AGRICULTURE ▪ HORTICULTURE ▪ FORESTRY ▪ ENVIRONMENT ▪ AMENITY

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Landwards

VISION 2038 *PART THREE*

MECHANISATION

WHAT TRACTORS, MACHINERY AND NEW TECHNOLOGY WILL BE IN COMMON USE IN 2038?

In this issue

IAgrE

TECHNICIAN GRADE

NEW ROUTE INTO IAgrE FAMILY

DAIRY EQUIPMENT TECHNICIAN

The Technician grade of IAgrE Membership is for those who are qualified at a vocational or technical level. They may have completed an apprenticeship or extended diploma. Alternatively they may have gathered technical training at work or participation on an IAgrE approved training programme such as Parlour Safe.

To qualify, you will be working in industry and will have built up experience and career development in the workplace.

You will be keen to be part of the IAgrE family and seeking a cost effective way of getting involved and benefiting from being part of the community of professional engineers.

The IAgrE Technician Grade for Parlour Safe Technicians

If you are registered under the Parlour Safe scheme and have attended training courses at Reaseheath or Hartpury Colleges you are eligible to apply for IAgrE membership and use the letters TIAgrE after your name and on your business card as a way of demonstrating your high standards to your customers and colleagues.

If you have completed the training and assessment at Parlour Safe Category 3 and above you can also apply to become a professionally registered engineer.

This will permit you to use the title of Engineering Technician and join the growing number of engineers who use the letters EngTech as a demonstration of high standards and professionalism.

ACCREDITATION SCHEME

PARLOUR SAFE

To apply and find out more:

Go to the IAgrE website and complete the Application Form iagre.org/technician. With your completed application form, you will also need to provide a current full and detailed CV which describes in detail your working history and experience. We will need copies of academic certificates and details of education/training.

For further information contact Alison membership@iagre.org or 01234 750 876

EDITORIAL: STEM-ING THE TIDE

In July 1969, the world was transfixed by the outstanding skills of engineers and scientists behind the successful launch and safe return of Apollo 11, putting man on the moon for the first time. Replaying those scenes from Houston control half a century ago in recent documentaries was truly astonishing. Computer equipment was still rudimentary and the tension on the faces of the engineers was palpable.
If there was a moment from the 20th Century that would have excited potential engineers, that was it. And yet was it?
In the very same week in July 2019, came the announcement in my home-town that Salisbury UTC (University Technical College) is to close next year "for lack of pupils". Opened in September 2015, the building had been adapted and extended from the recently closed main police station at a cost of more than £8 million. So much for a renewed interest in STEM subjects.
Now it is likely that the Salisbury UTC had specific issues because other UTCs in the region are flourishing. Engaging young people with engineering remains a challenge, and as the Royal Academy of Engineering President, Dame Ann Dowling, writes in this issue "connections with schools are complicated, with more than 600 organisations involved in STEM education, so many options can make it difficult for schools to find out what is on offer". In other words, streamlining the STEM infrastructure should be a priority.
There are however positive signs. It is significant that many independent schools are now encouraging pupils to consider practical BTec courses as the A-level requirements for university have been toughened up. BTec courses can be taken in association with A levels and passes are equivalent to A level and accepted by most universities and colleges. The most popular BTec courses are in business studies, computing and science with engineering and countryside management featuring strongly.
We still need to get the engineering message in general – and agricultural engineering message in particular – out there at every opportunity, but green shoots are appearing.

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IAgrE is a founder member of EurAgEng, a licensed body of the Engineering Council and a founder constituent of the Society for the Environment

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OTHER FEATURES

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Robotic lettuce harvester Field tested at G's Growers

The 'Vegebot', developed by a team at the University of Cambridge, was initially trained to recognise and harvest iceberg lettuce in a lab setting. It has now been successfully tested in a variety of field conditions in cooperation with G's Growers, a local fruit and vegetable co-operative.

Although the prototype is nowhere near as fast or efficient as a human worker, it demonstrates how the use of robotics in agriculture might be expanded, even for crops like iceberg lettuce which are particularly challenging to harvest mechanically.

Crops such as potatoes and wheat have been harvested mechanically at scale for decades, but many other crops have to date resisted automation. Iceberg lettuce is one such crop. Although it is the most common type of lettuce grown in the UK, iceberg is easily damaged and grows relatively flat to the ground, presenting a challenge for robotic harvesters.

"Every field is different, every lettuce is different," said co-author Simon Birrell from Cambridge's Department of Engineering. "But if we can make a robotic harvester work with iceberg lettuce, we could also make it work with many other crops."

"At the moment, harvesting is the only part of the lettuce life cycle that is done manually, and it's very physically demanding," said co-author Julia Cai, who worked on the computer vision components of the Vegebot while she was an undergraduate student in the lab of Dr Fumiya Iida.

The Vegebot first identifies the 'target' crop within its field of vision, then determines whether a particular lettuce is healthy and ready to be harvested, and finally cuts the lettuce from the rest of the plant without crushing it so that it is 'supermarket ready'.

"For a human, the entire process takes a couple of seconds, but it's a really challenging problem for a robot," said co-author Josie Hughes.

The Vegebot has two main components: a computer vision system and a cutting system. The overhead camera on the Vegebot takes an image of the lettuce field and first identifies all the lettuces in the image, and then for each lettuce, classifies whether it should be harvested or not. A lettuce might be rejected because it's not yet mature, or it might have a disease that could spread to other lettuces in the harvest.

The researchers developed and trained a machine learning algorithm on example images of lettuces. Once the Vegebot could recognise healthy lettuces in the lab, it was then trained in the field, in a variety of weather conditions, on thousands of real lettuces.

A second camera on the Vegebot is positioned near the cutting blade and helps ensure a smooth cut. The researchers were also able to adjust the pressure in the robot's gripping arm so that it held the lettuce firmly enough not to drop it, but not so firm as to crush it. The force of the grip can be adjusted for other crops.

"We wanted to develop approaches that weren't necessarily specific to iceberg lettuce so that they can be used for other types of above-ground crops," said Iida, who leads the team behind the research.

Iida's group at Cambridge is also part of the world's first Centre for Doctoral Training (CDT) in agri-food robotics. In collaboration with researchers at the University of Lincoln and the University of East Anglia, the Cambridge researchers will train the next generation of specialists in robotics and autonomous systems for application in the agri-tech sector.

Agricultural robot shipments to increase sharply

Forecast to rise from 60,000 units in 2018 to more than 727,000 by 2025

According to a new report by analysts Tractica, global shipments of agricultural robots will increase at a fast pace over the next several years, rising from approximately 60,000 units annually in 2018 to more than 727,000 by 2025.

The market intelligence firm anticipates that drones (UAVs) will top the list among agricultural robot categories, followed by driverless tractors, material management robots, soil management robots, and dairy management robots. Tractica forecasts that such shipments will drive a total annual market value of $87.9 billion worldwide by 2025.

"Robots and automation technologies have the potential to dramatically improve crop quality and yields, reduce the amount of chemicals used, solve labour shortages, and provide hope for the economic sustainability of smaller farming operations," says senior analyst Glenn Sanders.

Sanders adds that these factors are driving strong demand for robots throughout the farming process, including planting, pruning, weeding, pick-and-place, sorting, seeding, spraying, harvesting, and materials handling.

FROM HYDRAULICS TO HEALTHCARE

Ben uses ag engineering background to design mobility equipment

IAgrE Member, Ben Clarke has translated his design skills in agricultural engineering to work with Benmor Medical, a manufacturer and provider of mobility equipment.

Formed in 1996, Benmor Medical was the first company in the UK to specialise in bariatric patient handling equipment and now offers an extensive range of bariatric equipment, including beds, seating, slings, wheelchairs and standing aids.

With experience developing mechanical products, Ben is responsible for product design, development and key component selection, working alongside sub-contractors to refine the mechanical design of pre-existing medical bed products and managing new product projects.

Awarded the New Holland Trophy after graduating top of his class with a First-Class Honours degree in the field of Agricultural Engineering BEng (Hons) from Harper Adams University in 2016, Ben an associate member of Institution of Agricultural Engineers is on course to become an Incorporated Engineer. He also worked on placement with Lite-Trac.

Having gained substantial experience in developing bespoke machinery during a three-year stint with one of the UK's largest manufacturers of agricultural machinery he will aim to use his ingenuity to bring new ideas to the medical device sector.

Ben commented: "I've not had the chance to work in the medical devices sector before and I'm always keen to learn new things and be challenged so the learning curve offered by Benmor was a challenge I couldn't turn down.

"In the short amount of time I've worked for Benmor Medical, I've been shown how difficult life can be for the Bariatric patients our products cater for. I'm excited to help build and expand our already successful product range and help give more of these people a better quality of life."

"The bariatric market is ever-changing, and adapting to the growth of this complex patient group requires us to expand our workforce with highly qualified individuals," said Peter Staddon, Managing Director of Benmor Medical.

"Ben's previous skills ensure he can bring new innovation and enhancement to our product range while providing design and engineering expertise to our in-house manufacturing process".

Farm safety

Agriculture the deadliest UK industry

To co-incide with Farm Safety Week (15-19 July), the NFU urged farmers to take extra steps and start implementing changes on their farms.

It follows the release of new figures which showed that agriculture is still the deadliest UK industry.

39 people have lost their lives on farms in one year alone, according to the Health and Safety Executive (HSE).

But farmers across the country are now ramping up their efforts to make health and safety on farm a priority. Practical changes were being made during Farm Safety Week to ensure safer working and more resilient businesses. The NFU hosted a series of workshops to advise farmers how simple changes to their farms and businesses can make a big difference, with nearly 900 farmers attending since the beginning of May alone.

NFU Vice President Stuart Roberts said there has been an 'undeniable shift' in many farmers' approach towards health and safety. "The conversation around health and safety is changing, but as HSE figures have shown, conversation alone isn't enough.

"Farmers need to put their words into action and commit to making real changes on their farms, such as wearing a helmet when driving an ATV or having a secure escape route when handling cattle."

He added: "Effective safety measures are a fundamental part of any successful business. It should not be treated as an add-on or something we do only because we have to, but rather a core part of how we look after ourselves and our businesses."

The NFU is encouraging farmers not to limit safety to just one week of the year as farming businesses run all year round.

"To every single person that lives on, works on or visits a farm – speak up if you see any unsafe practices. We all have a responsibility to look for risks. Don't leave it up to someone else," Mr Roberts said.

HSE figures outline that the main causes of farm fatalities were moving vehicles, livestock and falling from height.

Farms and estates are also recommended to hold pre-harvest health and safety briefings as a reminder to all staff of the risks involved during this busy time of year and what steps they should take to mitigate them.

Robert Gazely, health and safety specialist with Strutt & Parker, said harvest was an intense time of year so making time to thoroughly brief all employees, both new and existing, was essential.

"Farms become busier not only in terms of workload but also machinery movements and numbers of employees – including temporary harvest staff – operating together," he said.

"Pre-harvest health and safety briefings are strongly recommended as a way of reinforcing the importance of health and safety issues and are a practical way of providing employees – and family members – with the information, instruction, training and supervision that they need to stay safe."

Mr Gazely said briefings should include information such as the location of first aid kits, accident books, assembly points, fire extinguishers and electric isolation points.

Parlour Safe accreditation

'RAISING THE BAR' FOR DAIRY TECHNICIANS

Parlour Safe, the Milking Equipment Association's (MEA) industry training scheme for engineers and technicians, has been approved by the Institution of Agricultural Engineers (IAgrE), in recognition of its professional quality and the standard of its training.

Parlour Safe has seen increasing demand in recent years, as dairy farmers seek to work with professionally accredited technicians to maximise parlour efficiencies.

The MEA has worked closely with the industry and with Reaseheath and Hartpury Colleges to create a categorised, modular course structure that offers the latest practical and technical information on all aspects of parlour management, from dynamic testing and cow welfare, to health and safety and building design.

Comprising four categories, depending on knowledge and experience, Parlour Safe gives individuals a recognised industry accreditation with now both Category 3 and Category 4 awarded with IAgrE approval. This gives qualifying individuals the opportunity to join IAgrE and register as Engineering Technicians (EngTech) with the Engineering Council.

Commenting on this latest development, Ruth Bailey, Chief Executive, MEA, says, "I am thrilled for everyone involved with Parlour Safe that it has once again received this prestigious status from the IAgrE, which acknowledges the expertise and technical abilities of milking machine engineers and technicians".

IAgrE CEO Alastair Taylor commented: "This approval puts Parlour Safe technicians at the same status as those working across many engineering and technology sectors, and after successful completion of Parlour Safe training and assessment, they will be able to gain full IAgrE membership and become registered as Engineering Technicians.

The dairy industry should be proud that the technicians who install and maintain milking equipment have the same standing as those working in aviation and other complex sectors. We should celebrate our technicians' achievements in this way. It is great news for our industry and the people who work in it. It really does raise the bar".

New Agri-Tech Research facility opens at Pershore College

Businesses and students to collaborate on new products and services

A new Agri-Tech Research Centre has opened at Pershore College in Worcestershire. The centre has been funded with the support of £500,000 from Worcestershire Local Enterprise Partnership (LEP).

It houses a research and teaching laboratory, an outdoor vertical farm system and an indoor fully-automated hydroponics chamber.

It also contains robotic and computer-based technologies used to educate students on modern applications of food production.

Attendees enjoyed presentations and demonstrations on a number of topics as well as a tour around the centre with Professor Roy Kennedy, leader of the college's agriculture technology programme.

The keynote speaker was Alastair Taylor, chief executive of the Institution of Agricultural Engineers, who spoke about the need for agri-tech to solve issues in world food production.

He said: "I very much welcome the work of Pershore College to raise awareness of the role of agri-tech in securing global food security. We wish the centre every success and look forward to seeing it developing with new innovations and enterprises."

The visitors also heard about a new project which aims to engage technology businesses to develop new solutions to challenges faced by the sector.

The GrowAgri Worcestershire project, part-funded by the European Regional Development Fund, will deliver business support for small to medium-sized enterprises to support business growth, increased productivity and to introduce new products, processes and services.

Professor Kennedy said: "We were absolutely delighted to welcome so many of our partners, stakeholders and businesses to the official opening.

"Pershore's agri-tech centre will be a key resource for industry, where businesses can come and be trained in innovative technologies and work with students on projects to help develop solutions to the many challenges facing the agriculture and horticulture sector."

Gary Woodman, chief executive of Worcestershire LEP, said: "Pershore College is playing a crucial role in addressing current and pressing skills shortages that act as a barrier to business innovation and growth."

ROLE OF AGRICULTURAL ENGINEERS IN CLIMATE CHANGE

There should be no delay addressing key issues to avoid widespread actions in the future.

IAgrE President
PROFESSOR JANE RICKSON CEnv, FIAgrE

President's Musings

In 2011, Sir John Beddington, the Government's Chief Scientist and Head of the Government Office for Science produced his influential 'Foresight' report on the "Future of Food and Farming: Challenges and choices for global sustainability". Unfortunately, there was little specific mention of agricultural engineering in the report, but the IAgrE rectified this by highlighting to Sir John directly the importance of agricultural and biosystems engineering in advancing sustainable farming and food production.

There was little specific mention of agricultural engineering

I think we now have another opportunity to demonstrate the critical role of agricultural engineering in overcoming a major global challenge: climate change (or climate crisis / emergency as some call it now). Last month, the International Panel on Climate Change (IPCC) launched their report on "Climate Change and Land" (*https://www.ipcc.ch/srccl-report-download-page/).* The report states that global warming (caused by elevated levels of atmospheric greenhouse gases of carbon dioxide, methane and nitrous oxide) and associated climate change (CC) have significant impacts on soil, water and vegetation, affecting peoples' health, wealth and livelihoods.

The report predicts that it will not be possible to grow staple crops where they are grown today, affecting local supply chains, retailers, consumers and international commodity markets.

ABOVE: Sir John Beddington

PROVIDING SOLUTIONS

This has huge implications for food security. So should we increase inputs (of water, fertiliser, pesticides, etc.) to continue to grow these crops? Will these inputs make food production uneconomic (especially given the already small margins on many agricultural commodities)?

Is there a role for GM crops to adapt to climate change?

Is there a role for GM crops to adapt to climate change (Prime Minister Johnson spoke of relaxing the rules on GMOs in his acceptance speech).

Should we change the crops currently grown to ones more suited to the 'new' climate? Is our ability to grow vines, olives and even tea in southern England a result of climate change?

Does changing land use / crop type bring unintended consequences, such as higher rates of soil damage?

The report estimates that agriculture, forestry and other land uses contribute 23% of all man-made greenhouse gas emissions, so what better time to show how agricultural engineering can provide the solutions to these issues too?

The report calls for cost-effective land management practices that will reverse, mitigate and/or adapt to global warming and climate change.

These include increasing carbon storage in soils by taking CO_2 out of the atmosphere; cover cropping over winter to reduce the impacts of climate change and extreme weather events (such as soil erosion from heavier rainstorms); and reducing tillage intensity to avoid CO_2 losses from bare ground.

Agricultural engineers are well qualified to understand that these measures will have technical, economic, environmental and social consequences. IAgrE members also have the expertise and knowledge to provide the advice and training that will be needed to implement these adaptation and mitigation practices.

The Report warns that delay in addressing climate change will increase the need for more widespread action in the future (i.e. "prevention is better than cure"). Ignoring the issues today will limit the number of options available tomorrow and will reduce the effectiveness of those options in reducing the effects of climate change.

However, none of this is new to us: "Decarbonising Agriculture" was the theme of our Annual Conference back in 2017.

ROYAL ACADEMY OF ENGINEERING UPDATE UPDATE

The Evolution of Engineering

As she nears the end of her 5-year term as President, Professor Dame Ann Dowling OM DBE FREng FRS reflects on her time at the helm of the Royal Academy of Engineering.

During the past five years, the Royal Academy of Engineering, and the engineering landscape in general, have seen some significant changes, including political and changes to funding as well as a focus on diversity and industry's relationship with academia. In 2014, I was the first woman to be appointed as President of the Academy and this September marks the end of my five year term. I am pleased to say that, since then, diversity and inclusion (D&I) within the profession has been high on the agenda.

The skills shortage in engineering has been persistent, but we are beginning to see some progress, particularly in engaging young people. The ***This is Engineering*** campaign, which the Academy launched in 2018 with several partners, has helped to open up engineering to a new generation and demonstrated the wealth and breadth of opportunities available in the profession.

Research carried out at the end of the campaign's first year has shown that consideration of engineering as a career option has almost doubled among teenagers who have seen the campaign films, and increased more significantly among females and black, Asian and minority ethnic students.

As well as addressing the perceptions of, and attitude towards, engineering careers among young people, we have also needed to focus on bringing engineering into the classroom. There are many excellent programmes aimed at doing this, but these are not having an effect at the scale needed, and the connections with schools are complicated, with more than 600 organisations involved in STEM education.

So many options can make it difficult for schools to find out what is on offer and limits the opportunity to transfer best practice. The Academy and Engineering UK have begun to explore how best to work together to simplify and streamline the whole engineering community's outreach to schools.

When I was appointed as President one of my first tasks was to lead a review, commissioned by the

then Department for Business, Innovation and Skills, examining how government could support the development of more effective collaborations between business and university researchers, which are so crucial to the UK economy.

As well as policy changes, the review has led to developments in how the government supports universities and businesses to build collaborations. Innovate UK immediately simplified its interface to business, making it easier for companies not already engaged in collaborative research to start, an approach that has subsequently been taken up by UK Research and Innovation (UKRI).

Professional Engineering Organisations

The Academy's establishment of the National Engineering Policy Centre, bringing together the expertise of all of the UK's professional engineering organisations to provide advice to policymakers, is a significant step forwards in growing that influence. Just before my term began, the Academy launched the Enterprise Hub, which has become one of its success stories. It was originally developed to take the 'best of best' UK-based entrepreneurial engineering innovators and companies and provide them with pre-seed funding and a package of mentoring, training and bespoke support to encourage success, and therefore contribute to the UK's economic growth.

The Academy's international activities have gone from strength to strength over the past few years, supporting the training of hundreds of international entrepreneurs to help develop innovations that address local challenges, linking researchers with like-minded academics from other countries and building partnerships with engineering institutions across the globe. This year also sees the start of the second series of Global Grand Challenges Summits, with a two-day event hosted by the Academy in London that will bring together policymakers, innovators and the next generation of engineers from across the world to build collaborative solutions for our future.

Engineering is playing an increasingly important role in society, and the engineering landscape has evolved significantly since I took up this post, progress that I believe the Academy's activities have contributed positively to. Collaboration, investment, a greater supply of skills, and D&I are all key to ensuring that the brightest minds can continue to innovate. There has never been a more important time for the Academy to advance and promote excellence in engineering so that our profession can continue to contribute to societal wellbeing and economic growth.

This an edited version of the full article that appeared in Ingenia June 2019.

CEO

Reflections on a changing world

MEMBERS ARE THE KEY

IAgrE on the cusp of enormous technological change and challenges

Edward Hansom *CEng MIMechE AMIAgrE*

As I write this, my first CEO Reflections for Landwards, it is with a mixture of excitement, anticipation and (a little) trepidation as I approach my official start date as the new CEO. I have already visited Harper Adams University, a couple of Colleges of Further Education, this year's AGM held at the National Fluid Power Centre in Worksop, the offices of the Engineering Council and the Agricultural Engineering Association and am about to visit the offices of the Society of the Environment. All of which shows me that the IAgrE covers a diverse variety of disciplines, careers, industries and specialisms. Members themselves are engineers, technologists, environmentalists and scientists working in agriculture, horticulture, forestry, amenities, academia and the environment. My first impressions of the sheer scale of the remit are breathtaking.

IAgrE will have an increasingly important part to play

I am also taking over at a very interesting time. The industries supported by the IAgrE are on the cusp of enormous technological change and challenges. Issues such as food security, the effects of climate change, changing diets, food waste, GMOs, farm workers and land utilisation that had previously been restricted to such outlets as this journal are now regularly discussed at a national level in our newspapers and on the broadcast media. I have already witnessed drones, robots, vertical farms, autonomous farm vehicles and 'digitized' animals. I even now know the difference between hydroponics and aquaponics. I realise that the IAgrE will have an increasingly important part to play in meeting these challenges and shining a light on where it is all leading.

REMAINING RELEVANT

In the next few months I intend to get out and about to increase my knowledge of these subjects and to meet the members. As far as I am concerned it is the members who are the key, not only to this Institution, but to every Institution. The IAgrE must remain relevant to its membership and it is my job to make sure that it does. The recent membership survey, which ended in July, will be informing my opinions and direction for the immediate future together with such issues as the 'professionalism' of registered members, legislation, member benefits and better use of the internet and social media.

Institutions inhabit a rather nebulous space in society and often go unnoticed to the wider public. We do, however, have a part to play and, arguably, in the aftermath of such incidents as the VW emissions scandal and the Grenfell Tower disaster one of ever-increasing importance. Who else will uphold the key values of engineering, science and technology and put public safety at the forefront of technological advancement? Does the public trust faceless corporations or politicians to do this? Institutions occupy a unique position between academia and industry, a place that they often fail to capitalise upon. I will endeavor to explore the reasons for this with a view to adding value to both.

Institutions occupy a unique position between academia and industry

ALASTAIR'S LEGACY

My dream for the IAgrE is a strong Institution that becomes the first point of contact for those seeking advice and information about 'AgriTech'. I intend to deliver a vibrant and growing membership supported by an enviable host of member benefits. I will build upon the excellent legacy that Alastair leaves behind him after 6 years of loyal service.

I look forward most of all to meeting the members and key stakeholders and finding out what you want.

MEET YOUR NEW CHIEF EXECUTIVE

Having spent a lifetime at the 'sharp-end' and with professional engineering institutions, Ed Hansom believes that the engineering profession still flies 'under the radar' for most of the general public.

Edward Hansom (he prefers Ed) was appointed as IAgrE's 16th Chief Executive (including those who held the title of Secretary) in May 2019 to succeed Alastair Taylor. One of his key roles will be to focus on membership and recruitment into the Institution representing a sector also lacking in widespread public recognition.

He says "I think the word engineering is still the problem. It simply doesn't resonate strongly enough with the general public. In the US and in other countries, engineering and engineers are revered and valued in a way that is simply not the case in the UK. Maybe it's a cultural thing although I do believe that it has Victorian connotations here in the UK. In a recent poll, just about the only engineer that respondents could come up with was Isambard Kingdom Brunel – and he died in 1859! Just look at the contribution that British engineers have made over the past 100 years or so in every field – and yet there does not appear to be any stand-out role models".

ROYAL NAVY

Ed Hansom gained a Bachelor of Engineering (BEng) in Mechanical and Production Engineering from Huddersfield Polytechnic in 1987 with no real preference for a future career. During his final year at Huddersfield, he met up with a former school friend who had joined the Royal Navy straight from school and who extolled the opportunities in the 'senior service'.

He enrolled on a 'taster' course at HMS Drake at Plymouth and was immediately hooked. The next stage was to apply to take the 3-day Admiralty Interview Board test for prospective Officers in the Royal Navy. "That was pretty challenging" says Ed "and comprised fitness testing as well as mental and aptitude tests. I didn't think I'd done very well, but apparently had passed all the requirements and was selected to attend the Royal Naval College at Dartmouth for further training before my first posting".

His first deployment was onboard HMS BRISTOL, a type 82 destroyer which had seen extensive service in the Falklands but which had been converted into a training ship.

At this stage, Ed was classed as Officer-under-Training and was engaged in all aspects of the ship's operation. During his time on board, HMS BRISTOL he visited the United States and the Caribbean. On passing out from Dartmouth he joined his first operational ship HMS BOXER, a Type 22 Frigate, and saw service in the Gulf during the Iran/Iraq war.

He then completed his formation as an Engineer Officer in the RN by starting his Marine Engineering Application Course at the Royal Naval Engineering College in Manadon – now, sadly no longer in existence.

He then joined HMS PENELOPE in his first of several sea-going appointments as a Marine Engineer Officer. "There was never a dull moment" he says, "We were engaged in the Gulf following Iraq's invasion of Kuwait in 1990 and were part of the first NATO force to sail into Tallin, the capital city of the former Warsaw Pact country, Estonia, after the fall of the Berlin Wall. I also had the opportunity to visit the giant US John F Kennedy aircraft carrier".

Following his period at sea, overseeing mechanical and engineering aspects of, mainly steam-powered ships, Ed took up a shore-based post at the Defence Research Agency (DRA) at West Drayton, the Ministry of Defence's science and technology organisation that included the Admiralty Research Establishment, Royal Aerospace Establishment and Chemical and Biological Defence Establishment.

PROFESSIONAL INSTITUTIONS

At the end of his commission in 1995, and after 8 years in the Royal Navy, Ed returned to 'civvy street' and found a job working for a small family company manufacturing ultra-sonic equipment based at Midhurst, West Sussex. "It was to be a very enjoyable stepping-stone" he said "but not being a member of the family, I could not progress". After a year or so of post-military adjustment he started looking to use his naval and engineering experience to further his career in a more challenging role.

In August 1997, Ed moved to London to become the Director of Professional

Landwards Editor, Chris Biddle talked to Ed Hansom shortly before he took up his post as the new CEO of IAgrE on 2 September 2019

Affairs at the Royal Institution of Naval Architects, an internationally renowned professional institution whose members are involved at all levels in the design, construction, maintenance and operation of marine vessels and structures.

"It was a wonderful opportunity but a strange time" he says "because I was pitched into central London in the week of Princess Diana's death which seemed to dominate life in the capital for a time".

It was to be a fairly short tenure and in 1999, he spotted an opportunity to join the Institute of Marine Engineering, Science and Technology (IMarEST) as Head of Professional Affairs and Membership which brought together marine engineers, marine scientists and marine technologists into one multi-disciplinary professional body. Being a fully international body, Ed travelled extensively promoting professional standards, and visited Russia and the West Indies as part of his role.

In 2008, however, he was made redundant as part of re-organisation at IMarEST.

This was to open the door to probably his most important role to date when he joined the Institution of Mechanical Engineers (IMechE) in September 2008 as Professional Development Adviser. It was to be an important and pivotal role. Ed says "I created the IMechE policy, developing standards and processes for further learning to assist graduate engineers gain the requisite academic base required for registration".

He also collaborated with the National Skills Academy for Railway Engineering (NSARE) and established strong links with many Universities, Colleges of Further Education, the Armed Forces, the MoD, BAE Systems, Rolls Royce, as well as numerous SMEs in the engineering sector. He was also IMechE representative on various 'Trailblazer' apprenticeship development groups.

EXCITING ERA

In short, Ed brings to IAgrE a wide-ranging skills-set to ensure that the Institution maximises every opportunity to provide members with the tools to enhance their careers through professional development, as well as building interest and membership opportunities amongst the agri-tech engineering community.

Ahead of his appointment, Ed has joined Alastair Taylor in attending a few meetings including a visit to Harper Adams University and attending a STEM open day for over 900 school children at Sparsholt College near Winchester. "The cutting edge technology at Harper Adams and initiatives such as the burgeoning Hands Free Hectare project illustrate that agri-tech engineering is entering an exciting phase. The concerns and interest in environmental matters expressed by the children at Sparsholt show that IAgrE will have a pivotal and important role in shaping responsible and sustainable food production and land management in the years ahead".

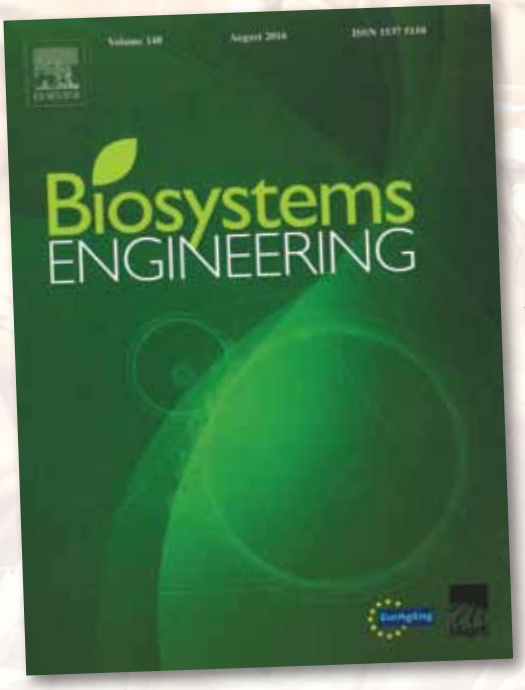
Ed Hansom is relishing the challenge. As the father of two teenage daughters ("sadly neither has caught the engineering bug yet!") he recognises that there must be a connection between bodies such as IAgrE and the new generation of professionals in a rapidly changing world.

Returning to his concerns about engineering not getting the recognition it deserves, he says "Fifty years ago, engineers and technicians including many from the UK, turned heads and minds with the Apollo moon landing. As engineers, we benefit from such outstanding achievements whatever our speciality. It is a pity that the Bloodhound project stalled because that would have created huge publicity".

"I don't think that there is any reason why future food production using sophisticated technology, robots and drones shouldn't get the general public equally engaged. It is really up to us to tell the story and set out what exciting opportunities are to be had in agri-tech engineering".

HMS Boxer

Biosystems Engineering



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

Biosystems Engineering
Volume 181, May 2019, Pages 63-72
A novel automated transplanting system for plant tissue culture
Tien Jung Lee, SMA Zobayed, Flavio Firmani, Edward J. Park
Simon Fraser University, Surrey, BC, Canada
JRT Nurseries Inc., BC, Canada

Micropropagation is an advanced vegetative propagation technique for producing high quality and disease-free plants in a short time period. With the increasing demand in agriculture, horticulture, and medical applications, micropropagation has become increasingly important in plant tissue culturing. However, this process is very tedious and labour intensive. A novel automated micropropagation system is developed to reduce the labour cost as well as to increase the throughput and reduce contamination risk by minimising human contact. The system was prototyped and proof-of-concept pilot testing was conducted with one type of blueberry plant, achieving up to 90% success rate. Furthermore, the experimental results showed that its production rate is comparable to the current industry throughput of the manual process. The proposed automated system has a high potential to meet the increasing demand for rapid multiplication of planting materials.

Biosystems Engineering
Volume 182, June 2019,
Pages 107-122
Numerical investigation on the effects of building configuration on discharge coefficient for a cross-ventilated dairy building model
Qianying Yi, Hao Li, Xiaoshuai Wang, Chao Zong, Guoqiang Zhang
Aarhus University, Tjele, Denmark
Zhejiang University, Hangzhou, China
China Agricultural University, Beijing, China

To estimate the ventilation rate of buildings, the orifice equation with a fixed discharge coefficient (Cd) is often applied. However, values of Cd may be not a constant for the openings of naturally-ventilated dairy buildings. The main objective of this study was to investigate the influence of the building configurations on the Cd value. In addition, since the value of the pressure difference across the opening is crucial to the application of the orifice equation, another objective was to evaluate the accuracy of using the orifice plate method in pressure difference measurements. The investigations were carried out using computational fluid dynamics simulations. The results showed that applying the orifice plate method to measure the pressure drop could result in up to 18.9% relative error in estimates of Cd for the case with an opening ratio of 81.4%. It can be concluded that the Cd value should be specified according to the opening configurations in the application of the orifice equation.

Biosystems Engineering
Volume 183, July 2019, Pages 26-46
Angle estimation between plant parts for grasp optimisation in harvest robots
Ruud Barth, Jochen Hemming, Eldert J. Van Henten
Wageningen University & Research, Wageningen, The Netherlands
Wageningen University & Research, Wageningen, The Netherlands

For many robotic harvesting applications, position and angle between plant parts is required to optimally position the end-effector before attempting to approach, grasp and cut the product. A method for estimating the angle between plant parts, e.g. stem and fruit, is presented to support the optimisation of grasp pose for harvest robots. The hypothesis is that from colour images, this angle in the horizontal plane can be accurately derived under unmodified greenhouse conditions. It was hypothesised that the location of a fruit and stem could be inferred in the image plane from sparse semantic segmentations. The paper focussed on a sweet-pepper harvesting robot. Each task was evaluated under 3 conditions: laboratory, simplified greenhouse and unmodified greenhouse. The requirements for each task were based on the end-effector design that required a 25° positioning accuracy.

COVER FEATURE: **VISION 2038** *Part Three*

MECHANISATION

What tractors, machinery and new technology will be in common use on UK farms in 2038?

Agriculture is conservative in nature. Large field areas need to be covered quickly in variable weather conditions. In recent years that has meant bigger and ever more powerful tractors and equipment. But concerns about soil quality, labour availability, environmental issues and fuel sources are growing, whilst the need persists to produce enough food for a rapidly growing world population from finite resources.

Change is all around. New technology abounds. But how quickly will farmers adopt and integrate radical new equipment into established production methods?

BIRTH OF IAgrE: 1938 STEEL WHEELS AND PARAFFIN

In 1938, there were 60,000 tractors in use in Britain and reckoned to be almost 1 million working horses. But these were to be rapidly replaced as sales of tractors grew in order to maximise food production in the war years. The predominant fuel was paraffin with a provision for starting on petrol. No electric systems were fitted apart from a magneto for ignition. Only a minority of tractors were equipped with pneumatic tyres. Hydraulic systems were not entirely unknown as Harry Ferguson had developed a rudimentary system for height control of implements during the 1930s.

POST WAR: TOWARDS THE NEW MILLENIUM HEAVIER, BIGGER, FASTER

There was a significant linear increase in tractor horsepower, from around 100hp in 1990 to today where over 200hp is the norm and average horsepower across all models (over 50hp) has risen to more than 150hp in the UK. Road speeds have increased from 20mph to over 40mph with certain models. Versatility has been improved with sophisticated powertrains, providing shift-on-the-go aided by electronic control units (ECUs). Driver comfort has improved out of all recognition. Front axle and cab suspension systems, coupled with advanced seating, air conditioning, and progressive reduction of noise levels have transformed operator comfort.

MECHANISATION 2038?
Robots, step by step

"Whilst full automation is often hailed as the ultimate aim in technological development, and future agriculture systems may look very different from those of today, only very few large companies can afford the disruption of full automation. So this long-term vision will require a gradual transition from current farming practices, and most farmers will need technologies than can be introduced step by step, alongside and within their existing systems".

THE FUTURE OF ROBOTIC AGRICULTURE: UK-RAS WHITE PAPER 2018

Agri-Food is the largest manufacturing sector in the UK. It supports a food chain that generates over £108bn a year, with 3.9m employees in a truly international industry and exports £20bn of UK manufactured goods.

However, the global food chain is under pressure from population growth, climate change, political pressures affecting migration, population drift from rural to urban regions and the demographics of an ageing global population. A recent Industrial Strategy White Paper ***Agricultural Robotics: The Future of Robotic Agriculture*** published by the UK-RAS Network (Robotics and Autonomous Systems) reviews the state of the art in the application of RAS in Agri-Food production and explores research and innovation needs to ensure these technologies reach their full potential and deliver the necessary impacts in the Agri-Food sector.

The opportunities for RAS range include; the development of field robots that can assist workers by carrying payloads and conduct agricultural operations such as crop and animal sensing, weeding and drilling; integration of autonomous systems technologies into existing farm operational equipment such as tractors; robotic systems to harvest crops and conduct complex dextrous operations; the use of collaborative and "human in the loop" robotic applications to augment worker productivity; advanced robotic applications, including the use of soft robotics, to drive productivity beyond the farm gate into the factory and retail environment and increasing the levels of automation and reducing the reliance on human labour and skill sets, for example, in farming management, planning and decision making.

THE VISION

The UK-RAS vision is a new generation of smart, flexible, robust, compliant, interconnected robotic and autonomous systems working seamlessly alongside their human co-workers in farms and food factories.

Electric farm and factory robots with interchangeable tools, including low-tillage solutions, soft robotic grasping technologies and sensors, will support the sustainable intensification of agriculture, drive manufacturing productivity and underpin future food security.

To deliver this vision the research and innovation needs include the development of robust robotic platforms, suited to agricultural environments.

Technology adoption is likely to occur in measured steps. Most farmers and food producers will need technologies that can be introduced gradually, alongside and within their existing production systems.

Thus, for the foreseeable future, humans and robots will frequently operate collaboratively to perform tasks, and that collaboration must be safe. There will be a transition period in which humans and robots work together as first simple and then more complex parts of work are conducted by robots, driving productivity and enabling human jobs to move up the value chain.

RAS technologies in agriculture will become ubiquitous in the next 5 to 10 years. Robots are helping us to determine the input quantities in order to achieve desired outcomes. There are many challenges and strains in the current state of the technology for agriculture and the mechanisms for its control and governance.

CHALLENGES

RAS technology has the potential to transform food production and the UK has an opportunity to establish global leadership. However, there are particular barriers to overcome to secure this vision.

1. The UK RAS community with an interest in Agri-Food is small and highly dispersed. There is an urgent need to defragment and then expand the community.
2. The UK RAS community has no specific training paths or Centres for Doctoral Training to provide trained human resource capacity within Agri-Food.

3. While there has been substantial government investment in translational activities at high Technology Readiness Levels (TRLs), there is insufficient ongoing basic research in Agri-Food RAS at low TRLs to underpin onward innovation delivery for industry.
4. There is a concern that RAS for AgriFood is not realising its full potential, as the projects being commissioned currently are too few and too small-scale. RAS challenges often involve the complex integration of multiple discrete technologies (e.g. navigation, safe operation, grasping and manipulation, perception). There is a need to further develop these discrete technologies but also to deliver large-scale industrial applications that resolve integration and interoperability issues.
5. The successful delivery of RAS projects within Agri-Food requires close collaboration between the RAS community and with academic and industry practitioners. For example, the breeding of crops with novel phenotypes, such as fruits which are easy to see and pick by robots, may simplify and accelerate the application of RAS technologies. Whilst Research Councils and Innovate UK directly fund different aspects of Agri-Food, there is no coordinated and integrated Agri-Food research policy.

TO MAKE THE VISION WORK

There is a range of technical problems that need to be addressed in a systematic and visionary manner. The authors of the White Paper make several recommendations to the government, funding agencies, industry and research centres:

- UKRI, including Research England, funding is required to train and expand human expertise for Agri-Food RAS. This may include Centres for Doctoral Training but should also provide provision for lower-level skills development through to apprentice level.
- The community needs to be defragmented. Investment in Network+ grants to stimulate and condense the community alongside the establishment of larger scale Agri-Food RAS hubs including demonstration farms. We recommend that these hubs are virtual and multi-centred, working tightly with farmers, companies and satellite universities to create the infrastructure to catalyse RAS technology.
- New networks must comprise academic and industry Agri-Food domain expertise (crop and animal scientists, farmers, agricultural engineers), as well as representation from national RAS and government laboratories (such as the Agri-Tech Centres and Catapults), to ensure RAS solutions are compatible with industry needs.
- The UK Research Councils, such as the EPSRC, STFC, ESRC, BBSRC, NERC and MRC, would benefit significantly from a coordinated Agri-Food research foresight review that integrates RAS technologies.
- To deliver impact, Agri-Food RAS needs to integrate multiple technologies and resolve significant interoperability issues through a small number of large scale integration or "moon shot" projects to demonstrate routes to resolve these issues and deliver large-scale impact.
- With the new changes there is a big potential for cooperation with China, India and other countries in addressing global challenges such as sustainable food security (see, for example, the UKRI Global Challenges Research Fund).
- The ongoing and large-scale government investment behind high TRL (e.g. Innovate UK led) research addressing Agri-Food sector needs is impressive. However, these investments will not succeed without investment in large-scale lower TRL research.

REFERENCE

The Chairman of the UK-RAS Network, Prof Guang-Zhong Yang CBE, FREng writes "This white paper aims to provide an overview of the current impact and challenges facing Agri-tech, as well as associated ethical considerations. It is our plan to provide annual updates so feedback is essential - whether it is to point out inadvertent omissions of specific areas of development that need to be covered, or to suggest major future trends that deserve further debate and in-depth analysis. Please direct all your feedback to whitepaper@ ukras.org"

The White Paper was authored by Prof Tom Duckett, Prof Simon Pearson (both University of Lincoln), Prof Simon Blackmore (Harper Adams University) and Prof Bruce Grieve (University of Manchester) plus numerous other contributors.

www.ukras.org

OPINION

"Precision Agriculture? We've not really got started!"

Professor Simon Pearson on farming in 2038

Whilst significant advances have been achieved in developing autonomous machines for horticultural and soft fruit applications, the industry still has a long way to go in applying new robotic technology for 'big ag' according to Simon Pearson who heads up the Lincoln Institute for Agri-Food Technology (LIAT). "We've really only just got started" he says "so the vision of a completely autonomous future by 2038 is ambitious".

The Institute is part of the University of Lincoln, and its researchers are engaged in the development of technologies which add value or solve challenges across the food chain, 'from farm to fork', working with partners in industry and academia locally, nationally and internationally.

There is little doubt that a rapidly reducing availability of seasonal labour is hastening the need for research and adoption of agricultural machinery that relies on minimal operator levels. In 2005, British farms employed over 22,500 EU-born workers according to Government estimates, a number that has significantly dwindled since the Brexit vote.

Simon Pearson believes that the driving force for small scale robotics could well come from applications in crops that are labour intensive or from developing countries, particularly as costs come down and the range of tasks achievable increase. "Experience and application in those systems could then spread into standard equipment, but at the moment I don't see anything other than a diverse application of autonomous and standard machines in UK farming".

Researchers at LIAT have been developing a multi-purpose robotic platform, Thorvald, which can perform tasks such as picking fruit, carry trays of strawberry plants across fields and apply ultraviolet light at night to kill mildew.

He does not see the death of big tractors. "They will continue to be a key machine for 'broad acre farming' but will become ever more sophisticated. It is the implements, the drills, the sprayers and the like that will become ever more intelligent" he says "which is why major corporations such as John Deere have acquired technology companies such as Blue River Technologies".

"However, the tractor makers will need to share their data more freely with developers in order to maximise the efficiency of tractor and machine. In the end, it's the availability of 'big data' and the machine learning and artificial intelligence that will unlock the real potential of precision agriculture, particularly across 'big-ag'".

Although diesel engines have never been cleaner, he believes that external pressures will prompt moves to alternative power sources. "Methane, produced on farm is a growing option, and electric tractors will feature in the future, particularly as battery technology improves and we perhaps move to fewer, energy-sapping tools such as ploughs and rely more on no-till solutions".

One commodity that is not in short-supply, says Simon Pearson, is the availability of top class, highly qualified young engineers working in the field of robotics. "We have to make sure we harness their skills and visions for the agri-tech sector" he says "because competition for their talents is fierce across all industries".

FUEL SOURCES
Diesel power – or what?

Is the end is nigh for the diesel engine?

This despite manufacturers finding costly solutions to meet Tier 4 and ultimately Tier 5 regulations on carbon emissions. Extraordinarily, harmful emissions have been driven down by 99% since the original Tier 1 regulations.

Nonetheless, engineers have been seeking alternative power sources for over 100 years.

Around 1900, German company Brutschke used their factory's 'off-peak' electricity to power an electric tractor used for ploughing.

In 1925, a Scottish landowner built an experimental tractor powered by a 12.5hp motor, and in Russia during the post war years, the number of electric tractors at work increased by 300% although the numbers were small.

The first tractor to be powered from a fuel cell was an experimental model built by Allis Chalmers during the 1950s.

But today, the race is on to find alternative power sources to diesel power. Lightweight machines such as self-driving feed shovelling robots in stalls and forklift trucks in stores require relatively little power are mostly close to the mains outlet, so they were amongst the first to become electric.

Now the technology exists for the large, heavier equipment. Various electric trial models have already been launched. They tend to be mini-loaders and feed mixing trucks.

Whilst many agree that conventional fossil fuels may have had their day as the primary energy source, the experts have no idea what will happen for tractors and when.

After all, they must remain usable at full capacity over long periods. A day's ploughing, land levelling or transporting loads of several tonnes requires more than current alternative technology allows.

In summary, there are four options: hybrid, methane, electric and hydrogen. This is also the order in which experts believe that they will begin to be used in agriculture.

Hybrid technology, a diesel engine that is supported by an electric engine, is the easiest within reach, according to John Deere. A spokesman said "Diesel alternatives are simply still too expensive. Diesel is still the most efficient. Hybrid technology with an electric engine or generator could help the diesel engine to maintain revs more consistently, for example."

John Deere itself offered the E Premium, in which a generator drove the internal components, such as the radiator fan. Two hundred were sold, but its successor, the 6210 RE never went into production due to lack of interest. "When it comes to external power, it's a bit of a chicken-and-egg situation. Who wants to invest in a tractor to drive electrical machinery if there is no decent machinery available? And vice-versa."

John Deere is focusing fully on electric drives, like the SESAM tractor that appeared at the SIMA agriculture show. The fully electric tractor features a huge battery pack that allows it to drive for an hour at full capacity. The problem is that electricity requires a great deal of storage capacity and space, and battery packs are still too bulky and expensive. John Deere recently unveiled the alternative: a tractor on a long extension cable, which winds in and out depending on the distance to the power socket. To a John Deere 6210R tractor the company added a 1,000-metre electric cable attached to a power grid situated at the edge of the field.

The project, GridCON, does away with both an onboard battery and a traditional cab. Observers have described it as "an electric tractor with an extension cord". Deere itself describes the machine as the "first vehicle to be fully electric, permanently cable-powered, and capable of fully autonomous operation in the field."

In terms of functionality, the tractor uses a cable connected to a power grid at a field's border able to transfer power continuously at more than 300 kW. While a 100 kW electric motor powers the tractor's IVT transmission, a 200kW electric motor offers power for implements. Other components include a drum that's attached to the tractor that holds 1,000 metres of cable. During operation, the system feeds cable out and in, and a robotic arm guides the cable to "keep the operation friction-free and at low load." GridCON employs an intelligent guidance system to prevent the tractor from running over the cable.

The tractor, which Deere tested at its European Technology Innovation Centre in Kaiserslautern, Germany,

New Holland Methane Tractor

John Deere GridCON

can operate autonomously at slightly faster than 20 km/h following preset rows. Operators can also guide the tractor manually via remote control, which Deere says is particularly useful when manoeuvring it to begin work on field borders.

AGRICULTURE STILL A POOR BUSINESS CASE

Even so, the development of a fully electric drive is quite a way down the line, and that includes heavy-duty equipment. Tesla, for example, has already produced a goods vehicle that is fully electric. It is also quick to charge: a thirty-minute charge will enable the vehicle to travel almost 650 kilometres.

There is the parallel with agriculture: a tractor that is meant to run all day at full power requires an excessively large battery pack and is still too expensive. For 100 kW use for four hours, the battery cost has been estimated at around £40,000.

As tractors and self-propelled machinery are left unused for long periods after seasonal work, this becomes an expensive business. By itself, agriculture is a very poor business case for electric power. One idea could be to make batteries exchangeable, as is the case with hand tools.

Fendt and India-based firm Escorts have just launched electric models. However, both are at the lower end of the horsepower range, with Fendt's e100 Vario being the more powerful, offering 67hp.

Fendt sees it as a practical, battery-powered tractor, more suited to livestock farmers, running for 1-2 hours at a time. "The battery can provide 4-5 hours of power when fully charged, and then during lunch, it can be supercharged before working for another spell in the afternoon." say the company.

Fendt e100 Vario

Charging normally takes five hours, but there is a supercharge option that tops up 80% in 40 minutes.

Next year, Fendt plans to sell a limited number of up to 20 units and learn from the experiences of these farmers.

Battery size is projected to be reduced by half within 10 to 15 years. Perhaps lithium-air batteries will have moved beyond the experimental stage in 10 to 15 years' time. They are actually extremely light and small, but it's still difficult to tell what will happen – and it is likely that charging time will probably halve over the next ten years.

METHANE IS WITHIN REACH

Many engineers see a future for engines that run on gas. Methane will increase rapidly in popularity over the next 5 years. FPT Industiral for example, has just such an engine ready, and whole fleets of them are being used in goods vehicles. The tractor stays the same, and you have your own methane tank with you out in the field.

Many believe hydrogen technology to be still far too underdeveloped and more suited to use later down the line. While hydrogen shows some potential, because relatively large quantities of energy can be stored compactly, the process of converting to and from hydrogen is still quite inefficient. In addition, all the safety aspects are still not adequately guaranteed.

New Holland, in particular, became well-known for its NH2 experiment involving a tractor running on hydrogen, before switching its attention to methane via two trial models. Methane has since been the subject of much experimentation by tractor manufacturers, and Steyr, Valtra and New Holland have already demonstrated their results.

PERSPECTIVES

Selected features from latest professional engineering and related journals.

In this special supplement we reproduce, by permission, articles and features from professional and business journals that we believe are relevant and of interest to IAgrE members.

HYDROGEOPHYSICS FOR AGRICULTURE: CAPABILITIES AND LIMITATIONS

The following paper was presented by IAgrE Student member, Guillaume Blanchy *(Lancaster University/ Rothamsted Research)* **to the IAgrE South Midlands Branch in February 2019. The co-authors of the paper are Chris Watts** *(Rothamsted Research)* **and Andrew Binley** *(Lancaster Environment Centre, Lancaster University)*

Wheat is one of the most important global crops, being grown on more land than any other commercial crop, and currently providing 20% of total calories consumed by humans worldwide, being second only to rice. A 60% increase in demand is expected by 2050, as the global population increases towards 10 billion.

Designing Future Wheat is a collaboration of several UK organisations, namely Rothamsted Research, John Innes Centre, the Earlham Institute, NIAB, Institute of Food Research, the University of Bristol, the University of Nottingham and EMBL-EBI.As part of the project, scientists are seeking to identify traits tolerant to UK drought and temperature stress scenarios. We need to know how soil structure and the availability of nutrients and water interact with genotypes to permit deep rooting.

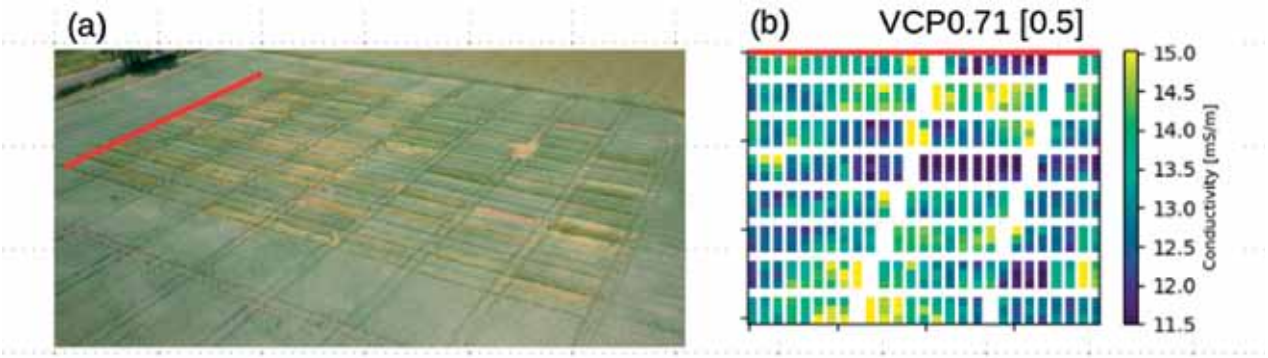
To facilitate this study, agricultural engineers are developing a number of practical and innovative technologies for in-field above and below ground phenotyping, including use of drones, robots and other ground-based systems.

One of the more challenging aspects of this study is to discover how wheat roots interact with the soil. Here we explain how we are using hydrogeophysics methods to non-destructively rapidly screen hundreds of wheat varieties in the field.

What is hydrogeophysics?

Many people in the UK will associate geophysics with archaeology from the popular TV series *Time Team*. In fact, geophysics is a very broad discipline of Earth sciences. Hydrogeophysics focusses on the investigation of properties and processes in the Earth that are related to hydrology (the study of Earth's water). Hydrogeophysics uses a range of techniques, many of which were developed for mineral exploration, to 'look into the ground' and improve our understanding of where water is, where it is moving and what is controlling it. Methods based on sensing electrical properties are popular in hydrogeophysics because the presence of water (or its movement) can be detected by changes or variation in electrical properties (a wet soil conducts electricity easier than a dry soil).

We can measure electrical properties of the soil without disturbing it, which makes the technique particularly attractive in agriculture. In fact, commercial systems are available today using arrays of coulter-electrodes towed behind a tractor to measure soil electrical conductivity (the property of the soil that describes the ease at which electrical current will move



Picture (a) of the 216 plot field experiment consisting of 71 wheat varieties + fallow plot replicated three times. (b) Background measurement of apparent electrical conductivity measured at 0.5 m depth with the VCP0.71 coil configuration revealing field patterns associated with different soil textures. Note 2 diagonal lines represent previously unknown buried high voltage cables

through it).

Another method, called electromagnetic induction (EMI), doesn't need any contact with the soil and works a bit like a metal detector. It is actually used for very large scale studies, such as mineral prospecting, using sensors mounted on aircraft.

How are we using hydrogeophysics?

The attraction here, however, is that from EMI measurements close to the ground surface we can map variation in soil electrical conductivity at shallow depths. And since the presence of water effects soil conductivity then perhaps we can monitor changes in the amount of soil water (due to uptake by crops) without even touching the soil.

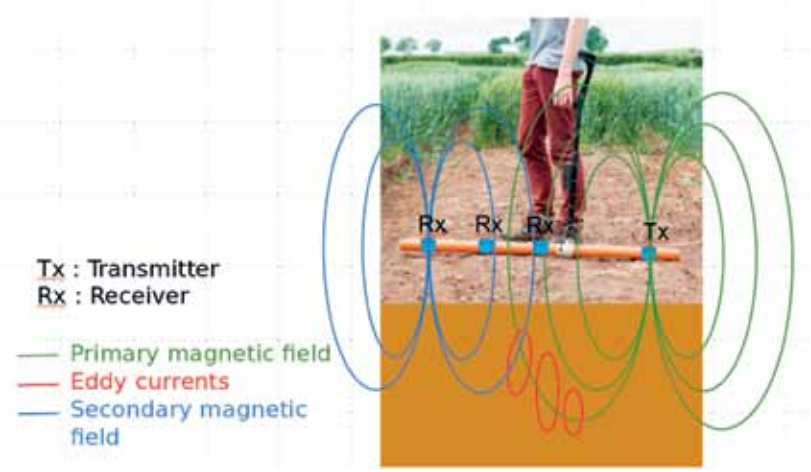
If we can do this then perhaps we can assess how different varieties of wheat extract water from the soil (how much and how deep?).

How does EMI work?

We are currently using a CMD mini-explorer electromagnetic conductivity sensor (GF Instruments, supplied by Allied Associates, Dunstable, UK). This device is composed of a tube with different coils inside: one transmitter coil (Tx) and three receiver coils (Rx1, Rx2 and Rx3).

EMI instruments measure an apparent electrical conductivity, σ_a This represents the weighted average of soil electrical conductivity over a depth range that depends on the separation distance between the transmitter and receiver coils, as well as their orientation. The transmitter coil creates an electromagnetic field, which when it enters the soil creates a signal that can be sensed on the receiver coils and allow us to determine the ground electrical *apparent* conductivity.

Multi-coil devices allow the recording of different apparent conductivities over different depths. We can use these measurements in a



Internal working of the EMI device (CMD Mini-Explorer). The primary field is created by the transmitter. Electrical conductors in the soil create 'eddy currents' which can be sensed by a secondary magnetic field at the receiver coils.

type of mathematical modelling called *inverse modelling* to obtain a depth-specific electrical conductivity.

How to use it to measure root water uptake?

Soil moisture is a dynamic property under growing crops, dominated by root water extraction driven in turn by evapotranspiration. To monitor soil drying we use EMI surveys carried out regularly throughout the growing season to compare different varieties of wheat.

The first set of measurements are taken shortly after the crop emerges but when the soil is at field capacity: this is called the background survey. All subsequent surveys are expressed in changes in electrical conductivity to the initial background survey.

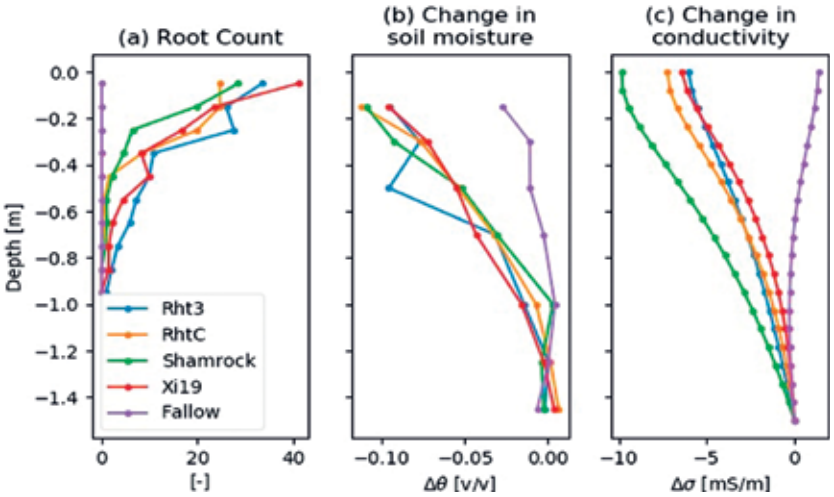
As all other soil properties stay virtually the same so changes in electrical conductivity are mainly driven by the changes in soil moisture, that can be related to root water uptake. The one exception is soil temperature which is measured continuously allowing a correction factor to be applied to the EMI output.

Additional measurements such as soil moisture content from neutron probes and root counts from the soil cores have been recorded to be compared to the EMI results. Figure 3 shows how the change in electrical conductivity from EMI is related to the change in soil moisture (from neutron probe). There is a particularly clear distinction in this case between the fallow plots and the cropped plots. Both electrical conductivity and soil moisture change also show very good agreement with the root counts obtained from soil coring. Note that all the different wheat varieties are very similar mainly because of there wasn't any major water stress during this growth season (2017).

What are the limitations of this approach?

During this work we have identified that the relationship between the transformed electrical conductivity and soil moisture content is highly site specific.

Hence, there is a need to establish a relationship for each field or even



Profiles of different wheat lines and fallow plot in term of (a) root count, (b) change in soil moisture from neutron probe and (c) change in electrical conductivity from EMI.

for different locations within the same field if the field soil is heterogeneous. e.g. clay-rich area will present a much higher increase in electrical conductivity with increasing soil moisture compared to sandy soil. Looking at change with time allows to overcome some of the static effects of the soil but not all.

The second main limitation is that apparent conductivity data measured from the EMI device needs to be post-processed to build a depth-specific electrical conductivity profile. This process called 'inversion' is well established for other hydrogeophysical methods but still to be improved for EMI. This forms part of my PhD.

Conclusion

In conclusion, hydrogeophysics provides a potentially useful tool for wheat root phenotyping under field conditions. In this article we have focused on the EMI method and shown how it offers us a high-throughput, non-invasive screening technique to compare soil drying profiles of different wheat varieties throughout the growing season. However, field-specific relationships are needed to obtain more accurate soil moisture results and the inversion of apparent conductivity to depth-specific electrical conductivity can still be improved. Overall, this method has a great potential for agricultural applications.

ACKNOWLEDGEMENTS

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2019 **IAgrE** Journalists Award

How to secure longer-lasting point and tine metal

The following article by James Andrews won the 2019 IAgrE Journalists Award. It was published in and is reproduced by kind permission of the Farmers Weekly. The article has been slightly abridged for Landwards and represents the author's views and are not necessarily endorsed by IAgrE.

Picking the right wearing metal for your cultivator or drill isn't always about plumping for the cheapest deal. James Andrews visits a UK firm that specialises in engineering longer-lasting and higher-performing alternatives

Soil engaging parts are one of those boringly inevitable expenses when running a cultivator or drill.

But while many shop around for the cheapest lumps of metal to haul through the ground, a company in North Yorkshire has been gathering a loyal group of followers for its harder-wearing premium versions.

JJ Metcalfe and son's offerings boast lifespans between four and 10 times that of conventional heat-treated steel and promise to maintain their performance until the point they're fit for the scrap bin.

Part of that's due to the designs company director Mike Metcalfe creates, but it's also helped significantly by the use of ultra-hard tungsten carbide at the main wear points.

Retrofit parts

JJ Metcalfe started out as an agricultural contracting outfit back in 1947, with Mike Metcalfe's father John at the helm. Most of his work centred on sugar beet production, but he was also a keen and successful match ploughman - this is where the family interest in cultivation equipment began.

After a stint as a rally driver and race-engine builder, Mike came back to the family business and began making parts for their sugar beet harvester. This then quickly grew into a sideline business as other contractors asked him to supply them.

But it was when he was asked to produce a lower-cost point for a Tim Howard subsoiler that he got into building parts for cultivators. He then quickly started doing work for other manufacturers including Heva and Simba, before moving on to selling retrofit parts for most brands of machine. The company now has a seven-strong team, including Mike's daughter Abi and son Jonny.

Tungsten Carbide

This wonder material is second in hardness only to industrial diamonds – as used on oilrig drill bits – and is apparently particularly effective

at standing up to the abuse of an abrasive soil.

However, unlike steel that's used to form the whole component, this comes in thin tiles that need to be attached in some way. And herein lies the problem – getting these slithers of ultra-hard metal to stick to a component that gets dragged through the soil is a tricky business.

"I tried and failed several times and after being led up the garden path by a so-called expert and wasting a lot of money, I eventually gave up," says Mr Metcalfe.

But a few years after abandoning hope he came across a specialist brazing system that kept them firmly in place. This creates a strong bond under the whole tile, which can't be achieved by welding. "We get the odd one coming off, but it's fairly rare and we offer a guarantee to replace them if they do," he says.

Over the past decade or so, the application of tungsten carbide has become one of the company's main specialties and it now applies the tiles to products sold by many household names including Heva, Cross Slot, Philip Watkins, Plowman Brothers, Dale Drills and Simtech.

It also makes tungsten carbide equipped versions of parts for almost all common cultivator models, as well as a number of popular direct tine drills. For those not listed in the parts book, they also offer a retrofit service.

The material's only nemesis is particularly stony ground, where the hard, but relatively brittle tiles can get chipped. To counteract this they offer a slightly softer (but still very hard version) that is more resistant to sharp impacts.

Tungsten-carbide capped parts are usually considerably more expensive than standard metal. But according to Mr Metcalfe, the extended lifespan and reduction in spannering time, means it still makes economic sense.

Added benefits

There are also some agronomic benefits. On conventional components manufacturers generally increase the lifespan by adding more metal and making the leading edges thicker or longer.

But although this looks like you're getting a lot for your money, it quickly wears to a blunt, rounded shape that can compress and smear the soil, says Mr Metcalfe. When this occurs at depth it can have serious effects on root growth as well as water and air movement.

This doesn't happen with tungsten carbide, he says. Due to the hardness of the metal, parts can be made smaller and sharper so that they cut cleanly through the soil profile. This eliminates smearing, removes compaction and helps improve drainage.

The tiles also wear evenly and never round-off so the parts maintain their performance throughout their lifespan.

NG System

A more recent addition to the firm's portfolio is a universal point that can be grafted on to any brand of subsoiler or min-till cultivator.

It's called the NG system and with various interchangeable shin and wing options it can be adapted to suit various different applications.

The main selling points are the fact that it's low draft, creates minimal disturbance at the surface and has interchangeable wing and shin options to suit different operations. It also has replaceable wear sections to increase the life of the component. These are simple to change, with just a roll pin holding them in place.

As you might imagine, its design relies heavily on the use of tungsten carbide, which is used on the leading edge, shin sections and wing tips.

This has allowed the point to be kept short, reducing the power needed to pull it and the shin to be left vertical, rather than curved. The main benefit of this is that stops clods rolling up the leg and ending up at the surface.

The sharp pitch of the point is also designed to give greater shattering in dry conditions and the wings have been carefully angled to give just the right amount of lift.

It comes in four standard options – the first is a low draft version that has narrow sections all the way down the shins and is designed to work between 4 and 12 inches. These then gradually increase in thickness, up to option four, which is designed for deep working up to a maximum of 20in.

However, Mr Metcalfe reckons 18in is the most anyone should really be working at. "When you get deeper than that the weight of the soil above pushing against the lifting force of the wing can cause more compaction in the soil profile."

All models have the option of wings from 150mm to 300mm and prices for the whole assembly range from about £250 to just over £350. Option two, with a shin that's wide at the base and narrow at the top, combined with a 200mm wing accounts for 90% of the sales.

The units are generally welded to a machine's existing upper leg assembly, but JJ Metcalfe can also supply full replacement legs for most machines.

Mr Metcalfe is also working on an even harder-wearing version called the NG Endurance. This will incorporate bands of tungsten carbide on the sides of the shin sections to prevent the rear of the unit wearing thin.

Direct drill coulters

The rise in demand for direct drilling has also prompted Mr Metcalfe to come up with a coulter kit to convert existing min-till machines.

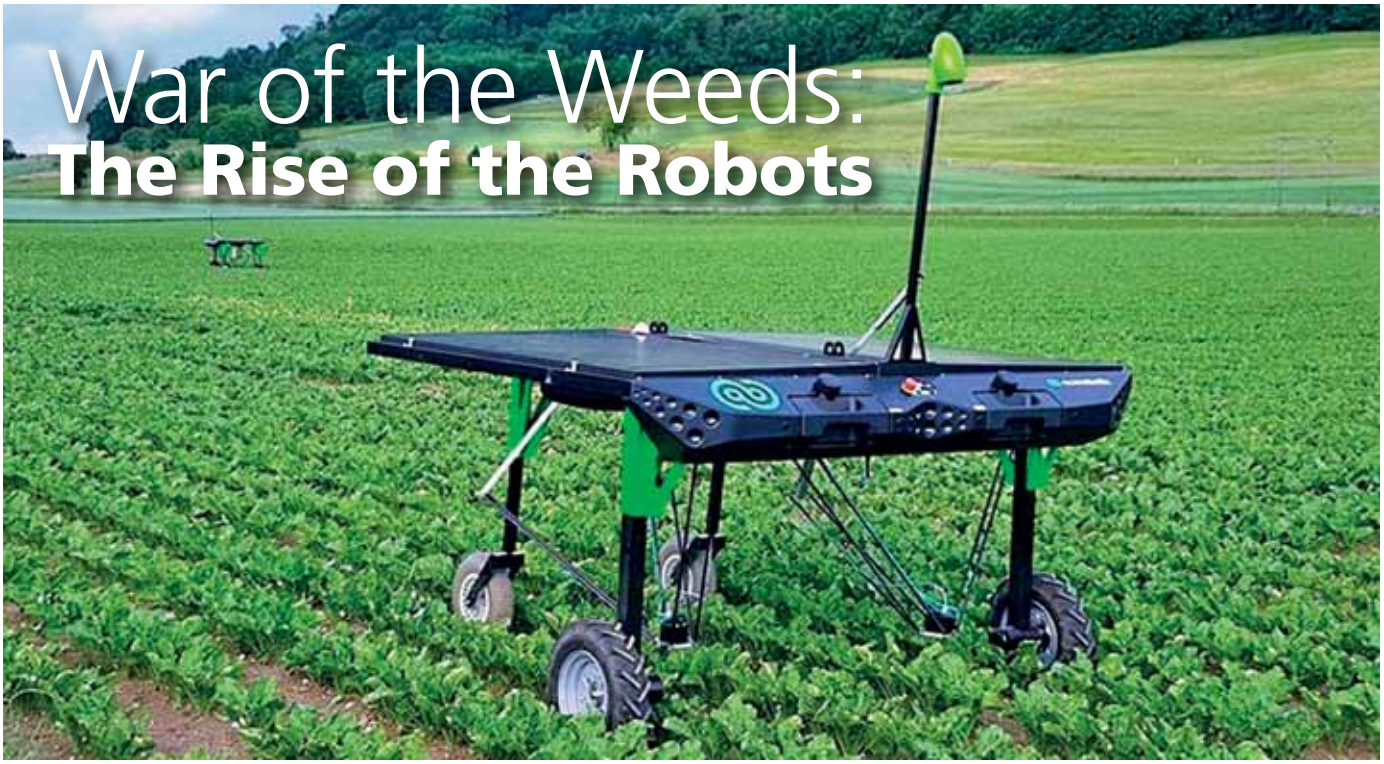
This was originally designed as a direct replacement for Horsch's Duet coulter, meaning it would bolt directly to a CO or Sprinter drill. However, since its launch in 2015, he has also come up with versions to fit Simba's Freeflow and Vaderdstad's Seed Hawk.

These coulters are designed to work directly into stubble or cover crops and offer minimal soil disturbance to reduce blackgrass germination.

To do this, Mr Metcalfe made the coulter just 12mm-wide and added a tungsten carbide-tip to create a clean opening and make it last longer. There's also a bulge of hard-facing weld on either side of the point to create the correct-sized opening for the seed tube mounted at the rear.

Points can be replaced by removing one roll pin and on one of the original farms to test the system they have been lasting for about 750ha.

Prices for the conversion cost £78 per coulter and there's the option of adding a liquid fertiliser tube for £8 per unit.



War of the Weeds: **The Rise of the Robots**

Dr Peter Wootton-Beard RNutr: IBERS, Aberystwyth University.
Article published in Farming Connect June 2019 and in Food and Futures issue 12 July 2019

The wrong plant in the wrong place earns itself the mantle of 'a weed'. Anything other than the target crop may compete with it for light, water and nutrients, reducing the potential harvest. Many weed species are highly adapted to take advantage of short windows of opportunity. Through rapid growth and reproductive cycles, they are far better adapted than the delicate, mollycoddled, but nevertheless precious edible crops that producers want to grow. The advantage therefore, must be afforded to the underdog, and therefore every horticultural producer does their best to stack the decks in its favour through either chemical, mechanical or manual weed control measures.

The weeds have accepted that they may lose a battle, but in true Hollywood style, they intend to win the war. Increasing levels of herbicide resistance are being reported, alongside a reduction in the number of herbicides considered safe to use, particularly for organic production. Couple this with a scarcity of manual labour and an increase in its cost, and the scene is set for the weeds to triumph. There are environmental and social benefits to these changes, but crops still need to be grown, and producers still need to make a living, so new methods of weed control are required.

The key targets for innovation in weed control are improvements in precision, to limit the health impacts of chemical control, and increased automation, to reduce reliance on manual labour. Robotic weeders are one such innovation, and this article aims to describe the ways that they operate, as well as providing practical, technical guidance as to how they can be used by producers, both now and in the future.

Methods of operation

Robotic weeders come in a range of shapes and sizes, but in general they can be divided into those which deliver chemical herbicides and those which automate traditional processes of mechanical weeding such as hoeing.

The first type of 'robots' are those which are still manually operated, and

designed to reduce the amount of labour required and change the mode of that labour from the physical task of removing weeds by hand, to the more efficient method of directing a machine to do so. They can be thought of in the same manner as tractors, or combine harvesters – as labour saving devices. Many are self-guiding using simple odometry sensors or GPS technology, requiring only adjustment to the desired route, or factors such as how much herbicide to apply, or how vigorously a mechanical hoe operates.

Such devices may not deserve the title of robot, since they do not act without human intervention, a characteristic which commonly defines a 'true' robot.

Weeders such as Lettuce Bot (Blue River Technology), now well established in the US, are pulled over the top of a vegetable crop by a tractor, and utilises computer vision equipment to compare an image of every plant encountered with an extensive database of control images. Upon detecting an unwanted plant, the machine delivers a precise application of concentrated fertiliser (or herbicide if desired), killing the weed but enriching the nutrient content of the soil for the surrounding crop.

There are equivalent mechanical systems such as Robovator (F. Poulsen Engineering), which use the same computer vision technology to avoid the crop, whilst deploying tools to disturb the soil. In such machines, planting plans can be pre-loaded and the tool used to deliver the weeding action can vary from a mechanical hoe to a thermal weeding tool utilising a pinpoint flame or heated oil, a targeted laser device or a combination of tools for different areas of soil.

These robots are considered to reduce the labour requirement for weeding by a factor of 10. They operate at 2-4 mph and may cost somewhere between £100,000 and £200,000 to buy, depending on their specifications. Their computer vision tools can be combined with seed/seedling mapping, and allows them to remove weeds closer to the crop.

A new range of bots, such as Ecorobotix (Ecorobotix Ltd.), take similar tools but remove the need for manual control, instead adding a wider range of sensors, and automating the process using complementary technologies such as solar power. Much like solar-powered lawn mowers, these machines are able to be programmed with a route to follow or guide by remote technologies, given a schedule to operate upon, and then left to complete the task unaided.

Technologies

Evaluating the potential to use a robotic weeder in any given production system, requires a robust understanding of the technology it utilises, its potential benefits, and its limitations. A range of technological solutions to automation in agriculture are tested as part of the Hands-Free Hectare, an innovative test case for future production methods.

Where it goes

The first level of technology is that which decides where the robot can go. For labour saving devices, that may be as simple as following the tractor to which it is attached.

However, at the next level of automation, robots acting independently can be guided by real time kinematic global position systems (RTK-GPS), which use satellite navigation techniques (an advance on a car's 'Sat. Nav.'). There are examples of weeders using these systems such as DINO (Naïo Technologies). The system allows the robot to act without supervision, assuming that an accurate map of the area is available. These systems can be coupled with seed/seedling geo-referencing, which allows the robot to be guided by the position in which the seeds were originally sown.

This relies on precision sowing and the ability to store and retain accurate records.

What it 'knows'

The ability to refine the application of robotic weeding depends on how much information is available upon which to base decisions. Robots commonly contain a multitude of remote sensors, collecting information on environmental factors such as meteorology, soil parameters, and on-board activities. The accuracy of this information, its interpretation, and the ability to record it, each contribute to informed decision making, either by a person controlling the use of a robotic weeder, or in the future by the robot itself, either responding to changes or applying situation specific settings. The sensors can also be used to monitor general information about the production operation which, even if they are not used to directly adjust the performance of the robot, can still be informative at a farm business level.

How it 'sees'

The robot needs to be able to differentiate between a weed and a crop plant. This is the basic difference between a simple tractor mounted between-row weeder, and a precision robot capable of weeding within rows. Plant identification relies on the ability to assess biological morphology, spectral characteristics (colour/ reflectance) and texture. The use of biological morphology relies on shape recognition, and the fact that each species has a unique shape, something which is particularly challenging for crops which are closely related to weed species. Advances on these technologies include a transition from 2D to 3D cameras, multispectral imaging and plant identification libraries containing many thousands of images of crops and weeds from every conceivable angle to act as a reference point.

How it acts

Once a weed is detected, the robot must take action. The way it does this has an impact upon its capacity and accuracy. If it is applying a chemical treatment, it must be able to do so selectively and accurately using advanced micro-spraying technologies and highly accurate spray nozzles. This not only ensures satisfactory weed removal but also contributes to the environmental benefit of using a robot. If the action delivered is mechanical in nature then the type of tool, and its sensitivity are the critical factors. A range of precision tools are utilised on robotic weeders including hoes, finger tines, oscillating discs and cutters. There are also examples of other precision tools applying flames, freezing, lasers, air blasts and even 160°C heated food grade oil to kill weeds.

What it needs

In order to operate, a robot needs a power source, and a maintenance regime. Robotic weeders can be operated by being towed, but there are also examples with diesel engines, battery power (chargeable) and on-board energy generation through solar panels. The source of power may determine somewhat, the ability of the robot to act autonomously, but also the need for a fuel source and the associated costs. The ability of the robot to detect problems such as blockages, and fix them will also impact upon autonomy, whilst the requirement for maintenance may result in labour costs which are removed from the field, being reapplied in the farm yard.

If it learns

The critical ability, which could lead to genuine labour free weeding, is the ability of a robot to not only measure and record information, but to act upon it, and potentially, to actively learn from experiences to improve performance. At present, this factor is reduced to the 'intelligence' level of the robot, i.e. its ability to make decisions based on the information it receives rather than to rely on the direction of a human supervisor.

This could include elements such as an ability to detect its own inefficiency and repeat an action, rather than relying on follow-up manual labour, or to pause activity during a heavy rain shower.

Practical considerations

If only the task at hand, namely weeding a row of vegetables is considered (without any social bias) then the main disadvantage of a robot is its inability to be reactive to complex and highly variable environments that are typical of real-life production systems. Whereas a human can alter their activity to suit the imprecise nature of fields which are not square, flat, or necessarily precision planted, a robot cannot, at present, make such adjustments.

This limits their application to row crops, which are precisely planted, and prevents their effective use on broadacre crops, closed canopies or on land which undulates. The limitations of using such a system, in a Welsh small-scale horticultural context are currently being investigated.

There are limits too, to the use of certain technologies. Computer vision works well on a clean, green leaf, but it cannot make an accurate determination if the leaf is dirty for example. The accuracy of differentiation between weed and crop is also technically challenging, particularly at the seedling stage, which means a loss is expected for mistakes, or inadvertent damage caused by imprecise application of mechanical tools.

In these scenarios there are fine margins of error, particularly at relatively high speeds.

Where there is even spacing and predictability, the robot can cope, but any deviation from that creates the possibility of accidental crop damage, or the need to repeat the process by hand.

If a robot applies a chemical treatment, it too is limited by the availability and regulation of effective chemicals. Whilst it may offer environmental benefits through the precise application of a given chemical, it could still fall foul of changes in regulations or policy which prevent their use. Furthermore, specific crops may have a limited range of approved treatments (e.g. spinach) which may limit the ability of a producer to use the same robot for multiple crop types.

Producers must also evaluate the economic case for using a robotic system. Whilst the pressures outlined in this article apply universally, there is still no guarantee that a robot would prove more cost effective than hand weeding, or that the need for labour would be eliminated.

A comparative study of labour requirements between hand hoeing and robotic hoeing reported that the average number of person hours needed to weed 100 m2 was 0.241. Once the robot had passed, the number of 'follow-up' person hours needed to render the plot completely weed free was 0.102, a reduction of 57.5%. This highlights the fact that a robot does not necessarily replace labour, but may simply reduce it, and although this figure would improve with each pass of the robot over the same row, it may not be able to achieve the same efficiency as a person.

The cost of the equipment must also be factored in, for example the previously featured 'Robovator' could cost £100,000 to buy and around £213 per Ha to operate.

Whilst the operation cost may be roughly a tenth of the cost of hand weeding the same area, the costs associated with purchase, maintenance and depreciation are additive, and unique to the robot.

The factors which are unique to the specific farm business are perhaps the most important considerations. Robots cope best with well-established stands, low weed densities, and crops which are larger than the weeds. Any deviation from this ideal scenario is likely to make operations less efficient, and either require more equipment

(and therefore cost) or more follow-up labour.

Robots are also, most effective before weeds become established, and early interventions are considered crucial for a high degree of success. Meeting these specifications may mean that, for the time being, robots are best suited to speciality crops, such as asparagus or lettuce. Research has also highlighted the importance of intelligence in the robotic system (the ability to accurately detect the weed and/or the crop), essentially this means that the more equipment the robot has, the closer it can get to the crop, and the more effective it can be. This indicates a diminishing return with simpler, less costly technologies. The operation and programming of robotic systems requires fewer human hours, but the ones it does need require a high degree of technical competence, skills which are currently in short supply.

Future opportunities

The future of robotic agriculture rests upon the ability to produce 'true' robots, machines that are entirely independent of human control. This transition from processes which are more automated to processes that are fully automated will typify the evolution from what is referred to in the literature as agriculture 4.0 to agriculture 5.0. The key technological advancement that would enable this to become a reality is the development of genuine artificial intelligence – the ability for a robot to learn. In a recent publication, a weeding robot was considered truly robotic if it met the following criteria:

1) It had the ability to monitor the crop, weeds, weather and soil in real time.
2) It could decide when the crop needed to be weeded.
3) It could choose the optimal weeding implement.
4) It could take the weeder to the field that needed to be weeded.
5) It could adjust the chosen implement for optimum performance.
6) It could monitor itself for blockages and mechanical problems, and fix them.
7) It could continually monitor and adjust performance in the field.
8) It could return the weeder to the farm once the task was complete.
9) It could clean, maintain and store the weeder.

This list simply seeks to highlight the difference between a labour saving device, and something truly robotic, and that there is a large difference between them. However, most of the technology required to achieve this already exists, particularly in terms of remote sensing. With the ability to 'learn' and apply that learning to variable contexts, robotic systems may well be able to replace labour to a much higher degree than is currently possible.

Near market improvements in robotic weeding include improved weed/crop differentiation through rapid advances in image analysis techniques and the potential for crop tagging. Alongside this are improvements in precision instruments, able to get closer to the crop, with minimal disturbance and damage. Robots also have the potential to be quickly updated through software, which can make them more responsive to changes in technology and trends for data driven decision making brought about by the advent of the internet of things.

Skills training, policy making and regulatory mechanisms need to keep pace with the capabilities of technology for them to be efficiently utilised. The most commonly quoted milestone for the predication of human activity, particularly in terms of agricultural output is 2050. Any consideration of weed management in 2050 will need to be able to take the early promise of today's robotic labour saving devices and apply them to the most complex production systems as well as the most extensive. It has recently been reported that an entirely different approach would be required for broadacre crops, and to achieve truly sustainable intensification, that is the field on which the robots must next do battle.

SUMMARY

Robotic weeders exist, which are both efficient in terms of their ability to complete the task of weeding, and also cost effective compared with the manual alternative.

However, they are best utilised where conditions are highly predictable, namely on well established stands, which are precision planted, have low weed densities and where the crop is larger than the weed. The level of technology currently available precludes their effective use in 'irregular' production scenarios where the robot may encounter a 'surprise' which it hadn't expected (e.g. change in angle, soil conditions, row spacing, etc.). This makes their use in many real-life horticultural settings challenging. Trials are underway to provide information of these factors, and how to mitigate them for small scale producers. In order to become truly robotic and replace human labour, weeders will need to be able to process a wide range of data, make effective decisions, and learn from their in-field experience.

Background information:
This project has received funding through the Welsh Government Rural Communities - Rural Development Programme 2014-2020, which is funded by the European Agricultural Fund for Rural Development and the Welsh Government.

Feedback

Responses to **Landwards** Feedback to the Editor chris.biddle@btinternet.com

THANKS

This letter serves two functions. It is firstly a response to CEO Alastair Taylor's reflection "making our voice heard", but also a necessary vote of thanks to Chris Biddle for the vital role he has played in changing the look and feel of Landwards.

For an institution to remain valid, relevant and active, it is essential that it actively searches for both horizontal linkages, while maintaining and retaining its own internal and vertical structures. Abiding ties with students, with its membership, with the greater Industry, and with the area of ultimate benefit, at the heart of which is the crucial interface between sound engineering and agriculture.

I think our outgoing CEO has skillfully navigated the Institution along this challenging and sometimes difficult path.

Without risking our identity, he has created and consolidated important linkages in numerous fields. Influencing policy development in complex new areas like automation, evaluating newly robotised activities and abilities, pursuing alternative energy sources, increasing safety in our work environments, increased use of active data tracking and a vast and diverse range of emerging technical activities, all of which have increased our 'horizontal spread' into related but not pure agricultural engineering. This is by no means a comprehensive list.

Behinds the scenes, I imagine this process involves a great sifting out of material to find value. The effect of this guidance and judgement cannot be overstated, because it has kept IAgrE a vigorous and relevant specialist agency for change, providing real grassroots guidance. In our current environment, market relevance is vital, and this has enabled us to grow and develop.

A body like this can only grow if these tasks are handled well, and it is my belief that we are indebted to him for these many achievements. His article posed the question - what are the benefits of membership? For me personally these linkages have been invaluable and profound.

My membership helped me in setting up a series of meetings with leading experts in the UK, and these in turn lead to my work in developing high-volume day-old chick transport systems in South Africa, with a final tally of 15 such units built locally and in operation. That is a bolts and nuts example of the kind of horizontal cross pollination I refer to, mixing line haul road transport with animal welfare concerns, thermal load control and air flow design in high ambient temperatures. It really is applied agricultural engineering at the coal face.

Then, equally, thanks must go to Mr Chris Biddle who has had a huge influence on the look and feel of the landwards journal, the Institution's portal to the world. He has eased it successfully into the electronic age, given it a fresh look and feel, and added so many features that have made it altogether more accessible and reader friendly.

He has always been receptive to new ideas and permitted input from new sources and related industrial developments from many quarters. I think this has been a remarkable team of people, and they have broken through many barriers and achieved remarkable things.

If I would make one suggestion, it is that IAgrE should make available high quality copies of the outstanding photographs often used to illustrate the magazine. Many of them are good enough to warrant printing and framing, and they could become a small income stream for the body. There is something special about these pictures to an Agricultural Engineer.

Sincerely yours, with thanks
J H Ward MIAgrE

LARGEST INVESTMENT

Members might be interested that my company, Farm Services Ltd has purchased a new Mastenbroek 40/20 Drainage Plow, the first drainage plow built in and operated in England for over thirty years and is the most unique and advanced drainage machine in Europe. It will be the largest investment ever made by the company in its 75 year history and represents a considerable vote of confidence both for the land drainage industry and farming in general.

The custom-built machine is 30 tonnes in weight and is capable of laying 60mm, 80mm, 100mm and 160mm diameter plastic land drainage pipe to a depth of 1.8m.

It demonstrates our commitment to installation with a trenchless drainage plow. This technique is uniquely suited to large scale agricultural drainage schemes, offering precision installation and an unmatched speed. Although once common in the UK, today most drainage is installed with a chain trencher, however as I found out during my Nuffield Scholarship this is not the case in the rest of the world. The machine will be partly funded by European Agricultural Fund for Rural Development Grant.

Rob Burtonshaw MIAgrE

REFLECTIONS

Although I was raised on a farm and as such was immersed in the technology of the day from an early age, it was 1976 when I went to college to follow the City and Guilds 030 Technicians Certificate in Agricultural Engineering and when I look back, what a great course this was!

Four years, including a year in industry led to my own graduation in 1980 and later the City and Guilds Full Technological Certificate (FTC), which was a wonderful result.

When I reflect on my studies and the technology of the day, a "big" tractor was 100 horsepower and a four furrow plough would have been considered as state of the art. Hay and straw bales were small by today's standards and a combine harvester with a four metre header was something we could only see in films from America.

Our farming practices were from a different age. Stubble burning was permitted back then, and I can recall Lincolnshire glowing from north to south. Deep ploughing, rotovators and power harrows, spraying everything in sight, and precious little thought of the environment, and soil and water protection.

Forty plus years on and things have certainly changed. Machinery is much larger and the number of UK manufacturers miniscule by comparison. In the seventies, we had a good number of British tractor manufacturers with factories the length and breadth of the land. As regards developing the next generation, those agricultural colleges in most counties (Lincolnshire had three) have largely gone with now much more of a regional presence.

It is easy to look back at all of this with rose tinted spectacles but frankly I don't!

ABOVE: With Chris Whetnall 2013

EXCITING TIMES

Forty years on and our industry is as exciting as it ever was. With robotics, automation, Agritech and a new focus on animal and environmental welfare, the industry today would be unrecognisable for those of us who started out in the seventies.

And how exciting this is.

In recent years, developments such as the Handsfree Hectare and vertical farming can only amaze us. Our task is to amaze a new generation of new technologists. Easier said than done so one of my key reflections is how important it is to find a way of engaging with those who will lead us into the 2030s and beyond.

I am not one of those who looks back saying that "things were much better back then". They were different but I am not sure they were better – it is all relative.

I was first introduced to IAgrE around 1977. We were taken to branch meetings at the current East Midlands Branch which mostly took place at Brooksby College. I became a member and a registered engineer in the early eighties. It was what you did!

It was made clear to me that joining your professional institution was something you did. No question. There was no debate.

I held IAgrE in great revere back then (and still do) and was in awe of those great engineers from the likes of Silsoe College and Newcastle University. Who knew that I would go on to become the IAgrE CEO towards the end of my career?

My father passed away twenty years ago and I know he would have been amazed by my achievements. I reflect that he was growing up during the second world war which must have had a huge impact upon his options and opportunities.

I am proud that I started out as an Agricultural Engineer and ended in the same industry. I might have had a few diversions along the way but it does remind me that it is a great industry with wonderful people and great minds.

CHALLENGES

When I look at my six years in charge of IAgrE, I hold mixed emotions. There is always that tinge of sadness (which I bet everyone has) over those things I could have done had I had more time and resources, and those things that didn't go so well. It is too easy to dwell on these things when you are a self-critical character and care about what you do.

Fundamentally, you always want to leave things better than you find them and I hope I did. Inheriting the IAgrE ship from such a successful and longstanding CEO and Secretary was never going to be easy but both Chris Whetnall and Elizabeth Stephens who had been in post for so many years did leave me with a great ship. I hope I have left it in good shape.

ABOVE: Presenting IAgrE Journalists Award 2016

So what is my reflection?

My six years at IAgrE has been at a challenging time for the country. We have been emerging from a lengthy recession following the economic crisis of the early twenty first century followed by a period of political uncertainty as the country decided its future relationship with Europe and the rest of the world. Without a doubt this has impacted on the general mood of society. In that respect, half of my tenure has been influenced by a general feeling of anxiety which extends across society and the industry we serve. Keeping positive and upbeat has been

Alastair Taylor reflects on his 6-year term as Chief Executive Officer of the Institution of Agricultural Engineers (IAgrE), and also on his wider career as an Agricultural Engineer

ABOVE: Branch meeting in Ireland with President Jane Rickson 2018

something which has pushed all of our tenacity to the limit.

Against all of this has been an evolving engineering profession. Over my tenure, the relationship with the other professional institutions has improved and we now share information and meet much more frequently than we ever did when I started.

It is an interesting reflection that we all share the same challenges be that from the routine matters of staffing and resources through to the more difficult issues of what to do with a member who is unwilling to engage with the recording of CPD.

The saying "better together" resonates here and there is certainly an opportunity for working with those institutions that complement our work.

Maintaining and growing membership numbers has been a challenge. Not everyone understands the value of professional standing, networks and knowledge. It has been interesting to reflect upon our mission and purpose and to refine this. Demographics have a role to play and I have been blessed with the support and steer from our elder statesmen who might be elder in terms of years but are certainly not in terms of their attitude and approach which is as youthful as it always was. At the same time it has been great to engage the younger generation - and what a fantastic group this is. They are the future and those I have met make me feel sure that the industry and the institution is in good hands.

TEAMWORK

I have enjoyed working with some great people. We are a small team and as such develop a close working relationship. It is inevitable that we live each other's challenges and celebrations and there have been plenty of those on the way.

We sometimes disagreed and I would be first to acknowledge that I can be very challenging. Beyond that, it has been good fun to work with such a loyal bunch. The same goes for our volunteers and partners. Without them we would be nothing.

There are of course things that disappoint. Getting the message of membership and registration across is a challenge. Not everyone buys into it. The "What's in it for me?" question can be difficult to answer and in a harsher world where there is more choice, and a source of good quality information is perceived to be a mobile phone search, it makes it difficult to win over all the hearts and minds we need to. I wish I had done better here. On the other hand, it has been good to engage with the Engineering Council and Society for the Environment to develop standards.

I think our "can do" approach is well received.

I have been particularly proud of our work to promote the agricultural engineering discipline. We are well regarded by the Royal Academy of Engineering and where possible, we have got involved with developing policy and practice.

At times it has been a "one-man mission" to change the world but over time, we have succeeded in raising awareness of the subject of global food security and now new areas such as the carbon agenda and emerging engineering solutions such as automation.

Conferences and events have been an interesting diversion and having been involved with six annual conferences, the quality of speakers and debate has been outstanding.

ABOVE: At 80th Anniversary celebration Wrest Park 2018

The vision and dedication of the four Presidents I have served has been wonderful. I count them all as friends and from time to time we have dealt with some complicated issues. Members would not, and should not be aware of some of the background things we have to do. Much of it is mundane but nonetheless important in a world of compliance and challenge.

So I step forward into my new career. I have always been up for a new challenge I know that whatever is around the corner will be interesting and engaging. No one retires these days. We just evolve. I know that my career as an Agricultural Engineer, from farmers son "on the tools" through to CEO of my own professional institution has served me well for whatever comes next.

It has been my pleasure.

ABOVE: Elizabeth Stephens retirement party 2017

LANDWARDS CONFERENCE 2019

BIG DATA

WEDNESDAY 30TH OCTOBER 2019
VENUE: PETERBOROUGH SUITE,
EAST OF ENGLAND ARENA, PETERBOROUGH

HOW WILL BIG DATA LEAD TO SMARTER FARMING?

Introduction by IAgrE President, Professor Jane Rickson *CEnv, FIAgrE*

OUR 2019 Landwards Conference focuses on the role that information technology will play in the economic and timely production of food.

The phrase ***Big Data*** has only entered our vocabulary relatively recently, so we need to understand the challenges and opportunities this brings to farmers and the agri-tech sector in general.

The 21st century has seen a rapid increase in the amount of data being collected throughout the agricultural supply chain. Farmers use sensors for soil sampling and mobile apps, cameras and drones to monitor pests and diseases, mapping of fields – all generating huge amounts of data.

BUT how can farmers, agribusinesses and researchers gain real ***value*** from "***Big Data***"?
The challenges and opportunities for agricultural engineering include:

- Smart sensors and devices produce vast amounts of data that should provide unprecedented decision-making capabilities.
- ***Big Data*** is expected to have a large impact on Smart Farming and the Internet of AgriThings throughout the whole supply chain.
- ***Big Data*** is expected to cause major shifts in roles and power relations among traditional and non-traditional players.
- Governance (incl. data ownership, privacy, security) and business models are key issues to be addressed in future research.

The UK agricultural industry should harness the power of data to support decision-making and ensure future success. However, data experts say 90 per cent of the data collected is wasted.

This conference will explore how '***Big Data***' is being used to improve agricultural practices, and how farmers and technologists should work together to extract the value of '***Big Data***' and identify future development opportunities.

*The **2019 IAgrE Landwards Conference** is certainly an event not to be missed!*

CONFERENCE INFORMATION

east of england arena and events centre

The East of England Arena and Events Centre (EEAEC) is one of the country's largest conference and events venues, hosting a wide range of indoor and outdoor shows and exhibitions. Situated on the East of England Showground, the venue hosted the LAMMA Show for a number of years.
The IAgrE conference will be held in the Peterborough Suite.

COST:
FULL MEMBER:
Delegate £100 + VAT,
Retired Member £75 + VAT
Student Member £40 + VAT
NON MEMBER:
Delegate £150 + VAT
Retired £100 + VAT
Student £50 + VAT

INFO:
www.iagre.org/conference-2019
Telephone: 01234 750876
Email: secretary@iagre.org

CONFERENCE PROGRAMME AND SPEAKERS

MORNING PROGRAMME

09.30 **Arrival, Registration and Networking**

09.45 **Opening Address: Professor Jane Rickson,** *President IAgrE*

10.00 **The role of Big Data in unlocking unimaginable solutions to feeding the world and environmental protection.**
Benjamin Turner, *COO, Agrimetrics*

10.20 **How will Big Data Transform Agriculture? Practical Lessons from the Farm**
Oliver Wood, *Precision Technology Manager, Omnia Precision Agronomy*

10.40 **The Next Generation: CLAAS LEXION Combine Harvester**
Dr Joachim Stiegemann, *CLAAS Product Management*

11.00 **Coffee and Refreshment Break**

11.30 **IOT for Agriculture**
Anthony Furness, *Visiting Professor, Harper Adams University and IAgrE member*

11.50 **Big Data: Changing the paradigm for small farms**
Luke Halsey, *Farm 491*

12.10 **Panel discussion: Will Big Data be as revolutionary as the tractor and mechanisation** *Chaired by* **Andy Newbold,** *IAgrE Past President.*

13.15 **Lunch**

AFTERNOON PROGRAMME

PANEL DISCUSSIONS AND WORKSHOPS

14.00 **(A) Role of the Royal Academy in developing research and policy on emerging technologies**
Dr Nick Starkey, *Director of Policy Royal Academy of Engineering*

(B) Development in the use of artificial intelligence, imagery and data analytics
Will Wells, *Chief Executive Hummingbird Technologies*

14.30 **(A) Role of the UK Digital Champion and developments in agri-informatics**
Ron Corstanje, *Cranfield University*

(B) Big Data and the Livestock Sector
Mark Rutter, *Harper Adams University*

15.00 **(A) Development of a soil management information system for Horticulture**
Rob Simmons, *IAgrE member and researcher, Cranfield University*

(B) Use of Big Data to support autonomous systems and agri-robots
Simon Pearson, *Lincoln University and IAgrE member*

PLEASE NOTE: The programme above is correct at time of going to press. Any changes to timings, speakers or conference topics will be updated regularly on the Conference website www.iagre.org/conference-2019.
SPONSORSHIP PACKAGES for this prestigious event are available.
Please contact Sarah McLeod at IAgrE Head Office for details Tel: 01234 750876 Email:secretary@iagre.org

BEHIND THE SCENES

Professional Development Committee

Whether you are a new member of IAgrE and on your journey to becoming professionally registered or an established member and registered engineer or environmentalist maintaining your knowledge, skills and competence, continuing professional development (CPD) will form a vital part of your working life.

We probably undertake much more CPD than we realise, and a common myth is that it can only be gained by attending a course or technical event. In reality, professional development comes from many sources – even watching a TV programme on some aspect of engineering and technology.

The IAgrE Professional Development Committee meets once a year to oversee our processes and procedures for professional development. It is a subcommittee of the Membership Committee. In addition, they look at members CPD submissions and conduct peer reviews – a feature of IAgrE membership which is well received.

SAMPLING

The key role of the committee is to test and challenge the institutions approach to monitoring members CPD. There is an expectation from the Engineering Council and Society for the Environment that IAgrE will sample the CPD records of a proportion of active members.

This sampling process can lead to some anxiety from those members selected although the reality is that although most members participate in a wide range of CPD activities, they don't always record it.

The Professional Development Committee considers how records might kept by more diverse means such as voice memos, screenshots and even photographs of informal records "on the back of a fag packet" as the saying goes.

Although the committee meets just once a year, its activities spread across the year.

IAgrE offers a unique service by providing members feedback on their CPD submission. This goes beyond the minimum expectation but the opportunity for a member to have a peer look at their work and provide some supportive comments appears to go down well. Each member of the committee will be linked to the CPD records of five or six members.

They will have a look at it and offer some words of support. It might be a superb record in every respect with the member going on to reflect upon what they have learnt and how they are going to use the new knowledge. In this case it is a "gold star" and affirmation that the member is on the right track.

Other CPD submissions might benefit from some further reflection. Whilst other institutions offer feedback as an option, IAgrE seeks to provide some feedback to every member. A few have commented upon how valuable it is to have some words of support and encouragement countered by some thoughts such as "have you considered this" or "don't forget the value of that". The process of reviewing a peers CPD is for the relevant member of the professional development committee. It is a supportive process.

PHONE RECORD

The committee goes on to think about how IAgrE can promote CPD opportunities to members and how we can help colleagues to make the best of it. They also consider some of the more challenging questions as to how we should handle a situation where a member refuses to submit their CPD record. Everyone acknowledges that we are busy people and for some, it is a challenge to find the time to record CPD. Perhaps we can handle this through a professional discussion over the phone. In fact we have been trying this out recently and have gone on to make a recording of the conversation.

Hey presto – there is the CPD record!

And that got the Professional Development Committee thinking. Why don't we offer members the opportunity to have a formal meeting with a peer to discuss their career development?

All of us have been at a point in our working lives where some friendly advice would help us on the way to the next stage of our careers.

The Professional Development Committee is an enjoyable way to get involved with IAgrE. It meets just once a year and conducts most of its activity on-line. You might want to get involved and you would be made very welcome. All of this voluntary effort adds to the success of IAgrE and more importantly the success of its members. Professional Development will always be at the heart of our work as a Professional Engineering Institution.

Why not get involved?

ABOVE: PDC Meeting held at Cranfield on Tuesday 13 August. Pictured (clockwise l to r) are Jane Rickson (IAgrE President); **Ed Hansom** (CEO Designate); **Rob Simmons; Lance Butters; Melvin Johnson** (PDC Chair); **Jim Loynes; William Waddilove; Sarah McLeod** (IAgrE Secretariat); **Graham Higginson; Alison Chapman** (IAgrE Membership) **plus Alastair Taylor** (who took the photo). **Apologies were received from PDC Member Malcolm Carr-West**

DOUGLAS BOMFORD TRUST

The Douglas Bomford Trust,
The Bullock Building, University Way, Cranfield,
Bedford MK43 0GH
Telephone: +44 (0)1234 750876
www.dbt.org.uk enquiries@dbt.org.uk
@BomfordTrust Secretary: Alan Plom
Administrator: Elizabeth Stephens

Alan Plom, Secretary to the Douglas Bomford Trust (DBT) reports on recent activities and says "One of our objectives is to enable and encourage personal development and this article illustrates the diverse range of topics undertaken by students sponsored by the Douglas Bomford Trust.

'TIS THE SEASON FOR AWARDS . . .

The Trust's Award for the student on an Environment Theme course at **Cranfield University** who **'best demonstrated the application of engineering and technology for sustainable agriculture'** this year went to **Eleanor Chandler**. The title of her project was '***Climate change impacts on macadamia production in Malawi'.*** Unfortunately, she was not able to receive her prize in person.
At the **Royal Agricultural University** (RAU), DBT's Chair, **Nick August** presented the Trust's annual prize for **'Best Agricultural Engineering Dissertation'** to **Oliver Pritchard,** for his undergraduate dissertation on '***Use of thermal cameras to accurately detect changes in body temperature of young calves'***. Oliver was commended for his enthusiasm, skills and knowledge throughout his studies and he has provided the baseline for three new projects, to continue this exciting area of research at RAU. Oliver, (who suffers from profound deafness) said that he was looking for a future in technology/ precision farming, but alongside his studies, he is a member of the GB triathlon team, and would also like to turn professional. We wish him great success, whatever path he follows.

RIGHT: DBT Award recipient Oliver Pritchard with RAU's DBT-funded Chair of Agricultural Engineering, Dr Karen Rial-Lovera.

Another DBT-supported student following a track of a different kind is **Matthew Torok,** who received a DBT Scholarship grant at **Harper Adams University** (HAU) this year to enable him to develop a **Lawn Mower Racing team** and share his expertise and enthusiasm for engineering with other students through this particular vehicle. He has spent a lot of time after his exams improving his racing mower including an extra 700rpm from the engine, new exhaust system and new tyres all making it more stable and roll less.
Obviously not one to let the grass grow under his feet, Matthew has also found time to work as a mechanic fettling racing cars including a Cooper Chevrolet at the Masters Historic Motor Race weekend at Brands Hatch, an Aston Martin DB2 at Thruxton, and HAU's rally car at the Goodwood Festival of Speed.
Another DBT **HAU Scholar Sam Scales** has also spent his prize money to boost his performance - by buying an iPad Pro with Apple Pencil Portfolio keyboard. This has made a major difference during a difficult year by helping Sam to integrate and improve how he records information, writes reports, produces sketches, presentations and design calculations.
Liliana Castillo-Villamor is a Geography and Earth Sciences PhD student at Aberystwyth University, aiming to develop a method to identify anomalies within crop plots using satellite imagery as part of a four-year, international collaboration funded through the International Partnership Programme run by the UK Space Agency. She has just returned from an enjoyable and educational (DBT-funded) field trip to Colombia and Perú where she was also able to exchange knowledge and train local agronomists on intelligent monitoring of crops using 'satellite earth observation'.
A copy of Liliana's interesting report will be posted on the Trust's website. ***www.dbt.org.uk***.

MEET A TRUSTEE:

Nick August *(Trust Chairman)*

Nick has been Chair of the Board of Trustees since November 2018. Involved in farming all his life, he grew up on the 400ha family farm which he now owns and manages. Located in The Cotswolds he also runs a local contracting business, providing a wide-range of services.
He is passionate about the land, soil health and carbon sequester, and has actively embraced conservation agriculture for the past decade, pioneering the use of Precision Farming by converting to Controlled Traffic Farming in 2008.
Nick is a consultant, guest lecturer at UCL and RAU, and actively promotes this technology around the world. He is also a member of the 'PrecisionStory' team based at San Jose in California, promoting the benefits to businesses of the 'Internet of Things 'and `Big Data'. Nick has regularly attended workshops on precision farming and carbon sequester in Brussels and was a keynote speaker at the European Conference on Precision Agriculture in 2017.
Nick continues to be an active sportsman, playing for his local hockey team, climbs mountains and loves 'back country' skiing. In between all this, Nick has been an active Trustee since 2015, becoming Deputy Chair in 2016 and took over as Chair from Malcolm Crabtree in November 2018. He brings his enquiring mind and sound practical farming perspective to the Board, as well as his experience and enthusiasm for agricultural engineering and technology.

Membership Matters

MEMBERSHIP ENQUIRIES
IAgrE The Bullock Building, University Way, Cranfield, Bedford MK43 0GH
Telephone 44 (0) 1234 750876
e-mail: secretary@iagre.org www.iagre.org

CHARITY DRIVE TO SUPPORT PROSTATE CANCER

IAgrE Past President Peter Leech and AEA Past President Graham Dale will drive over 1000 miles to raise awareness and funds for Prostate Cancer.
The Round Britain Coastal Drive (RBCD) is organised by the XK Club for owners of Jaguar XK cars. Peter and Graham will be driving the first 6 stages totalling approx. 1000 miles in a 60 year old XK150.
Graham and Peter are both retired members of the Landbased Engineering Industry. Graham was managing Director of Lely UK who were also the Toro commercial distributor for the UK and Peter was a senior executive of John Deere Ltd.
Support the drive through Peter and Graham's Just Giving page.

Peter Leech


Graham Dale

Link is via news story on IAGRE website

HELLO AGAIN EAST ANGLIAN BRANCH

We are delighted to report that the East Anglia branch is being resurrected. The first meeting for the 2019/2020 season will be held at CLAAS UK at Saxham on 24th September 2019 which will begin at 7.00pm with a short meeting to discuss committee members, future programme etc. This will be followed by a tour of CLASS workshops and showroom before a talk by CLAAS on the Future of Engineering in Agriculture. The meeting will close at 9.00pm.
As this is the inaugural meeting, Members are requested to let David Seccombe (07766 206208) know if they wish to attend as soon as possible.

MEMORIES ARE MADE OF THIS . .

Every membership organisation is only as effective – as it's members, who often have fascinating and illuminating stories to tell about their career path. IAgrE is no different. Which is why the Secretariat is compiling members' recollections and ideas that helped shape their career in the agricultural engineering sector. Below is one such account from a long-term member:
RALPH ALCOCK CEng CEnv FIAgrE
The Institution recently gave me a certificate recognising my 50 years as a member and suggested I briefly summarise some of my memorable experiences.
I couldn't have wished for a better career! I started as a lecturer at the West of Scotland Agricultural College. From there I went to the agricultural engineering department at Tralee RTC, and then to Curtin University in Perth Western Australia.
My next appointment was at Rutgers University in New Jersey, USA where I joined a team working on large scale composting and some initial work on the feasibility of electric vehicles for use in agriculture.
My next position was at South Dakota State University where I eventually became professor and head of the Department of Agricultural and Biological Materials Engineering. My research involved a team working on battery powered vehicles, a version of which was adopted by INCO in Canada. I was also involved in studies on traction and on root growth and was fortunate to work with a number of visiting scientists, including Dr Hettiaratchi from Newcastle University. Then on to the National Tillage Crops Research Centre in Carlow, Ireland working on spatial variability in grass crops. My last 'stop' was as Principal of Rodbaston College in Staffordshire. Did I enjoy every minute? Well, almost!


ABOVE: Alastair Taylor, CEO intoducing Ralph Alcock, CEng CEnv FIAgrE at the IAgrE Awards and celebrating his 50 years with the Institution

MEMBERSHIP BENEFIT

Would your finances cover you if you were unable to work?

How would you cope if you couldn't work for an extended period? Nobody likes to think of the unexpected, of course. But a surprising amount of people in the UK would fall upon serious financial trouble in the event of a debilitating illness or injury.
In a recent study 30% of people admitted that they had no backup plan in place if they were unable to work. That wouldn't be a problem if we were a nation of avid savers. But let's face it, that's not the case. In fact the average Brit's savings would last 32 days before the pot ran dry.

The welfare state is great, but...

Why are we so unprepared? Research by Royal London found that 48% of working private renters would turn to state benefits to make ends meet if they were unable to work for three months or more. And while it's true that benefits would help, it's unlikely to be enough.
The actual sum you would receive from out-of-work benefits is just £92.05 per week for the employed or £73.10 for the self-employed. Compare that to an average household spend of £554.20 per week, and it's clear that the safety net is not without serious holes.

Low confidence in insurers

The same study found that only 4% mentioned income protection as a contingency plan for being off work. Why is that? Well, it could have something to do with the public's perception of dealing with insurance companies. Surveys have found that 59% of consumers feel that making a claim is 'daunting, complicated and time-consuming'. Not only that, but consumers estimate that insurance companies pay out only 47% of the time.
Thankfully, the reality beats the perception.
A cohort of those surveyed had actually claimed before, and of those, 71% actually rated the experience positively. Payout rates are almost double the perception, too. Insurance companies often have payout rates of over 90%.
And PG Mutual's payout rate is a pleasing 97% over the past three years, totalling £2.55 million. The top three claim categories being musculoskeletal (26%), infections and flu (22%) and gastrointestinal (14%).

Make the most of your IAgrE membership

If you want to be prepared for whatever life throws at you, income protection makes perfect sense. In return for a small proportion of your salary each month, PG Mutual will pay up to 70% of your income while illness or injury prevents you from working until you reach age 65.
And it gets better. PG Mutual share their profits with their policyholders. When you join they create a Profit Share account for you, depositing your cut of the company profits each year. You can claim this as a lump sum when you choose to leave the scheme or your policy matures.
Best of all? As an IAgrE member you are entitled to **20% off** your first two years of cover. Just mention the discount code '**IAgrE**'. To get started call PG Mutual on 0800 146 307 or find out more at pgmutual.co.uk.

NORTHERN IRELAND BRANCH

Meeting held 7 June 2019
Report by Terence Chambers

Northern Ireland branch IAgrE members and their guests recently enjoyed their annual social evening which took place at Clandeboye Estate, Bangor, Co Down.
The privately owned and independently run 2000 acre Clandeboye Estate, is one of the largest of its type in Ireland and the family first settled there in 1674.
Since then various generations have maintained and developed it in their own styles. Frederick Hamilton-Temple-Blackwood, the first Marquess of Dufferin and Ava (1826 – 1902) also had a distinguished international diplomatic career which included being both Governor General of Canada and Viceroy of India.
Clandeboye Estate was used as a military training base during both World Wars and hosted Regiments including the 36th Ulster Division on its way to the Western Front.
The current owner is Lady Lindy Hamilton -Temple-Blackwood (The Marchioness of Dufferin and Ava) who, as well as overseeing the running of the estate, is a well-known successful artist under her maiden name of Lindy Guinness.

Enterprises

The estate's 2000 acres include the largest broad leaf forest in Ireland (1000 acres), a large lake, extensive private scenic gardens, a courtyard and 620 acres of agricultural land.
The large courtyard area buildings, which include the banqueting hall, other function rooms, an art gallery and an integral church, are now routinely hired as a popular unique venue for weddings and other functions.

The gardens contain a wide range of plants and other unique features such as the bee garden with its wild-flower meadow and Georgian-style bee house. The award-winning Holstein and Jersey dairy herd is central to the agricultural enterprise. Around 10 years ago it was decided to begin using the milk to produce yoghurt.
The Clandeboye Estate brand is now well established and distributed through the usual UK / Ireland supermarkets and many independents. A unique feature of the packaging is that the pictures on the yoghurt pot lids are all copies of paintings by the Marchioness.
The Estate has also installed an 1800 cubic metre Hochreiter anaerobic digester. It uses slurry from the dairy herd, whey by-product from the yoghurt making process and crops grown in the estate to produce the bio-gas to fuel the generator.
It supplies the Estate's electricity requirements with the surplus being exported to the grid. Hot water is piped from it across the estate to heat the residence and the buildings in the courtyard. The digestate sludge is returned, as fertiliser, to the land and there is current participation in a scientific trial using solids separation to manage the phosphate content.

Conservation ethos

The Dufferin Foundation operating within Clandeboye Estate has a strong commitment to environmental issues and Conservation Volunteers, Northern Ireland, is based there.
The latter operate from within the 3-acre walled garden growing very large numbers of local broad leaf tree species for wider distribution throughout Northern Ireland.
There is also a schools initiative programme in which teachers and pupils are encouraged to take advantage of the outdoor classroom dimension of the Estate. This adds a practical 3-dimension perspective compared to the current widespread use of digital images.
The IAgrE visit began with a meal in the courtyard function room followed by a most enjoyable and informative talk around the history and running of the estate by Mr John Witchell (Estate Manager).
He followed this with a guided tour around the scenic gardens and the working anaerobic digester. We very much appreciated the opportunity to see and discuss how this beautiful and impressive estate is being run. More information about it can be viewed on www.clandeboye.co.uk

WEST MIDLANDS BRANCH

West Midlands Branch Meeting
Tuesday 9 April 2019
Will robots eventually do everything?
Speaker - Graham Higginson, Harper Adams University
Report by William Waddilove

Can Robots do everything? Well we do not have the answer as yet but we were shown examples of the research work being done at Harper Adams University which covered the elements of several of the processes.
Graham Higginson first spoke about the wide spectrum of light and how by using specific light wavelengths could show up different features. For example the green on a potato which was barely visible to the naked eye but was clearly seen using the appropriate colour. Similarly the appropriate light wavelengths could be used for identifying stages in selecting fruit ripeness.
One of the pictures he showed us was a strawberry picking machine. On the single plants in the laboratory it seemed to be doing a good job. It could locate and pluck them off the plant. They were aware that the next stage, the handling, needed a lot of developing. So this machine could have a use and it's using its own light source.
We could see the potential for this sort of robotic machinery working 24 hours a day on this rapidly ripening crop.
Another example of a machine was a 'weeder' giving weeds a blast with a laser but avoiding the lettuce plants. As it was pointed out at the moment it is a very expensive piece of machinery but with the potential to be developed. I can remember buying laser pointers for work in a lovely presentation box for £110. Now they are everywhere and even as ornaments on key rings. This is certainly a 'watch this space' development.
And the Hands Free Hectare project? Yes it is continuing but they are now working on a 'hands free farm' with the equipment working several fields and driving itself to the fields. All quite exciting for an agricultural engineer.

West Midlands Branch
Hill Close Garden Visit
Tuesday 14 May 2019
Report by William Waddilove

Hill Close gardens in Warwick is a fascinating restored remnant of leisure gardens which were once common in Victorian times. As many town houses had no or minimal outdoor garden space these leisure gardens were where people would come as a nearby private space for fresh air and leisure. Just as you would use your back garden. Typically they would be within walking distance and usually with a hedge surround to give privacy and a summer house. Here would be a lawn, flowers and possibly some vegetables. Just the place to visit on a sunny May evening after work as was our visit.
We were invited there by Mike Sheldon one of our branch members who is a regular volunteer. After an introduction to the history of the gardens and being told how they had been saved from developers we had a guided tour.
They are now run as a separately managed organisation with the full support of the council. Mike is particularly interested in garden machinery and equipment and he introduced us to some of the collection of horticultural and garden equipment that he had collected. This is including an impressive range of lawn mowers and hoes.
Soon there will be a new visitor welcome centre, in addition to the large meeting room. Mike has been asked to set up a display of gardening equipment when it is completed. He is currently thinking about ideas for this introductory museum display to tell the story of gardening in Victorian times.

Visit to BIFoR (Birmingham Institute for Forest Research) incorporating Free-Air Carbon Dioxide Enrichment Facility (FACE), Norbury, Staffs.
Report by Bill Basford.
28th June 2019

A new facility as part of the University of Birmingham to study the impact of climate and environmental change on woodlands has been developed within an ancient woodland area in West Staffordshire. Most people agree that our climate is changing and that the Industrial revolution is linked to increasing CO_2. Wrekin members took up the opportunity to visit this facility which, while researching the effect of CO_2 increasing levels includes a fascinating range of applied engineering principles and data collection.
The facility is planned as a long-term approach and incorporates 6 basic arrays of steel towers and gantries which allow CO_2 to be introduced from forest floor to canopy top. 3 of these arrays are for control and the remaining 3 are active in gas introduction. On 3rd April 2017, coinciding with the spring flush of the oak trees, the facility was switched on, crowning three years of careful planning, construction involving helicopter transfer of many masts and arrays and subsequent testing.
For the entire growing seasons, three 30-metre-wide plots of mature oak forest have been immersed in an atmosphere with elevated CO_2 concentration, topped up from current values of just above 400 ppm (parts per million) to 550 ppm, a roughly 38% increase, which the entire globe is likely to see by 2050. Note that up to the industrial revolution the CO_2 concentration may have been around 250 ppm.
Over the entire season, downtime is minimal (only 2.5% of the time), and more than 90% of the time target concentration is within narrow tolerances. These performance measures compare favourably to the only other 2nd generation forest FACE

in Australia, and also to previous smaller scale facilities.
Members were introduced to the many facets of woodland management occurring in commercial activity but learn't that this study seeks not to manage the woodland allowing natural development and degradation, unless safety is challenged. Passing into the woodland study area over foot dips the group then was restricted to confining foot pressure to tracks and elevated gantry walkways. The study includes researchers from almost every specialism which may affect tree development from soil-based studies to the overall ecology of the forest with rope access skills being essential for full observation and monitoring of tree development.
Questions were raised from right across the group as every halt and viewpoint identified different recording equipment from gaseous, light, temperature, meteorological, tree growth by both physical and sound systems being involved.
Insect traps and monitoring have shown variations within the canopy densities at high and low levels.
Data collection and transfer has not been problematical with only few issues in connections being found.
Normal woodland animals are allowed to enter and leave the facility highlighting the need to offer 'natural' influences rather than man-made.
As the visit developed more and more questions flowed which underlined the holistic approach of the facility.
There was no doubt that all who attended gained much from the visit and left with both an enlightened view as well as unanswered questions.
A fascinating visit. The facility has an excellent web site with many pictures, videos and articles.
https://www.birmingham.ac.uk/research/bifor/face/index.aspx

EVENTS AND BRANCH MEETINGS

IAgrE EVENTS

Tuesday 17 September 2019 6.00pm – 8.00pm
Alastair Taylor's Retirement Party
Blenheim Room, Mitchell Hall, Cranfield

Thursday 26 September 2019 9.30am-4.30pm
IAgrE Forestry Engineering Group (FEG) Symposium
Theme: New Developments in Timber Extraction
Newton Rigg College, Penrith, Cumbria
Further details: www.iagre.org/events/FEGSymp2019

Wednesday 30 October 2019 9.30am-4.30pm
IAgrE 2019 Landwards Conference
Theme: Can Big Data lead to Smarter Farming?
Peterborough Suite, East of England Arena, Peterborough
Further details: www.iagre.org/events/IAgrEConf2019

Tuesday 5 March 2020 10.30am-2.30pm
IAgrE Technical Visit: Severn Trent Water
Hosted by: Dr Alex Cooke CEnv MIAgrE
Stoke Bardolph, Nottinghamshire

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

BRANCH EVENTS 2019-20

EAST ANGLIA BRANCH

Contact: David Seccombe
07766 206208

Tuesday 24 September 2019 7.00pm-9.00pm
Technical Visit: CLAAS UK, Saxham
Includes: Tour of CLAAS facility and presentation on
"Future of Engineering in Agriculture"

EAST MIDLANDS BRANCH

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

Tuesday 8 October 2019 7pm for 7.30pm
Visit: Sharman's Agricultural Ltd
College Farm, Gonerby Moor, Grantham, Lincs

Tuesday 12 November 2019 7pm for 7.30pm
Visit: Bifrangi UK Lincoln
Tower Works, Spa Road, Lincoln

Tuesday 10 December 2019 7pm for 7.30pm
Technical Meeting: Latest Welding Techniques
Speaker: Christopher Punshon, TWI Ltd
Quorn Lodge Hotel, 46 Asfordby Road, Melton Mowbray

Tuesday 14 January 2020 7pm for 7.30pm
Technical Meeting: Demolition!
Talk by A R Demolition, Nuneaton
Quorn Lodge Hotel, 46 Asfordby Road, Melton Mowbray

Tuesday 11 February 2020 7pm for 7.30pm
Visit: Household Sprayers Ltd
Roughton Moor, Woodhall Spa, Lincoln

NORTHERN IRELAND BRANCH

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

Tuesday 15 October 2019 8.00pm
Technical Talk: Tractor Implement Connectivity and Compatibility in Practice
Speaker: Jim Wilson, Soil Essentials
CAFRE, Greenmount

Wednesday 19 February 2020 8.00pm
Visit: Northway Mushrooms Compost Facility
Speakers: Elaine Shaw and Tom McDonnell
Assemble at Quinn's Corner prior to visit to Northway

SOUTH EAST MIDLANDS BRANCH

Contact: John Stafford **01525 402229**
john.stafford@silsoe-solutions.co.uk

Monday 7 October 2019 7pm for 7.30pm
Technical Talk: Benefits of Precision Farming
by David Bowman and Andrew Williams
4 Grovemere Court, Bicton Industrial Park, Kimbolton PE28 0EY

Monday 12 November 2019 7pm for 7.30pm
Technical Talk: Building an International Cricket Square
by Alex Vickers
The George, George Street, Maulden

Monday 2 December 2019 7pm for 7.30pm
Technical Talk: Speaker Daniel Hefft
Venue TBC

Monday 15 January 2020
Technical Talk: Hands Free Hectare: Lessons learnt Speaker: Kit Franklin
Venue TBC

Monday 3 February 2020
AGM and Student Presentations
Venue: TBC

Monday 9 March/Tuesday 10 March 2020
Technical Talk: Robotics
Speaker: Simon Pearson, Lincoln University Venue TBC

Monday 27 April 2020 (TBC)
Technical Talk: Reducing Food Loss and Waste
Speaker: Marie Carmen, Cranfield University
Venue TBC

WESTERN BRANCH

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

Wednesday 9 October 2019 Afternoon
Visit: Rolls Royce Fedden Centre
Sir Roy Fedden Heritage Centre, Filton, Bristol

Wednesday 11 November 2019 7.30pm
Professional Talk: Professor Paul Miller Reflections on the work of the NIAE/ Silsoe Research Institute
Royal Agricultural University, Cirencester

Wednesday 20 November 2019 Afternoon
Visit: Rexquote Broadguage Business Park, Bishops Lydeard, Taunton

Wednesday 11 March 2020 Evening
Technical Meeting: AGCO development of IDEAL combine harvester
Speaker: Tim Walters, AGCO
Broadguage Business Park, Bishops Lydeard, Taunton

WEST MIDLANDS BRANCH

Contact: Ian Moore
westmids@iagre.biz

Wednesday 25 September 2019 7.30pm
Talk: 'The Lanchester Archive' by Paul Henderson
Community Centre, Stockton Road, Long Itchington CV47 9QP

Wednesday 23 October 2019 7.30pm
Technical Talk: Kubota Tractors and Groundscare Equipment
Speaker: Andy Southerton
Toft Farm, Dunchurch

Wednesday 27 November 2019 7.30pm
Talk: Chedhams Yard Working Museum
Community Centre, Stockton Road, Long Itchington CV47 9QP

Tuesday 3 December 2019 7.30pm
Technical Talk: Ground Vehicle Engineering at Cranfield
James Brighton, Cranfield University
Friends Meeting House, 37 Maidenhead Road, Stratford-on-Avon

WREKIN BRANCH

Contact David Clare
01952 815097 dclare@harper-adams.ac.uk

Tuesday 8 October 2019 7.30pm
Technical Meeting: Details TBA
AEIC, Harper Adams University, Newport

Tuesday 12 November 2019 7.30pm
Technical Meeting: Deep Sea Drilling
AEIC, Harper Adams University, Newport

Tuesday 10 December 2019 7.30pm
Technical Meeting: Details TBA
AEIC, Harper Adams University, Newport

Tuesday 14 January 2020 7.30pm
Technical Meeting: Details TBA
AEIC, Harper Adams University, Newport

Tuesday 11 February 2020 7.30pm
Technical Meeting: Car Advanced Driver Assist Systems
Speaker: AVL
AEIC, Harper Adams University, Newport

Tuesday 17 March 2020 6.30pm
AGM followed by Talk
AEIC, Harper Adams University, Newport

INDUSTRY EVENTS

Friday 18 October 2019 6.00pm-midnight
IMechE Midlands Annual Dinner and Conference
National Motorcycle Museum, Solihull

Tuesday 22 October- 23 October 2019
N8 Agri-Food Annual Conference
The Principal Hotel, York

Tuesday 5 November 2019 9.30am-3.45pm
2019 Soil and Water Conference
Harper Adams University, Newport
(This event is repeated on 7 November in Devon,
20 November in Yorkshire and 21 November in Essex)

Wednesday 6 November 2019
Agri-Tech East REAP Conference
Rowley Mile Conference Centre
Newmarket Racecourse

Friday 8-Saturday 9 November 2019
Land.Technik Ag Eng
Hannover, Germany

Wednesday 20 November 2019 10am-3.00pm *Ag Careers Live 2019* Villa Park, Birmingham

Wednesday 20 - Thursday 21 November 2019
Midlands Machinery Show
Newark

Dates and details are correct at the time of going to press

Further information and updates from the Events page at www.iagre.org

MEMBERSHIP CHANGES

ADMISSIONS
Member
Pywell L (East Midlands)
Momi J K (West Midlands)

Associate Member
Tunstill T J (East Midlands)
Yang X (Southern)

Affiliate
Hawker R (Western)

Technician
Lamont A G (Western)

STUDENTS
Newton Rigg College
Shepherd J B

Cambridge University
Wang Z

Royal Agricultural University
Housam H

Coleg Sir Gar
Dyer A
Evans R M
George M
Lewis A I
Lewis B
Lewis P J
Lloyd S L E
Young R E R

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

Mr D J Wilks, AIAgrE (East Midlands)
a member since 1975

TRANSFERS
Member
Tuer W S (Yorkshire)
Webb S (S Eastern)
Henderson H (East Midlands)

ENGINEERING COUNCIL REGISTRATIONS
EngTech
Webb S (S Eastern)

LONG SERVICE CERTIFICATES (July to September 2019)

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

Name		*Date of Anniversary*
60 years		
Kenneth Charles Baxter	MIAgrE	18 Aug 2019
Desmond Armstrong Telford	MIAgrE	18 Aug 2019
Ronald James Roberts	MIAgrE	18 Aug 2019
50 years		
Peter Beverley Leeds-Harrison	MIAgrE	24 Jul 2019
Michael Joseph Percy	MIAgrE	24 Jul 2019
35 years		
Robert Paul Burtonshaw	MIAgrE	2 Jul 2019
Jill Foster Browning	MIAgrE	10 Jul 2019
Carlton Boswell	FIAgrE	12 Jul 2019
John William Garne Young	FIAgrE	12 Jul 2019
Michael John LeFlufy	MIAgrE	12 Jul 2019
Richard James Dain	FIAgrE	12 Jul 2019
George Howard Jackson	FIAgrE	12 Jul 2019
Luis Ferdinand Waldmueller	AMIAgrE	13 Jul 2019
Trevor Roy Cumby	MIAgrE	24 Jul 2019
Melvyn George Kay	FIAgrE	28 Jul 2019
John Christopher Jeffery	FIAgrE	30 Aug 2019
Nigel Pemberton Donkin	AMIAgrE	30 Aug 2019
25 years		
Jonathan Charles Puddifoot	MIAgrE	7 July 2019
Matthew Charles William Home	AMIAgrE	1 Aug 2019
David Graham Bennett	MIAgrE	1 Sept 2019

ACADEMIC AND COMMERCIAL MEMBERS

ACADEMIC MEMBERS

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

Bishop Burton College
York Road
Bishop Burton
Beverley HU17 8QG

Brooksby Melton College
Asfordby Road
Melton Mowbray
Leics LE13 0HJ

Coleg sir Gar
Gelli Aur Campus
Llandeilo
Carmarthenshire SA32 8NJ

Cranfield University
Cranfield
Bedfordshire MK43 0AL

Duchy College
Stoke Climsland, Callington
Cornwall
PL17 8PB

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

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

Harper Adams University
Newport
Shropshire TF10 8NB

Hartpury College and University
Gloucester
GL19 3BE

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

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

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

Myerscough College,
Bilsbarrow
Preston
Lancashire PR3 0RY

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

Pallaskenry Agricultural College
Co Limerick
Ireland

Plumpton College
Ditchling Road
Lewes
East Sussex, BN7 3AE

Reaseheath College
Reaseheath,
Nantwich
Cheshire, CW5 6DF

Royal Agricultural University
Cirencester
Gloucester, GL7 6JS

Sparsholt College
Sparsholt,
Winchester SO21 2NF

SRUC – Auchincruive
Auchincruive Estate
Ayr, KA6 5HW

University of Manitoba
Winnipeg
Canada
MB R3T 2N2

Warwickshire College Group
Warwick New Road
Leamington Spa CV32 5JE

Wiltshire College Lackham
Lacock
Chippenham
Wiltshire SN15 2NY

COMMERCIAL MEMBERS

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

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

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

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

Alvan Blanch Development Co
Chelworth, Malmesbury
Wiltshire SN16 9SG

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

BAGMA
225 Bristol Road
Birmingham B5 7UB

Briggs Irrigation
Boyle Road
Corby, Northants NN17 5XU

City and Guilds
1 Giltsput Street, London EC1A 9DD

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

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

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

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

FEC Services
Stoneleigh Park
Kenilworth, Warwickshire CV8 2LS

Fullwood
Grange Road, Ellesmere
Cheshire SY12 9DF

Househam Sprayers
Roughton Moor
Woodhall Spa, Lincs LN10 6YQ

HSS Hire
25 Willow Lane, Mitcham
London CR4 4TS

JCB Rocester, Staffs ST14 5JR

John Deere Ltd
Harby Road, Langar
Nottinghamshire NG13 9HT

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

Mastenbroek Ltd
83 Swineshead Road
Boston, Lincs PE21 7JG

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

Orby Engineering
Craigmore Road, Newry BT35 6JR

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

PlantTech Research Institute
Bay of Plenty, New Zealand

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

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

Teagle Ltd
Blackwater
Truro, Cornwall TR4 8HQ

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

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

Elva and Scimitar years

In retirement, former IAgrE President **Dr Dan Mitchell** enjoys his long-held passion for historic cars

After Dan retired from the electricity industry, he was elected IAgrE President (2002-2004) and recruited 2000 students across sixteen Colleges into membership. He has continued as a Consultant and both an Engineering and Management mentor for staff in Electricity companies in the UK and abroad including Enel in Italy, Escom in South Africa where he had helped to establish seven Farm Energy centres and the Iceland Electricity company expanding their use of lighting in horticulture based on John Weir's work. He was also Reader in Engineering at Harper Adams University, Governor at Writtle College and on the Advisory Council at the Royal University – all at the same time! "It was" he says "a unique insight into agricultural education. He also spent 20 years as an English judge for the CLAAS Stiftung student awards scheme and helped to expand the number of British colleges participating

Ten years ago he was elected as Board member for AGAHST to represent action groups affected by HS2 throughout Warwickshire. During this time, he petitioned against HS2 in front of the House of Commons and House of Lords select committees. His cost petition at £138 billion, excluding 11 costs that could not be determined at the time, including compensation was not challenged by the HS2 legal team and his petition on the Electrical Engineering aspects showed that HS2 is unlikely to work. During this Petition, HS2 refused to guarantee that the trains would work.

ELVA

Thanks to earning a lot of money during his practical year he bought a second-hand Elva Courier Mk2 sports car (MGA engine) www.elva.com during his first year at Wye College, only finding out then that he had to attend an interview to get third party only insurance!

Dan entered a sports car race for amateurs at Brands Hatch and finished 8th out of 25 cars but had to drive back to Wye in the wet on bald tyres and take the car off the road for 3 months to save up for a new set of tyres!

He says "Lotus,Elva and TVR were the lead sports cars in the 50s and 60s being lighter, faster (0 to 60mph in 10 seconds) and more economical than the MGA, MGB Austin Healey and Triumph sports cars of the time. I had helped weld friends' rusty steel cars, so a fibreglass car was a big attraction. Elva cars was owned and developed by Frank Nichols in Sussex (the name came from the French *elle va* 'she goes')"

"Frank was a remarkable engineer and even built one of the first large fibreglass lifeboats for the RNLI. Colin Chapman of Lotus had a high regard for the Elva racing cars and the ELVA BMW and ELVA Porsche cars competed well with the Lotus 23.

Elva became Elva McLaren when Bruce McLaren joined them and eventually became McLaren as we know them today. Bruce McLaren is the only man to both design and build his own Formula One car and win the championship with it.

"I kept my first Elva for 7 years and 60,000 miles then sold it to buy a 1964 Elva Courier Mk 4 T Type in 1967 from Bob Danvers Walker, the radio commentator, but he retained his famous number RAD10. This car had an MGB engine and parallel link fully independent rear suspension. I kept this car for 9 years and 110,000 miles including using it for farm advisory visits all over

LEFT:
My first 2 Elvas

Our feature looking at the hobbies and pastimes of IAgrE members when not engaged in their day-jobs. CHRIS BIDDLE reports

ABOVE: Dan's Middlebridge Scimitar today

LEFT: Blue Elva BMW Mk 7 S

Scotland and England - regardless of the weather. I had to fit a second fuel tank as I regularly drove the 600 miles from Aberdeen to Dawlish in Devon when I was courting my wife Meg ! I also fitted twin ignition coils and twin fuel pumps as they had a habit of failing regularly on long journeys usually at night!"

"Both Elvas still exist. The Mk 2 is raced in Belgium and the Mk4 T Type is in America. I recorded the source of all the parts for these cars and have answered enquiries from Elva owners for over 55 years"

"When I retired, I put a wanted ad on the Elva web site and bought another Mk4 T Type, this time the 1963 prototype from someone to whom I had supplied parts over 50 years ago. It had been partly rebuilt on a new zinc plated Chassis but still needed plenty of work to bring it up to its condition today. Next year Elva celebrate 60 years since their formation, and I have also been fortunate to have driven an Elva BMW Mk 7S racing car.

SCIMITAR GTE

"In 1975 I bought my first Reliant Scimitar, a dark blue 5a which we owned for 14 years- and was much more comfortable for the Aberdeen to Dawlish trips than the Elva. On one occasion on an icy road, a Scimitar crashed through a 3ft thick stone wall south of Aberdeen close to our house. It turned upside down and travelled 90 yards across a ploughed field. The occupants survived which deeply impressed me, so I bought an Immaculate low mileage 1973 Scimitar from a seller based in Edinburgh. We also owned and restored a convertible Scimitar GTC for 7 years.

Middlebridge Engineering bought out the rights to the Scimitar in 1988 and made over 400 improvements to the car. These included fitting the Scorpio 2.9 litre EFI engine and gearbox. There was also improved suspension by Harvey Bailey, extra sound deadening and a galvanised chassis .

I went to the factory near Nottingham for a test drive and was most impressed. Top speed was now 140mph and economy over 30mpg.

In the Electricity industry there was pressure on Managers to have company cars, but I resisted and ran my car on the running agreement. After much negotiation, I bought the Middlebridge Prototype on which all the development work had taken place. Over 30 years it has never once let us down and in July was one of 28 Middlebridge cars on show at the Silverstone Classics meeting and was one to go around the full Silverstone track during a celebration parade lap. The drivers were instructed not to exceed 40mph, but you can guess that was soon ignored!

Princess Anne still has her Middlebridge chassis number 5 and kindly allowed us to hold a celebration of 25 years at Gatcombe 5 years ago. When she was President of the Royal Association of Dairy Farmers, I was the Ag Engineer on the committee and regularly swapped experiences on cars. Her car was delivered late, so she drove our Prototype for 2 weeks, and has been caught speeding in her car several times!

I designed and built my own 3 car brick garage 38 years ago incorporating a pit because regular and thorough maintenance is the answer, and as a result In 48 years of Scimitar ownership and 385,000 miles, we have never failed to both get to our destination or return home".

www.middlebridge-scimitar.co.uk

BOOK NOW

LANDWARDS CONFERENCE 2019

BIG DATA

Will it lead to Smarter Farming?

IAgrE

WEDNESDAY 30TH OCTOBER 2019

PETERBOROUGH SUITE, EAST OF ENGLAND ARENA, PETERBOROUGH

Why attend?

- Find out how 'Big Data' is being used in UK agriculture today
- Gain an oversight of technological developments emerging in modern Smart farming and the contributions of agricultural engineering and AgriTech initiatives
- Learn about cutting edge developments and emerging best practices of using 'Big Data' in land-based industries
- Contribute to the Big Data and Smart Farming debate
- Meet like-minded people and forge future business relationships
- Develop ideas and initiate new approaches alongside industry leaders

Full details and programme on pages 22-23