamometer. Compared to the 5 axis machining centre seen earlier and modern dynamometers as used by larger companies, the dynamometer was definitely low tech, but as Roy says 'it works'. In fact, the manual control gives more flexibility. Up to date instruments have been retrofitted, so data can easily be recorded and stored. Julian ran an engine up, peaking at over 8,500rpm, and despite the engine being in an enclosure and everyone wearing ear plugs, the noise was overwhelming.

After the workshop tour Roy invited us to look at his 'toys'. Out in the yard was an Abbot self-propelled gun which Julian started up, and roared up and down the farm track. It always amazes me that the military go to great lengths to camouflage their vehicles, when from my experience you can hear them long before you're ever able to see them. Roy then slid open the doors to a large barn to reveal the only surviving operational Harrier GR3 Jump Jet. After all of us had sat in the cockpit, Roy advised us to stand back as he started it up. Finally, being agricultural engineers, we could not miss Roy's tractor shed which housed approximately 20 classic tractors and excavators. The largest was a Caterpillar D10, the two cylinder donkey engine of which Roy expertly hand cranked and started, which was then used to crank and fire up the main engine.

Everyone had an informative and thoroughly enjoyable afternoon. Roy and Julian are supporters of the Midlands Air Ambulance, so with a donation from the Wrekin Branch and additional individual donations from members, a total of over £210 was raised.

The author getting ready for takeoff!

John Deere's eAutoPowr transmission and Chris Wiltshire, Tactical marketing manager

October branch meeting -

'So what are we working on now at John Deere'

Report by Bill Basford

In October Chris Wiltshire, John Deere's tactical marketing manager addressed a face to face audience at Harper Adams University with additional on-line participants, approaching all the areas of current and future energy resources, digital data recording and equipment modifications from tillage through to harvesting.

Initially, he tackled the subject of what energy source will be the primary one for the reasonably early future. In describing the use of the highly developed diesel engine based on fossil fuels he added into the mix that of biofuels, hydrogen and fuel cells, full and hybrid electric, and others. Seeking confirmation from the audience of which would be the primary objective to concentrate on from the company's point of view, he quickly summarised that in fact all areas of future energy resources would need to be tackled. Each source could have application in different situations. In fact 'concentrate on them all rather than one single source'.

Chris then took us on a journey of diesel development, electrical potential for vehicles as well as extreme ideas, some of which reflected to even the mid 70's from the blue sky thinking of the time, remember cable guidance?

Precision agriculture probably meaning different things with the tramlining of the 70's then was contrasted to the tremendous ability of electronic management, satellite control, and digital resources present in the current day. He outlined the ability to bring all of the data into the mix from the on-farm level e.g. nutrients, treatments, cultivations and link this to the optimum level of any treatment for a particular condition. In addition, the management and data collection by manufacturers for optimisation of performance, development and advisory purposes was summarised. In short it seemed that recording and storing considerable data was now possible. The challenge of that data recorded being comprehensively considered in a practical manner across a wide range of sensing remains, to achieve optimum performance.

This presentation was recorded and will be available through the IAgrE website.

Membership Matters

A reflection and some poetry from Northern Ireland

This is a transcript from a letter received by the Secretariat from Hugh McIlvenna upon receipt of his 50 year Long Service Certificate.

Hello, I wish to pass on many thanks for the certificate of 50 years membership with the Institution. It brings back many fond memories of times gone past, we had the privilege of visits to many engineering firms and talks on many interesting subjects.

I wish to share a few comic things during my employment as field repair on farms in Northern Ireland. I took an apprentice with me to assist stripping an engine from a tractor and I warned him to carefully keep all parts together on a steel tray. Suddenly a chicken flew down from the roof of the hayshed, landing on the tray of parts and scattering them on the floor. The lad looked at me and said "Hugh, I think we have got the fowl pest!"

A farmer called me one night and said "My van has severe vibration in the engine to the extent that my wife is just a blur!"

Finally, a poem for the Institution:

There is an Institution of Agricultural Engineers
It embraces many clever members that work like well meshed gears.
They consist of many branches spread across the land
Now if you have a problem they are pleased to lend a hand.
Be sure the Northern Ireland Branch is special we would say
By having branch associates they help in every way.
Now many of these members will soon be round the clock
Perhaps a branch associate could hacksaw through their lock?
The Northern Ireland Members send greetings far and wide
Just send to them your problems, they will take it in their stride.

Membership Changes

1/8/2022 - 31/10/2022

Admissions

Fellow

Mr Nathan Watkins (Herts & Essex

Member

Dr Javaid Afzal (USA)
Mr Muhammad Chaudhary (Yorkshire)
Mr James (Billy) Keating (N Ireland)
Mr William Richmond (N Ireland)
Mr Ravindra Balakrishnan (Sri Lanka)
Dr Sarah Parsons (Wrekin)
Mr Stephen McKean (N Ireland)
Mr Barry Anderson (Scotland)
Mr Stuart McClimont (Southern)

Associate Member

Mr George Upfield (South Eastern)

Affiliate

Mr R David Isaac (East Midlands)
Mr Colin Loud (East Midlands)

Technician

Mr Archie Hawkins (West Midlands)

Student

Harper Adams University

Katia Zacharaki
Aamir Dalal
James Weller
Tsz Hin Wong
Robert Weston
Jack Jamison
Harri Griffiths
Matthew Carlise
Adam Preece

Cranfield University

Elizabeth Haison
Kate Jones
Dalia Jaison
Hetvi Shah

University of Surrey

Oscar Jackson

Munster Technological University

Ahmed Al Hassan
Cillian Malone-Walker

University of Lincoln

Chamodi Amarasinghe
Opeyemisoluwa Oluyede
Bamidele Adedeji
Mehmet Aksoy
Yvonne Metet
Safiyat Moshood
Ayomide Famoye
David Ekunola
CAFRE
Ewen Power
Kevin Daly
Alexander Kerr
Daniel McVey
Ethan McKee
Matthew McGuigan
Joshua McKeown
Corey Lee
Peter Grant
Hugh Warnock
Martin Groundwater
Joshua McKee
Eion Barry
Jack Copeland
John Killen
Sam Garvin
Joshua Emerson

Wiltshire College

Edward Jones
Charlotte Harrall
Toby Northeast
Louis Dew
Jack Mee
Fin Lynch
Caleb Eaton
Ben Hawes
Joshua Case

Coleg Sir Gar

Dylan Eastlake
Deio Lewis
Carwyn O'Connor
Ellie Jones

Readmission

Member

Mr Jamie McKeown (N Ireland)

Associate Member

Mr Tom Beach (West Midlands)

Affiliate

Mr James Sandercock (East Midlands)

Deaths

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

Mr Ian Charles Smeaton – IEng MIAgrE

A valued member of the Institution for over 50 years. Ian joined in 1968 as an Associate Member. He gained his Incorporated Engineer registration in June 1976 and moved to Member grade in September 1980.

Mr Geoffrey J Shaw – IEng MIAgrE

A valued member of the Institution for over 60 years. Geoffrey joined as a student in 1962 and transferred to Associate Member grade in 1966. He moved to Member grade in January 1973 and went on to gain his Incorporated Engineer registration in May 1973.

Mr John Christopher Jeffery FIAgrE

A valued member of the Institution for nearly 40 years. John joined as a Fellow in 1984.

Transfers

Fellow

Member

Mr Ryan Scott (Northern Ireland)

Associate Member

Mr Alexander Ogg (Western)
Mr John Beale (West Midlands)
Mr Kyle Reed (Wrekin)

Affiliate

Technician

Mr Oliver Lee (Yorkshire)

Engineering Council

Registrations

CEng

Mr Thomas Sutton (Wrekin)
Ms Vimbai Pachawo (Portugal)

IEng

Mr Henry Thorpe (East Midlands)

EngTech

Society for the environment

CEnv

Academic members

Askham Bryan College
Askham Bryan, York, YO23 3FR

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

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

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

City College Norwich
Easton, Norwich, Norfolk, NR9 5DX

Coleg Cambria – Llysfasi
Rhuthin, Sir Ddinbych, LL15 2LB

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

Cranfield University
Cranfield, Bedfordshire, MK43 0AL

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

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

Harper Adams University
Newport, Shropshire, TF10 8NB

Hartpury College and University
Gloucester, GL19 3BE

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

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

Munster Technological University
Tralee Clash, Tralee, Co Kerry, Ireland

Myerscough College
Bilsbarrow, Preston, Lancashire, PR3 0RY

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

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

Reaseheath College
Reaseheath, Nantwich, Cheshire, CW5 6DF

Royal Agricultural University
Cirencester, Gloucester, GL7 6JS

Salesian Agricultural College
Pallaskenry, Co Limerick, Ireland

Sparsholt College
Sparsholt, Winchester, SO21 2NF

SRUC – Auchincruive
Auchincruive Estate, Ayr, KA6 5HW

Suffolk New College
Suffolk Rural Campus, Charity Lane, Otley, Suffolk, IP6 9EY

University of Manitoba
Winnipeg, Canada, MB R3T 2N2

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

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

Writtle University College
Lordship Road ,Writtle, Chelmsford, Essex, CM1 3RR

Long Service Certificates

	Name	Grade	Date of Anniversary
50 years	Sidney Denis Cartmel	MIAgrE	19 Oct 2022
35 years	Richard Charles Philip Green	MIAgrE	3 Nov 2022
	David Andrew Clare	AMIAgrE	3 Nov 2022
	Benjamin Arthur Kendall	MIAgrE	17 Nov 2022
	Alan Amadeus Valentine	MIAgrE	24 Nov 2022
	Alastair John Taylor	HonFIAgrE	26 Nov 2022
25 years	Jonathan Kenred Bailey	AMIAgrE	20 Nov 2022
	James Richard Evans	AIAgrE	22 Nov 2022

Commercial Members

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

Agri-EPI Centre
Easter Bush, Roslin, EH25 9RG

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

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

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

Amazone Ltd
Orchard Farm, Hurst Lane, Aukley, Doncaster, South Yorks, DN9 3NW

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

BAGMA
225 Bristol Road, Birmingham, B5 7UB

Case New Holland
Cranes Farm Road, Basildon, Essex SS14 3AD

City and Guilds
1 Giltspur Street, London, EC1A 9DD

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

Claas UK Ltd
Saxham, Bury St Edmonds, Suffolk, IP28 6QZ

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

Douglas Bomford Trust
The Bullock Building, University Way, Cranfield, Bedford, MK34 0GH

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

Fullwood
Grange Road, Ellesmere, Cheshire, SY12 9DF

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

HSS Hire
Building 2, Think Park, Mosley Road, Manchester M17 1FQ

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

Knight Farm Machinery
Wireless Hill Industrial Estate, South Luffenham, Rutland, Leicestershire, LE15 8NF

Magna Specialist Confectioners Ltd
Magna House, Stafford Park 3, Telford, Shropshire, TF3 3BH

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

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

Merlo UK Ltd
The Paddocks, Headlands Business Park, Salisbury Road, Ringwood, Hampshire BH24 3PB

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

NFU Energy Services
Stoneleigh Park, Kenilworth, Warwickshire, CV8 2LS

Nick Young Tractor Parts
Unit 2, The Forge, Moor Road, North Owersby, Market Rasen, Lincolnshire, LN8 3PR

Reesink UK Limited
1-3 Station Road, St Neots, Huntingdon, PE19 1QF

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

Spaldings Limited
25-35 Sadler Road, Lincoln, Lincolnshire, LN6 3XJ

Teagle Ltd
Blackwater,Truro, Cornwall, TR4 8HQ

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

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

Professional

The Douglas Bomford Trust

The DOUGLAS BOMFORD Trust
SUPPORTING AGRICULTURAL ENGINEERING

Jubilee, justification, jubilation, and jollies

Trust Secretary Alan Plom looks back at recent events and opportunities:

Jubilee

The last Landwards featured a report on the Trust's 50th Anniversary event held in September. Our Trustees would like to thank all who attended and the speakers who made it such a success. A more detailed review is now available on our website, which includes additional background and links to the presentations, photographs, and testimonials.

The excellent Inside Agri-Turf podcast (produced by former Landwards editor Chris Biddle,) provides highlights covering the Trust's evolution through to the forward look by our new Patron Dr David Llewellyn.

Justification

Trustees welcome feedback and the testimonials of past and current alumni reflect how the Trust's support can benefit individuals in their studies. Thanks go to Harper students Rhodri Williams and Will Flittner; Marta Sanzo Miró and Matt Home (Cranfield); Barnabas Pickford (Nottingham) and Josie Lynch (Worcester).

Two of the speakers (Nick Tillett and Paula Misiewicz) and some written testimonials also described the long-term impact of the Trust's support on subsequent careers and businesses. We hope that a 'Student Forum' will be set up, enabling individuals to share their experiences along with advice on completing studies or research.

This graphic depicts the Trust's current approach and activities, but Trustee Paul Miller described our emerging strategy, being developed in collaboration with Cranfield MSc students over the past three years. Their horizon-scanning and model framework will help the Trust identify priorities and enable more effective targeting of sponsorship.

Jubilation

We attended several other celebrations recently. HAU's Graduation Ceremonies for the 'Classes' of 2020, 21 and 22, RAU's and Cranfield's. Congratulations to all our alumni. Your degrees were well-earned in the face of the pandemic, and we wish you all success in your careers.

Not just 'Jollies'

It has been a pleasure to meet socially with alumni, academic and industry colleagues at numerous other events too, including the recent IAgrE Landwards Conference.

At last, we have started to receive reports from those now able to spend their Travel Grants However,

Trustee Nick August and his combine

we are reassured that our sponsored trips are never 'all play and no work'.

Marta Sanzo Miró enjoyed her Trust-sponsored trip to Dublin to attend the 11th World Potato Congress at the end of May, as part of her PhD project on reducing in-store potato losses. Marta was active in the Cranfield MSc horizon scanning group.

Barnabas Pickford (who has been supported by the Trust since his A-levels, via the Arkwright Scholarship Scheme and is now a 3rd year MEng at Nottingham University) also provided an interesting report on his visit to the 100th SIMA in Paris. He was impressed by the range of new ideas from start-ups, not just the biggest and latest autonomous machines from established manufacturers. Many related to spot spraying, weed detection and electronic weeders. 'Combined power' machines are also starting to feature.

Richard Robinson attended this year's Arkwright Scholarship Awards Ceremony at the IET in London, where he met two of our four new A-level students he will be mentoring over the next two years. The aim is to encourage students to study undergrad courses related to agricultural engineering and hopefully pursue a career in the sector.

Earlier in the summer, Trustee John Baines called in at Glasgow University to check on progress with Scott Ewings' 'LEDs for Vertical Farming' project and Trust Chair Nick August hosted a group of MSc Students from UCL on his farm, to give them a better understanding of the challenges faced by farmers and the contribution of agricultural engineering to food production.

For further information, see the Trust's website:

www.dbt.org.uk

or contact the Secretary Alan Plom via:

enquiries@dbt.org.uk

You can also follow:

@BomfordTrust

on Twitter and on LinkedIn, for news of interesting events, opportunities, or developments.

Research Round up

Converting grazing land to arable 'unsustainable' in west country and other parts of northern Europe

Crop failures and small yields likely as climate change stops farm machinery from accessing fields

Converting farms from livestock to arable would lead to regular crop failures, according to an analysis of one the UK's largest beef and sheep rearing regions.

The Rothamsted Research-led study focused on the southwest of England in response to questions over what could happen to UK livestock farming communities as society shifts towards more plant-based diets.

The bad news for farmers is that the chances of successfully growing winter wheat on fields once used to raise livestock could be as little as 28% in future, as increased rainfall will make sowing the crop impossible in some years.

Forecasts show that in the absence of climate change, yields could be greater than 14 tonnes per hectare - but when the near certain impact of increased future rainfall on sowing and harvest dates were included in

The bad news for farmers is that the chances of successfully growing winter wheat on fields once used to raise livestock could be as little as 28% in future.

the simulation, it fell in some situations to less than 3 tonnes per hectare.

Lead author Dr Lianhai Wu said: "Adapting to the changing climate and changes in consumer demands will force us to diversify land from its current uses. Livestock grazing is the main type of farming across the west of the British Isles and it has been suggested that grasslands in the region could be converted to other land uses, such as growing cereal crops.

"However, our simulations suggest that, for the southwest of England and regions under a similar combination of soil types and climates, planting winter wheat between October and December would be impossible in some years because of constraints on soil 'workability'."

'Workability' is defined as the ability of a soil to support being ploughed, and along with 'trafficability' – the capacity of soil to support heavy farm machinery without becoming damaged – is determined in part by the weather, soil properties, and the previous impact of machinery.

On arable land, unsuitable soil conditions during the sowing or harvest periods will decrease yield if sowing or harvest are delayed - or even prevent it entirely.

The study, which also involved SRUC, looked at three soil types common across the southwest, under the current climate and three climate predictions from the Met Office.

Across the soil types and climate scenarios, the chances of successfully sowing winter wheat between October and December ranged from 28 to 76%, whilst harvesting was predicted to be less impacted by the predicted increases in rainfall.

Research Round up

The study also looked at the implications for soil carbon storage and greenhouse gas emissions if grassland that had three cuts a year to provide silage, was converted to winter wheat.

Including two other greenhouse gases, nitrous oxide and methane, in the calculations, it showed that whilst the average greenhouse gas emissions from soil growing ryegrass were higher than from the same land converted to wheat, this was compensated for by the greater amounts of carbon stored within the ryegrass.

Grasses return more of this carbon to the soil after they die, and as such, carbon stocks declined annually after converting grassland to wheat by 165-280kg of carbon per hectare, depending on climate scenario and soil type.

"Grassland conversion in the region would not be sustainable in terms of carbon sequestration although applications of livestock manure or other organic materials could mitigate soil C losses to some extent," said Dr Wu.

"In terms of storing carbon in the soil, converting grassland to winter wheat is therefore unsustainable in areas with soils and climates similar to the southwest of England, such as many other areas in the UK and northern Europe."

Heavy rain days

The climate models show the number of heavy rain days, those with more than 2cm of rain, will increase in the southwest from 6, to as many as 17 days a year, by the end of the century.

Delays to sowing and failure to harvest a crop in some years due to wet weather made the idea of conversion to arable a 'non-starter' for livestock farmers in the southwest, said Dr Wu.

"But the question still remains – if we are going to eat less meat and rear less livestock, what happens to these farmers and these farming areas?"

Farming for the future – how agroforestry can deliver for nature and the climate

Agroforestry – farming with trees – could be pivotal in helping the agricultural sector reach net zero by 2050, according to new research carried out by Cranfield University, which underpins a report by the Woodland Trust.

The Cranfield research explains that agriculture is responsible for 10% of UK territorial greenhouse gas emissions with the net effect of 'land use, land use change and forestry' responsible for another 1%. To meet net zero targets for 2050, the report says it is essential that farm businesses implement practices to reduce their greenhouse gas emissions, which may typically amount to around two to four tonnes of carbon dioxide equivalent per hectare per year on arable and grassland farms respectively. In comparison, the average per capita emission of a UK citizen is about eight tonnes of CO_2 equivalent per year.

One way to offset greenhouse gas emissions is to increase the area of tree cover on farms using agroforestry. Using models and experimental results, the research shows that growing trees alongside crops (known as silvoarable agroforestry) could lock up eight tonnes of CO_2 equivalent per hectare per year over 30 years. A silvopastoral system, where 400 trees per hectare were planted on grassland, was predicted to lock up 16 tonnes of CO_2 equivalent per year over 40 years.

Assuming no other reduction in agricultural emissions, establishing agroforestry on 20% of arable land and 30% of grassland could enable UK agriculture-related emissions to reach net zero by 2050 whilst maintaining high levels of food production. Integrating trees into farming systems can also provide benefits for wildlife, enhance soil health, and moderate runoff and water flows. It can also lead to enhancement of other ecosystems services including pest control in organic systems, and pollination.

Paul Burgess, Professor of Sustainable Agriculture and Agroforestry at Cranfield University, who conducted the research with Dr Anil Graves, Senior Lecturer in Land Use Systems, said: "Consumers and retailers increasingly want food derived from farms with zero or negative greenhouse gas emissions. Increased tree planting (agroforestry) is one of the few ways that farm businesses can maintain food production whilst achieving net zero targets over the next 30 years. Because the carbon sequestration of newly planted trees is initially slow, planting needs to occur now to achieve targets for 2050."

The full Woodland Trust report, with links to the Cranfield report on greenhouse gases and a Woodland Trust report on biodiversity, is available to view on the Woodland Trust's website.

www.woodlandtrust.org.uk

SocEnv
Society for the Environment

"The launch of REnvP is a landmark moment for environmental professionalism, providing more individuals with the opportunity to gain professional registration and achieve external verification of their competence."

Dr Emma Wilcox
Chief Executive Officer of the
Society for the Environment

Progress your career with REnvP

launched in partnership between the Institution of Agricultural Engineers (IAgrE) and the Society for the Environment is the new grade of Registered Environmental Practitioner (REnvP).

This is a huge step forward to ensure high standards of professionalism and proven competence are met by those working to enhance and protect the environment across every sector.

This registration is timely and relevant for agricultural engineering and the associated technology sectors and the intention is that professionals in the industry will apply. The industry includes many different disciplines which need people to apply a professional approach and the Registered Environmental Practitioner grade is ideal for this.

Why should I register?

- Improve your career and salary prospects
- Stand out from the field
- Join a network of dedicated professionals
- Demonstrate your competence and skills.

Register through IAgrE now:

t: +44 (0) 1234 750876
e: membership@iagre.org
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Although the standards are high, IAgrE makes the process simple.

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