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Landwards

VISION 2038

WHAT WILL AGRICULTURE LOOK LIKE IN IAgrE's CENTENARY YEAR?

In this issue

IAgrE

TECHNICIAN GRADE

NEW ROUTE INTO IAgrE FAMILY

The recently introduced Technician grade of IAgrE Membership is for those who are qualified at a vocational or technical level and have completed an apprenticeship or extended diploma.

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

You will also be keen to be part of the IAgrE family and seeking a cost-effective way of getting involved and benefiting.

The IAgrE Technician Grade may include

- Farm machinery service engineers with manufacturers, suppliers or dealers
- Those people working in precision farming
- Those working in soil science as technicians, instructors and trainers.

IAgrE Technician members will have a technical qualification in agricultural engineering, land-based technology or related engineering or scientific subject at Level 2 and above.
This will include, for example, an extended diploma, advanced apprenticeship or equivalent in an appropriate subject.

To apply or find out more:
Go to the IAgrE website and complete the Application Form. 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: ENQUIRING MINDS

ANY club or organisation is only as good as its members. It's a phrase that runs around my head every issue of *Landwards* as I compile the reports of branch activities. And that's the thing with engineers – they have an enquiring mind. IAgrE is such a 'broad church' that it is not surprising that the range of talks and visits by branches reaches into virtually every area of our life.

Yes, there is a fascination in our heritage, but that is more than off-set by a desire to learn about the latest innovations.

A quick gaze through the subject matter covered by IAgrE branch meetings over the past year takes in wind turbines, processing of fresh vegetables, treatment of waste material, history of the Land Rover, Stilton cheese, tea production – as well as the evolution of agricultural equipment from the forerunner of the combine harvester to todays advancements in robotic technology.

Inevitably, some branches rarely pass up the opportunity for a tipple. Cider making, gin production and breweries have all featured.

Some branches bemoan the lack of numbers, others have a very healthy regular turnout. All one would say, if you don't already tag along to your local branch events, then give it a try – there is always something to interest those who have an enquiring mind.

IT has been a real eye-opener, putting together the feature in this issue on the Next Generation. I've talked to primary school teachers who have fully embraced the opportunity for their pupils to design a Tractor for the Future. Even at an early age, we can start planting a seed that helps young people appreciate where their food comes from - and how it is produced.

It is also clear from those who go to speak with older children about to make career choices, that our industry is a complete mystery. Yet given the opportunity, we have the resources and the information to really turn heads. We need more volunteers to take the message, demonstrate their enthusiasm and explain the sheer job satisfaction in agri-tech. Becoming a STEM ambassador would be a good start – and IAgrE has plenty of inspirational people in its ranks to be very effective messengers.

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TRADE PRAISES NEW LAMMA SHOW

Echoes of a revived Smithfield show

The move of the LAMMA show from its outdoor venue at Peterborough to Birmingham's NEC was welcomed across the board by visitors and exhibitors alike with strong attendance on both days. Many visitors thought it had echoes of the once popular Royal Smithfield Show at Earls Court.

One of the most interesting aspects was the re-establishment of a major UK exhibition as a launchpad for new products from international manufacturers.

While never truly an international show, and notable this year for the absence of some key names among the larger multinationals, LAMMA has long had a reputation as a key show for UK manufacturers involved in sectors where UK engineering is strong, particularly sprayers and hedge trimmers.

This year, though, it was notable that key global players used the reinvigorated event to make major launches. Among them was JCB who revealed a completely new cab design for its key Loadall telescopic handler models.

Among the overseas-based multinationals to make a major announcement was fellow handling specialist Manitou. The French firm made a global announcement that it was integrating its Mustang skid-steer range into its Manitou product line, under the full Manitou brand and livery.

But there was also plenty from the UK makers including Shelbourne Reynolds who announced larger diet feeder models and a twin-rotor hedge trimmer head, while RG Knight revealed a series of upgrades for its key trailed and self-propelled sprayer lines.

TALE OF TWO YEARS
The second day at LAMMA 2018 was cancelled due to a violent wind-blow (left), never a danger at the National Exhibition in 2019

TRACTOR SALES HOLD UP IN 2018

Despite a dramatic drop in sales during December 2018, the Agricultural Engineers Association (AEA) have announced that for the full year of 2018, 12,102 tractors were registered, a +0.6% increase compared with January-December 2017 – the highest annual figure for 4 years.

December 2018 saw 849 UK registrations of agricultural tractors (over 50hp), almost 38% down compared with December 2017.

Stephen Howarth, agricultural economist at the AEA said, "Tractor sales in December 2018 were well below their level in the same month a year ago, when registrations were inflated by the inclusion of a large number of machines being pre-registered in advance of the entry into force of new regulations. That said, apart from 2017, the December 2018 total was the highest figure for December since 1994"

Once the impact of the December 2017 registrations is adjusted for, this suggests the market actually grew by between 5% and 10% during 2018."

IAgrE CEO TO RETIRE

Alastair Taylor to step down in the Autumn

IAgrE Chief Executive, Alastair Taylor, has decided to take retirement in September in order to spend more time with his wife at home in Shropshire. "I have thoroughly enjoyed my time at IAgrE as CEO and look forward to continuing my association with the Institution as a volunteer after my retirement. I always planned to be with IAgrE for five years and by the time I finish it will be nearer six" he said.

"Meanwhile, I am fully committed to IAgrE for the next 6 months and look forward to continuing in post until a suitable replacement may be found".

Prior to joining IAgrE in October 2013, Alastair was a Commissioner with CAVTL (Commission on Adult Vocational Teaching and Learning) and Vice-Principal of Hartpury College. Additionally, he has run his own company, Greendale Learning and Development (GLAD Ltd) which deals with quality improvement services for the UK Education, Learning and Skills sector.

The search for Alastair's replacement is currently underway, and the IAgrE Executive are planning to commence interviews at the end of March.

IAgrE PHOTOGRAPHIC AWARD

Image of Trimble RTK base station

Nick Barlow from Marlborough has been announced as the winner of IAgrE's 2018 photographic competition. The theme was Agritech in Action and was run as part of the Institutions' 80Th anniversary celebrations.

A delighted Nick commented: "This photograph was taken at a harvesting roadshow in Oxfordshire. The manufacturer had set up a Trimble RTK base station and I thought that it would make an interesting technology subject with the blue tractor in the background complementing the colour of the tripod. I had to wait until late afternoon for the right light and shot with a narrow depth of field to emphasize the importance of the base station."

Nick is based just outside Marlborough in Wiltshire and has for many years pursued a keen interest in developing his photographic skills including gaining an LRPS distinction from the Royal Photographic Society and a period teaching his craft at a Further Education college. Having retired after more than 40 years in the agricultural machinery supply industry, Nick continues to offer photographic and marketing support to the agricultural industry and, as a member of his local camera club, has the time to enjoy the competitive and social sides of photography.

IAgrE CEO, Alastair Taylor commented: "We had an interesting range of entries for this competition and as a keen photographic enthusiast myself, it was great to see the work of photographers in the rural community."

The competition was judged by the

Royal Photographic Society president, Robert Albright HonFRPS who said "I liked this picture because it shows the dramatic scale of modern agriculture in a setting which demonstratesstrong pattern and tonal variety."

JOHN DEERE ELECTRIC CABLE TRACTOR PROJECT

Continued development of electrification for farm machinery

John Deere has developed an electric cable powered tractor developing up to 400hp. The GridCON research project and tractor are part of the company's continued efforts in the electrification of agricultural machinery, offering new opportunities for farms to supply and use their own energy.

John Deere presented the first fully electric tractor, known as the SESAM (Sustainable Energy Supply for Agricultural Machinery), in 2016.

The GridCON tractor looks very different to its predecessor, as it features no cab and no rows of batteries underneath the bonnet. It is the first vehicle to be fully electric, permanently cable powered and capable of fully autonomous operation in the field.

Based on a John Deere 6210R tractor, GridCON utilises a cable connection from the field border to the machine, which transfers power continuously at over 300kW. A 100kW electric motor powers the IVT transmission, and there is an additional outlet for implements powered by a 200kW electric motor.

A drum fixed to the tractor carries up to 1000m's of cable, although the length can be extended if required. In the field, the cable is fed out and reeled in while guided by a robot arm to keep the operation friction free and at low load. An intelligent guidance system is also used to prevent the tractor running into or over the cable.

At work, the tractor follows pre-set rows fully autonomously at operating speeds of up to just over 12mph (20kph). The vehicle can also be guided manually using a remote control, which is particularly useful when manoeuvring the tractor to start work on field borders for example.

A power supply of 2.5kV AC is required, and the GridCON tractor uses a 700V DC bus for electric power distribution both onboard and for implements. The machine employs a cooling infrastructure for off-board electrical use, while total efficiency of the drivetrain is in the region of 85 per cent.

Total empty weight of the working prototype GridCON tractor including cable drum and robot arm is about 8.5 tonnes, so it is about the same weight as a conventional John Deere 6195R tractor but with twice as much power. Research engineers are aiming to reduce the weight further by at least one tonne.

Besides this favourable power to weight ratio, the concept offers the twin benefits of noiseless and emission-free operation. Compared to battery-powered tractors, the GridCON tractor also delivers around 50 per cent lower machine and operating costs.

HARPER ADAMS SUPPORT NEW NI-PARK

Shropshire-based agri-tech research hub

A world leading agri-tech research and innovation hub is to be built in Newport, Shropshire.

Ni-Park will be an enterprise and science park in due course creating up to 950 jobs and providing a range of flexible space for technology focused firms including start-ups, small and larger businesses.

The park will create new full-time skilled jobs and help deliver on the vision to place the UK at the forefront of advanced sustainable agriculture.

Ni-Park is supported by funding through the Telford Land Deal and Marches Local Enterprise Partnership and is supported by Harper Adams University, a world leader in Agri-Technology research and development. The site will attract investment from high tech businesses, both established and start-ups, and stimulate complementary research and development activity linked with the University.

Ni-Park will encourage supply chain growth across a wide range of companies engaged in new agricultural technologies, benefitting from links to Telford's strong advanced manufacturing sector. The initial plans for the park were created in 2015.

Vice-Chancellor of Harper Adams University, Dr David Llewellyn, added: "Telford has already been identified as a high potential opportunity for agri-technology investment by the Department for International Trade, and we are working with companies in the UK and overseas to encourage them to consider Ni-Park as a location for their business.

"Ni-Park will build on the expertise in agri-technologies at the University, most recently demonstrated in the multi-award winning, and world-first, Hands Free Hectare project which used autonomous vehicles and drones to grow arable crops. The Government-funded Agri-EPI Centre for Innovation in engineering and precision farming also has a presence on our campus. By working with the Local Authority on this latest project we hope to see Ni-Park act as a catalyst for economic development and as a means to successfully transfer the latest technologies into farming practice."

The Ni-Park site has also been identified as a Strategic Employment Area which will meet the local employment needs and demand around Newport.

Its strong links with Harper Adams University will provide opportunities for leading high efficiency agri-tech research and innovation through the university's partners and students.

FUNDING FOR SMALL ROBOT COMPANY

£2.5 million raised to date

THE Small Robot Company, a British agri-tech start-up for sustainable farming, has announced that it has raised £1.2 million on Crowdcube equity crowdfunding. It reached its initial funding target of £500,000 within minutes of its launch.

The company's successful campaign received support from far and wide. Its biggest support came from the farming, technology and 'eco' communities. Investors included Matt Jones, Principle Designer at Google AI; Mark Ellingham, founder of the Rough Guides; and Andrew Ward, MBE, Farmers Weekly Farming Champion and Arable Farmer of the Year.

Small Robot Company harnesses the power and precision of robots and Artificial Intelligence (AI) to improve the way that food is produced and minimise chemical usage. It says it will make farms more profitable, and increase yield and efficiency, through using small robots instead of tractors. Its farmbots, Tom, Dick and Harry will plant, feed and weed arable crops autonomously, with minimal waste.

This now takes the total funding raised by the Small Robot Company to £2.5 million in total to date. This includes two awards from Innovate UK, £300,000 seed funding from farmers (including £90,000 in presales), £50,000 raised from Indiegogo crowdfunding, and a £50,000 Horizontal Innovation Award from the Institute of Engineering and Technology.

"This is game-changing for Small Robot Company. We have already made phenomenal progress. Just one year on from our foundation, we already have three prototype robots and an AI that can tell Wheat from Weed," says Sam Watson Jones, co-founder and fourth generation Shropshire farmer. "With this backing through Crowdcube, we are now poised to completely transform food production."

"We were overwhelmed with the support we received from far and wide, and in particular from the farming community, who fuelled our initial success. Thanks to hundreds of farmers flocking to support us, we smashed our target within minutes. Approaching two thirds of our initial success was due to farmers, who collectively contributed several hundred thousand pounds between them. This then fuelled our campaign to achieve more than double our goal."

CEO

Reflections on a changing world

Alastair Taylor *IEng CEnv MIAgrE*

AGRI-TECH IRELAND

Important role for IAgrE 'across the water'.

Over the past few months, I have enjoyed two trips across the Irish Sea to support our most westerly members. IAgrE has always been well supported, both in Northern Ireland and in the Republic. I am struck also, by the number of young people who are following vocational courses in Landbased Engineering at the likes of the Greenmount and Pallaskenry Colleges as well as those who are following Agricultural Engineering degrees at the likes of IT Tralee down there in Kerry. It is always great to meet the staff and students and tell them a little bit about IAgrE and what we represent.

The popularity of Agricultural Engineering studies in wider Ireland brings home the importance of the farming industry to the local economy. On my recent visit, it was interesting to be driven from Shannon to Tralee, a couple of hours drive. They certainly do get plenty of rain in that part of Ireland and the farming systems reflect that with plenty of dairy, beef and sheep production. You can't help but think that it would be a good place to trade in milking equipment, grassland machinery and waste management systems and even on that short drive, we passed several machinery dealerships. Plenty of career opportunities for budding Agricultural Engineers.

Plenty of career opportunities for budding Agricultural Engineers.

There also appears to be a healthy farm machinery manufacturing base in Ireland with some very significant names designing and producing some highly innovative equipment. A visit to any trade show of field demonstration with show case all of this. You have to admire the tenacious Celtic Tigers who seem to be roaring very well vocally when it comes to our discipline. Long may it last.

Yet a conversation with a few staff and students exposes a challenge. At such a distance from the heart of Europe with all of its research, innovation and major names, our friends say how hard it is to keep abreast of all of the latest developments. The physical distance is the challenge and they are hungry for knowledge and information.

This is where IAgrE has a role to play. We are good when it comes to co-ordinating knowledge and people together in one place. We are well connected and can probably gain the support from a manufacturer to make the trip "across the water" to address a suitable gathering. This was the purpose of my visits.

Back in October during my visit to Northern Ireland, I was joined by, IAgrE President, Jane Rickson who gave a well-received lecture to an enthusiastic crowd on the importance of soil management. The other reason for that visit was to talk to the Agricultural Advisory Service for Northern Ireland on the benefits of professional body membership and associated professional registration. With a following wind, we should be able to attract a new cadre of IAgrE members in that part of the world and with that we can regrow our community of members and establish new networking opportunities.

My second visit, to the South, in January was similarly useful and my discussions with members and college staff suggested a keenness to regrow our knowledge transfer activities, perhaps based around IT Tralee where IAgrE accredits their degree programmes thus allowing graduates to apply for Incorporated and Chartered Engineer registration through a straightforward process. My big take away was a thirst for information on Precision Farming technologies so perhaps we should make that our starting point. As I thought about it some more, it did make me wonder if the best people to lead our activities should be the students themselves. After all, they are the future.

A thirst for information on Precision Farming technologies

So, in these challenging times, where our relationship with Ireland, North and South, is in the news most days, I feel that we owe it to our friends to make their distance and remoteness no barrier to our continuing success.

We need no "backstop" to do this!

CENTRE FOR DOCTORAL TRAINING IN AGRI-FOOD ROBOTICS

Collaboration between Universities of Lincoln, Cambridge and East Anglia

A new advanced training centre in agri-food robotics will create the largest ever cohort of Robotics and Autonomous Systems (RAS) specialists for the global food and farming sectors, thanks to a multi-million pound funding award, it was announced this week.

The world's first Centre for Doctoral Training (CDT) for agri-food robotics is being established by the University of Lincoln, UK, in collaboration with the University of Cambridge and the University of East Anglia.

The Engineering and Physical Sciences Research Council (EPSRC) has awarded £6.6m for the new Centre which will see a massive influx of high-level robotics expertise at a vital time for the agri-food industry. The CDT will provide funding and training for at least 50 doctoral students, who will be supported by major industry partners and specialise in areas such as autonomous mobility in challenging environments, the harvesting of agricultural crops, soft robotics for handling delicate food products, and 'co-bots' for maintaining safe human-robot collaboration and interaction in farms and factories.

Professor Tom Duckett, Professor of Robotics and Autonomous Systems at Lincoln, is the new Centre Director. He said: "Automation and robotics technologies are set to transform global industries – within the UK alone they will add £183bn to the economy over the next decade. Agri-food is the largest manufacturing sector in the UK – twice the scale of automotive and aerospace combined – supporting a food chain, from farm to fork, which generates a Global Value Added (GVA) of £108bn, with 3.9m employees in a truly international industry.

The Centre brings together a unique collaboration of leading researchers from the Universities of Lincoln, Cambridge and East Anglia, located at the heart of UK agri-food business, together with the Manufacturing Technology Centre, supported by leading industrial partners and stakeholders from across the food, farming and robotics industries. These include John Deere, Syngenta, G's Growers, Beeswax Dyson, ABB and the Agricultural and Horticultural Development Board.

It is one of 75 new CDTs to be funded by the EPSRC (part of UK Research and Innovation (UKRI)) in what is hailed as one of the country's most significant investments in research skills, designed to equip the UK with the next generation of doctoral level researchers it needs across the breadth of the engineering and physical sciences landscape.

Dave Ross, CEO of the Agricultural Engineering Precision Innovation Centre (one of four Agri-Tech centres established by the UK government), said: "This exciting project has strong synergies with our existing academic partners and will help greatly in the development of advanced robotic and engineering technologies for the agri-food sector. Our consultation with industry continuously indicates that there is a critical shortage of highly trained robotics and autonomous system engineers to meet future anticipated demand. The PhDs resulting from this project will have a significant impact. We look forward to connecting the students with our wider industry and academic partners for mutual benefit."

IVEL AWARD WINNER VEENHUIS NUTRI-FLOW SLURRY ANALYSIS

Veenhuis Machines BV has won the Ivel Award from the Institution of Agricultural Engineers for its Nutri-flow real-time slurry analysis. Their system uses near-infrared spectroscopy to monitor NPK and ammonium levels in slurry in real time.

Alastair Taylor, CEO of IAgrE said, "As precision farming advances it's great to see technologies being developed to measure the nutrient value of slurry. This allows precision application as part of a wider farm nutrient plan. We should not underestimate the technological and engineering skills required to develop a product such as this."

The NIRS analysis technique determines the levels of nitrogen, phosphate, potassium, ammonium and dry matter in organic manure which helps to recover soil health and reduce nitrate leaching.

The company also won a Silver Future Innovation award at LAMMA.

In 1902 Dan Albone, a Bedfordshire inventor, designed and patented the first practical and successful light internal combustion engine agricultural tractor, setting up Ivel Agricultural Motors Ltd in Biggleswade in 1903. The awards committee of IAgrE decided in 2007 that it would be fitting for the Institution to celebrate the name of Dan Albone by making an annual award using the Ivel name.

President's Musings

THE NEXT GENERATION:

What talents will be required, and how will they be recruited?

IAgrE President
PROFESSOR JANE RICKSON CEnv, FIAgrE

The Government's long-term AgriTech Strategy aims to make the UK "a world leader in agricultural technology, innovation and sustainability; exploit opportunities to develop and adopt new and existing technologies, products and services to increase productivity; and contribute to global food security and international development."

The Strategy recognises that an agri-tech revolution is taking place, with breakthroughs in nutrition, genetics, informatics, 'big data', satellite imaging, remote sensing, meteorology, precision farming and low impact agriculture.

Just recently, BBC Radio 4's Farming Today devoted its content to innovations in agriculture, including the use of drones, big data, robotics and software engineering. So does that mean the next generation of agricultural engineers has to acquire the necessary skills and talents in these areas?

There's plenty of evidence to show this technology revolution is taking place. You may have seen Microsoft's sophisticated, corporate advert showing how they are developing Artificial Intelligence (AI) to help "feed the world without wrecking the planet".

Their FarmBeats programme (www.microsoft.com/en-us/research/project/farmbeats-iot-agriculture/) recognises the need to increase the world's food production by 2050, using finite land resources and uncertain water supplies.

Microsoft believes the answer is "data-driven farming", where data, coupled with farmers' knowledge and intuition can help increase farm productivity and reduce costs.

They admit that getting the data is a bottleneck, but FarmBeats uses low-cost sensors and drones to fill in any gaps.

According to their website, installing cloud-connected sensors on a farm and analysing the data using Microsoft AI systems with vision and machine learning algorithms creates localised predictions for farmers as to when to plant, water and harvest to create more food and less waste.

They admit that getting the data is a bottleneck.

Closer to home, colleagues here at Cranfield have developed a Soil Management Information System (SMIS) funded by AHDB Horticulture. It's a data-driven decision-making tool aimed at improving crop productivity, whilst reducing the causes and symptoms of environmental damage such as soil compaction.

Novel agri-informatics techniques are used to unearth [forgive the pun] patterns of 'cause and effect' for soil management practices and outcomes for different soil types, crops, previous crops, year, etc., so supporting decisions on sustainable soil management.

The success of these and other innovative projects suggests new multi-disciplinary skills are needed to collect the data, process it and interrogate it, whilst being able to interpret and translate the results into practical, cost-effective, field-based solutions.

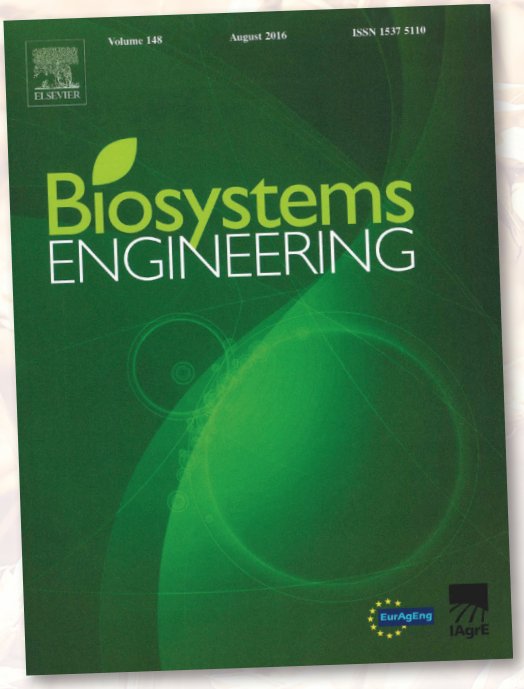
To ensure that vital linkage, we need collaboration between growers, farmers, agronomists, soil scientists, land managers, agri-informaticists, software developers, knowledge exchange advisors and statisticians - surely all of them then qualify as "agricultural engineers of the future"?

We need to encourage those in disciplines not traditionally associated with agriculture / agricultural engineering to think laterally and rise to the challenge of applying their skills and knowledge to our own industry.

Important to always keep our direct connection with the land.

Finally, I have no doubt that future agricultural engineers at all levels will need to be familiar with terms such as 'cloud based technologies' etc. (there's a video of a future farm, where the farmer effortlessly controls all field operations from his computer in the comfort of his home), but it is equally important to always keep our direct connection with the land – literally to have our 'boots on the ground' (I'm glad to see the farmer does eventually 'walk his fields' at the end of the video). It's essential we don't lose sight of what ultimately underpins agriculture (and of course, other land based industries too) - and that is the soil (well, as a soil scientist you would expect me to say that!).

Biosystems Engineering



Biosystems Engineering, owned by IAgrE, and the Official Scientific Journal of EurAgEng, is published monthly with occasional special issues.

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For further details of the depth and breadth of articles accepted for publication in Biosystems Engineering, visit:
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For details of the preferential rates for members for subscriptions to both the paper and electronic versions of Biosystems Engineering, visit the IAgrE website at:
www.iagre.org/biosystemsinformation

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 175, November 2018, Pages 106-114
Research Paper - Open Access

Impact of global warming on the odour and ammonia emissions of livestock buildings used for fattening pigs

Günther Schauberger, Martin Piringer,Christian Mikovits Werner Zollitsch
Stefan J Hörtenhuber, Johannes Baumgartner, Knut Niebuhr, Ivonne Anders,
Konrad Andre, Isabel Hennig-Pauka, Martin Schönhart
University of Veterinary Medicine, Vienna, Austria,
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University of Natural Resources and Life Sciences, Vienna, Austria

Ammonia and odour are the most relevant pollutants emitted from livestock buildings used for monogastric animal production. Because of clean air regulation in Europe, total ammonia emissions reduced by 23% from 1990 to 2015 whilst, anthropogenic warming became more evident. By a simulation of the indoor climate of a confined livestock building with a mechanical ventilation for 1800 fattening pigs, the modification of the odour and ammonia emission was calculated for the period between 1981 and 2017. For ammonia emission, a relative increase of 0.16% per year was determined. But following the clean air endeavour between 1990 and 2015 emissions over that period were reduced by 23%. The global warming signal counteracting this reduction in the range of 4% during this period, which means that the overall reduction for the ammonia emission was only 19%. Odour emissions also increased by about 0.16% per year This case study on the fattening pigs shows that the global warming signal has a negligible impact on separation distances.

Biosystems Engineering
Volume 176, December 2018, Pages 185-197

Transfer of agricultural work operation profiles to a tractor test stand for exhaust emission evaluation

Johannes Ettl, Heinz Bernhardt, Peter Pickel, Edgar Remmele,
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Technical University of Munich (TUM), Freising, Germany
John Deere European Technology Innovation Center, Kaiserslautern, Germany

Recently, emission legislation was extended by adding testing procedures during real-world operations. The recording of so-called real driving emissions (RDE) with portable emission measurement systems (PEMS) is complex, especially for non-road applications, such as tractors. Emission-relevant sites and environmental conditions vary widely, and RDE measurements with PEMS are limited to an observation period of only a few hours. A feasible methodology is presented to determine exhaust emissions for specific tractor operations that are representative of longer periods. Based on long-term recorded GPS data, as well as engine control unit (ECU) speed and torque data from a tractor, six work-specific test cycles were developed and transferred to a tractor test stand. By comparing ECU data from test stand operations with ECU data recorded during field operations, the quality of the procedure was assessed. Emission measurement was conducted. Nitrogen oxides (NO_x), carbon monoxide (CO), hydrocarbons (HC), particulate matter (PM) and particulate number (PN) emissions for the tractor works considered with rapeseed oil (DIN 51605) and diesel fuel (CEC RF 06-03) were lower under real operation conditions than those when applying the legal non-road transient cycle (NRTC). Thus, using rapeseed oil fuel instead of diesel fuel offers a huge potential for reducing greenhouse gas emissions.

Biosystems Engineering
Volume 178, February 2019, Pages 1-8

The remarkable slenderness of flax plant and pertinent factors affecting its mechanical stability

Camille Goudenhooft, Tancrède Alméras, Alain Bourmaud, Christophe Baley
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Flax fibres have traditionally been used for textile applications and more recently, for composite reinforcement. To increase fibre yields, varietal selection has been used to develop varieties having high fibre content while retaining good resistance to lodging. This has led to impressively slender structures of flax compared to other herbaceous plants. The mechanical stability of flax is related to its specific architecture. An anatomical study provides information about the architecture of flax stems, including the repartition of the internal reinforcing tissues being phloem fibres and xylem. By using three-point bending tests, flexural modulus is evaluated along the stem. Although flax plants have an unusually slender structure, they are mechanically stable. Stability of the plant comes from a high stem flexural modulus that originates from an external ring composed of high-performance fibres, while an inner thick porous xylem provides the plant with a high resistance to local buckling. This demonstrates that it is possible to keep increasing fibre yield through breeding without jeopardising plant stability.

BEHIND THE SCENES AT IAgrE

1 The Membership Committee

A key aspect of professional membership organisations of all kinds is the concept of your membership and registration application being reviewed by reputable peers – in this way, the profession regulates itself.
In this respect, IAgrE is no different to any other professional body.
At IAgrE we are blessed with a committed Membership Committee but they do need your help so please read on to find out what you can do and how you can get involved.
Membership Committee Chair, Malcolm Carr-West says:
"I have always found my work on the Membership Committee an enjoyable activity and I suspect it is for all those members involved.
It is a great way of influencing the work of the institution. The ability to attend meetings and the networking that comes with that is more of a benefit that you would first think. Committee members not only learn about how professional bodies are run, they also get some idea of the direction they are heading.
Things like CPD, the need for ethical behaviour and compensation in degrees have all been discussed well in advance of their becoming common knowledge in the industry. This is not only useful to the individual but also to their employer.
It could be argued that the knowledge gained from attending the committee is essential to those responsible for employing personnel and for those involved in training. Such intelligence benefits employers so any companies with an eye to the future should see the benefits of releasing staff to get involved"
The President is an ex-officio member of the Membership Committee, and when our current President was new in post, she attended her first meeting only to be surprised by the variety of activities and the high quality of challenge and debate. Our standards are certainly held in high regard, a point that is noted by an Engineering Council observer who joins meetings when possible (IAgrE has observers on the membership committees of other professional bodies).

So what does the Membership Committee do?

1. They review membership applications at the corporate grades of Associate Member, Member and Fellow. The application form, associated CV and certificates are sent to two reviewers. A recommendation will be made and the reviewers reports and the application is then discussed at the next meeting of the committee with full committee ratification of the decision. On some occasions there is debate. Fairness is at the heart of the work. Once a decision is made, the new member will be informed of the outcome.

2. Provides advice and guidance. Usually, the secretariat can look at an application and suggest the most appropriate grade but on occasion, such as a novel qualification or background, the best way forward is for the whole committee to discuss the application and provide the potential member with advice.

3. Reviews applications for professional registration such as Chartered Engineer or Chartered Environmentalist. These are always more complex as the candidate needs to show how they meet the relevant professional standards. These applications can be quite substantial. The same process applies with two similarly registered members conducting the review. Again, their decision is considered by the committee with advice provided if needed. Professional registration is a two part assessment with those who have been successful in the first part moving on to the second stage – the Professional Review Interview (PRI).

4. Conducts Professional Review Interviews (PRI). These are very interesting and involve the candidate meeting with two similarly registered peers to discuss how their work meets the relevant professional standards. They can last up to a couple of hours. From time to time they are held by Skype, in recent years we have interviewed candidates in Australia and the Middle East.

5. Reviews all policies and procedures. Both the Engineering Council's and the Society for the Environment's standards are subject to continual improvement and these changes need to be implemented through IAgrE policies and procedures. These need to be double checked and corrected where needed. A keen eye for detail is needed here.

6. Looks at university degrees to see if they meet the knowledge and understanding requirements of the relevant standards. This is called accreditation and requires a visit to the university to look at the programme details, meet the staff and students, look at the quality of assessed work and review resources. All accredited degree programmes have to be reviewed every five years. IAgrE accredits degrees in the UK and Ireland.

7. Approves vocational training programmes. This is very similar to accreditation and includes diplomas and apprenticeships as well as bespoke training such as Parlour Safe. This activity includes a visit to the college or training provider to review resources and meet with students.

8. Keeps oversight of our CPD monitoring ensuring that our members are keeping themselves up to date and at the top of their game. All professional engineers are expected to keep records of their CPD.

All of this is vital to the future success of IAgrE and is also good fun.

It is very important that we have current and active members serving on our membership committee and we have ways of working which suit all interests and capabilities. People are busy so some can only participate for a few days a year.

We do our best to work electronically these days so your physical attendance at meetings, whilst encouraged, is not always essential.

This is how you could help IAgrE:

1. Join the membership committee – get involved – maintain our standards.
2. Get yourself trained as an assessor so that you can review applications.
3. Join the team of Professional Review Interviewers.
4. Join the university course accreditation team – especially helpful if you work in industry.
5. Host a membership committee meeting – we like to get out and about if we can.
6. Join our team of trained CPD reviewers.

If you are interested, and we hope you are, please get in touch with the IAgrE Secretariat and we will advise you on next steps.

WANTED:

YOUR EXPERIENCE, YOUR JUDGEMENT, YOUR VIEWS

Join the IAgrE Committee and help maintain our standards

- Train as an assessor
- * Be a Professional Review Interviewer
- Join the University/Colleges course accreditation team
- * Host meetings
- Be a trained CPD reviewer
- * Approve vocational training programmes

• Flexible arrangements ***• Much work done electronically***

Further Details: **Alison Chapman**
membership@iagre.org
01234 750876

COVER FEATURE: **LANDWARDS 2019**

VISION 2038

"Britain can lead the world in a fourth agricultural revolution"

During 2018, the **Institution of Agricultural Engineers** (IAgrE) proudly celebrated its 80th Anniversary – and now looks forward to the next big Anniversary, its Centenary in 2038.

But what will agriculture look like in just under 20 years? What will exercise the minds of the officers and members of the Institution? There is little doubt that the landscape of this country will have evolved, possibly out of all recognition. The way we farm, the machinery we use, what we eat, how it will be produced – and of course, the people. Where are the next generation of agricultural engineers going to come from and what skills will they need?

Addressing the Oxford Farming Conference in January, Environment Secretary Michael Gove said "Britain can lead the world in a 'fourth agricultural revolution' to make farms dramatically more productive".

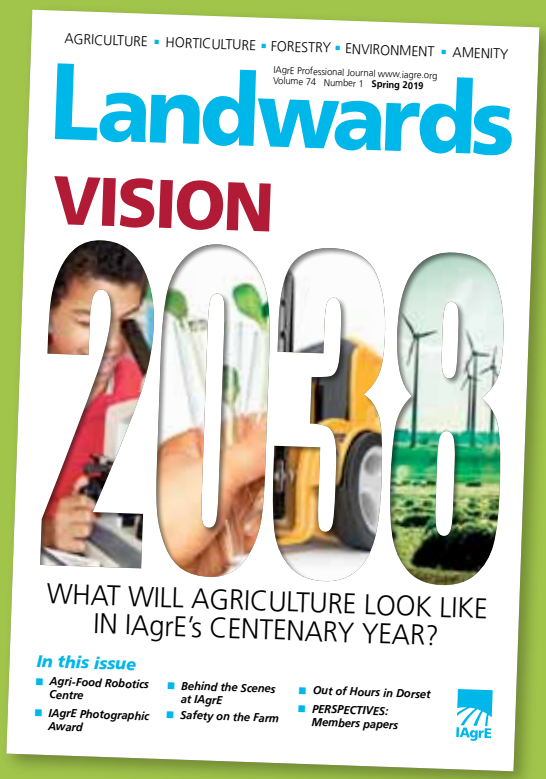
In Landwards for the whole of 2019, we are going to outline the practical and potential driving forces that will shape our industry during the next two decades. Our forthcoming issues will examine four key areas:

- **THE NEXT GENERATION:** (*Spring issue*)
  Where will they come from and what skills will they need?
- **FOOD:** (*Summer issue*)
  What will we be eating, and how will it be produced?
- **TRACTORS AND MACHINERY:** *(Autumn issue)*
  New developments, what will be required?
- **ENVIRONMENT:** *(Winter issue)*
  What will our countryside look like and IAgrE's role?

There are so many exciting innovations in development that it would be easy to imagine our countryside in 20 years being farmed by a swarm of robots managed from a central hub.

But that loses sight of farming's DNA, the human factor. Farmers have a special 'sixth-sense'. They have the eyes, ears, smell and empathy for their craft. Farming is never an exact science – the elements see to that.

Whatever innovations come into increasing common use, there will always be an over-riding human-factor to work hand-in-hand with new technology.



SOWING THE SEED

VISION 2038: **THE NEXT GENERATION**

INTRODUCTION

MANY agree that STEM subjects should be highlighted long before students begin to choose their specialisms at school or university writes Chris Biddle. Speaking to children in primary schools can help plant an important seed.

Sharing STEM with young people is partly to encourage children to do what they used to do in a pre-digital world. They can get to carry out hands-on activities such as building a bridge, making a crane or creating an aircraft, using carboard, paper or kits such as Lego or Airfix.

Generations of engineers found early inspiration from their Meccano sets. Developed by Frank Hornby in 1898, Meccano flourished throughout the first half of the 20th Century, but hit financial difficulties after Hornby's death in 1964. It has since been through several ownerships and was usurped by the increasing popularity of Lego which itself has been through several changes of fortune as digital activities took hold.

Whatever the undoubted attractions of the new digital age, there is surely no substitute for practical, hands-on, creative modelling to teach children how things work?

Another task for those promoting STEM is to address, from an early age, gender bias. Those Meccano adverts were exclusively aimed at boys.

There is a need for women in engineering to go into schools to promote engineering where they can much better help dispel stereotypes that engineering is a job for boys.

WHAT'S IN A NAME?

So once the STEM seed has been planted, how should we steer interest towards careers in agriculture and agricultural engineering?

We are, by definition, a niche sector. Not only in engineering where we are dwarfed in size by the motor industry, construction, railways, marine and aircraft, but in terms of visibility and public awareness.

And yet our role is pivotal to basic needs – food, health and the environment.

Over the years, there have been regular debates and arguments surrounding our name. To some, the term Agricultural Engineer has become an anachronism. A throwback to the heyday of farm mechanism. Recent moves to broaden the title into Landbased Engineering only really satisfy those who want to combine our myriad activities into one convenient 'pigeon-hole'. It either conveys nothing to the general public, or it hints at a completely different profession (one senior figure in our industry thought it referred to the army before being lured from another sector!)

Personally, I still think that Agricultural Engineer does the job for us. Even those in soil science or environmental disciplines within IAgrE seem happy, if not proud, to be described as Agricultural Engineers.

I wonder however, in the light of the rapidly changing technological advances spreading throughout our industry that we might reflect those better with a tweak to our description as Agri-Tech Engineers and Agri-Tech Engineering?

Not, I hasten to add, make changes to the IAgrE title or Constitution, but in the way we present ourselves to the outside world.

Happily, as you will read in this feature, there are plenty of exciting STEM initiatives going on across the country to sow the seed of opportunities within engineering in general. What we need to do is to channel that interest towards this vibrant, challenging and always fulfilling industry at every opportunity.

THE EARLY YEARS

The teaching of STEM subjects in Primary Schools is patchy. A recent Ofsted report highlighted the decreasing amount of time given to teaching science at primary school level and want science to be given the same status as English and Maths.

Recent Ofsted inspections have found that Science has become the 'poor relation' in the primary curriculum with the focus on the 3Rs pushing Science to the margins of the curriculum. Although the majority of primary pupils enjoy studying Science there is a weakness in the provision.

It is therefore all the more important that industries wanting to plant the seed of interest in their sector should take the initiative, even at an early age, which is why the recent Farmvention programme organised by the National Farmers Union (NFU) should be heartily applauded.

Farmvention (when farming meets invention) is a national STEM competition run by the NFU aimed at primary school children.

Pupils were set three exciting problem-based challenges that could be entered by individual children or in teams. The challenges were designed to make children think about the day to day issues faced by farmers and growers in England and Wales. Each challenge was supported by curriculum linked resources created in partnership with the Association for Science Education (ASE).

The three Farmvention challenges, which launched in September 2018, were:

Happy Hens: Design an environment for a flock of 100 laying hens providing the right diet, water, temperature, shelter and safety

British Snack: Should contain milk, beef, beetroot and oats and be nutritional, attractive and well-packaged

Design a Tractor of the Future: Should be labour saving, light to save damaging the soil, comfort for the driver and environmentally friendly

The entries were based on four criteria: How well the pupils solved the problem, creativity and innovation, the environmental impact of the design and the benefits the design will have for farmers and food producers.

Finalists were also able to present their ideas at the Houses of Parliament during British Science and Engineering Week 2019 in March as well as winning fully funded farm visits, robotics kits, data loggers and chef visits.

All entrants become certified 'farmventors' and receive a reward pack including a certificate and mini prize.

The NFU received more than 1,000 entries for the competition. The overall champion will win the grand prize of having their school turned into a farm for the day.

NFU President, Minette Batters said: "This is the NFU's first national competition for primary schools and there has been an incredible amount of enthusiasm from both teachers and pupils.

With more than a thousand schools entering their designs, the competition clearly demonstrates that food and farming has a place in education; not only to engage young children in STEM subjects, but to develop their understanding about rural life and where their food comes from."

TRACTOR OF THE FUTURE WINNERS

- Settle C of E Primary, Settle, North East
- Afeefa Haroon: Ronald Ross Primary School, London, South East
- Tracticians: Armitage C of E Primary School, Manchester, North West

Staff at the winning schools were delighted at the way the children embraced the challenge. At Settle C of E Primary school, Key Stage 1 pupils focused on designing the tractor of the future and used their engineering skills to design a 'Plug n Plough' concept tractor with interchangeable components.

Teacher Sarah Entwhistle said: "Year 1 worked incredibly hard on their Plug 'n' Plough entry. From the planning and design, through the creative challenge and on to the testing process where they were delighted to watch their ideas come to life attached to one of our school robots".

"We are all very proud that some of our youngest budding engineers are being given the chance to present their ideas during the exhibition at the House of Commons. The recognition and value this places on what young people can imagine and create, has inspired all of our children."

Meanwhile, at Armitage C of E Primary School in Manchester, Learning Mentor Douglas Allen said "We had about 11 children, mainly Key Stage 2, from our Science Club who formed themselves into the Tracticians Team, and from the start we decided to focus of a number of principles to be applied such as electrics, power generation, solar power. It really was a free-form discussion amongst the pupils, swinging one way then another.

There is little doubt that children develop a real curiosity about how things work at quite an early age and are never happier when trying to set fire or blow up stuff to see what happens – in our Science Club of course!"

Winners Settle C of E Primary School

SPREADING THE MESSAGE

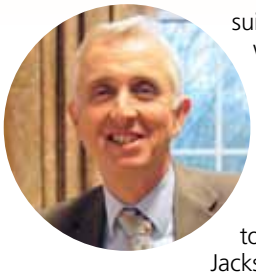
As pupils make their way through school and start to develop their thoughts about further education or learning on the job through an apprenticeship, how should our industry go about 'setting out its stall'?

It is accepted that, outside of those brought up close to a rural or farming community, the general public and the younger generation know very little about the opportunities, the careers and the job satisfaction offered by the land-based engineering sector. They are unaware of the scope, complexity, innovations and technological advances that run through this industry. Nor indeed, the vital role that this industry plays in feeding the world and protecting the environment.

***Landwards* talked to a number of key players who are taking practical and pro-active approaches.**

COLLEGE

Tim Jackson
Principal
Sparsholt College
Winchester



Sparsholt College primarily covers countryside-based subjects such as agriculture, engineering, fishery, veterinary, equine, forestry and woodland management. There are currently more than 1900 full-time and 3000 part-time students (including around 450 at HE level).

Set in 400 acres of beautiful Hampshire countryside and only three miles from Winchester, students can combine the buzz and social life of the city with the peace and tranquillity of the countryside.

Sparsholt is one of the first colleges to be awarded a zoo licence and home to 1200 animals comprising nearly 200 different species including meerkats, lemurs, donkeys and a red panda.

A 650m squared purpose-built fish house holds stocks of carp, catfish, tilapia and a massive range of ornamental species, whilst the Equine Centre provides a professional teaching environment for degree level study. Its facilities include stabling for up to 75 horses, a 60m x 23m indoor arena and three outdoor arenas with Olympic standard surfaces.

The College is home to the Potting Shed recording studio and garden for BBC Radio 4's 'Gardeners' Question Time', along with tropical glasshouses and an established orchard.

Sparsholt's full-size sports hall, exercise studio, fully equipped fitness suite and enormous climbing wall provides recreational and educational facilities – and the college's Football Academy has a close link with Premier club, AFC Bournemouth,

"So there is an awful lot to see" says Principal Tim Jackson "and we rarely get youngsters looking round who can't find something to engage them. We can show them at first-hand what agriculture, in all its forms, has to offer. Then if we get them 'hooked', what Sparsholt can do to achieve career opportunities.

"We hold Open Days for the general public during the year, and in 2018 hosted over 600 Year 9 (13 to 14 year old) pupils for an open day and educational seminar where we had five inspirational women speakers talking mainly about the digital opportunities that run through the sectors we cover".

This year, Sparsholt is holding a 'mega' STEM Digital event on 13 June whereby over 960 pupils from around its catchment area are to attend. Sparsholt will showcase all the STEM-based careers available in the land and environment industries both at post-GCSE and degree level.

The event is being supported by employers, universities and professional bodies (such as IAgrE) with whom it has strong links in the areas of technology, digital and science.

There will be hands-on activities for future careers in agri-tech, ecology and other animal health-based careers. The students will be guided around the countryside campus, the working farm, equine centre, horticulture facilities as well as the sports centre with climbing wall and many other exciting features.

"We hope this will be a day they will never forget, and which will give them plenty of inspiration for their future" says Tim Jackson "It will be a considerable logistical exercise to cram everything into the time available. We are providing coaches from the schools but cannot pick up before 9.00 and have to return before the normal going-home time for the pupils.

This means them being at Sparsholt for 4 or 5 hours, including a lunch which we will be providing, so it will be an interesting challenge moving nearly 1000 children around the site in just a few hours".

www.sparsholt.ac.uk

DEALER

Luke, Tom and George
AGCO Apprentices

Three young budding agricultural engineers explain why they have chosen to follow a path that promises

to lead to a successful career for the rest of their working lives.

The AGCO Academy Apprenticeship is now in its 20th year, and is in partnership with WCG (formerly Warwickshire College Group)

But why choose a career in agricultural engineering, and what are the prospects?

Luke Lovell, 17, a former pupil at Thirsk School and Sixth Form College, applied for his apprenticeship role with Brockhills of Yorkshire Ltd via a Facebook advert. "Brockhills have employed new staff directly and put them straight onto the apprenticeship scheme, and there currently is one other in the third year at the moment, so I was confident this was a good opportunity," said Luke.

Similarly, 17-year-old Tom Voase of P&B's Halsham depot in Hull, noted the track-record of his employer in developing staff through the AGCO apprenticeship, "I was fortunate enough to get the position at the Halsham depot, and soon realised that several of the technicians had either completed or were undertaking the AGCO apprenticeship scheme," explains Tom.

George Fenner, also 17 and a fellow AGCO Year 1 apprentice, started working one day a week for RW Crawford's Essex depot on leaving school, before being offered the opportunity to join the apprenticeship scheme.

"At this stage of my career, a lot of my time is spent shadowing colleagues, and learning from their experiences. My apprenticeship helps me to develop these skills and having access to the relevant equipment really does help," explains George.

Anthony Linfield, AGCO's training development manager, adds, "Land-based engineers that progress and can demonstrate high levels of expertise are a tremendous asset to all of us in the industry. Moreover, they are much in demand, and if Luke, Tom and George successfully complete their qualification, they can look forward to a rewarding career."

STEM AMBASSADOR

Nigel Summerfield
Group Customer Support Manager
Rea Valley Tractors

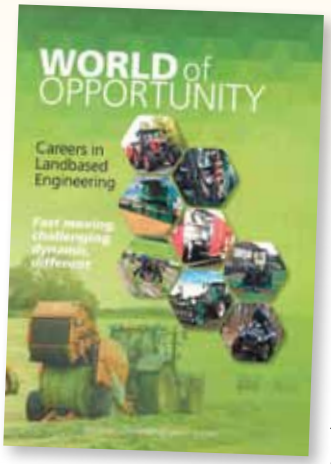
"After 30 years in the industry, I wanted to put something back" says Nigel Summerfield of John Deere and JCB main dealer Rea Valley Tractors, who operate from four branches in Staffordshire, Shropshire, Derbyshire and Mid-Wales.

About 6 years ago, he came across the opportunity to become a STEM Ambassador, so he could provide an insight into engineering in general - and agricultural engineering in particular. He now attends career fairs, school assemblies and specialist seminars promoting career opportunities in the agri-tech industry.

Nigel is attached to a STEM Hub, Entrust STEM based in Stafford, who provide opportunities to address teachers, pupils and others "I can choose what I go to, how many events I attend during the year" he says.

"When I go to careers events, it is clear that agricultural engineering is noticeable by its absence, very few people know anything about our sector.

Initially it can be a tough challenge to explain how, what and why the agricultural machinery sector operates. But when you start to get into all the technology and innovation in todays tractors and machinery, their jaws drop open!"



Nigel is extremely pleased that the industry has produced an excellent careers publication World of Opportunity (*published jointly by IAgrE, AEA and BAGMA*) "It sums nicely all the different training and job opportunities in our industry which encompasses so many different sectors".

Staffordshire is home to many engineering enterprises, headed by JCB. "As a JCB dealer, I am full of admiration for the career opportunities they offer within the company" says Nigel "but I think they could do more to attract the right talent into their dealer network".

It is disappointing to Nigel that more industry people, across the age ranges, haven't considered taking their knowledge, experience and job satisfaction into schools by becoming STEM Ambassadors.

"I was at a John Deere Managers meeting recently when the usual topic came up about finding new staff. I talked about the STEM Ambassador programme – but nobody knew anything about it!

In my view, we have to put ourselves about a bit more. When I talk to young people about our 'world', they are blown away by the technology – so we really have got a great deal to offer".

www.reavalleytractors.com

WHO ARE STEM AMBASSADORS?

STEM LEARNING is a partnership between government, charitable trusts and employers, and dedicated to raising young people's engagement and achievement in STEM subjects and careers.

The STEM Ambassadors service operates through 19 regional STEM HUBS spread across the UK (go to www.stem/org.uk for details).

It will include people from a range of disciplines and backgrounds, including engineers, designers, architects, scientists and technicians who help bring a new and inspiring perspective to STEM lessons and career opportunities.

The aim is to ensure that teachers, schools and colleges, as well as youth and community groups, are able to access STEM Ambassador support to inspire and engage young people with STEM subjects.

There are currently over 30,000 STEM Ambassadors from more than 2,500 different employers.

They volunteer their time, enthusiasm and experiences to encourage and inspire young people to progress further in science, technology, engineering and mathematics (STEM) subjects.

Through a range of activities, including presentations, mentoring and careers talks, STEM Ambassadors play an essential role in inspiring the next generation with the world of STEM subjects and careers.

Coming from a broad range of sectors, STEM Ambassadors are engaging, enthusiastic, dedicated and committed, and continually change young people's perceptions about STEM Careers and about the types of people who work in those roles.

www.stem.org.uk

AGRICULTURAL ENGINEER OF TOMORROW

On a farm in Hampshire, Chris Biddle meets up with a young robotics engineer who would never have regarded himself as an agricultural engineer

Robin Jackson

Robin Jackson grew up in London. He always liked dabbling with 'techie-things', 'Pimp my Bike' was an ongoing project at school – and he had the appetite to learn lots about how lots of things work.

From school, he won a place at Leeds University, and emerged after 4 years with a Masters Degree in Mechatronics and Robotics.

We discussed his journey from the classroom to a muddy field on the Waitrose -owned Leckford Estate in Hampshire where he was making some adjustments to Tom, an agri-robot. Not much larger than a spaniel, with similar characteristics, Tom is part of the emerging stable of robots being developed by the Small Robot Company where Robin in now engaged as part of the technical team. So that makes him an agricultural engineer. "I suppose it does" he says.

He got involved in the project when Small Robot Company (SRC), who have recently raised over £2.5 million in funding from Innovate UK, the Institute of Engineering and Technology (IET) and a crowd-funding initiative, took part in summer camp last year run by Bristol Robotics Lab.

Robin was one of six young robotics engineers who were given the task of designing the first serious prototypes for SRC's robotic farming platform. To date, the SRC stable has consisted of Tom, Dick and Harry, working concept machines which linked to a central controller, Wilma.

'JACK'

The task for the team was to design a multi-purpose robotic platform which would be used for spraying, weeding or sowing. It is to be known as 'Jack'. The project ran from June to September 2018, during which time they brainstormed the purpose, the design and the practicalities.

For instance, the wheel joints had to rotate through 360 degrees and had to be strong enough to support the weight of the robot and allow for a payload of up to 200kg initially - and up to a tonne in the future. The type of motors, batteries and on-board controllers to be used had to provide the best power-to-weight ratio and movement.

With all the benchwork and 3D CAD work completed, it was time to seek out manufacturers who could turn the product into a feasible prototype "That was probably the most eye-opening part of the project" says Robin "getting expert feedback from manufacturers on the type of materials and construction we should work with, most of which we had not considered".

Robin puts 'Tom' to work

During final testing phase, one of the most innovative solutions came about using a Raspberry Pi running ROS to enable each leg of the vehicle to operate as a separate system with its own power supply and micro-controllers.

Since completing the project at Bristol, Robin has been visiting the 20-odd test farms where Tom, has been mapping the fields and remotely identifying plants in order to build up a comprehensive database for the future.

"The farmers have been absolutely terrific, the whole family turn out, eager to see the machine at work, wanting to get involved. The practical engagement with potential end-users has been invaluable – and I've learned a lot about farming in a few short months."

NEXT ISSUE: VISION 2038 THE FUTURE OF FOOD

Robots, vertical farms and virtual fencing could soon be part of the British farming landscape, according to a recent NFU report the ***Future of Food 2040***.

Landwards Summer issue will consider what we will be eating and how it will be produced in IAgrE's Centenary year in 2038.

Published June 2019

PERSPECTIVES

Selected extracts from latest UK's professional engineering journals.

This issue we publish two recently submitted papers from IAgrE members which we believe will be of considerable relevance and interest to members.

SOIL DEGRADATION

Timothy Havard NDA MSc CEnv EngTech MIAgrE considers the current state of soil quality and rivers in the UK, and argues for a system of mandatory soil loss and pollutant measurement

FROM Bob Evans article *(Landwards Summer 2018*), he is clearly frustrated with many aspects of the soil erosion debate, and rightly so. But there needs to be more of a policy and strategy focus so the problem can be addressed in a rational manner.

If money is to be spent let it be spent on reliable data and sound interpretation. There is a global problem and just because it's not quite so obvious in temperate climate agriculture, but blindingly obvious in the tropical climate, does not make it any less of a problem within an area or country.

In my approach I discuss, as Bob has done, some of the historical aspects. How did we get here?

I have learnt from hard experience over the last half century, that food prices, relative to the local economy, will sort themselves out.

It takes time, but sadly a lot of people get hurt if the farming community is the one to hate - but the farmer always re-appears. I'm sorry if Bob has a pig effluent problem but, like all these trending ideas on how to farm, they come and go - along with the effluent. If there is excess effluent anywhere in the system, something is wrong – so here's my solution.

WATER FLOW

I'VE watched the soil erosion problem grow here in the UK, and across sub-Saharan Africa and the Middle East since 1964 when I left the UK for Tanganyika (as was) where poorly managed logging, bad road layouts and inadequate drains caused great scars.

Land degradation and soil erosion DOES matter in the UK and I would suggest that the losses are not minimal. They are masked by many of the 'chemicals' that Bob is rightly concerned about. I've measured soil losses on wind blow soils in East Fife greater than Bob is quoting.

However, the damage done down-stream to poorly designed and maintained drainage systems and by the amounts Bob is quoting, is considerable. How much was spent on sorting out the Somerset Levels debacle? Yes, water quality is poor, but why?

I would suggest that 'someone' is allowing pollutants to enter the 'drainage' system.

So, let's get back to the farm drain as a start point and measure flows and their content through the whole catchment area. But also make sure all institutes and members of society are obliged to measure all the other flows into the drainage system – and no exceptions please. There's a lot more muck entering the riverine system from many other sources.

I totally agree that in many places

the flow rates are erosive - too steep a slope which allows the water to carry a higher 'load'. In many cases, this is a soft engineering problem. There is also a need for far better land layouts particularly on grade 1 & 2 soils (high productivity).

If the Climate Change aficionados are to be believed, there will be a significant increase in extreme weather events, especially storm intensity. Never good news for land managers but it certainly means a lot more soil degradation and associated erosion. This is not new, but now much more likely to be coming to a place near you.

Although there have always been discussions in academia about the state in the UK over who should actually be responsible for the wellbeing of the country's natural resources; particularly Land and Water. This issue is now main stream in the media - and with a vengeance.

This is stimulating the politicians to tinker with an already out of date set of regulations but with funds that are supposedly to *compensate* land owners and managers for work done for stewardship. It has thus also opened the old debate on the pros and cons of the nationalisation of natural resources, particularly land and water.

In a time when the general media is struggling to grasp the links between Global Warming and its effect on local weather patterns, it is also struggling to understand the effect of these storms on the soil, water flows - and ultimately food prices. The BREXIT problems and fluctuations in the value of sterling just adds to the woes.

The present policy/strategy vacuum, and thus degree of uncertainty for agriculture, along with the Brexit driven food and agricultural issues including the government subsidy debate, seems to get worse. But at the end of the day the actual question is, who picks up the bill? Land owners, tenants or the state?

This begs the question who is "The Landlord' – the land owner or the state? Who is the Tenant? Who is The Steward? Many thought that 'slipper' farmers were bad enough under the EU CAP regulations, receiving subsidies really intended for the land manager, but that now looks as if it was a minor blip compared to what is now coming down the drain. In this fog of uncertainty, the agricultural community needs to ask themselves the question just who has management rights and thus who is covering the costs?

'LANDSCAPE'

THE concept of stewardship infers the positive management and wellbeing of something we hold in trust for others, particularly future generations. In the case of natural resources, stewardship is complex, often running in parallel to ownership and, in a farming/agrarian environment, it often means a lifetime.

It is neither a 5-year political cycle nor a 15-year financial cycle and not a natural time scale that man can reasonably predict with any degree of certainty. However accelerating erosion and land degradation is clearly down to poor stewardship and should be a matter of great concern to all.

As the laws of physics (gravity) determines that in the natural world things tend to move 'down the slope', we need to start at the top of the slope if any sense is to be made of the processes of erosion, flooding and thus land degradation.

In this discussion I avoid the term landscape as "landscape" seems to be more of a subjective romantic perception rather than an objective description.

It's good for the media and tourist promotions as it has taken on the meaning of whatever vista can be seen at any given moment, but does not relate to the subtler hidden ground features. An open view over vast tracks of land and water no doubt makes nice pictures and enjoyable walking, but is it stable or just a passing phase? What is seen today is most certainly not what previous generations saw nor what generations in the future will see. There have been massive changes with the nature and value of ground cover, from significant woodland/ perennial cover to heavily grazed short-term grass, to annual massive over cultivation.

A careful study of the past natural history of any locality –at least the past 300 years – can be illuminating; particularly its vegetation and drainage history.

A close look at much of the uplands of the UK in summer these days will show a heavily overgrazed, seriously

denuded landscape, some areas badly damaged by fire and others over used as a leisure resource. The living blanket of vegetation, naturally developed, over long periods of time to absorb the rainfall, has gone. It has been killed by historic deforestation, over-grazing, too heavy a footfall and now drought in summer.

We also need to remind ourselves that 'soil' in the uplands is a bit of a misnomer. It is really a few bits of grit and organic matter very easily lost, a skeletal soil. In the higher more exposed land there is very little time each year when ground temperatures are adequate to allow the complex processes of soil development to take place, and very little time for very specialised plants to grow and lock in this soil.

There is also now a growing mass of good reliable data to support the view that there are changes in local weather patterns associated with this loss of vegetation. Reduced summer rainfall or the same amount of rain is delivered in fewer more violent storms and reduced early morning dews. Global warming perhaps, but records clearly show increasing storm intensity along with longer periods of drought, especially in the summer months.

With this scenario, should we really be surprised by increased silting up of drains, increased dirt load and significantly increased peak riverine flows, leading to urban flooding? There is also a growing awareness, as we move down the slope out of the uplands and into arable land that there is increasing pressure to hit the optimum planting dates needed to obtain the intensive crop cycles that allow reasonable gross margins to be sustained. This has led to the use of ever larger/heavier equipment in less than ideal ground conditions, which in turn has accelerated soil degradation and seriously increased the erosion potential.

High clay fraction soils are probably the worst affected by the development of plough pans, compaction at depth and loss of soil structure at the surface. This has been further exacerbated by the loss of the annual muck application or straw incorporation (organic matter). No organic matter equals reduced micro-flora (mycorrhiza) and fauna activity and leads to poor soil structure and reduced moisture retention.

The long-established habit of ploughing and cultivating up and down instead of across the slope hasn't helped either. And by the way, this is not an argument for organic farming but for organic matter on the farm. It's not the same.

5-YEAR CYCLE

LAND degradation by surface water flow has two important aspects. First it separates out and moves, albeit slowly, significant amounts of silt and clay from within the soil profile. Differential separation, the smaller particles require less energy to move, along with organic matter down the slope within a field.

First, this in-field erosion lowers soil fertility and moisture retention which in turn reduces crop yield and, over-time, the value of the land. Secondly, this silt, clay and organic matter; a direct loss from the soil profile plus larger material if the water flow is powerful enough, moves down the slope via the river system, causing blockage and damage in the riverine system.

This in turn causes urban flooding, especially if the overall drainage design is limited or inadequate in the first place. Clearly the initial problem, the loss of the best parts of the soil leading to land degradation is followed by more damage, and a massive dirt load blocking the drainage system. Now, as flows slow down on the lower flatter slopes, 'dirt' nicely sorted into sand, silt and clay plus any larger material, is differentially deposited in the flood areas thus spoiling good land, often irretrievably. Remind you of anything? The Somerset levels?

Surely the need for sound, long term, broad based, natural resource management comes into focus.

There is good reason to believe that by overgrazing, fire, excessive footfall and drier summers our uplands are not in good health. They are not sustaining a healthy vegetation cover and are thus releasing rapidly,

along with a great deal of dirt, the increasing storm water flows into a degrading riverine system. From this it follows that the present stewardship of the uplands has a problem and that problem is manifesting itself throughout the riverine and associated water/drainage catchment area.

Further down the slope, the mid-slopes, aggressive land preparation, with little reference to soil degradation and organic matter loss, has reduced moisture retention and thus increased erosivity. This degradation should have started to show up in falling crop yields and falling profitability. Unfortunately, many years of crop and/or land subsidies and other subsidised support through 'sympathetic' agricultural finance and tax regimes - aided and abetted by the massive increase in on-farm horsepower - has masked this slow, but very real, decline in inherent soil fertility and structure. The now defunct heavily subsidised excessive drainage schemes that encouraged inappropriate cropping regimes, also exacerbated the loss of organic matter on many susceptible soils.

Who did it? We all love a blame hound, but clearly, we are all guilty to some degree. However, the land use system used by most land managers for the last 100 years, has not really been under their direct or even indirect control for some time - and certainly not since the 1940s.

From the onset of the food production system brought about by the urgent needs of the Second World War, much of the UK's farming systems have been heavily constrained, even manipulated by government cheap food policies plus carefully controlled access to funds. And we should not forget that land on an island will always have an obvious scarcity value which distorts its resource value, especially when used as collateral against borrowing by the banking system.

Have we forgotten the problems of the late 70's and early 80's with high interest rates (over15%) and farmers selling off their land to lease it back? The wide range of subsidies, all based on short term agricultural policies driven by the 5-year political cycle, has created massive constraints on long term stewardship.

The state has clearly learned a trick or two how to manipulate the land and water resources for, at best, a 5-year cycle. Remember the bulk of the voters are urban dwellers and governments do not like 'bread riots', but this is a very damaging cycle time for the land.

FORESTRY

HOWEVER, irrespective of any national policy or strategy, land managers and their families still need to live whilst crops come to fruition. Sadly, there is little or no evidence that society or governments in the past, having disrupted the long-term perennial crop cycle, have been willing to support land managers over a long enough period until a new long-term stable vegetation cycle is re-established. Indeed, quite the opposite.

Annual cropping and very short-term grass leys (if any) have become the norm with virtually no perennial crops. Any attempt to maintain a minimal 5- or 7-year grass, grain and roots rotation with associated livestock is now laughed at. The problem seemed to gain momentum in the 1960s & 70s that hedges and small coppices, and even fruit trees, were removed to increase field size and maximise machine efficiency along with massive new drainage.

This whole process was driven by annual crop production subsidies along with various forms of tax relief on capital expenditure, and all fully supported by a regime of very short-term financing by the banks. There was not much room for a long-term land use strategy to be followed.

A few were brave enough to be labelled a 'dog & stick' farmer, but not many. The fact that forestry has never been treated as if it were part of a cropping system demonstrates the short-termism of Government.

A way forward must be found that allows the rural community; and independent land users, to live and work on the land. Nurturing it and enhancing the long-term quality for the next generation. The apparent growing trend to ever larger land holdings is not likely to lower erosion potential, nor will it improve bio-diversity unless forestry in its widest sense is in the mix. Extensive land planning over several land holdings is

most likely to be more productive.

This encourages adjoining holdings to maintain their identity but to establish adjacent larger woodlots, shared water storage and irrigation/drainage systems in sync with the slope, the soil type and the associated river basin drainage system. This approach retains the strength of the mixed management and risk spread that is the back bone of UK agriculture. To sustain the long-term vegetative cover over many land types does require much thought.

For this to work land managers will need to be paid. Paid, not compensated, once a sound and balanced view of what a given piece of land can best achieve. Very long term or zero revenue earning land management in the uplands is essential if this erosion problem is to be solved - but someone will have to pay. Whatever system is to be employed, all land users, direct or indirect, will have to be jointly responsible for a river basin with a minimum 25-year management plan that integrates with adjoining river basin systems.

ZERO-DISCHARGE REGIME

LONG-CYCLE perennial cropping such as fruit trees, timber of all types, coppicing etc. and general ground cover as a management system, supported by well-balanced use of the water resources, is an essential element of any stable system. Sustainable vegetative cover for a specific area must be encouraged. If that vegetation is needed, not as a crop but as a protective cover (upland bogs for example), society must be prepared to pay someone to manage that cover. Lowland areas should then be able to obtain water for supplementary irrigation on the lower slopes as well as being free of significant flood events. And land that is capable of intensive use should be used for such. All organic waste must be processed, especially sewage and not incinerated or worse, discharged into coastal waters.

Processed organic material (digestat or char) after taking out the energy and being checked for any other nasties, must then be returned to land that can best benefit. A zero-discharge regime is required as we should not need reminding that our coastal waters are just an extension of the farmland and crops pretty much in the same way.

For such a system to work there is a need for a reliable honest measure of land quality and an associated degradation index. A key and critical aspect of any real time land quality measuring system will be its reliability, plus a trusted and independent measuring technique that is acceptable to land users. It must assure fair payments to those land managers who enhance land quality and punish those that have not. By having a real time quantitive measure, a set of remedial actions can also be offered that can come in to affect rapidly.

The principal easily measurable feature of the bulk of UK Land is the flow and content of the local farm drainage system as it feeds into the greater water catchment area or river basin. Rates of flow and the dirt/waste load held within those flows at any point within the system is a good surrogate measure of land degradation.

The breakdown and identifying of the materials within the flows is paramount. Failure to lower the volume of dirt should attract a penalty and a falling dirt load should attract payments. A nation-wide set of electronic real-time silt/dirt traps, along with water flow meters displayed by an app, is desperately needed to identify and map the critical areas.

REWARD SYSTEM

WE already have a national soil map and we have satellites and drones. The state, if it really wants to, can devise a reward system aimed at sustaining the land owners on the land they know, and love, to make a sound-living whilst carrying out a critical transition to long term stable cropping systems.

An island the size of the UK with 68 million people cannot afford to waste its soil and its water. The farming community is clearly happy, in general, to manage the land to grow food and other useful crops.

I would suggest this type of programme would be best organised and run through the University system so that the data is properly recorded, reliable and believed. The finance is a matter for the state as 'the national guardian'.

We should not forget however there is a pressing need for those who probably don't read or even see Landwards and similar publications, that if they want to keep their landscapes, they should be made aware of the problem. If such a real-time proactive system of land degradation management was taken on board by society along with land managers, backed by the state, there would be a reasonable chance of success.

And wonder of wonders after a few years a 'landscape', will still be there in a place near you. Changed, yes, but with more shrubs and trees, in much better health. So go walk your dog, but on a slip-lead, and take home your rubbish along with the dog's mess.

Think where you ride that mountain-bike or park your car. Livestock including deer may well be fewer in number but will be around for a while yet - so will the badger and other well known animals. Oh, I forgot, check your dog and yourself for ticks.

Like politicians -they seem to get everywhere.

DESIGNING A BRIQUETTING MACHINE

Agglomeration of agricultural waste products in Africa

Harper Adams student, James Shaw, is currently studying for a Masters Degree in Agricultural Engineering. Prior to commencing his studies, he gained experience in Zambia working for a commodities processing company where he saw the quantity of biomass waste materials that are produced by the processing of agricultural products.

For the last 3 years, he has been researching and developing a machine that is suitable to commercially briquette material wastes from the agricultural processing industry - a machine that is commercially viable and sustainable in low cost environments, such as Africa.

With financial support from the Douglas Bomford Trust he has manufactured a machine to test and demonstrate briquetting theories, with this report based on a larger report produced of the project activities to date, demonstrate briquetting theories.

BACKGROUND TO BRIQUETTING

Techniques of collecting compacting materials, for example straws and grass, mainly for storage, has been used within most periods of civilisation. Industrial methods of briquetting, similar to today's techniques, were used in the latter part of the 19th century where briquettes were made from coal and peat. Even though the process of briquetting coal and peat was common place in the late 19th and early part of the 20th century, the briquetting of organic materials was not as common until the mid-20th century due to the increasing higher energy costs and environmental considerations.

Briquetting and pelleting is the process by which organic matter, and more recently metals, is compacted into standard blocks or pellets to increase the overall density for the sole purpose of combustion or ease of storage.

Currently European, Chinese and Indian manufacturers dominate the market, with stand-alone commercial machines available with capacities ranging up to 2-3t/hr. Generally, any material can be used for the manufacture of briquettes or pellets providing that the material has a sufficient internal binding element, whether naturally occurring (eg. Lignin) or physically added to the raw material.

The main purpose of briquetting is to reduce the overall volume of a material to enhance its volumetric calorific value whilst using materials that would have otherwise gone to waste. There have been various studies and methods by which the calorific value of a briquette can be determined, although generally it is said that 2kg of briquetted material is equivalent to 1 litre of fuel oil.

Briquettes ideally should also have the same burning characteristics of conventional fuels, such as wood or coal.

There are also some disadvantages to be considered before radically converting the main fuel source to briquettes or pellets from conventional fuels.

The ash content of many of these agricultural by-products is significantly more than that of conventional fuel sources and can cause significant slagging inside the boiler furnace, thus damaging the boiler. Due to the environment where many of these agricultural by-products are grown, as well as poor harvesting

techniques and natural characteristics, the by-products are subject to a high silica content as well as sand and silt contamination. All of which can cause significant wear to a briquetting machine.

ZAMBIA

Prior to starting my degree, for two months I was based in Chipata, Zambia where I worked for a Zambian commodities processing company called COMACO.

All raw materials brought into the COMACO cooperative, including rice, soya beans, groundnuts and maize, were processed at their main manufacturing hub in Chipata and then sold to supermarkets both in Zambia and Malawi under their consumer brand 'IT'S WILD'.

Within the Chipata hub they produce peanut butter, animal feed, briquettes and processed rice, and I was mainly involved and trained on their Weima Briquetting machine system provided by Alvan Blanch Development Company Ltd, UK.

The Weima TH1500 briquetting machine has a capacity of 2-t/day and has a hydraulic cylinder that provides the compaction to form the briquettes. The raw material used to create the 0.7kg 150x75x55mm rectangular briquettes was groundnut shells, a by-product to the on-site peanut butter production. These briquettes were then sold to local breweries within the eastern region as well as used internally in their roasters as a fuel source to roast the peanuts before further processing.

Groundnut shells by nature have a high silica / sand content, such that when these shells were compressed by the machine, the machine experienced significant wearing to the die even though the die had been heat treated and hardened.

A further issue was identified with the raw materials. Farmers who were

selling these raw materials were paid by weight and it was not unknown for farmers to add additional foreign materials to the material to increase their payment – and often causing significant damage to the machinery. With this leading to significant damage to the machinery as a result.

The basic structure of a groundnut, of which 45% is shell, is that of a 25mm length knobbly interwoven textured shell with usually 2-3 peanuts inside each shell.

Generally, as the groundnuts are grown in sandy soils the shells have a relatively high silica (sand) content which forms within the shells as the shells develop, and this is difficult to remove.

The other main by-product freely available at Chipata was rice husk, a by-product from the rice processing industry. Similar to groundnut shells, approximately 25% of the rice crop is husk which also has a high silica content of approximately 30-40%.

Cotton ginnery waste, also known as cotton trash, is another by-product available in abundance. Traditionally the waste is reincorporated back into the soil or composted. However, due to the large quantity of waste from the cotton ginneries, responsible and sustainable disposal is becoming increasingly hard and costly. Cotton trash/waste has a high oil content from broken and waste seeds in the manufacturing process. This oil contaminates the cotton waste improving the calorific value of the product making it an ideal product to use for briquettes.

However, it has a very high ash content, so will cause significant slagging in boilers.

There are many other agricultural by-products that can be formed into saleable briquettes, including hazelnut shells, tobacco dust, almond shells, sunflower seeds, coffee and various straws. With most having a higher calorific value than conventional wood.

MACHINE REQUIREMENTS

The aim of the project was to develop a low-cost machine capable of producing briquettes from agricultural by-product wastes, aimed and marketed at the overseas markets such as Africa and Asia who are the largest producers of these agricultural by-products.

As European levels of maintenance, quality of parts and knowledge are not available, nor viable within these regions, the main aim of the machine would have to be its ability to be used, maintained and fixed locally by people of limited engineering knowledge. In summary

- The machine must be of a suitable cost (ideally $10,000/$20,000) so that the machines total operational costs are less than the sale of briquettes to enable the operation to be financially sustainable. This compared with the current cost of other machines costing from $15,000 - $120,000.
- All wearing parts should be as small as possible and easily replaceable. All parts would be standard and 'off the shelf' with no parts or components custom manufactured.
- All parts of the machine should be simple enabling them to be easily fixed with standard tools – and repair carried out by competent personnel rather than expensive qualified overseas engineers.
- Troubleshooting could be undertaken remotely, and solutions could be explained preventing the need for a qualified engineer to visit.
- Simple electronics.
- Easily adjustable to a wide variety of briquettable products and materials.

Briquetting machine in Zambia

- Variety of power sources to suit the location and environment.
- Easily adaptable, so parts and components could be interchangeable.
- Machines could be static or have the ability to be transported to different locations.
- The machine needed to have several safety systems in place to prevent injury during maintenance or adaption.

Prototype briquetting machine

TEST MACHINE

Initially before any research into different designs could be carried out, a test machine was required. A steel skid was created as a mounting point for the different theories so that these ideas could be tested and adapted easily without the need for full redesign.

Compared to other briquetting machines currently available, the test machine is continuous. This means that material is continuously fed and pressed into the die. The advantage of using this type of die in the test machine is cost. The first die prototype in the test machine is made up of 5 different sections, which are all standard 'section 40' stainless steel pipe fittings. The theory is that the test machine die compresses material from 2.5" diameter to 1.5" diameter and then due to material swell the die increases in size from 1.5" to 2" diameter.

The electrical system uses limited complex electronics and simply relies on relay logic systems which can be easily adapted and withstand fluctuating voltages as experienced in developing environments.

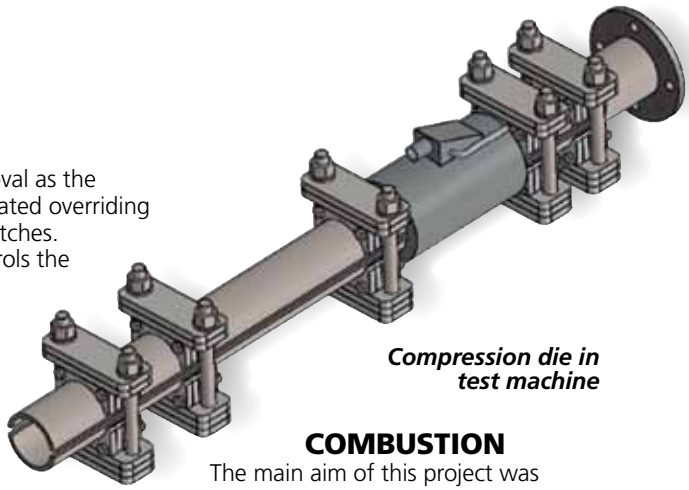
Within the test machine there are two electric motors 3kW and 0.75kW, providing power to the hydraulic pump and hopper agitator. When the test machine is operating, two modes were programmed into the electrical control system. Manual and Automatic. The Manual mode primary function is for machine set up and blockage removal as the cylinder could be operated overriding all position control switches. Automatic mode controls the cylinder position from two position switches connected to the cylinder.

There is a temperature probe which feeds a signal to a temperature control unit which displays the temperature of the hydraulic oil on a screen. The control unit also was programmed to turn on a fan, not currently installed, when the temperature of the hydraulic oil rose. This system was later adapted to monitor die temperature.

During the first initial testing, the machine could produce briquettes of the desired density through the first die prototype. However, due to the steep nature of the compression reduction sections of the die, material was not able to flow fully through the die but only up to the first reducing section.

To overcome this initial issue, a second longer die with a variable compress rate was manufactured. With the added length (and later an addition of a heating source) material was able to successfully flow through the die with the desired briquette density >1000kg/m3. This was due to the increased dwell time the material was under constant pressure for.

As well as the mentioned above, in all I produced 6 variations of the prototype, eliminating issues as they arose.



Compression die in test machine

COMBUSTION

The main aim of this project was not necessarily to investigate the combustibility of different briquette types as there has been investigations into their calorific values.

The groundnut briquettes have a higher ash content than standard softwood, around 10% compared to 4%. This causes the briquettes to smoulder. However, with the addition of an aeration source, the groundnut shells do burn efficiently with a flame. This was a problem initially experienced in Zambia where the briquettes were being sold to rural households as a cooking fuel. The stoves that they were using were made using recycled car wheel hubs. Whilst they worked well with conventional fuels, e.g. charcoal and firewood, they didn't work well when the groundnut shell briquettes were used. However, the groundnut briquettes burnt efficiently when there was a flow of air, provided by a simple adaptation to the stoves.

FOOTNOTE

Whilst this report has introduced the work that James has been doing over the past few years, it is only an abridged version of the full report he produced for the Douglas Bomford Trust. Any further questions or further interest can be made directly to JamieShaw1997@hotmail.com

The electrical system

MEMBER PROJECT

In this series we spotlight original and innovative work by IAgrE members

Engine Turnover Stand

David C Preece.
EngTech MIAgrE
For and on behalf of Howard Marshall Engineering Ltd, Papplewick, Nottingham

In this day and age, education in our industry comes in many forms – text books, workshop manuals, video clips, formal training sessions and of course experience. We know working with our own junior apprentices that practical experience is more difficult to obtain on the larger machine components such as the diesel engine.

The time factor when working on customers machines precludes detailed examination and measuring of components that are not strictly connected with the repair that has been undertaken.

As a small engineering company in the East Midlands, Howard Marshall Engineering specialises in custom built machines, and were delighted when approached by a training organisation to build a bespoke educational tool. In fact six of them!

The simple brief was to produce a diesel engine *'turnover stand'* seems easy enough. When the details were released much more thought and design detail was required.

A summary of the detailed build included: -

- Stand that is mobile in the training room both manually and by fork lift for storage.
- Engine could be completely rotated and dismantled including removal of the crankshaft.
- The rebuilt engine must be able to safely start and run.

The latter two of these requirements turned this undertaking into a most interesting project.

The Build

A 25mm thick mounting plate attached to a 85mm cross shaft with a 100:1 worm drive gearbox , mounted on a robust frame was the starting point.

Rollers are contained in the tips of the support legs and a castor wheel below the single main frame upright.

The main frame upright contains the fuel tank and supports the battery box, the control panel and to top it off, a tool tray and a handle to manually move the unit. Once the centre of gravity had been established, with and without the flywheel it was necessary to mount the engine so that the best possible access was provided to be able to work on the fuel injection system.

The engine can be rotated with or without the cooling package installed.

The electrical system is relatively simple, consisting of a battery, starter, alternator and control box. Consideration was given to the fact that immediate start-up may not occur after re-build, so the main isolator and cables were over specified for this size of engine to allow continued cranking without undue overload of the components. The control box is fitted with a key start, warning lights and a RPM counter.

An emergency stop switch shuts down all functions.

Students using these engine stands will be able to learn, in a practical way about subjects which many technicians take for granted. Junior apprentices need to know and experience what 140Nm torque actually is and how to apply it, along with all the other settings and adjustments. These stands will allow students to carry out the practical side of these workshop procedures.

We have been pleased to manufacture these units as part of the very front line of teaching the next generation of field technicians.

If you have a project that is in the public domain and which you'd like to tell your fellow IAgrE members about, please send details/photos to The Editor chris.biddle@btinternet.com

INVESTING IN AGRICULTURE

Major corporations are increasingly seeing investment opportunities in agriculture

MICROSOFT

Although technology undoubtably can help farmers, its adoption is often slow and limited because the farms usually do not have power, or Internet connectivity - and farmers are typically not technology savvy. Microsoft is one of the companies working on end-to-end approach, from sensors to the cloud, to solve the problem.

They believe that data, coupled with the farmer's knowledge and intuition about his or her farm, can help increase farm productivity, and also help reduce costs. Getting data from the farm is often extremely difficult since there is often no power in the field, nor internet in many cases. As part of their FarmBeats project, Microsoft is building several unique solutions to solve these problems using low-cost sensors, drones, and vision and machine-learning algorithms.

Taking a close interest in this project, is Microsoft Corporation founder Bill Gates. He writes in a recent blog

"Just 25 miles from downtown Seattle, Dancing Crow Farm looks like any other farm. There are rows of crops and farm implements and freshly picked peppers piled up under a lean-to. But if you talk to owner, Sean Stratman, it quickly becomes clear what makes his farm so special. Sean knows more about his land than almost any other farmer on earth.

Dancing Crow Farm is the pilot site for FarmBeats, an amazing new project that hopes to make farmers more productive by arming them with data.

When most people think of groundbreaking digital technology, they don't picture soil sensors. But a farmer who knows the temperature, pH, and moisture level of his soil can make all sorts of informed decisions that save money and boost yield.

For example, fertiliser works better when it's applied to moist soil. But how do you know when to fertilise?

Soil that feels dry is often still damp below the surface. You'll end up fertilising more often than necessary if you go by touch alone. But if you know exactly how much moisture is in your soil at any given moment, you can fertilise only when you need to.

The problem is that most existing digital platforms that provide this kind of information are expensive. Sensors can cost hundreds of dollars each, and each one only covers 10 meters. The cost is so prohibitive that only the very richest farmers can afford them.

A team of researchers at Microsoft want to change that. In FarmBeats, they've developed a series of innovations that might one day put data in the hands of even the poorest farmers.

The main innovation is in how FarmBeats sensors transmit data.

Most farms have poor or no access to the Internet. In the United States, 20 percent of people living in rural areas don't have access to even the slowest broadband speeds.

Most farm data systems require expensive transmitters to connect - but FarmBeats relies on a clever workaround by using TV white space.

White spaces are unused TV broadcast spectrum. If you've ever watched an old TV, you've seen white spaces before. They're the "snow" you'll sometimes see while flipping through channels.

Here's how FarmBeats works: The whole system is powered by solar panels. You place a small number of sensors, one every couple hundred meters in the ground. You then attach your smart phone with the camera facing down to either a drone (if you have money to spare) or a helium balloon (if you don't).

You walk around the fields with the camera, creating an aerial map of the farm. Data from both the sensors and the phone are transmitted via TV white space to your computer, where an edge device stitches everything together into a data map.

The data generated by FarmBeats has been a game changer for Sean and Dancing Crow Farm. He can use up to 30 percent less water for irrigation and 44 percent less lime to control soil pH. Information on soil temperature and moisture levels has helped him better time the planting of seeds, so he gets a more productive harvest. Because Dancing Crow Farm is located next to a river, flooding is a problem.

FarmBeats' aerial imaging capabilities precisely document flooding patterns, so he's able to better plan what he plants where. The system even helped Sean identify parts of the farms where inadequate drainage was affecting the quality of beans.

It'll be at least a year before every

component of FarmBeats is available to the public—and even longer before the cost comes down enough for broad adoption.

Even as they continue working on the current version, the FarmBeats team is already working on the next generation of their technology. They just released a paper demonstrating for the first time that Wi-Fi signals can be used to collect soil data. Using only their smart phones and super cheap RFID tags buried in the ground, any farmer could get important information about their land—no special, high tech equipment required.

The Wi-Fi technology is still theoretical, but I'm glad brilliant minds are thinking about how we can help the poorest farmers gather data and increase yield. For farmers, who rely on the food they grow to feed their family, FarmBeats could be a real salvation.

More than three-quarters of the world's poor rely on agriculture to earn a living. If we're going to win the fight against poverty, we must help farmers—and I believe that FarmBeats could be a powerful tool to achieve this".

YAMAHA MOTOR

The Japanese motoring giant Yamaha Motor recently announced Agriculture as one of its next big areas of growth. Nolan Paul, Head of Yamaha Ventures recently gave an interview to the organisers of the World Agri-Tech Investment Summit in San Francisco. He said

"Actually, whilst most people aren't aware of it, Yamaha Motor has been involved in agriculture since 1991 through our unmanned helicopter spraying operations in Japan.

So, while you may not associate the Yamaha brand with agriculture, it's not a foreign concept within the company.

Why did Yamaha Motor announce Agriculture as one of its 3 new growth markets alongside MedTech and Autonomous Solutions? It's really about moving into adjacent spaces

where we can leverage Yamaha's core capabilities to build entirely new businesses as opposed to new product lines.

When you're a $15bn company it becomes harder and harder to generate competitive returns, particularly when your largest revenue generating businesses are on a lower growth trajectory.

In that sense, Agriculture is compelling for Yamaha Motor. It's an industry whose products touch every person on the planet, every day, several times over.

It's an industry that is starving for automation, particularly as resources of all types – labour, water, land, chemicals – become scarce and heavily regulated.

And it's an industry where we think our capabilities can be stretched across the entire value chain, from lab, to farm, to processing, to delivery. So it's a massive market opportunity with strong customer demand for solutions that Yamaha Motor wants to deliver.

Every CEO has probably seen that graph of the life expectancy of Fortune 500 companies and its rapid decline over the last 50 years due to the acceleration of innovation and technology. As a result, any corporate, large or small, needs to continually be asking themselves, "How do I stay relevant in such a dynamic and fast-paced world?"

A new £100m fund is called Yamaha Motor Exploratory Fund, so, as the name implies, we're very much targeting exploratory investments focused on disruptive innovations. Nothing incremental. Nothing close to the core. We want to ensure there is sufficient degree of separation from Yamaha's current product portfolio.

That's especially important for our investments in AgTech. Our biggest weakness is also our biggest strength, which is we don't have a major legacy business in Agriculture. As a result, there's no point in us entering a new market in an incremental way.

We need to focus on transformational outcomes that break the paradigm of traditional Ag. To do that, we're taking a holistic approach across the whole value chain. For example, it's not just about putting robots in the field. It's about putting robots in the field with the right genetics in the right production system.

To be honest, I think the biggest threat to the long-term success of AgTech is incomplete and superficial investment strategies from both corporates and investors. The industry has been very good at highlighting macro and micro trends, identifying disruptive opportunities, and investing in transformational solutions.

But we've been poor at defining what winning strategies will look like as actual businesses.

The biggest challenge facing robotic companies in achieving market penetration is **-** Mother Nature. All companies developing technology for the farm are at the mercy of a crop's growing cycle and an uncontrolled environment. Unfortunately, many of these crops have annual cycles with single harvest periods. That means your trial environment is severely limited.

As a result, it's not a surprise that development times for these robotic technologies have been so long. It's a function of iterations and hardware iterations aren't quick even in a fully controlled, 24/7 operating environment. Throw in all the variability associated with weather, seasonality, genetics, cultural practices – and it's a tough nut to crack.

The World Agri-Tech Investment Summit takes place in San Francisco 19-20 March 2019 and in London 15-16 October 2019

SAFETY ALWAYS FIRST

IAgrE is involved with two leading Farm Safety organisations as they work to reduce both the physical and mental challenges of farming.

IAgrE is one of 20 organisations partnering with the NFU in the **Farm Safety Partnership** which has committed to work towards reducing farm work place fatal accidents by 50% by 2023.

To help achieve this ambition, the NFU and FSP partners are launching a year-long safety campaign in 2019 focusing attention on four of the top causes of farm work place fatality and injury.

The aim of the campaign is to highlight changes that can be made by farmers to farm work place behaviours which if implemented have the potential to significantly improve the safety record of agriculture and save lives often at minimal cost.

The themes for 2019 are:

- **Transport** – January - March
- **Livestock** – April - June
- **Children** – July - September
- **Falls from height** – October – December

FSP chairman, Stuart Roberts said "Our ultimate ambition is to reach a point where there are no deaths in the farming industry. Our target on the way to achieving this is to at least halve the number of deaths over the next five years.

"We are all aware that agriculture has a terrible track record when it comes to health and safety in the workplace, and the FSP is working with the industry to reverse this.

I genuinely believe we are starting to see farmers and their workers responding and it's now time to redouble our efforts in this area. Initiatives launched by the NFU and other FSP partners are having a positive effect, but we need to see more action on the ground.

"With the partnership delivering a coordinated campaign and looking at specific actions each season, we can really focus our approach on changing behaviours.

A new NFU Vehicle Health Check Guide has been released to help farmers maintain and use vehicles safely and comply with the law. Members can support the transport safety focus on social media using #drivesafetyforward.

Farm Safety Partnership

Fatalities in agriculture 18 times the rate for all industry

Figures published in the Health and Safety Executive's report 'Fatal injuries in agriculture, forestry and fishing in Great Britain 2017/18 show 33 people were killed as a result of farming and other agriculture-related activities during the year.

Being injured by an animal – work with and near cattle caused the most deaths.

Agriculture has the highest rate of fatal injury of all the main industry sectors, around 18 times higher than the All Industry rate – and nearly half of the agricultural workers killed were over 65.

MIND YOUR HEAD CAMPAIGN

IAgrE is supporting this year's Mind Your Head campaign.

The campaign is organised by leading farming charity **Farm Safety Foundation** to raise awareness and tackle the stigma of the growing issue of mental illness in farming.

Recent research by the charity reveals that 81% of farmers under 40 believe that mental health is the biggest hidden problem facing farmers today and 92% believe that promoting good mental health is crucial if lives are to be saved and farmers kept safe.

Alastair Taylor, CEO of IAgrE said: "We are backing Mind Your Head! as it's important to raise awareness of the issue in the industry. Farming can be a highly stressful occupation and the industry is exposed to a unique set of circumstances and stressors. Farming has the poorest safety record of any occupation in the UK and stress is often a key factor in many of the accidents, injuries and illnesses taking place on farms".

Stephanie Berkeley, who leads the Farm Safety Foundation said: "The Mind Your Head campaign will continue to raise awareness of what the next generation consider the 'biggest hidden problem' in the industry and highlight the help available. This year we will also put a special focus on building personal resilience for farmers at this critical time".

DOUGLAS BOMFORD TRUST

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@BomfordTrust Secretary: Alan Plom
Administrator: Elizabeth Stephens

Douglas Bomford Trust Secretary Alan Plom writes: The role of the Trust in supporting students and funding research, study tours, etc, is very relevant to the theme of this issue of Landwards, which is focusing on *'The Next Generation'* and asking what talents will be required and how they can be recruited.

MEET A TRUSTEE

In this column I would like to introduce our Trustees. First to be highlighted is one of our newer Trustees, **Eur Ing Dr Keith Hawken.** Keith is literally recognised worldwide, in his role as the AEA's Technical and Standards Director. In addition to his direct and influential links with manufacturers, Keith brings to the Trust his 45 years' experience of working in the industry and with standards organisations internationally. He started his career as an apprentice Tool Maker/Fitter and Jig and Tool Design Draughtsman (with Qualcast) and subsequently worked for ATCO and Bosch, before joining the AEA in 2000. On the way, his knowledge and expertise has been recognised by various professional and academic qualifications, including his Doctorate through US Universities in Delaware.

Keith recently gave a presentation on behalf of the Trust to the ***Agricultural Engineers Association (AEA) Education and Training Committee***. Keith explained the role of the Trust and our strong desire to get manufacturers and other organisations to identify and provide opportunities for our sponsored students to receive mentoring and gain experience of the industry. The Arkwright Scholarship Scheme, which aims to encourage A-level students into engineering, was also welcomed. We hope to follow this up with a presentation to the AEA's Outdoor Powered Equipment Committee.

HARPER ADAMS SCHOLARSHIPS

The Douglas Bomford Trust work closely with the Harper Adams Development Trust to allocate a number of Scholarships each year to support students of agricultural engineering.

Trustee Professor **Paul Miller** attended HAU's Scholarship Presentation Ceremony on 13 February to present our Certificates to the latest round of successful applicants who were interviewed last November. These were: **Alan Mobbs** and **John Nixon**, (both on the MEng Agricultural Engineering course); **Matthew Torok** and **Sam Scales** (on MEng and BEng Automotive Engineering (Off-Highway) courses respectively) and **Thomas Mellor** (BEng/BEng Hons Agricultural Engineering).

They intend to use their funding for a variety of purposes, varying from purchasing reference materials, IT equipment, CAD software, etc, to help with their coursework and projects or to overcome physical difficulties, to developing a 'Cutting Edge' lawn mower racing team. In addition, The Trust also agreed to provide some extra funding for **Anita Woolf**, who received a DBT Scholarship last year, to help her establish a 'Women in Engineering' Network at HAU. We wish them all good luck.

INTERNATIONAL INFLUENCE

We have mentioned before the interesting international 'Desalination' Project the Trust was funding at **Aston University**. This is one of several international projects that we are currently funding and it has successfully brought together students from universities in Israel, Jordan and Palestine, together with the UK.

The first phase of the project is nearly complete and the project leader Dr Phillip Davies has recently moved to Birmingham University. Trustee **Professor Paul Miller** and Secretary **Alan Plom** recently met with Dr Davies and his associate Clive Lipchin (Head of Centre for Trans-boundary Water Management) from the Arava Institute for Environmental Studies in Israel, who outlined their interesting philosophy for stimulating peace and development through cross-border collaboration.

Although they hadn't recognised it, the increasing demand for water and improving soil condition to meet the global challenge to feed the increasing population will help to develop and steer more young people involved in what they saw as 'environmental studies' and engineering (in its various 'pure' disciplines) towards agriculture.

TRUSTEES R.I.P.

It is with great sadness that we report the recent deaths of two of our ex-Trustees.

JIM ROBINSON passed away on January 17th after a short illness. He was Vice Chair of our Board of Trustees when he stood down in November 2016 and was well-known throughout the industry, having studied at the National College of Agricultural Engineering, Silsoe in 1967-70, alongside current Trustee and ex-Secretary Paul Miller. Jim brought expertise gained in the sugarcane industry and as a Mechanisation Adviser with Massey Ferguson Export. He was instrumental in initiating our involvement with the ***Arkwright Engineering Scholarship Scheme***. One of his legacies will be this Scheme continuing to successfully encourage young (A-Level) students into agricultural engineering.

ANTHONY BURGESS MBE, died suddenly on 1 November 2018. Although not a member of IAgrE (he was a Chartered Accountant), Tony made a significant contribution as a Trustee and supporter of developing young agricultural engineers. He was MD of the family business F H Burgess for over 30 years. Throughout his career in accountancy, Tony also maintained a direct interest in farming through managing his own 70-acre arable and timber-growing farm. He was also on Harper Adams' Board of Governors for 25 years before becoming Chair of the Harper Adams Development Trust in 2004. Tony was also a director of the Agri-Food Charities Partnership (AFCP), and he received an MBE in 2016.

MEMBERSHIP ENQUIRIES
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Happy Birthday NIAE

25 November 2018
Report by William Waddilove

Well it would have been happy birthday if The National Institute of Agricultural Engineering (NIAE) had still been there. November 1948 was the date when King George VI visited this revered establishment of Wrest Park at Silsoe, Bedfordshire. English Heritage who now have full possession of the house and its grounds wished to celebrate the anniversary.

This was a special open day to publicise some of the work that had been done there. IAgrE were invited to have a stand and had assisted in some of the exhibits which were spread over the state rooms (the large ornate rooms along the back of the house overlooking the garden).

One of the focal points of the day was a talk about the history of Wrest Park and the Institute. Whilst it was publicised and they said no booking was necessary it attracted a lot of our members and ex staff including ex-president Brian Legg, who had been the penultimate director. They had put out about 50 chairs but at the first presentation there had been over 100 present and they were standing outside the door to listen! But it was a good summary of the history of the house and the estate.

The displays featured the work of the NIAE and development projects although they barely touched on the small area that I had been involved in as part of the farm building department studying the treatment of animal waste. The day had attracted a lot of ex staff and I met one who had been working on a related project albeit after my time! I also met some old staff who had wanted to go along their usual corridors but were now 'prevented' (well it is not their building any more). In a way it was disappointing that so little of this magnificent country house building was accessible although we were able to enjoy the extensive gardens.

The old ADAS offices on the ground floor were now an exhibition about the de Grey family who had owned it and alongside one of the walled gardens was a newly built café. I had hoped to have ventured around the many buildings I knew but they seemed out-of-bounds, so I never saw where the 'artificial pig' (heated by electricity) and other projects were based.

And regards the college, all the building is demolished, and this included the several buildings that the Institution had occupied. I think the estate designers could do to invest in a ruler! There seemed no organisation or structure to the wiggly roads.

IN BRIEF

CONTACT DETAILS

Members are now able to access other members contact details from the website database - unless a member has specifically chosen to opt out. To look at this facility and/or to opt in or out, please log onto the IAgrE web site.

IAgrE ON BBC RADIO4

Professor Jane Rickson, IAgrE President took part in the BBC Radio4 Farming Today programme on Saturday 26th January which looked at agricultural technology. Part of the programme concentrated on the Agri-Epi Centre Hub at Cranfield, one of four Agri-Tech centres established by the UK government.

ERRATUM

In the IAgrE 80th Anniversary publication, Horizons, there were two errors in the listing of Past Presidents
1969-1971 should read H C G Henniker-Wright
1988-1990 should have read Professor B D Witney
We apologise to members and readers for this error. *Ed*

BELOW: IAgrE President Jane Rickson and former President Paul Miller man the IAgrE stand (left), whilst another former President John Fox (right) signs the 'I Was Here' book.

New Members

We have recently welcomed two new Commercial Members to IAgrE, from two different regions and completely different businesses. To illustrate the diversity of IAgrE membership, we profile below both companies – and welcome them to the Institution of Agricultural Engineers.

ACE AQUATEC LTD

Ace Aquatec partners with world leading experts in different scientific fields to apply breakthrough technological developments to aquaculture and marine industries.

Co-founded in 1999 by inventor John Ace Hopkins and investor Annette Pyne-Carter after they saw the impact that technological innovation could have in accelerating the adoption of responsible fish farming practices.

From it's head office in Dundee, Ace Aquatec manages global R&D projects, manufacturing at two UK factories, and co-ordinating installers and engineers worldwide. They also have a Canadian office and distribution partners in key markets.

Ace Aquatec has grown from a family run business into a global supplier of aquaculture solutions retaining a key focus on local partnerships and personal customised solutions.

ORBY ENGINEERING

Newry-based Orby Engineering is a long-established company with over 60 years engineering experience and is famed for manufacturing high-quality feeding systems for dairy parlours. The company (originally based in Portadown) was founded by Orby Brown, who ran the family-owned business for many years. When the company came up for sale due to retirement the Brown family were happy to sell the company to Stephen Cromie, the managing director of Exact Group NI.

With a background in farming himself, Stephen did not have to be convinced of the merits of the Orby feeder, as his father had used Orby feeders in his milking parlour for over 30 years and never once had to repair them.

Stephen and his wife Marie strongly believe that Orby can now be taken to another level with increasing marketing activity and more efficient manufacturing processes.

NOTICE OF MEETING

Notice is hereby given that the **Seventy-third Annual General Meeting** of the Institution will be held at the **National Fluid Power Centre,** Carlton Road, Worksop S81 7HP on **Thursday 2nd May 2019 at 11.15am**.

AGENDA

1. To receive and confirm the minutes of the seventy-second AGM held on 24th May 2018.
2. To propose as an Ordinary Resolution: ***"That the Annual General Meeting authorises the Trustees of the Institution to review members' subscriptions and to make such adjustment, if any, as may be required with effect from 1 January 2020"***.
3. To consider and adopt the Annual Report for the year ending 31 December 2018.
4. To receive and adopt the Accounts for the year ending 31 December 2018.
5. To announce nominations for election to Council for the 2019/20 Session.
6. To re-appoint Landers Accountants Ltd, registered auditors, as reporting accountants and to authorise the Executive to fix their remuneration.

By Order of the Trustees

A.J. Taylor . **Alastair J Taylor, Chief Executive & Secretary**

NB: ALL PAPERS ARE AVAILABLE ON THE IAGRE WEBSITE

SHARING THE KNOWLEDGE

Alan Plom writes: Reading in Landwards about the interesting speakers and diverse topics presented at Branch meetings is a good source of ideas for other Branches. SEM Branch hasn't reported on our activities for a while, so this summary of meetings from the past couple of seasons might give some inspiration.

IAgrE faces the challenge of recruiting and retaining new members and this edition of Landwards is focusing on the 'Next Generation'. Branches can play an important role in attracting 'pre-professionals' and South East Midlands Branch have tried various ways to get younger people involved.

STUDENT COMPETITIONS

For many years, our AGM in February has been based around a competition for students**.** Four or five are invited to present a 15-minute summary of their research and answer questions. They are judged on style of presentation, their ability to take questions, use of visual aids; technical content and clarity of message. The winner receives a £100 cheque, but all participants benefit from the discipline needed and many have gone on to hold significant positions in the industry, worldwide, too.

Two years ago, all four students were from Cranfield University. As ever the competition was close - so much so that the judges called it a draw between **Agnese Mancini** (who spoke about soil micro-topography and the effect of different cover crops on soil erosion) and **Tom Storr** (on the potential of companion crops with maize to improve soil health and yield).

Participation in our Competition has also encouraged some postgraduate students not on 'pure ag-eng' courses to join IAgrE. Last year's winner **Jon Beale**, working at Cranfield on field-scale measurement of soil moisture using satellite data and 'cosmic ray probes', chaired the Inst of Physics West Midlands Branch was also stimulated to join IAgr"

in 2018, Harper Adams University (HAU) was ably represented by **Toby Adeyemi,** who spoke about predicting water status (and stress) of plants using transpiration dynamics. We were also pleased to welcome **Martin Wozencroft**, a first from the Royal Agricultural University (RAU). Martin's ideas to develop an autonomous litter picker for dangerous environments such as highway verges epitomises the breadth and influence of 'agricultural engineering', as it is uses similar technology to auto-weeders.

This year the competition also had a distinctive soils theme, and was won by **Guillaume Blanchy**, from Lancaster for his presentation 'Hydrogeophysics - its capabilities and limitations'.

Next, husband and wife duo from HAU was another notable first. **Magdalena Kaczorowska-Dolowy (Magda)** is the third in the series of HAU's 'Traction and Tillage' projects, demonstrating how Controlled Traffic Farming (CTF) can increase crop yield through improved root development. Magda's 'other half' **Przemek Dolowy** (linked with Dublin University as well as HAU) is investigating whether soil compaction can be detected using remote 'non-invasive' proximal sensing methods, such as electro-conductivity scans and Ground Penetrating Radar (GPR) - also comparing different traffic regimes, cultivation depths, and monitoring crop performance. GPR has shown tentatively promising results.

Another first timer from Nottingham University was **Dimitrios Mallis** .

He intrigued us illustrating how a new (digital) approach for animal monitoring can be used to estimate 'high-level' animal behaviour, improving efficiency and animal welfare. 'Landmark Localisation' is an improvement on current image analysis techniques, which have limited ability to correlate body parts.

Finally, **Joseph Martlew** from Cranfield returned to the soils theme. His project aims to improve methods for quantifying and alleviating subsoil compaction, using laboratory research and NIAB's long-term field experiments to assess potential solutions to provide practical guidance for growers.

Our judges had a hard time separating their excellent presentations, but they managed to complete their deliberations during the Branch AGM, in time to hear our President **Professor Jane Rickson** give her President's address

The Branch also established **The Shepperson Award**, a trophy presented to a local post-graduate or under-graduate student each year in memory of Gordon Shepperson, a leading researcher in forage conservation at NIAE, Silsoe. This was presented at last year's SEM AGM to David Clarke but the Branch Committee is pleased that it is now incorporated in the "IAgrE CNH Industrial Award".

LEFT: 2018 winners Martin Wozencroft (RAU), Cranfield's Jon Beale (clutching his winners cheque!)

ABOVE: Gordon Shepperson Award winner David Clarke with Branch Chair Tim Chamen

ABOVE: 2019 Front row: Tim Chamen (Branch Chair) and Magda Kaczorowska-Dolowy (HAU). Back row: Joseph Martlew (Cranfield), Dimitrios Mallis (Nottingham), Przemek Dolowy (HAU), with winner Guillaume Blanchy (Lancaster).

ARRAY OF TOPICS

Having Cranfield University 'on your doorstep' is a good start! Speakers and topics over the past couple of seasons have included an introduction to the Agricultural Engineering Precision Innovation ***(Agri-EPI) Centre*** by **Ron Corstanje**, who described its new engineering and sensing technologies - benefiting from a combination of self-funded commercial projects and support from Innovate UK.

Last year, **Prof Stewart Williams** introduced us to '***3D printing and manufacture***, with a tour of Cranfield's internationally-renowned 'Wire +Arc Additive Manufacturing' (WAAM) facility.

We returned to Cranfield again recently for our first meeting in 2019, when we were treated to an excellent talk by **James Brighton** on ***"Advanced Vehicle Technologies in Agricultural Engineering"*** and a tour of the **Off-Road Dynamics Testing Facility**. The breadth of and investment in their work is staggering, including a test track for fully automated vehicles and a wide range of test equipment for tyres, transmissions, soil engaging equipment , advanced vehicle instrumentation and lightweight material structures."

Our technical programme follows the usual pattern starting in October and ends with a visit before the summer "recess".

We try to follow up meetings with related topics and visits to give members a 'feet on the ground' insight. Over the past 2 'seasons' this has included following up on a presentation in 2017 by **Russell McKenzie,** a farmer and Nuffield Scholar from Cambridgeshire who shared his experiences with ***no-till.*** Last summer we were able to compare a farm using low input systems on controlled traffic (CTF) with a conventional farm.

F.B. Parrish & Sons in central Beds have grown cereals, alliums and potatoes on a full CTF system for 10 years. Ploughing is no longer undertaken, and tillage inputs are decreasing each year. We then visited Lionel Shaw's farm on the outskirts of Luton - a conventionally managed farm which has gradually moved to a system of no-till (some fields for 10 years), successfully growing a range of combinable crops.

Unilever's **Dave Sharp** shared his 38 years of experience in ***tea production***, from field to teabag. We were surprised to learn that only two varieties (adapted to different climates) form the basis of all teas - from "white" to "black" - and it is just a matter of which leaves are picked, their subsequent processing and blending.

Mike Slater took us back to our long-running theme of '***soil health'***, stressing the importance of careful soil management to ensure long-term sustainable production and to realise the potential of new crop varieties and described how Frontier Agriculture's 'Soil Life' Service measures the vitality of soils and recommends solutions to improve them.

Committee member **Richard Jones** did not disappoint when he outlined the history and surprisingly diverse range of equipment produced by his company, ***Astwell Augers Ltd***. He suggested that to ensure survival of businesses, entrepreneurs need foresight, to be "light on their feet", and enjoy an element of luck.

This latter factor was well-demonstrated by a company at the other end of the size scale, when **Peter Delaney** described the worldwide development of ***AGCO's*** innovative new ***'IDEAL' combine harvester.*** Designed with ease of service in mind after an extensive survey of users, it won an Innovation Award at Agritechnica.

AGCO have produced an 'augmented reality' brochure and two stirring sales films showing this 'stealth-black' machine in action almost tempted some of us to open our chequebooks, but fortunately there were only 4 available for demo in the UK at the time.

In contrast, 'Kubota's Vision' gave us a fascinating insight into how a relatively small but global company, through customer focus, has set its sights on competing with the world leaders in tractor production. Training Managers Keith Miller and Mike Bywater showed the passion needed to make this a reality.

Deep Mukerjee from another multi-national manufacturer, Bosch Rexroth, spoke about Smart Machines and how ECUs, data connectivity and clever software are all helping to increase safety, efficiency, performance and reliability of their wide range of agricultural machines."

In the Spring we were treated to another fresh topic with a talk on ***pea and bean harvesters*** by **Robert Plant** of PMC Harvesters Ltd. Robert described the technology involved in today's complex machines, including PMC's unique five beater threshing and crop monitoring system.

An edifying talk on '***Electricides'*** by **Dr Mike Diprose,** was on a completely different wavelength! A pioneer of weed control using electricity, Mike has over 35 years' experience leading research at Sheffield University and is a Director of RootWave [a Ubiqutek brand]. This alternative method of weed control is now being commercialised for crop production and the amenity sector.

MEMBERSHIP

Like other Branches we are finding it difficult to get 'new blood' involved in the Branch. This has been much harder without the regular stream of new students and research workers following the demise of the Silsoe Research Institute and Silsoe College.

In addition to our annual Student Presentation Competition, we have looked outside our own discipline too. For example, we have held joint meetings with IMechE's Automobile Division, taking it in turns to choose the topic and provide a speaker.

We are also keen to attract and involve local farmers such as **James Hunter** a long-serving member and Vice-Chair of our Committee and we also recruited **Matt Redman** (a local farmer/contractor who writes for Farmers Weekly) after he spoke at one of our meetings.

We thank our speakers who have provided us with excellent and diverse presentations and commend them all to other Branches. Attendance at our Branch technical meetings isn't high but remains consistent at an average of 18

We have discussed trying to reach out to a wider member audience by holding a technical meeting during the day rather than in the evening or recording presentations and making them available online.

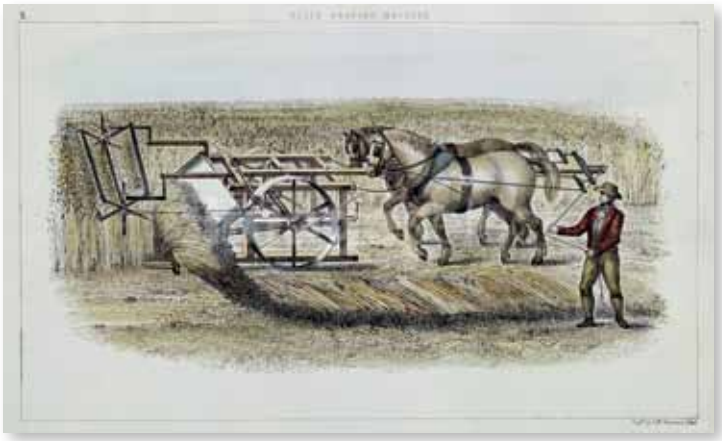
Jaguar and Land Rover; iconic British cars and business for over 70 years
John Holland, Jaguar Land Rover
13 November 2018
Report by William Waddilove

Beginning his presentation with the original 1948 homemade video by the Wilk's brothers playing in the first prototype Land Rover on the beach at Anglesey, our members knew they were in for something special from our guest speaker John Holland.
John has been with the company for over 21 years and came to share the rich company history and some exciting adventures throughout his automotive engineering career.
Today John is the Head of The Jaguar Land Rover Way; the integrated management system through which JLR delivers great performance through high standards, effective processes and disciplined control, all based on learning and improvement.
John also leads JLR's global corporate intranet for the 44,000-strong workforce; the framework of how new businesses are delivered; a programme of business excellence and has recently been invited to lead the first stage of the exciting partnership with Waymo, the world's leading fully autonomous car company, with JLR's new incredible I-Pace SUV Battery Electric Vehicle (BEV).
The stories behind the modern company began, Jaguar Cars Ltd. emerging out of William Lyon's SS Cars since 1922, and also post-war Rover developments with brothers Maurice and Spencer Wilks, Chief Engineer and Managing Director respectively, together launched the first Land Rover. The whirlwind history of both companies continued with many videos of the iconic and spectacular products throughout the years.
The journey continued with the most beautiful E-Type Jaguar, to the record-breaking Range Rover flagship of the brand, however John explained his particular passion for the Discovery, for which he has previously held the positions of Launch Manager and Manufacturing Principal Engineer.
John described the journey up until the current ownership under the Tata Group.
With a history in farming and agriculture, where a very practical approach to problems is needed, John says he loves solving technical problems with machinery, and at JLR, working on engineering, manufacturing and warranty problem solving over the years, he developed to become the Head of the 6-Sigma Programme, as a "Master Black Belt" leading many thousands of specialists in engineering and business improvement projects. *"The secret, in a complex industry, is to talk to people, often the combination of observations, opinions and experience of others can help you identify the root cause of seemingly complex problems"*.
He was particularly proud about a particular problem that he solved, and John showed us the patent certificate

featuring his name.
We were all inspired by John Holland's 'we can do' approach.
Having spoken about the first Land Rover he showed us some pictures of the new Defender, but sadly only those as guessed by various car magazines, and then told us we would just have to wait for the official launch!

The Reverend Patrick Bell and his Great Invention
Speaker: James Wallace
4 December 2018
Report by William Waddilove

James Wallace now proudly celebrating his 94th year and our oldest branch member has been fascinated by the design and development work of the Reverend Richard Bell (1799 to 1869).
Probably being an engineer at the Massey Ferguson Kilmarnock factory where they made combine harvesters helped his interest.
James love is still combine harvesters and what they do; he has after all spent all his life working on them.
The forerunner of the combine harvester was Bell's machine. Bell was concerned that heavy manual work was making young men old before their time. One of the foremost tasks that were doing this was scything.
In Scotland that would probably be the oat crop that would stand chest height.
He was concerned that there must be a better way and so secretly he made a machine. It had to be done secretly for fear of a Luddite reaction.
To test the cutting action he had to create a crop by standing up stalks of cereal in lumps of clay.
The machine was successful, and he was willing to share the design. We don't know how many machines were made but the same principal is still used. Take control of the crop and guide it to the cutting mechanism and then pass it in an orderly manner to the next stage.
Discussion concentrated on the continued development through the knotting mechanism to the binder and onto the combines that James had been involved with. At first there were combines imported from America, but the headers were designed and made there as the conditions here are very different with much heavier crops and rain. The discussions also included him talking about the design of guards which involved his interactions with the safety the design process.
The creation of Bell's cutting machine was so well thought of that the news reached the London papers and upon his retirement he was awarded £1,000 to assist his retirement.
James did ask all those in the room if anyone had worked with horses? (No one had besides himself as a young boy) and 'Was there anyone who had used a scythe?' (A few)
We ended the meeting with a short film showing how scythe blades were made in a water powered forge in the 1950's.



Electric car battery technology
CAFRE Greenmount
31 January 2019
Report by Terence Chambers

We enjoyed a presentation and interactive discussion on the subject of the engineering challenge in the transition from "**ICE (Internal Combustion Engine) 2 ACE (Automated Connected Electric) power for vehicles"** by Joseph McCullagh, an electrical engineer with Jaguar Land Rover (JLR).

He began his presentation showing that electrically powered vehicles are not a recent invention. Work to use electrical power for vehicle propulsion started back in the mid-1800s with the work of Auyas Jedih in Hungary (1828) and Thomas Davenport in the US (1834).
The invention of the lead-acid rechargeable battery in France (1859) by Gaston Plante made mobile propulsion, without a trailing power lead or external conductor rail connection, feasible for vehicles. The first production electric car in the UK was produced for taxi work in London by Thomas Parker (of the Elroll-Parker Company) in 1884.
Production of the affordable, mass produced Model T Ford, from 1908, brought popular motoring to the wider public. The electric starter (invented by Charles F Kettering in the US in 1912) was quickly and widely adopted across the industry because it made petrol cars safer and easier to operate. As a result, electric powered cars had lost most of their market share to petrol powered versions by the 1930s.
However, some electric vehicles continued to be used for short-range urban delivery work. Around 1961, the National Union Electric Company in the US built a small electric car, the Henney Kilowatt, with a 40 miles range. By 1990, environmental concerns about vehicle exhaust emissions in cities prompted California State to introduce new air quality standards.
Silicon Valley entrepreneur Elon Musk boosted the concept further in 2008 by introducing his well- publicised Tesla Roadster luxury electric sports car. Other manufacturers were also involved in developing either hybrid or fully electric cars. The best known and first mass produced hybrid was the Toyota Prius with over 4.3 million having been sold worldwide since its introduction in 1997.
Electric-only vehicles, also known as Battery Electric Vehicles (BEVs) which do not have an internal combustion engine, have been introduced by mainstream car manufacturers and have now gained a significant share in this sector of the market. Examples include the Nissan Leaf (2010), the Mitsubishi i-MiEV (2010), the Renault Zoe (2012), the BMW i (2013) and Hyundai Ioniq (2016). Jaguar Land Rover's all electric vehicle (2018) is the I Pace which is a performance all electric 395 BHP all-wheel-drive SUV.

BATTERY
The Lithium -Ion battery is the heart of an electric car. It is a high cost item making up around 1/3rd of the total cost of the vehicle. Typically 450 v drives the traction motor and there is also a 12v system for the vehicle management system and ancillaries. Battery discharge generates heat (some of which can be utilised for cabin heating) and requires clear ventilation around it. Because of the substantial amount of energy stored within a charged battery it must be well protected from impacts or any circumstance which could cause a short circuit. Manufacturers work closely with road traffic safety authorities to ensure that safe isolation methods are in place and emergency service personnel know what to do following a vehicle collision involving an electric vehicle. Lithium -Ion Phosphate (LIP) is the current favoured battery chemistry but others also exist such as nickel manganese cobalt (NMC). The Jaguar 90 kWh battery has 36 modules (each module has 12 cells) and is built in Poland.

THE MARKET
The rise in the electric car market has increased demand for the rare metals, such as lithium, required for battery production but there are practical constraints. Customers, accustomed to their previous IC engine vehicles are impatient to ask for the highest performance standards and convenience.
One of these is the demand for increased range which can only be achieved by increased battery capacity and cost. In some markets the slow rate of development of a charging station network still makes it difficult to rely on an electric vehicle for long range travel and there is a demand for shorter charge times.
All vehicle types can be subject to negative publicity arising from reported incidents. One example, in the US, was around a fire which occurred in a Chevrolet Volt plug-in hybrid electric vehicle. This occurred when it was parked outside some days after a routine official government crash test. The cause was traced to an inflammable coolant leak ignited by a battery short-circuit around some damage caused during the side impact test. No such incidents have been reported since involving similar vehicles involved in road traffic collisions.
Before the chairman thanked Mr McCullagh for his most interesting and informative presentation, a further interactive discussion continued.

EAST MIDLANDS BRANCH

Customers First: Kubota Vision
Talk by Keith Miller and Mike Bywater
Held at Quorn Lodge, Melton Mowbray
13 November 2018
Report by Richard Clarke

Kubota have been around for years, we have all seen their equipment at local parks, on golf courses, on building sites and we have seen small compact and agricultural tractors around and about on the land.
But things have been changing, Kubota's continuous international growth is now putting them firmly in the larger tractor sector.
An informative presentation was given to the East Midlands branch of the IAgrE by Keith Miller, Service and Training Manager of Kubota UK and his colleague Mike Bywater, Group Training Manager also of Kubota UK.
Most of us present were surprised at the scale of Kubota globally. They have a product footprint in 110 countries, with 30 offices logistically placed between them. This in turn gives employment to 39,000 people worldwide in the various parts of the business.
Having expanded into Europe in 1974, Kubota have concentrated in growing five divisions within the company: Tractors, Ground Care, Construction, Engines and Spare Parts. Each of these has grown considerably since those early years and continues to do so with recent acquisitions such as Kverneland and Great Plains.
Back to the main subject of the evening - getting into the larger tractor sector, which already has four main players which have been dominating the market over the years. This called for a large cash injection in R&D, various focus groups were used to lay down the tractor specifications and features that would be required and that farmers wanted to buy. A new European factory was built in Northern France to accommodate the production of these new tractors.

The first five 'hand-built' tractors were used for the product launch in 2014 in France, which saw a wave of European dealers and customers get their first glimpse of these new larger tractors called the M7001 series (130-170hp). The following year production of these tractors started, along with an intensive dealer training programme to get the product out there and supported.
Keith Miller and his fellow colleagues at Kubota knew that product support would have to be second to none if they were to hit the ground running in this market. Over and above normal guarantees that were given to customers who purchased these larger machines, Keith felt other initiatives were required. Downtime would be limited to 24 hours before a replacement tractor was provided if a breakdown could not be fixed in that time.
Spare parts would be made available 24/7 by using a third-party company specialising in this process.

Dealer technical training was paramount to support this new product, with the main focus to get technicians to fix any problem first time.
The very first 50 tractors were professionally installed by Kubota UK with local dealers used for observation and assistance.
Regular farm follow-up visits were carried out by Kubota UK and dealer personnel to make sure these new larger tractors were reliably and efficiently doing what they were supposed to do.
Twice a year Japanese engineers still come over to the UK (as well as other European countries) to audit a number of these new higher horse power tractors, this process is called Kubota Insight Programme (KIP for short).
Last year 17 tractors came under close scrutiny in the UK. Customers are encouraged to oversee this exercise and to converse with the engineers and brainstorm ideas for the future, whether this is for new features, improving current ones or steering design for future development.
So far so good as the saying goes, with Kubota market share now growing in this new area of the business.
Other initiatives have been introduced in recent times to complement not just the larger tractors but other products Kubota manufacture.
On board diagnostic tools for machines that can support them, along with electronic database sharing of technical information which allows for rapid knowledge growth across the various markets.
Product update campaigns to fix known problems quickly and avoid downtime for other customers.
28 members and guests enjoyed an excellent evening with Kubota UK, giving us a great insight into how a manufacturer goes about bringing a new produce to market.

WESTERN BRANCH

Beer sampling with Gin chasers
Ramsbury Estates
3 October 2018
Report by Mike Whiting

The Western Branch of the IAgrE doesn't hide the fact that alcoholic refreshment provides a focal point when planning visits.
So after Wadworth's in Devizes and Thatchers in Somerset, our Chairman Rupert Caplat recommended a visit to Ramsbury near Marlborough in North East Wiltshire.
With the backdrop of the 19,000-acre Ramsbury estate, the brewery promotes sustainability throughout the process. The essential steam raising plant is fired by a biomass boiler charged from the sustainable woodland, with pigs consuming spent brewers waste which are destined for the smoke house and then the charcuterie. Most importantly the estate barley harvest is hauled to the maltings and then returned to the brewery after steeping and kilning.
Dhiraj Pujari was our tour guide for the evening who is also the head brewer and distiller. Whilst we ascended the open mesh stairs to peer into the huge vats, Dhiraj updated us on the principal facts for striking the balance to a perfect brew.
A temperature of 66°C is the optimum for releasing the barley enzymes, with a maximum hot water temperature of 72°C. The basic and common ingredient of H_2O is drawn from the estate's own borehole.
Three is the magic number with regards to the variety of hops required which are added at various stages of the brew.
The first hop provides the bitterness, a result of the alpha acid oil content and stays in the longest for the complete 75-minute boil. The 2nd hop supplies

the flavour and the third giving the aroma. Ramsbury ensures that it has a full range of options on the raw material supply front with access to 30 varieties of the brewer's favourite flower.
Fermentation takes between three to four days with the process continuing, albeit much slower up to the point of delivery to the glass. No extra enzymes are added which keeps the weekly production of approximately 35,000 pints as an unadulterated brew.

The majority of Ramsbury's output is destined for the casks and then distribution to pubs within a 30-mile radius. Although 40,000 litres are bottled each quarter by a contracted packer which keeps the on-site shop well stocked along with other specialist outlets.
After the group "QC checked" some samples of the Ramsbury beers, we then moved onto the distillery where the Gin is produced. We were introduced to another "Willy Wonka" set of stainless-steel pipework and copper vessels. Keeping the raw material balance right, gin uses the Ramsbury Wheat as its principal ingredient.
This is milled through the on-site grinder with enzymes added to breakdown the starches which doesn't occur naturally with the cereal grain. Distillers yeast is included in the ingredient list to generate an initial "slurry" mix. For those who prefer a Russian twist, the distilling method initially delivers a sample of vodka.
The key temperature in gin production is condensing alcohol from 78.5°C, so take the simple principle of evaporation in a tall vessel, and you'll be left with an "unrefined" sample. Although it's not that straightforward as the initial liquid racked off consists of "head", "hearts" and "tails". The latter two references are "reworked" to extract further available alcohol content.
Keeping the sustainability principal, waste is minimised resulting in an output of 1200, 70cl bottles per day with deionised water tempering the strength. Gin connoisseurs will be interested in the other flavourings which include; juniper, coriander, cinnamon, quince, lemon and orange peel, orris root and angelica.
The guided tour was enjoyed by all with Dhiraj having to restock his shelves in the shop after our visit. Well worth scheduling a visit when travelling through the glorious Wiltshire chalky rolling hills.

WREKIN BRANCH

Datatag security systems
AEIC Harper Adams University
13 November 2018
Report by Bill Basford

Dave Luscombe outlined the development of Datatag with Cesar systems established now for 25 years to an audience of both students and long serving members. Initially the system was developed by Yamaha and Matsui in 1992 the company being now privately owned from 2007.
Within the agricultural sector it was reported that in the UK 75% of new equipment was now involved with Datatag whilst 100% of motorcycles and jet skis sold within UK feature the system. The latter sector, with some other boats was reported as also used as a control system with prospective launches into harbours as a means of controlling not only theft but other criminal activities.
The Datatag system can include literally thousands of unique identification marks or tags (some smaller than a grain of rice and other traceable ultra violet dots) which can be permanently hidden within any property. Any thief then has the impossible task, even if main identifier plates are removed, of removing every single identification mark without damaging the stolen property to avoid the risk of detection. A Police Officer then only needs to locate and identify one or two of the marks to assist with a prosecution.
Datatag has made a major impact on reducing theft and the Crown Prosecution Service has a 100% successful prosecution rate when evidence has been supplied by Datatag. The systems are used to deter theft but increasingly they are being used as a valuable asset tracking system.
Accreditation has been granted to Datatag and Cesar systems all over the world with some major companies adopting the system since 2007 finding plant theft reduced by 63%.
It was reported that non Datatag market had an 8% equipment recovery post theft whereas 28% were recovered with the system.
Thus, insurance companies support the system often allowing premium discounts for use.
Major construction and city projects were reported to only permit Datatagged equipment on site for use and in the future emission control zones may only permit emission level tagged equipment to function.
Whilst border controls into UK are often directed to imports, the inclusion of Datatag has been linked to export prevention, even that vehicles in transport when stopped can be quickly scanned to determine ownership through a 24/7 call centre run by Datatag. Highways England is showing interest with training programmes reported for their patrol officers.
Retrofitting to vehicles was described being a reasonably low cost, as was hand and portable tool / equipment safeguarding. Whilst the security benefits described were a little off the normal beaten track for engineers the meeting gained a tremendous insight into asset protection and control.
www.datatag.co.uk

MEMBERSHIP CHANGES

ADMISSIONS
Member
Dale N (Yorkshire)
Gamble S (W Midlands)
Harper N (South Eastern)

Affiliate
Nichol G (S E Midlands)

STUDENTS
Cranfield University
Ene J
Fungenzi T
Martlew J P

London South Bank University
Idoje G O

University of Surrey
Xin Y

Prior Park College
Pickford B R

Sparsholt College
Baja J
Brearspear A C
Castle A J
Cross T F
Deadman A M
Flett J
Holland P
Hussey B
Kimber A
Maslen G
Millward M R
Murphy Cooper C J
Osmond E R
Phillips Beck C
Rose M
Sollis H B
Styles D
Walker T J

Wiltshire College (Lackham)
Beach T
Collier A
Currier-Teal J
Ford J
Gill J
Godwin G
Harris T
Head O A
Isaac A
Keen J
Kinsella A
Moate L
Oram L
Pollock K
Russell A
Simpson B
Stone T G
Ward K
Waterson W
Wheeler J
Williams J
Willis M

Liverpool John Moore University
Whitfield J A

I T Tralee
Bourke M
Folan P
Cusack S
Dean A
Hanley C
Hayes M
Hogan A
Hurley L
Mahon W
Moran C
O'Carroll A
O'Mahony T
Lawlor J
Tuite Maxwell J

University of Nottingham
Bhakkad Y
Chua Y S
Keen F C

Brooksby Melton College
Clarke H
Measures S
Peel C
People R
Seward O
Turbayne A
Watmough H
Webb D T

Harper Adams University
Chen X
Wu Y
Chen X
Chen
Roskell S
Fulton J

CAFRE Greenmount
Adair S
Angus T J J
Buttimer C
Darragh B
Davison A
Devlin M
Duncan J W
Goligher C
Jenkins M R
Lagan J M M
Mathews C
McCormick R J
McIlveen A
McIvor A
McKeag A
McMinn B
McMullan L
Meredith J
Parks M
Patton S
Robinson C S J
Sands E M
Sharhey S

READMISSION
Dr Obiechefu G C (Nigeria)
Dr Kaumbutho P G (Kenya)

DEATHS
We have learned of the death of the following members, and send our condolences to their family and friends
Webb G F AIAgrE (Member since 1953 Southern)
Robinson J R MIAgrE (Member since 1968 Southern)
Pinnock C N EngTech AMIAgrE (Member since 2012 South East Midlands)

TRANSFERS
Fellow
Dr Opara L U (South Africa)
Members
Carnell T (Western)
Clarke P (S Eastern)
Pattenden S C (East Anglia)
MacCurrach-Paine P (West Midlands)

Associate Member
Kings J J (East Midlands)

ENGINEERING COUNCIL REGISTRATIONS
CEng
Gamble S (West Midlands)
EngTech
Carnell T (Western)
MacCurrach-Paine P (West Midlands)

LONG SERVICE CERTIFICATES (1 January to 31 March 2019)

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

Name		*Date of Anniversary*
60 years		
Paul William Palmer	FIAgrE	13 Jan 2019
Michael James Hadley	MIAgrE	10 Mar 2019
50 Years		
William Beattie	MIAgrE	16 Jan 2019
Paul Charles Harvey Miller	HonFIAgrE	16 Jan 2019
35 Years		
James Peter Grindley	MIAgrE	9 Jan 2019
Jack Gilbert Ranyard	FIAgrE	12 Jan 2019

Name		*Date of Anniversary*
35 Years		
James Robert Meredith	MIAgrE	9 Feb 2019
David Alexander Frizelle	MIAgrE	6 Mar 2019
Nigel David Ede	MIAgrE	27 Mar 2019
25 Years		
Andrew Charles Newbold	FIAgrE	18 Jan 2019
Charles Timothy Pratt	MIAgrE	8 Feb 2019
Ian John Sayers	FIAgrE	23 Feb 2019

ACADEMIC AND COMMERCIAL MEMBERS

ACADEMIC MEMBERS

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

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

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

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

Orby Engineering
Unit 7-8 Craigmore Industrial Estate
Craigmore Road
Newry BT35 6LF

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

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

Household Sprayers
Roughton Moor
Woodhall Spa, Lincs LN10 6YQ

HSS Hire
25 Willow Lane, Mitcham
London CR4 4TS

JCB
Rocester, Staffs ST14 5JR

John Deere Ltd
Harby Road, Langar
Nottinghamshire NG13 9HT

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

Mastenbroek Ltd
83 Swineshead Road
Boston, Lincs PE21 7JG

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

Orby Engineering
Craigmore Road, Newry BT35 6JR

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

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

FORTHCOMING EVENTS

IAgrE EVENTS

Thursday 2 May 2019
Council Meeting followed by AGM and Awards
National Fluid Power Centre
Carlton Road, Worksop

Wednesday 21 August 2019
IAgrE Forestry Engineering Group (FEG) Symposium
Theme: New Developments in Timber Extraction
Newton Rigg

Thursday 17 October 2019
Council Meeting
Severn Trent Water (tbc)

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

BRANCH EVENTS 2019

EAST MIDLANDS
CONTACT: Richard Trevarthen
01509 215109
richard.trevarthen@gmail.com

Tuesday 12 March 2019
***Visit: Belvoir Brewery* 7pm for 7.30pm**
The visit includes a tour of the Brewery, followed by a buffet supper, Belvoir Brewery, Station Rd, Old Dalby, Melton Mowbray LE14 3NQ

Tuesday 9 April 2019 7pm for 7.30pm
East Midlands Branch Annual Dinner & AGM
The AGM will be followed by a two course Dinner
Quorn Lodge Hotel, 46 Asfordby Road, Melton Mowbray LE13 0HR

NORTHERN IRELAND
CONTACT: Ian Duff
028 8673 6977 duffi@iagre.biz

19 March 2019 6.30pm
AGM and Fendt: Our Journey and Vision for the Future
Speaker: Sean Gorman, AGCO Ltd
AFBI Hillsborough

26 March 2019
Joint Meeting
IAgrE and Northern Ireland Institute of Agricultural Science (NIIAS)
Hands Free Hectare
Speaker: Kit Franklin
Venue tbc

SOUTH EAST MIDLANDS
CONTACT: John Stafford
01525 402229
john.stafford@silsoe-solutions.co.uk

Tuesday 12 March 2019 7.30pm
Technical Talk - "The application of drones in agriculture"
Speaker: Ben Smith, Hummingbird Technology
Meeting Room, The George Inn, George Street, Maulden MK45 2DF

Monday 8 April 2019 7.30pm
Technical Talk - "Engineering for Pesticide Application – the science and the politics"
Speaker: Clare Butler Ellis
Maulden Church Hall, Church Road, Maulden MK45 2AU

Thursday 9 May 2019
Visit: Perkins Engine Company 2.00-5.00pm
Perkins Engines
Peterborough

WESTERN
CONTACT: Mike Whiting
07751 345580
mike.whiting@newmac.org.uk

Wednesday 13 March 2019 7.00pm
AGM & Talk - "Hands free harvesting journey, concept to evolution"
Royal Agricultural University, Cirencester

Sunday 26 – Thursday 30 May 2019
Trip to France & Belgium
Dates and timings to be confirmed
Kubota Factory, Dunkirk and New Holland Factory in Zedelgem, Belgium

WEST MIDLANDS
CONTACT: Ian Moore
0121 704 5700 ianm@whale.co.uk

Tuesday 9 April 2019 7.30pm
AGM 2019
Friends Meeting House, Stratford on Avon

WREKIN
CONTACT: David Clare
01952 815087
dclare@harper-adams.ac.uk

Tuesday 19 March 2019
AGM and Technical Meeting 6.30pm
AIEC, Harper Adams University

Tuesday 30 April 2019 7.30pm
Technical Meeting: TBC
AIEC, Harper Adams University

Tuesday 4 June 2019
Technical Meeting tbc
AIEC, Harper Adams University

INDUSTRY EVENTS

Wednesday 12 and Thursday 13 June 2019
Cereals 2019
Boothby Graffoe
Lincolnshire

Friday 15 March 2019 9.30am-4.30pm
Womens Engineering Society (WES) Conference
RAF Museum
Hendon

Sunday 23 June 2019
International Women in Engineering Day
There are several early sponsors on board for INWED 2019, including; Boeing, Cranfield University, GCHQ, Mercedes-AMG Petronas Motorsport, NSIRC, OPITO and Royal Academy of Engineering.

Wednesday 4 September 2019 8.00am – 3.00pm
Tillage-Live 2019
Deenethorpe Airfield
Northamptonshire

Tuesday 10 – Friday 13 September 2019
CIGR and AfroAgEng Conference
Theme: 'Challenges of Water Mobilisation and Soil Conservation in Better Adapting to Climate Change'
Rabat, Morocco

Wednesday 11 September 2019
UK Dairy Day
International Centre
Telford, Salop

Tuesday 15 – Wednesday 16 October 2019
World Agri-Tech Innovation Summit
5 More London
London

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

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

24/7 Out of Hours

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

DORSET WILDLIFE TRUST

Former IAgrE President Professor Mark Kibblewhite CEnv FIAgrE is a Trustee and current Vice Chairman of the Dorset Wildlife Trust which covers the landscape and sealife in one of the most diverse and environmentally important counties in the UK.

Deep in the Dorset Countryside, near the delightfully named village of Toller Porcorum, sits the Kingcombe Centre. Formerly a farm run by a family who used no pesticides or fertilisers, the 450-acre site is now owned by the Dorset Wildlife Trust (DWT) and houses a nature reserve, education centre, exhibition space, tearoom and accommodation in The Lodge B&B.

The reserve is still managed as a traditional working farm, grazed by sheep and cows. "The flora and fauna have been untouched by modern agricultural practices for many years" says Mark Kibblewhite "and is therefore full of flower-rich grassland, thick hedges, streams, ponds and wooded area to house a vast array of wildlife".

Kingcombe is just one of six Wildlife Centres owned and operated by DWT in addition to over 40 nature reserves spread across the county. Dorset houses some of the most spectacular and important heritage sites in the UK from the world-famous Jurassic Coast to the vast marine areas surrounding Portland and Poole Harbour. This is a largely rural community, the county has not one mile of motorway and the only major population centres are popular seaside resorts such as Bournemouth, Christchurch, Poole and Weymouth. There is no heavy industry to speak of – only boat-building and oddly a cluster of oil-wells in and around the Wareham area.

The preservation of wildlife in all its forms is important to residents and the millions of visitors who flock to the county each year. "Put together, the organisations responsible for looking after the natural habitat, both on land and at sea, such as the National Trust, RSPB and ourselves offer considerable employment and career opportunities and can be regarded as a major employer in the county" adds Mark.

Formed in 1961 the Dorset Wildlife Trust has over 27,000 members and an annual income of over £3 million, a third of which comes from membership subscriptions, the rest from fundraising, legacies and grants from bodies such as the National Lottery.

The Trustees come from a wide array of specialisms such as farming, veterinary, geology, ecology, finance – and in Mark's case, soil science. "My role is more managerial" he says "and only occasionally do I get involved in soil related issues. Our major priority is to maintain the 40-odd nature reserves in the best possible condition which, in itself, is a major logistical challenge".

DWT has many specialist groups within the organisation, including an Agricultural Group comprising farmers and landowners. "As you can imagine, there are a number of sensitive issues linking commercial agriculture and the environment, but on the whole the farming community are very supportive of our role."

Being a coastal county, the responsibility of DWT extends to both landscape and marine life. **Living Landscapes** within the Trust extends to managing and expanding habitats so wildlife can thrive across countryside and towns. It provides advice to farmers and maintains nature reserves as havens for wildlife.

Meanwhile the Trust's **Living Seas** concerns itself with everything from meadows of seagrass and forests of kelp to tide-scoured submarine cliffs. With the help of remote sensing techniques and an army of volunteer divers and shore-walkers, the Trust now has one of the best understood areas of seabed in the UK. For instance, at Kimmeridge Bay, on a stretch of the Jurassic Coast, the Fine Foundation Wild Seas Centre, provides interactive displays, aquaria, and a fascinating opportunity to explore the bay, its ledges and rockpools.

One of Dorset Wildlife Trust's current major projects is the construction of a new visitor Centre on Brownsea Island. The island lies in Poole Harbour and is reachable by boat from Poole Quay. The site of Baden Powell's early scout camps, the island is 500 acres of woodland, heathland and salt-marsh. Acquired by the National Trust in 1962, there are a few cottages and a castle leased to John Lewis for staff holidays, whilst the northern part of the island is a nature reserve managed by the Dorset Wildlife Trust.

Brownsea Island Nature Reserve is regarded as one of the most spectacular nature reserves in Britain, with a diverse range of habitats and wildlife. Its sheltered lagoon is particularly important for large flocks of overwintering birds and for nesting terns in summer.

"I can heartily recommend a visit to Dorset and a tour of any of our reserves and centres to IAgrE members who want to get close to nature" says Mark.

www.dorsetwildlifetrust.org.uk

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Dr Alexandra Cooke CEnv MIAgrE
Severn Trent Water

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