Agriculture • Horticulture • Forestry • Environment • Amenity

LANDWARDS

Winter 2002

- FALKIRK WHEEL
- VEGETABLE OILS
  Production
  Reuse as fuel

TOTAL MACHINE CONTROL

IAgrE JOURNAL Volume 57 No.6 www.iagre.org

STUDENT MEMBERSHIP

Dr Dan Mitchell, President

Last autumn, as your President Elect, I spoke to students at Writtle College and Harper Adams University College. With the support of Malcolm Carr West and Chris Bishop at Writtle and Jim Loynes and Geoffrey Wakeham at Harper Adams, we gained 75 student members for this Institution. The Douglas Bomford Trust provided financial support and we all agreed that this was well worth doing.

In May 2002, during my Presidential Address, I stressed that student membership is a key part of my strategy to grow our membership. Today's agricultural engineering and mechanisation students are this Institution's key members for the future.

I am pleased to report that, this autumn, talks have been given to the students and staff at:

- Writtle College
- Harper Adams University College
- Reaseheath College
- The Royal Agricultural College

And before Christmas plans are in hand to speak to students at:

- Cranfield University at Silsoe
- Askham Bryan College
- Lackham College and
- Walford College

As a result of the support of staff at these eight Colleges, I am pleased to inform you that we will have 170 new student members of our Institution. We have continuing support from The Douglas Bomford Trust which means that students can now have free membership throughout their courses. This means we will have a total of 245 student members, including existing student members, by Christmas. These students will go on to key positions in engineering during their careers. I would like to thank all the staff who have supported my strategy and the students who attended the presentations.

We also set a target of 20 new 'Eminent' members, a figure which we have also achieved. Each new member in this category is a senior manager in a key organisation within agricultural and rural engineering. The support of these members is also much appreciated.

As part of the marketing of your Institution, we have produced posters for company and college noticeboards. These are available free of charge from the Secretariat.

We can raise our profile in many ways and, as your President, I have put two posters up on key college notice boards in the last few weeks!

A card to promote membership to non members is also available and a copy is included in this issue of Landwards. These can be handed or sent to anyone interested in joining us.

So we have made some progress this year and I hope you will support these initiatives in 2003. If you are lecturing on engineering or mechanisation and would like me to talk to your students then do not hesitate to ask. I believe there is further scope for this strategy.

With my best wishes to you for a Happy Christmas and a successful 2003.

Dr Dan Mitchell
President

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LANDWARDS

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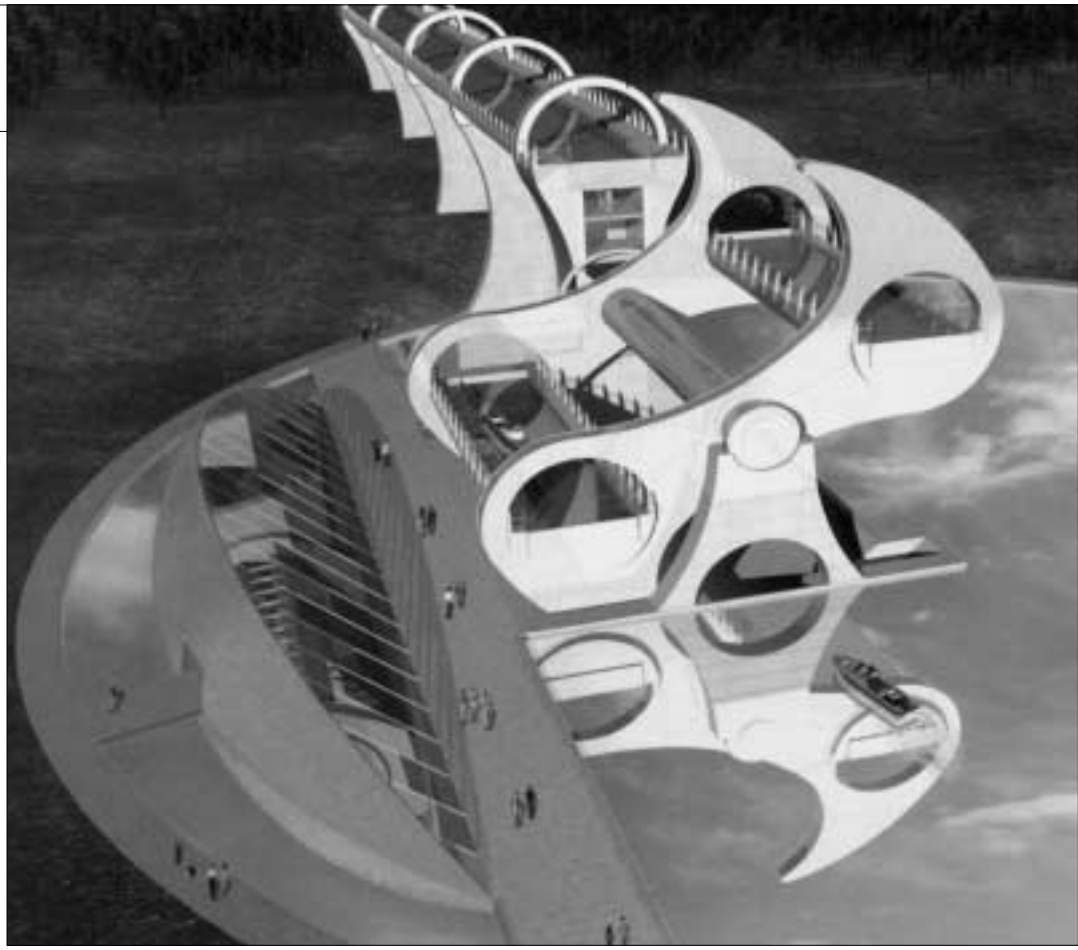

The Falkirk Wheel which joins the Forth and Clyde Canal and Union Canal is shown here, complete with visitors' centre (Photo: SKF)

THE FALKIRK WHEEL

Melissa K. Witney-Hunter

Introduction

The Falkirk Wheel, a unique giant rotating boatlift located close to the Scottish town after which it is named, was opened officially on the 24th May 2002 by Her Majesty Queen Elizabeth II. By the end of 2002, British Waterways and its partners plan to complete an huge £190 million waterway restoration programme which will see 350 km of waterways built or re-opened, spectacular new visitor attractions and even the first stretch of new canal in a century!

The restoration of waterways is currently taking place at the same rate as they were built at the height of 'canal mania' in the 1790s, creating attractive and accessible places on which to live, work and relax. Restoring waterways benefits everyone: renewing communities; protecting and improving the environment; creating jobs and boosting opportunities for new businesses. This particular regeneration also offers scope for exciting new buildings, visitor attractions and conservation of both a structure of great historical interest and the natural environment.

The Wheel is the centre-piece of the Millennium Link, a £84.5 million project led by British Waterways, which reopens and reconnects the Forth and Clyde Canal, and the Union Canal between Glasgow and Edinburgh. Up until the 1930s, the two canals were linked by a series of 11 locks. However, along with the demise of the canals, the locks fell into disrepair, were in-filled, and remain unusable.

Design

The Falkirk Wheel is expected to double as a new national landmark. The idea of connecting the canals via a rotating boat lift, was put forward and was originally conceived as a giant Ferris wheel with suspended gondolas. SKF proposed large, double row, spherical roller bearings and specially designed bearing housings to support the

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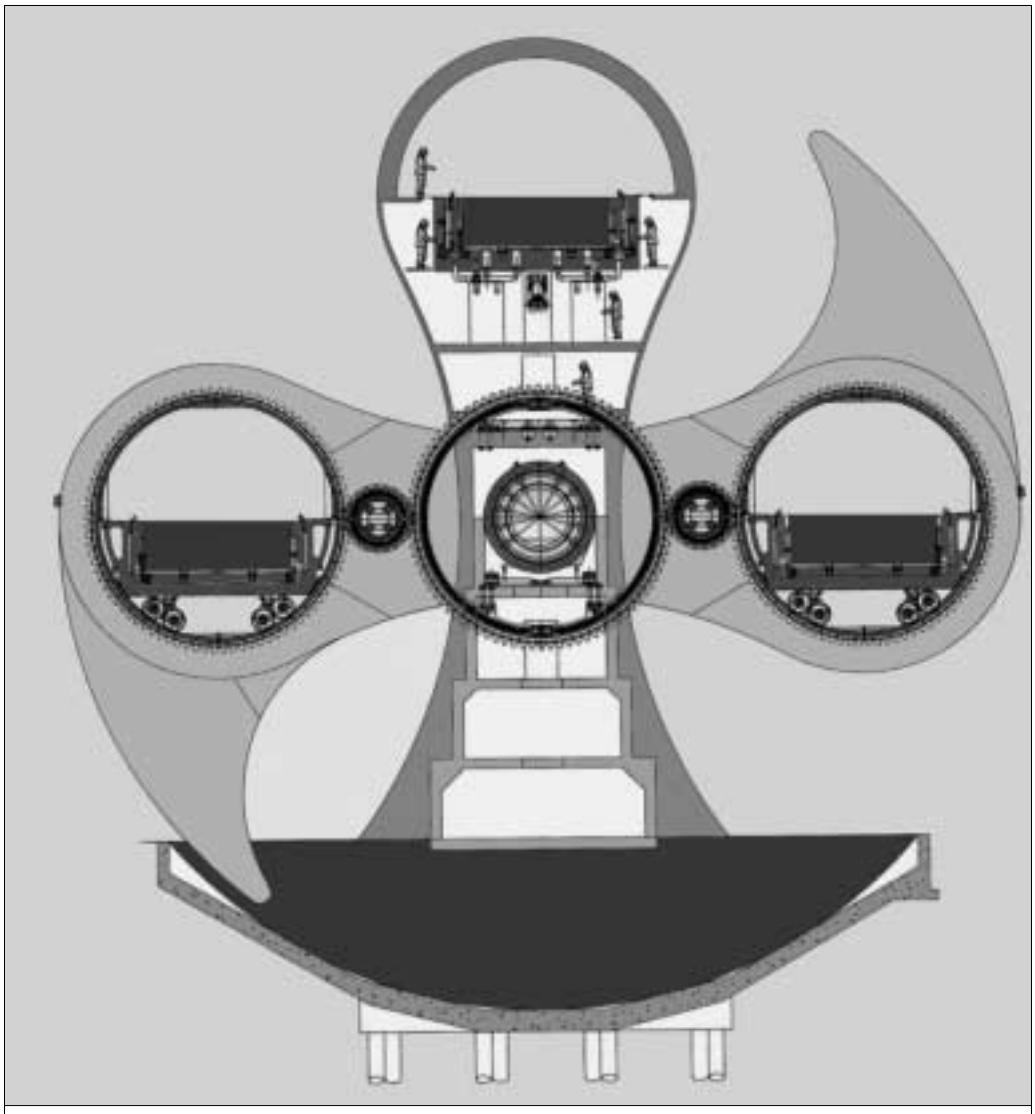

The Falkirk Wheel is a feat of modern engineering (Photo: SKF)

wheel. However, the final design, differing from the original, which progressed to construction evolved over the years into the radical concept which is now in use.

The Wheel measures 35 m in diameter, with an axle length of 28 m, and will transfer boats between the two canals, over a vertical gap equivalent to the height of eight double-decker buses.

The new design, came from the successful collaboration of several designers led by the Morrison Bachy Soletanche Joint Venture. It follows on from the much acclaimed initial design by Dundee Architects Nicoll Russell Studios and the exemplar designs by Engineers Binnie Black and Veatch.

Situated in a natural amphitheatre, the design itself is considered to be a form of contemporary sculpture and is endorsed as such by the Royal Fine Art Commission for Scotland. It takes the shape of a Celtic-inspired, double headed axe, in which two axe-shaped arms rotate in a continuous circle, 180 degrees at a time. It will simultaneously lift and lower two 22 m long caissons which each hold a payload of 300 t, comprising of water and up to four boats, and uses a series of synchronous gears to positively keep the caissons in the horizontal plane.

Build

Butterley Engineering, of Ripley in Derbyshire, won the contract to build the wheel and its engineering design consultant, Bennett Associates, of Rotherham in Yorkshire, invited SKF to provide a new bearing solution. To support the wheel, they developed a solution which uses a pair of purpose-designed, 4 m diameter, three row, slewing bearings, one positioned at either end of the wheel, with outer rings bolted to the support structure and inner rings bolted to the arms. The inner ring of one of the bearings is equipped with gear teeth to transmit the drive to the wheel.

The use of the slewing bearings was an unusual solution, as these are normally used in applications with heavy axial loads, such as those encountered in the rotational movement of large cranes. However, SKF specially designed these slewing bearings to be positioned on a horizontal axis and to cope with the specified combination of radial and axial loads. When the wheel is fully loaded, it weighs 1800 t which results in a radial load of 9095 kN per bearing. Each slewing bearing has three rows of cylindrical rollers, one for the radial load and two with smaller rollers for the axial loads.

Ten hydraulically driven gearboxes, via the geared slewing bearing, rotate the wheel. It turns at a rate of around 0.125 rpm, which sees it lift and lower boats at an average rate of 4 m/minute. With consideration given to the time taken for loading boats, the wheel is expected to complete a half turn about once every 15 minutes.

In operation, the wheel is maintained at close to perfect balance. With the caisson and the canal watertight doors open for loading and unloading, the water levels in the caissons depend on the level in the canals to which they are then open. Any vessel which enters a caisson, automatically displaces its own weight of water back into the canal and therefore has no net effect. When the caisson and canal watertight doors are closed, a pump system is brought into action to equalise the water levels in the two caissons to establish near perfect balance. The wheel drive system has, of course, been designed to handle a degree of imbalance due to differing water levels in the caissons. However, even allowing for this potential out of balance, the very low friction torque of the SKF antifriction bearings means that a rated torque of only 2972 kNm is required to rotate the wheel.

Although the bearings come with their own integral seals and have been designed to have a life expectancy of 120 years, SKF is also supplying extra seals of 4 m and 2.5 m diameters. This type of seal is specifically designed to withstand the conditions found in heavy-duty applications and, in this instance, will virtually guarantee the pre-

vention of any ingress of water.

SKF has also provided cross roller bearings, to support the idler gears, which will keep the caissons level at all times. The caissons themselves run on a wheel arrangement on circular rails, with each wheel mounted on two spherical roller bearings.

Millennium link

The Falkirk Wheel is part of the largest canal restoration project currently underway in the UK. Dubbed the 'People's Project', the Millennium Link is the biggest canal restoration ever in Britain, re-establishing the historic canal link between Glasgow and Edinburgh and coast to coast across Scotland. It will see the removal of over 30 obstructions on the Forth and Clyde, and Union Canals to make the 180-year-old waterways navigable once more.

The Forth and Clyde Canal, the world's first sea to sea ship canal, and a stretch of the Union Canal were opened in 2001, with the complete reopening of the Lowland canal network scheduled for May 2002. The Millennium Link is already attracting visitors, with the number of towpath users increasing as the restoration progresses. On the outskirts of Edinburgh, annual visitors to the Union Canal have already dramatically risen from 18,000 in 1998 to 75,000 in 2001. This extra activity will help local businesses as towpath visitors mean money invested in the area, according to research carried out.

Within the decade, the Millennium Link is expected to have generated over 4,000 new jobs along its length, attracted hundreds of boats and brought millions of new leisure visitors to the region.

Caring for old and new environments

A major challenge for the engineers working on the aqueduct leading from the Union Canal to the Falkirk Wheel was a structure dating from Roman times. The 59.5 km long Antonine Wall was begun in AD142 during the reign of the Roman emperor Antoninus Pius and stretched across central Scotland between the Firth of Forth at Bo'ness and the mouth of the River Clyde at Old Kilpatrick. Extensive consultation revealed that the safest way to connect the Union Canal to the Wheel was to tunnel underneath the wall. Needless to say, great care was taken during the construction of the 145 m tunnel to ensure that no aspect of this important historic structure was disturbed.

Stonework apprentices from the Historic Scotland stone masonry training college in Elgin have completed a special commission for The Millennium Link – the carving of 24 milestones for the Union Canal. Protecting the history of the canal is an important aspect of all the work being undertaken and the stones, measuring about 1.4 m in height, are inscribed in miles showing the distance from Falkirk to Edinburgh in both directions. Old Ordnance Survey maps were studied to discover the exact locations for the stones, all of which will be placed on their original sites.

In addition to consideration for the historic structure, attention was paid to regeneration of the surrounding area. Five thousand new trees were planted on a section of towpath at the site of the Falkirk Wheel. The 'Waterways Trust Scotland' organised the mass planting, which involved hundreds of local people. The trees, donated by local company Soroptimist International, were individually sponsored with the names of those involved placed in a commemorative book, on view in the Falkirk Wheel visitors' centre.

Project potential

The potential of the project has gained it a £32 million grant from the Millennium Commission, and financial backing from seven local authorities, Scottish Enterprise, the European Regional Development Fund, British Waterways and five local enterprise companies.

The Waterways Trust Scotland is working with local canal societies and others to raise £2.2 million from charitable trusts, corporate sponsors and public appeal. This towering structure is set to become a visitor attraction in its own right. Jim Stirling, Director of British Waterways, Scotland, said: "We always said that the Falkirk Wheel should be something special, we wanted to create something elegant that people would want to come and see. The wheel will be a symbol for Scottish innovation and ingenuity as well as a unique, thrilling experience for visitors."

IAgrE Scottish Branch members during their Summer Visit to the Falkirk Wheel on 21st August 2002, waiting for their 'turn' to be upwardly mobile, 'in transition', and barging clear of the immediate horizon! [Photos: G Owen]

Acknowledgements

For generous contributions to this article, we gratefully acknowledge: *Samantha Carberry, Marketing Designer, SKF (U.K.) Limited, Sundon Park Road, Luton, Bedfordshire, LU3 3BL. Tel:*

01582 496729 Fax: 01582 848091 E-mail: samantha@skf.ndo.co.uk Web: www.skf.co.uk, and British Waterways for additional information. Web: www.britishwaterways.co.uk.

The Waterways Trust is a registered charity. They need help to conserve and improve canals, as well as to provide fishing and canoeing facilities, picnic areas, improved footpaths and disabled access, for the whole community, throughout the United Kingdom. For more information or to make a donation please contact: The Waterways Trust Scotland, The Old Basin, Applecross Street, Hamiltonhill, Glasgow, G4 9SP. Tel: 0141 354 7540. Web: www.thewaterwaystrust.co.uk.

TRAINING

Trainers make tracks for latest quad bike facts

Representatives from six major ATV (All Terrain Vehicle) manufacturers (Honda, Kawasaki, Massey Ferguson, Polaris, Suzuki and Yamaha) were recently given the chance to demonstrate their latest bikes at a day-long event in Clyro, near Hay-on-Wye. The event was organised by Sector Skills Council, Lantra, to ensure its UK network of ATV training instructors were completely up-to-date with current technical and health & safety issues.

Used correctly, ATVs, or quad bikes, are very versatile vehicles with a wide variety of uses in the land-based industries, such as agriculture and forestry, which Lantra represents. But serious accidents can occur without proper training and instruction. "Ensuring ATV users are properly trained to handle their vehicles is essential, and particularly important in the land-based industries where they are increasingly used," said event organiser Kay Francis, Regional Development Consultant for Lantra. "The instructors had been extremely keen for an event like this, which would give them the chance to talk directly to the bikes' manufacturers and update their knowledge on the vehicles."

Over 20 instructors, from as far afield as Aberdeen and Cornwall, travelled to the Welsh border to make full use of the off-road track at the village's Baskerville Hall Hotel. All the instructors are members of Lantra's Professional Register, a comprehensive directory of quality-assured training and business support professionals. Representatives from the Health & Safety Executive were also in attendance to answer any queries from the instructors, and there was an opportunity to try the latest safety helmets from Logic.

"Our instructors not only found the event extremely useful in terms of finding out the latest technical facts and discussing health & safety issues, but also had great fun trying out the vehicles for themselves," said Tricia Hobin, Customer Service Manager for Lantra Awards.

A number of ATV training courses have been developed by Lantra Awards, all of which are delivered through Lantra's network of training providers and instructors.

MORE INFORMATION

For more information on ATV training in your area, contact Lantra Connect. Tel: 0845 707 8007. E-mail: connect@lantra.co.uk

PROFESSIONAL QUALIFICATION

New qualifications in farm diversification

Innovative courses in farm diversification and countryside management are among a new suite of BTEC qualifications for the farming industry launched by awarding body Edexcel.

The new BTEC National Awards have been developed in response to the growing need that farmers face to investigate alternative uses for their land. The college-based courses are designed to be accessible to people working in the industry. They can be delivered so that most of the studying is done in the evenings or during the winter months.

BTEC National Awards enable students to focus on a particular area of study. The farm diversification course allows investigation of subjects including sustainable farming systems, organic production and estate skills. Students interested in countryside management can specialise in game management, woodland management, water management, countryside interpretation, habitat conservation and rural tourism.

A BTEC National Award is equivalent to GCE A Level in standard and comprises six units, each approximately 60 hours in length. "Recent crises in the industry have made it more important than ever for farmers to be flexible and adaptable in order to maximise their returns. Ensuring that they and their employees receive top quality training in the latest techniques is one way of achieving this," said Lesley Brook, land-based specialist at Edexcel.

In total 89 new BTEC qualifications are available from September 2002 covering most aspects of land-based work from animal, horse and fish management to agriculture, horticulture and forestry. Further qualifications in land-based technology are due for 2003.

The new courses have been developed by Edexcel's land-based experts working with specialists from colleges and representatives from industry, government and other key organisations. They are offered at around 120 colleges of agriculture and further education in England, Wales and Northern Ireland.

BTEC qualifications are practical and work-related. Students learn by completing assignments and projects, applying their knowledge and skills to realistic work situations. Edexcel is one of the country's leading awarding bodies, offering academic and vocational qualifications at more than 6000 schools, colleges and accredited training centres.

MORE INFORMATION

Contact Edexcel. Tel: 0870 240 9800. E-mail: enquiries@edexcel.org.uk. Web: www.edexcel.org.uk

ENVIRONMENT

International report highlights way forward for UK compost standards

A comprehensive study comparing international composting standards around the world, published this week by the Waste and Resources Action Programme (WRAP), has emphasised the need for both statutory and voluntary standards for compost if the UK is to catch up with many of its European partners. Commissioned as part of WRAP's ongoing work to develop national standards for composted products in the UK, the research was carried out by a project team headed up by Eunomia Research & Consulting.

Entitled Comparison of Compost Standards within the EU, North America and Australasia, the study provides a detailed comparison of the precautionary/statutory and voluntary standards and Quality Assurance Systems (QASs) in place in these countries for composting, anaerobic digestion and mechanical and biological treatment. The study also provides a series of profiles, detailing the standards that operate in each country, which are being published as separate documents.

While the research found that the legal framework underpinning the standards differs widely, the systems devised to promote compost while protecting human, animal and soil health tended to have common elements in place:

- standards, often statutory, designed to regulate potentially harmful aspects of compost production and use;
- complementary standards, again often statutory, governing areas such as the environmental and health implications of application to land; and
- voluntary standards and Quality Assurance Systems (QASs) established to give confidence to consumers as well as clear specifications for defined end markets.

This combination of instruments designed to ensure environmental and health protection and fitness for purpose, where voluntary standards and QASs support the existing statutory regime, was shown to deliver the most effective approach.

The study also found that a decisive factor in creating the right framework for an effective composting industry, is the political will to support collection activities. Those countries with the most successful track record in composting are those which have encouraged the process through supporting legislation in addition to statutory standards. Legislation which requires source separating of organic waste, bans its landfilling or imposes high taxes on landfill has made separate collection and composting of biowaste a cost effective solution in countries such as Austria, Germany, Flanders and The Netherlands, where compost products are used in large volumes in a variety of applications.

Without what the study calls the 'background policy context', and where there are obstacles such as low waste taxes and constrained funding for waste management, the development of composting is not only likely to take longer but may even be compromised by prevalence of low quality composted products. As one of only a few EU countries without statutory standards for compost, the study concludes that biowaste treatment in the UK would benefit from being placed on a statutory footing, at least with respect to precautionary aspects. Any attempt to do this, however, will have to take account of the possibility of a new EU Directive on composting and should be devised broadly in line with the proposals in the EU's Second Draft Working Document on the Biological Treatment of Biowaste.

The study also highlights the importance of voluntary industry standards to maximise the market opportunities for composted products, and based on the comparative data, discusses and make recommendations on a wide range of issues, including input materials and the scope for compost 'classes'. Where to draw the line between statutory and voluntary standards is also explored as well as the issues involved in setting standards for the composting process itself and, more generically, the successful features of QASs.

The need for the development of tailored end user specifications is emphasised, along with the importance of effective market development and awareness raising and marketing, which should be supported not only by the government, but also by the municipalities, compost producers and all other stakeholders involved.

"Composting is high on the political and waste management industry agendas and this major piece of comparative research raises important questions about the strategic approach to composting in the UK," says Anne Riding, WRAP◊s Special Projects Manager. "The findings will help WRAP to tailor its work on the development of national compost standards, as well as future initiatives to develop end user specifications and improve market awareness and confidence in composted products."

> 'The study also highlights the importance of voluntary industry standards to maximise the market opportunities for composted products

MORE INFORMATION

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The study (ISBN No.1-84405-003-3) is available on the WRAP website at www.wrap.org.uk

Linking insurance with health and safety performance

Research just published by the Health and Safety Executive (HSE) examines how changes in insurance arrangements might better promote health and safety in UK companies.

Welcoming the research, Dr Peter Graham, Director of HSE's Strategy and Analytical Support Directorate, said "Insurance can be an important lever in motivating employers to practice good health and safety. The UK can learn much from systems operated in other countries and initial reaction to the research shows that there is a willingness from both employers and insurance firms to explore different options".

In the UK there are two main systems of financial compensation for workplace injuries and illness. These are:

- Employers' Liability insurance – under which employees may receive damages for accidents or ill health; and
- Industrial Injuries Disablement Benefit that provides 'no fault' state benefits.

It has long been argued that the Industrial Injuries Disablement Benefit scheme offers no incentive for companies to improve their safety record and that there is little evidence the Employers' Liability insurance does so either.

The research is a product of the 'Revitalising Health and Safety' (RHS) Strategy Statement launched by the Government and the Health and Safety Commission (HSC) in the summer of 2000. Revitalising makes clear that insurance has a key role to play in helping us achieve our health and safety targets, "The compensation, benefits and insurance system must motivate employers to improve their health and safety performance, in particular by securing a better balance in the distribution of the costs of health and safety failures" (Action Point five of the RHS Strategy Statement).

To take this forward the Health and Safety Executive last year commissioned research to look at how possible changes to our insurance and compensation arrangements might best motivate changes in safety performance and encourage greater business focus.

The main aim of the research – *'Changing business behaviour – would bearing the true cost of poor health and safety performance make a difference?'* – was to identify insurance instruments which could have an impact on the costs of health and safety borne by employers; look at the business factors concerning insurance that may influence employer behaviour, including business perceptions; and examine the manner in which such instruments could be implemented.

The research surveyed comparable overseas systems, sought the views of UK insurers, business and other stakeholders and explored the feasibility of options of using insurance as a motivator for improving employers health and safety performance.

The next step for HSC/E is to promote discussion of the research findings in association with the insurance industry, business, trade unions, Government and other stakeholders. The question central to that work is whether present insurance arrangements improve or impede health and safety? The role of HSC/E will be to facilitate that wide-ranging debate.

CONTACT

HSE Information Services, Caerphilly Business Park, Caerphilly, CF83 3GG. Tel: 08701 545500.

Easier read for OPE Directory

The AEA's **OPE Directory & Price Guide** - serving the outdoor power and equipment industries - has been 'turned on its head', to provide an even easier read for users.

OPE Directory - available in hard copy as an A5-sized book of 420 pages, or on CD - is published in February (Spring issue) and October (Autumn issue) and contains product information from 245 manufacturers and distributors.

When it was first produced in Spring 1995 the OPE Directory contained a Product index, a Trade name index and a Main listing of companies, their products and prices - in that order.

In the recently published Autumn issue the Main listing starts on page 3, followed by the Trade name index, which now includes a product column and indication of those products on offer to the Hire industry; the last section is the revamped Product finder.

OPE Directory & Price Guide is on subscription at £30 a year for the two issues, and is available by contacting: Angela Black, AEA, Samuelson House, Paxton Road, Orton Centre, Peterborough PE2 SLT.
Tel 01733 362925; Fax 01733 370664;
E-mail dg@aea.uk.com

Olive tree shaker in action - harvesting an olive crop (Photo: P Febo)

Steve Minett and Feld Kenwick

LOBE PUMPS FOR OLIVE OIL PRODUCTION

Introduction

Crude olive oil, which still contains fragments of crushed olive stones, is a very abrasive medium to pump. Spanish producers are discovering that lobe pumps from ITT Jabsco may be the optimal solution for this application.

The Spanish olive oil industry is centred on Jaen, 300 km south of Madrid in Andalucia which is the largest olive oil producing region in the country. Andalucians are rightly proud of their product which they claim is the finest in the world. The region produces about 350,000 tonnes per year, depending on the weather, selling for around 300,000 pesetas (ptas) per tonne. This gives an annual total of about £350 million.

To serve this industry, the engineering company Transmission y Rodajes SL was established in Jaen in the early 1970s and specialised in service, maintenance and parts supply for olive oil processing equipment. In 1991, a sister company called Centrifugacion Alemana (CA), was set up to sell olive oil processing equipment manufactured by the German company Hiller, and now has between 500 and 600 customers, mainly in Spain but also in Morocco, Portugal and Tunisia, served by its eight-strong work force.

Oil production

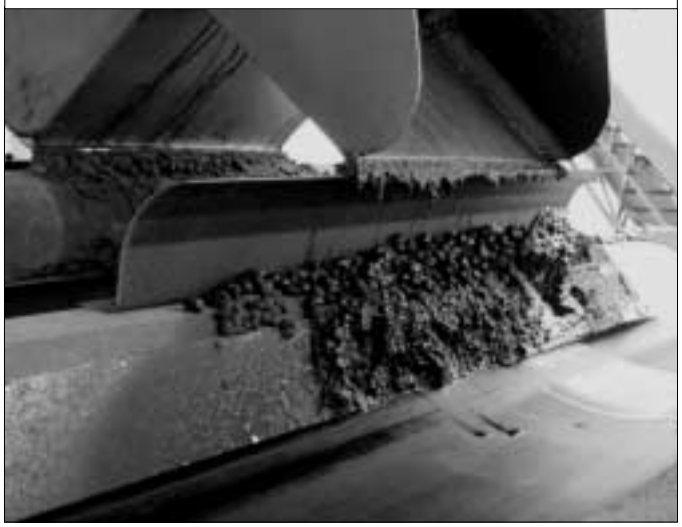
Fresh, ripe black olives picked from the trees give the best quality olive oil. Green olives are less mature and are consumed as whole fruit but they are not used for oil production. The growing season varies somewhat according to the weather but in Spain the fruit generally starts appearing in April. Harvesting mature trees starts around Christmas but the smaller trees are picked later, from January to March.

Fresh, ripe black olives in a hopper ready to be processed into olive oil

The whole olives are dropped into a grinder with an Archimedean screw which produces a paste of the raw fruit. The paste is transferred to a blender consisting of two long channels, one above the other, fitted with rotating paddles. As the paste flows along the top channel and back along the lower one, it is blended. In addition to this, the temperature of the paste is raised to 40ºC by thermostatically controlled heaters.

In the blender, the moisture content is adjusted to that of freshly picked olives, namely 60%. Olives which have been allowed to lie in the sun may

The whole olives are dropped into a grinder with an Archimedean screw, which produces a paste of the raw fruit; the paste is transferred to a blender, consisting of two long channels, one above the other, fitted with rotating paddles



have dehydrated and could need additional water. On leaving the blender, the crude oil passes through a wire strainer with a mesh less than 5 mm and is then pumped to a decanter which separates the nearly pure virgin oil from contaminants, such as fragmented stones and skins.

Final processing

The particle paste, which is separated out in the decanter, goes through another process to extract the non-virgin residual oil which is sold for lower grade applications. What is left of the particle paste is sold as a biofuel to local industries, for example a ceramics factory, and as domestic fuel.

The virgin oil is treated in a centrifuge which rids it of any final traces of particles and water before packaging and sale.

Pump selection

Extracting oil from olives involves crushing the fruit, including the stones, to produce a highly abrasive paste. Even after straining the crude oil contains fragments of stones which can seriously damage seals and the internal surfaces of pumps. Careful choice of pump types and materials, however, has reduced downtime from pump failure to a minimum.

Centrifugacion Alemana originally offered a screw pump for use in olive oil plant and, although it was the best available at the time, Technical sales manager Antonio Trujillo Anguita says that its performance was poor. "The main problem with screw pumps is that they can be damaged very quickly if they are allowed to run dry. This can happen quite easily if the operator fails to keep a careful check on the level of fluid at the pump inlet. After about ten minutes of dry running, the stators can be completely destroyed. At that stage in the refining process, the crude olive oil contains stone fragments and other contaminants and is an abrasive medium to pump. Even with a continued good supply of the pumping medium, therefore, the stators had to be replaced after pumping between 1 and 5 kt. After some years, therefore, we started to switch to lobe pumps for this application."

The virgin oil is treated in a centrifuge which rids it of any final traces of particles and water before packaging and sale

The main problem with the previously used screw pumps was that dry running could completely destroy the stators

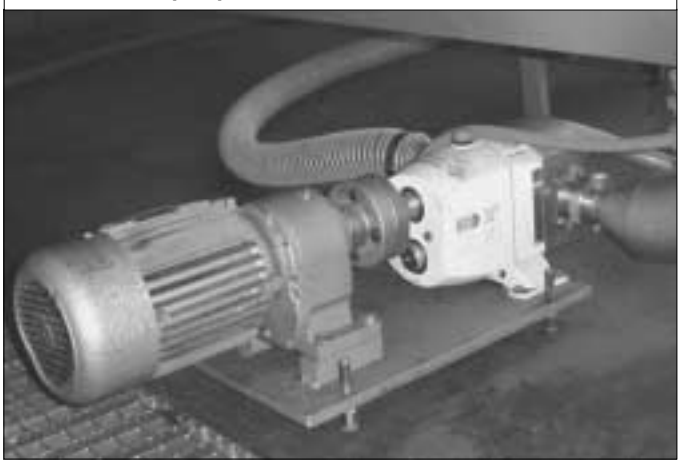
Lobe pumps

The family of twin rotor displacement machines, to which rotary lobe pumps belong, came under intensive development in the middle of the 19th century. They operate on a different principle to screw pumps. Two interacting, contra-rotating rotors, typically having three lobes each, are externally geared together so that they maintain a design clearance between themselves and between the pump housing. Lobe pumps produce a gentle pumping action without shear and without damaging the pumping medium. They are ideal for moving fluids with solid pieces in the stream since the pump head components are not easily worn.

Lobe pumps are available in sizes to suit a wide range of flows and with different design factors to suit the huge number of media needing to be pumped. Design factors include rotor clearance, which influences the volumetric efficiency of the unit since it determines how much of the pumped medium slips back from the outlet side to the inlet side. The length and profile of the rotors determine the pressures that the pumps can attain and of course the size and speed influence the volume flow.

One of the greatest advantages of a lobe pump is their inherent simplicity and the fact that they can be dismantled easily without disturbing the pipe

Fragments of stones can seriously damage seals and the internal surfaces of pumps; use of ITT Jabsco's Hy-line pump has reduced downtime from pump failure to a minimum



work or pump mounting. This makes them very useful for food processing applications where the plant must be cleaned regularly.

Competing designs

The first lobe pump that Centrifugacion Alemana offered its customers was a Spanish-built machine. This was an improvement on the screw pumps, originally supplied by the company, since it gave a stator life of between 5 and 6 kt. However, there were problems with the internal dynamics of the units and a number of them suffered housing failure. This was a serious fault since replacement involved dismantling the pipe work which was a time-consuming job.

Mr Anguita said, "During 2000, we began testing an ITT Jabsco Hy-line pump. We ran comparative trials against the Spanish equipment for a period and then dismantled them both. We made careful measurements and found that the Hy-line pump was the much harder wearing unit of the two. We also preferred the design since it had a removable back plate. This exploited the simplicity of the lobe pump principle and enabled our customers to clean the machine in situ without uncoupling the pipe work."

Design features

"The Hy-line's seals are positioned for easy inspection and replacement. They are fitted from the front which also makes them more accessible to product flow and for CIP liquids. As the seals are further forward than in many other pumps, they are mounted in the flow of the liquid. They therefore expose the sealing faces and the seal joints to the liquid, preventing the oil from partially drying out and becoming sticky. The full exposure also means complete circulation of the product is guaranteed, which avoids stagnant areas where bacteria can multiply", says José A. Rodriguez from Tecnica de Fluidos, ITT Jabsco's distributor in Spain. The seals are also balanced, giving controlled pressure between the faces for longer face life. The static face is energised instead of the rotating face, which eliminates wobble and the resultant shaft wear, to provide effective sealing, even at low pressures. Long life at high pressures is another advantage. The Hy-line design includes a flat crevice-free front cover, flush rotor securing screws, sealed drive splines and absence of recesses where the oil could stagnate and compromise maintenance or hygiene.

The pumps have scimitar type rotors and because they do not require accurate synchronisation, they are easier to bring into service and more tolerant of abuse. No shimming or other timing adjustments is required. The rotors are suited to pumping abrasive fluids since they do not touch each other or the rotor case when in operation.

The bearing arrangement utilises a simple preloading mechanism which can be adjusted without the shims and is easy to service. The rotor case is completely removable for easy replacement and provides a wide separation between product and gearbox. These features reduce dismantling and reassembly time during cleaning procedures, a factor well received at the production plant.

Customer feedback

Antonio Trujillo Anguita, Technical Sales Manager for Centrifugacion Alemana stated "Customer reaction to the Jabsco pumps was favourable. They commented on the superior quality and they especially liked the removable back plate which gives easier maintenance. It means that work can be done on the pump without taking the whole unit out of the system. This minimises production downtime."

Mr Anguita acknowledges that it is more expensive than other pumps but for large-scale users the reliability and ease of maintenance, which give increased uptime, are very popular with users. "They are very happy if a pump can give two or three years service without major attention" he added. "We are keeping accurate records of the pumps in service. In a few more years we shall have first hand experience of service life and we will be able to calculate accurate figures for total cost of ownership. That takes in initial costs, routine running costs and service. We expect this to be substantially below other equipment on the market."

Minett Media

Teagasc Crops Research Centre at Oak Park, with oilseed rape crop in foreground

Bernard Rice and Andreas Fröhlich

RECOVERED VEGETABLE OIL AS A VEHICLE FUEL

Introduction

Three recent developments have stimulated a renewed interest in the use of vegetable oils as diesel engine fuels:

• The introduction of a 20 p/litre remission of excise duty on biodiesel below that of ultra-low-sulphur diesel was confirmed in the UK 2002 budget

• The Transport Directorate of the EU has produced draft directives proposing mandatory substitution rates for transport biofuels in Member States. These are proposed to start at 2% in 2005 and reach 5.75% by 2010. A second proposed directive would limit remission of road excise to 50% but an alternative version giving Member States discretion to abolish excise on biofuels is also under discussion

• The threat at EU level to exclude recovered vegetable oil from animal feed rations following on the Belgian 'dioxin in chickens' incident of 1999 has been reactivated following the implication of food wastes in the recent UK outbreak of Foot and Mouth Disease.

While progress on the Transport Directorate proposal and food waste legislation may be slow, it is interesting to speculate as to whether or how the EU target substitution rates could be met by the UK. In the meantime, the 20 p/litre excise duty remission should be sufficient on its own to kick-start a UK biodiesel industry.

Feedstocks

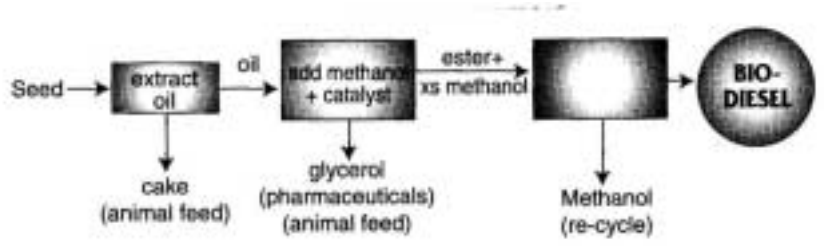
The most likely vegetable oil sources for vehicle fuel use in the short-term future in Northern Europe are twofold.

• *Oil-seed crops grown on set-aside land*

This is currently the main source of liquid biofuel in the EU. Production reached about 0.7 Mt in 2000 and, with rapid expansion in Germany, it will soon be well in excess of 1 Mt. The main concerns about this source are its high cost as a feedstock and the risk of being affected by unfavourable adjustments to EU agricultural

BIO NOTE

This paper was presented at the IAgrE Annual Conference entitled 'Faster by Design' and held at Harper Adams University College on 15 May 2002. Bernard Rice, MIAgrE and Andreas Fröhlich are research scientists at the Crops Research Centre, Teagasc, Irish Agriculture and Food Development Agency, Oak Park, Carlow, Ireland. Tel: +353 (0)503 70200 E-mail: brice@oakpark.teagasc.ie Web: www.teagasc.ie



Biodiesel production

policy.

• *Recovered vegetable oil (RVO) from the food processing and catering industries*

About 0.4 Mt of this material is collected in the EU and 0.1 Mt in the UK; with improved collection systems this could rise to 0.7 - 1 Mt in the EU, and 0.15 - 0.2 Mt in the UK. In the event of a ban on its inclusion in animal feeds, a fuel use is the most likely alternative.

Process/usage options for these oils include conversion to bio-diesel, or use in unprocessed form in modified engines in vehicles or central heat and power (CHP) plants. If the UK excise duty remission applies to biodiesel only, the questions of most immediate interest are whether the RVO collected in the UK is suitable for biodiesel production, and whether the quality requirements of the EU draft standard for biodiesel (prEN 14214) can be achieved with this material. The main findings of a recent study of these issues within the EU ALTENER programme are summarised in the paper detailed at the end of this article (Rice, Mittelbach and Pelkmans, 2000).

Recovered vegetable oil quality

As an indicator of the key oil quality parameters and levels required for biodiesel production, the purchase specification of two Austrian biodiesel plants using RVO as feedstock are included in Table 1. The main difference between these and the specification for animal feed is the limitation, in one plant, of free fatty acid levels to less than 2%. Table 2 contains the results of RVO analyses from a small biodiesel production facility in Austria, and from experimental work in Ireland. An estimate of the main characteristics and fatty acid composition of waste oil, collected from catering use in France, is included. Results of a small number of analyses, carried out in Ireland, of UK samples are also included.

Water content was very high in some Irish samples (Table 2). This indicates inadequate water removal at RVO assembly. Free fatty acid levels were higher in the UK and Ireland than in Austria, which probably indicates excessive storage periods between original use and recovery. Fatty acid composition was very similar in the oils from all three countries.

Table 1 Austrian purchase specifications for waste oils used in biodiesel production

Parameter	*Plant 1*	*Plant 2*
Water, %	< 1.0	Free from separated water
Free fatty acids, %	< 2.0	
Sediments, %	< 1.0	< 1.0
Fatty acid composition	No limits	No limits

Table 2 Composition of waste oils from Austria, Ireland, United Kingdom and France

Country	*Austria*	*Ireland*	*United Kingdom*	*France*
FFA content, %	0.78 – 2.64	1.9 – 7.4	2.6 – 5.8	< 4.0
Water content, %	0.25 – 2.25	1.0 – 5.0	0.3 – 1.8	< 1.0
Fatty acid				
C-16(0)	5.82 – 10.28	4.2 – 14.5	8.2 – 23.9	20.0 – 25.0
C-16(1)	0.25 – 0.41	0.0 – 2.4		0.3 – 0.7
C-18(0)	2.16 – 4.75	1.4 – 5.9	2.4 – 5.6	7.0 – 9.0
C-18(1)	47.74 – 58.90	52.9 – 65.8	48.0 – 60.4	45.0 – 51.0
C-18(2)	19.15 – 29.43	15.4 – 20.7	16.4 – 20.0	15.0 – 19.0
C-18(3)	4.35 – 8.76	4.1 – 8.8	2.5 – 8.2	0.4 – 0.7
C-20(0)	0.48 – 1.25	0.6 – 1.0	0.0 – 0.4	
C-20(1)	0.40 – 1.30	0.4 – 2.3	0.0 – 0.6	
C-22(0)	0.16 – 0.56		0.0 – 0.3	
C-22(1)	0.0 – 0.20			
Saturated fatty acids, %	8.73 – 16.03	6.6 – 21.4	10.6 – 30.2	29.0 – 36.0
Monounsaturated fatty acids, %	49.21 – 59.77	53.5 – 70.5	48.0 – 71.0	45.0 – 53.0
Polyunsaturated fatty acids, %	25.65 – 34.01	19.5 – 29.5	18.9 – 28.2	14.0 – 21.0
Iodine number	96.0 – 107.0	99.0 – 118.0		60.0 – 80.0

The high level of saturated fatty acids, mainly palmitic but also stearic, in French waste oil would present difficulties for biodiesel production. The main problem would be inferior low-temperature properties. The achievement of a high yield, from material with variable and sometimes high level of free fatty acids, would present a challenge for plant designers.

Quality of biodiesel from RVO

Data on the quality of biodiesel produced from RVO is available from commercial production in Austria and pilot plant trials in Ireland. Mean values of the main parameters, in these trials, are included in Table 3.

The quality of the biodiesel produced at the Austrian plant has continued to improve over the past two years (Table 3). In particular, the total contaminant level has been reduced, as well as the values for neutralisation number and water content.

Irish-Austrian investigations of the storage stability of various methyl esters, suggest that esters from waste oils may be more prone to oxidation than virgin oil esters, due to consumption of antioxidants in the cooking process. Austrian measurements of thermal oxidative stability of esters from waste oil have shown slightly lower levels than those from rape methyl ester (RME). It is not yet clear whether this is of practical importance.

In both countries, viscosity values were close to the upper limit. The cold filter plug point (CFPP) values would indicate a possibility of winter use problems in some EU countries. Irish research also indicated that additives that improved the low temperature perform-

Table 3 Quality of biodiesel produced from waste cooking oil

Parameter	Test method	Austria		Ireland	E DIN 51606
		1997	2000		
Density, g/ml	EN 3675	0.878		0.883	0.875 -0.9
Viscosity (40°C), mm^2/s	EN 3104	5.11		4.86	3.5 – 5.0
Flash point, °C	EN 22719	125			min. 110
CFPP, °C	EN 116	-6.0		-5.3	0.0 to -20
Conradson residues, %	EN 10370	0.03		0.09	< 0.05
Sulphate ash, %	DIN 51575	0.008		0.007	< 0.03
Cetane no.	ISO 5165	50.8			> 49.0
Water, mg/kg	ISO 12937	700	300	1100	< 300
Total impurities, mg/kg	DIN 51419	15.7	4.0		< 20.0
Neutralisation no., mg [KOH]/g	DIN 51558-1	0.35	0.23		< 0.5
Methanol, %	E DIN 51608	0.15	0.1	0.04	< 0.3
Monoglycerides, %	E DIN 51609	0.21	0.01		< 0.8
Diglycerides, %	E DIN 51609	0.12	0.04		< 0.4
Triglycerides, %	E DIN 51609				< 0.4
Free glycerol, %	E DIN 51609				0.02
Total glycerol, %	E DIN 51609	0.072	0.01	0.24	< 0.25
Iodine number, %	AOCS Cd 1c-85	101.0		107.0	115.0
Phosphorus, mg/kg	DIN 51440-1	7.0			10.0
Thermal stability, h	IP306 (110°C)		1.7		

CFPP, cold filter plug point

ance of rape methyl ester were less effective with RVO ester. Conradson residues were outside the limit and water content high in some Irish samples. The high water levels were probably due, mainly, to poor plant design. Otherwise the biodiesel produced was generally within specification.

Use of RVO ester in vehicles

In Austria, many vehicles have been using 100% waste oil esters without any problem. Only at very low temperatures (< -10oC) has it been necessary to blend the ester with mineral fuel. In Graz, buses using this fuel have covered 1.5 million kilometres to date. In a current EU ALTENER project, the University of Graz is examining the use of various esters, including waste oil, in modern common rail fuel injection systems.

In an Irish-Austrian EU ALTENER project, three vehicles were operated on blends of esters from various feedstocks, including waste vegetable oil and tallow – a fatty substance consisting of a mixture of glycerides, including stearic, palmitic and oleic acids and extracted chiefly from the suet of sheep and cattle. The only problems encountered were filter blockages at low temperatures. No other engine problems arose; even where there was a high level of dilution of the engine lubricating oil by the fuel.

Other considerations

There is some resistance in France to the concept of biodiesel production from waste vegetable oil, for the following reasons.

- Rapeseed oil is not generally used for cooking in France, and the oils used are less suitable for high-quality biodiesel production
- RME production and distribution is well established, and petroleum companies and engine manufacturers might resist a change to what would be seen as inferior raw materials. Problems would also be expected from the glycerine market if the glycerol were derived from waste oil esterification
- It is claimed that there are other potential uses in lipochemistry for waste cooking oil esters.

In Germany, where biodiesel production from virgin oil is expanding rapidly, the need to preserve the green image of biodiesel is also seen as a deterrent to the use of inferior grades of waste oil. Oleochemistry and bio-diesel are envisaged as competing for the higher grades, with low quality oils and animal fats being used in fixed industrial heating plants.

Conclusions

The following are the main findings of the study.

- RVO has potential as a feedstock for the biodiesel industry. The total volume of recoverable oil is substantial, and its supply varies little from year to year. It could therefore provide more stability than virgin oil production which is liable to change with EU agricultural policy.
- It is in every country's interest to recover as much as possible of this material before it enters the waste disposal system. The cost of the problems caused in drainage systems and landfills would be avoided, and its use as a renewable fuel would contribute to the abatement of CO2 emissions.
- RVO price is much lower than that of virgin oil, so RVO ester can compete with mineral diesel, with a much lower level of excise remission.
- With modern processing technology it is possible to produce biodiesel with most parameters up to international specification from RVO. However, the high saturated fat levels in some oils might be expected to yield biodiesel, with poor low temperature properties.
- RVO collection systems need to be streamlined to reduce collection costs, improve oil quality and increase the volume of oil recovered.
- Concerns about potential damage to the biodiesel image, adverse reactions from engine and component manufacturers, and effects on the glycerol market, may give rise to some problems. Storage stability of biodiesel, produced from waste oil, also needs further examination.

Reference

Rice B, Mittelbach M. and Pelkmans L. 2000 Waste oils and fats as biodiesel feedstocks: an assessment of their potential in the EU ALTENER Programme Final Report, Phase IV, Non-technical Barriers to the Development of Biofuels. Contract No. 4.1030/Z/98-529.

CONSERVATION

Shropshire farmer gets wild about flowers – with a little help from DEFRA

A Shropshire farmer is pioneering a new scheme which will restore much needed and much loved wild flowers to the countryside.

In the first trial of it's kind on a commercial farm Neil and Stephanie Dobson of Wall Farm, Kynnersley, near Newport, are creating wildflower meadows using three crucial ingredients: a Countryside Stewardship grant, wildflower seeds from a 200 year old meadow in Staffordshire – and speed.

In the past, attempts at creating viable wildflower meadows have proved tricky. Grass was cut, dried and bailed up before being spread onto a new site, possibly weeks later. This method resulted in many of the seeds dropping off before the new site was even reached.

Now, under the new scheme, speed is of the essence. Grass is taken from an established wildflower meadow – which matches for soil type and chemical make-up – and is spread on the new site immediately. This retains the flower seeds and is proving much more successful in preserving the diversity of flowers. The field can then be lightly grazed with no use of artificial fertilisers.

The advantages of this method of meadow creation are that it is much quicker, more effective and more environmentally friendly.

"We piloted this high speed method over the last two years and the results are amazing" says farmer Neil Dobson, "The success of the first meadow has meant that we are currently working on a new meadow – which we spread with grass seeds taken from the 200 year old Staffordshire meadow only this week. We also have a further 5 ha of wildflower meadows planned."

The move to lower intensity farming at Wall Farm has been gradual. Originally a dairy farm, then an arable farm, since 1994 the 132 ha have been dedicated to traditional breeds beef with prize winning Aberdeen Angus and Red Polls. The whole farm is under a Countryside Stewardship agreement, which compensates Mr Dobson for lower productivity.

Neil Dobson continues: "The traditional grasses promote slower growth of native cattle leading to later maturing and better flavour beef selling for a premium price. The benefit of taking part in the Countryside Stewardship Scheme is that we are now much more environmentally and financially sustainable with lower inputs and higher outputs. I have a real sense of making a positive contribution to the land."

Roger Owen, Rural Development Service Manager for the Department of the Environment, Food and Rural Affairs (DEFRA) in North Midlands said: "The results at Wall Farm are bringing real benefits to the local environment. It is an excellent example of how commercial farming can work hand in hand with conservation. We hope lessons learnt here can be used to help create similar meadows on other farms."

MORE INFORMATION

For further information about the Countryside Stewardship Scheme, or any other scheme under the England Rural Development Programme, visit the DEFRA website , or contact your local DEFRA Rural Development Service office.

POLLUTION

Immission values for soil protection – deposition values for cadmium

Editor: VDI Verein Deutscher Ingenieure (The Association of Engineers), Kommission Reinhaltung der Luft im VDI und DIN – Normenausschuss KRdL (Commission on Air Pollution Prevention of VDI and DIN – Standards Committee)

Passage of the German federal soil protection law as well as of the soil protection and waste-site clean-up regulations has created new requirements for ambient pollution control because of the impact these soil protection regulations have. Therefore, the various parts of VDI 3956 focus on the criteria for deriving deposition-limiting values to comply with the new requirements of the soil protecting regulations. Guideline VDI 3956 Part 1 addresses the objectives and basic terminology. Scientific basis of Part 2 of the guideline VDI 3956 on cadmium are the soil protecting, deposition-limiting values which were formulated by the Committee of German Federal States for the Protection from Pollution (LAI).

The Guideline deals with the occurrence and typical input pathways of cadmium. It describes the properties of cadmium and cadmium compounds in soils and suitable measurement methods. The important transfer paths of cadmium from soil to humans, soil to plants and soil to groundwater are covered in detail.

In addition, an assessment of the toxicity of cadmium and cadmium compounds to humans and the ecosystem is provided. Special attention is given to the criteria for deriving a deposition-limiting value for cadmium. The limit for cadmium deposition was set with the objectives of achieving a precautionary and lasting protection of the environment in mind.

MORE INFORMATION

Released in German and English Language. Price: 43.40 EUR. Substitutes the draft edition of December 2000. Available from: Beuth Verlag GmbH, D-10772 Berlin, Germany. Tel: +49 302 601-2759. Fax: +49 302 601-1263. E-mail: postmaster@beuth.de

Bimonthly WINTER 2002

MEMBERSHIP MATTERS

THE NEWSLETTER OF THE INSTITUTION OF AGRICULTURAL ENGINEERS

THE NEW 'SOCIETY FOR THE ENVIRONMENT'

At the 2002 annual conference of the Environment Agency, held at Stoneleigh on 23rd October, the formation of the 'Society for the Environment' was officially announced to the world at large.

This is exciting news for IAgrE and could have a positive impact on professional recognition for many IAgrE members. All those with an interest in the environment and sustainable development should read on.

A number of professional institutions with a prime focus in the well being of the environment have been considering how they can play a positive role in sustainable environmental management and development. They have concluded that they can best contribute by working in synergy. This will demonstrate to wider society a very important virtue in sustainable development, namely co-operation and teamwork. That co-operation has resulted in the establishment of the 'Society for the Environment' (SocEnv), an umbrella body made up of the following ten environmental institutions and learned societies:

- CIWEM (Chartered Institution of Water and Environmental Management)
- IAgrE (Institution of Agricultural Engineers)
- IEEM (Institute of Ecology and Environmental Management)
- IEMA (Institute of Environmental Management and Assessment)
- IES (Institute of Environmental Sciences)
- IFM (Institute of Fisheries Management)
- IPSS (Institute of Professional Soil Scientists)
- IWM (Institute of Wastes Management)
- IWO (Institution of Water Officers)
- RMetSoc (Royal Meteorological Society

SocEnv will be a company limited by guarantee and will be petitioning the Privy Council for a Royal Charter, which it hopes, will be granted by January 2004. This will mean that the constituent bodies of SocEnv will be in a position to grant the title of Chartered Environmentalist (CEnv) to suitably experienced and qualified professionals. There will be no membership of SocEnv for individuals, award of CEnv will only be possible for members of the constituent bodies.

IAgrE has been party to the discussions surrounding SocEnv's formation from the outset and Council considers that there will be many members of IAgrE eligible to register as CEnv. The recent survey of members bears this out with over 14% of the membership responding – an excellent return indeed. Of those responding, over 50% indicated an interest in becoming registered as a Chartered Environmentalist.

There will be an abbreviated form of application for existing members of constituent bodies ('grandparent rights') and it is planned to process these applications in time for registration on 1st January 2004.

It is anticipated that further institutions will join the society once the Royal Charter has been granted. There will be the opportunity to be full members (ability to award CEnv) and 'affiliates', without the awarding facility.

A draft charter and all of the necessary documents required for company registration are in preparation. A number of internal working documents have already been produced.

As and when documents are signed off by the various working parties, they will be reproduced on the IAgrE website **www.iagre.org**

Chris Whetnall

THE GREAT NAME CHANGE

You will remember that 'to change or not to change' the name of the institution is the question, with a request that those with a desire for change come up with a suitable new name. Suggested names would then be put to Council for them to select an appropriate name for putting to a vote of the Membership. In the event that Council did not feel that any of the suggestions were appropriate, then a vote would not take place and the name would remain the same.

The suggestions are in and Council reviewed them at the Council Meeting on the 7th November. This issue has, as expected, stimulated a fairly vigorous debate. Whilst the letter to members only asked for new name suggestions, a significant number of you took the opportunity to respond that you were opposed to a change. Indeed, strong views were expressed – both for and against.

Overall, 57 responses were received (two of which represented Branch views) and of

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FROM PAGE 1>
these only fifteen individuals suggested change was in order and suggested possible names. This perhaps reflects a general lack of desire for change.

In the event, the suggestions were put to Council. Taking into account the additional cost implications of a name change, Council did not consider any of the names submitted to have sufficient merit to justify a change. As detailed in the letter to members, the name will therefore remain the same.

However, it is planned that the emphasis on the words 'Institution of Agricultural Engineers' will reduce over time replaced by an increased use of the acronym IAgrE used together with a tag line suitable for the audience. This can be done at little or no extra cost.

Thus you will see a greater focus on the use of the logo, in its various forms, together with the supplementary logos representing the breadth of our interests across the land-based industries. We have represented this approach on the postcard enclosed with this issue of '*Landwards*'. Please make use of this card to hand out to potential members. Further copies are available from the Secretariat. These are also available with a blank reverse for overprinting for specific events or requirements.

WELL DONE HARPER ENGINEERS

Harper Engineers have won second prize in this year's Lord Stafford awards, which reward collaboration between universities and industry in the West Midlands. There were 15 finalists, so this is a great result in our first year of entry.

The Awards are aimed at encouraging a positive approach to innovation in the West Midlands, through business to university collaborations and each year produces a diverse and interesting range of applications, with this year being no exception.

All the judges visit the short-listed companies which enables them to gain a personal insight into the work taking place and the hope is that this work leads to more collaborative activity, which in itself will have a positive effect on the region's economy.

All of this year's applications proved that the West Midlands is a hot bed of innovative activity which can only be to the benefit of everyone who lives, works and visits the region.

The winning project was a crop desiccation and weed control flaming device developed by Green Dragon Flaming Ltd of Ross-on-Wye, in collaboration with Harper Adams University College.

Green Dragon Flaming produces equipment for crop desiccation. The collaboration with Harper Adams was to investigate the existing heat shield used in systems utilising propane burners. The aim of the project was to improve the performance of the heat shield, to maximise efficiency and provide a more durable and aesthetically pleasing product. The collaboration led to the production and introduction of an enhanced design solution, utilising materials used in the aerospace industries but providing the flexibility needed for locating the product on a unit which weighs 240kg.

Green Dragon was also assisted by the university CONTACT project, which aims to promote and aid collaboration between the business community and all the universities in the West Midlands.

Peter Darkins led for Harper on the project, whose advice helped increase the efficiency and durability of the product, while reducing the finished weight. Green Dragon Flaming received a cash prize of £3000 to assist further development and promotion of the product.

The work came from a lead from CONTACT, our HEROBaC 2 project with the rest of the West Midlands Universities.

Much credit is due to Nigel Jordan, our CONTACT field officer, for encouraging our links with Green Dragon and suggesting the project as a suitable finalist.

Dan Mitchell

Engineering Technicians on the move

Engineering Technicians will find it easier to gain professional recognition in some overseas countries following the signing of the Dublin Accord.

This agreement, signed by the Canadian Council of Technicians and Technologists, the Institution of Engineers of Ireland, the Engineering Council of South Africa and the Engineering Council of the UK, builds on previous accords which allow for the mutual recognition of qualifications accredited for IEng and CEng.

For further information see http://www.engc.org.uk/news/engineering_technicians.asp

Membership Changes

Admissions

Fellow
M G Kibblewhite (Bedford)

Member
S J Churchill (Essex)
J A Harris (Bedford)
D Russell (Cambridgeshire)

Student
C Swift (Shropshire)

Readmission

E A Hammad (London/Sudan)

Transfers

Fellow
A N Marchant (Devon)
C K Sankat (Trinidad)

Member
T M Farrow (Lincoln)
C M Johnson (Cheshire)
C P Pitelen (Norfolk)

Deaths

D H Sutton (Bedfordshire)
T F Weaving (North Devon)
P A Webb (Wiltshire)

Academic Members

Askham Bryan College
Askham Bryan
York
YO23 3FR

Cranfield University
Silsoe
Bedford
MK45 4DT

Duchy College
Rosewarne
Camborne
Cornwall
TR14 0AB

Harper Adams University College
Newport
Shropshire
TF10 8NB

Myerscough College
Myerscough Hall
Bilsborrow
Preston
Lancashire
PR3 0RY

Oatridge Agricultural College
Ecclesmachan
Broxburn
West Lothian
EH52 6NH

Pencoed College
Pencoed
Bridgend
CF35 5LG

Reaseheath College
Reaseheath
Nantwich
Cheshire
CW5 6DF

Sparsholt College
Sparsholt
Winchester
Hampshire
SO21 2NF

Wiltshire College – Lackham
Lacock
Chippenham
Wiltshire
SN15 2NY

Writtle College
Chelmsford
Essex
CM1 3RR

Sponsored student membership

The following **Douglas Bomford Trust** sponsored students have been admitted from Walford College:

M J Cheesman
A Curtis
M J Dorricott
T D Evans
J R Gittins
C Grafton
D L Hogarth
D E Jarrett
P J Jones
I J Millington
D J Rowlands
D Smith
S Smith
R E Watkin

The following **Douglas Bomford Trust** sponsored students have been admitted from Reaseheath College:

M C Allwood
J I Armitt
A Atherton
R Baker
C P Bell
R Black
J Blakeman
T G Burgess
G A Camm
U Cavanagh
O Cavenagh
M T Charlesworth
P Clinton
L J Coffey
T J Connor
J Corbridge
I J Crutchley
M R Daintith
A H Dale
W L Darlington
A D Elliott
S J Harrison
R A Hough
J Hoult
J L Howaston
G I Jones
J Kelly
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For further details, contact Elizabeth Stephens at the Secretariat. **E-mail: elizabeth@iagre.org**

NEWS OF MEMBERS

Congratulations to **Jim Ward** who has been awarded the degree of Master of Business Administration from Henley Management College. He started working towards this at the end of 1999, having completed the Henley DIM previously and submitted his final dissertation in April 2002.

Jim, who is based in South Africa, says that he continues to manage a fleet of animal feed tankers for Unitrans Freight, delivering about 1000 loads per month of animal feed throughout the Natal midlands. He is currently involved in making running improvements to the discharge equipment hydraulics, targeting fuel consumption and offloading times as areas for improvement. There is also the possibility of making greater use of engine mapping to maximise fuel efficiency during offloading periods and the challenges of maintaining the latest generation of US sourced International engines, that currently test the limits of the lubricant specifications available locally. Heavy local snowfalls and rain during July caused several feed tankers to get bogged down on farm roads and in some cases the pressure was on to prevent poultry houses and piggeries from running out of feed as a result. It is not all sunshine in Africa!

I am most grateful to **Colin Friedman** for the following information about his work in China. He is the manager of the Eisenberg Agri China's irrigation department and the general manager of the Company's drip irrigation factory. They manufacture dripline using drippers imported from Israel.

"I am now living in the Xinjiang Autonomous Region, North West China, in a small but beautiful city called Kurle. Kurle is located on the edge of the Gobi desert and is part of the old 'silk road'.

"I have been working in China for the last four years. Originally, I was based in Shenyang which is the capital city of Liaoning Province (Northeast China). There I dealt mainly with the changing hi-tech irrigation and agricultural techniques used in the locality. I specialised in upgrading the use of local 'sun greenhouses'. These greenhouses have a brick and mud back wall and sides. In addition, these structures also have a single transparent film wall on one side.

"Sun greenhouses are very efficient in conserving heat. The coldest temperature was recorded outside the greenhouses as -37°C whilst inside without heating it was +5 ^{o}C. They have however a disadvantage of available light and radiation. We used some for germination and nursery purposes and some for demonstrating the growing of vegetables, mainly:

- tomatoes
- cucumbers
- squash
- aubergine.

We were interested in selling the drip irrigation technology, both conventional pressurised drip irrigation and gravity-fed drip irrigation, imported seeds and seedlings from our own nursery.

"Approximately one year ago, I started working for Eisenberg Agri China which has its head office in Beijing. The company is highly committed to bringing advanced agriculture technology and water conservation technologies to China as well as preventing desertification. The majority of the work that I have done over the last year is research into preventing sands from blowing."

For members wishing to make contact with Colin Friedman for advice or while visiting China, **mobile tel: (0086) 13911098002 e-mail: cjfmsc:hotmail.com**

Tony Chestney

LONG SERVICE CERTIFICATES

Name	*Grade*	*Date of Anniversary*
35 years		
Roger Anthony Ballard	IEng, MIAgrE	12 Oct 2002
John Bradshaw	FIAgrE	12 Oct 2002
Colin Campbell	IEng, MIAgrE	12 Oct 2002
Peter Brook Percival Copeland	CEng, MIAgrE	12 Oct 2002
Michael Denis Purchas	IEng, MIAgrE	12 Oct 2002
Jonathan Guy Martin Wood	CEng, FIAgrE	12 Oct 2002
John Malcolm Heald	EngTech, MIAgrE	01 Nov 2002
25 years		
Richard Martin Frost	IEng, MIAgrE	16 Sep 2002
Maurizio Pierconti	AIAgrE	16 Sep 2002
Ahmed Mohammed Ahmed Musa	IEng, MIAgrE	16 Sep 2002
Lance Harold Rayner	CEng, MIAgrE	22 Sep 2002
John Leslie Butler	IEng, MIAgrE	22 Sep 2002
John Linwood Page	IEng, MIAgrE	22 Sep 2002
Richard James Butt-Evans	IEng, MIAgrE	22 Sep 2002
Royston Leslie Peter Lemberger	MIAgrE	22 Sep 2002
Paul Francis Hemingway	CEng, MIAgrE	06 Oct 2002
Stephen John Watson	AMIAgrE	10 Oct 2002
Robert Edward William Timmins	CEng, MIAgrE	17 Oct 2002
Michael Anthony Bird	EngTech, MIAgrE	09 Nov 2002
Brian Martin James	IEng, MIAgrE	16 Nov 2002
Graham John Barr	AMIAgrE	30 Nov 2002
Walter John Cracknell	CEng, MIAgrE	06 Dec 2002

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Government energy policy unrealistic, says Academy

The Government's energy policy is hopelessly unrealistic, expecting far too much from renewable energy sources and ignoring serious concerns about reliable gas supplies, the Royal Academy of Engineering has told Energy Minister Brian Wilson MP in a recent report. The Academy's engineering assessment is highly critical of the Energy Review published by the Cabinet Office Performance and Innovation Unit on 15 February.

The Academy's most immediate concern is about security of gas supplies, which the Energy Review assumes will continue to be plentiful and relatively cheap. However, the Department of Trade and Industry's (DTI's) own figures indicate that by 2020 the UK might need to import up to 90 per cent of its gas requirements. We could experience gas shortages as soon as 2004/5 in a severe winter. While Russia is expected to double its gas exports to the EU by 2010 the Government must address the planning, funding and operation questions involved in expanding the pan-European gas transmission network so that we can access imported gas. We will also need to build new storage facilities, as we become a gas importer. The Academy estimates this could cost the Government up to £13 billion by 2020, as the market is not likely to bear the cost.

The Energy Review sets a target of generating 20 per cent of our energy from renewable sources by 2020. While this is a laudable aim it is over-optimistic and fails to address the fundamental problem with all renewable sources – they are intermittent. "Experience on the Continent, especially in Denmark, has shown that grid stability can be adversely affected when the penetration of intermittent renewables reaches about 15 per cent," says the Academy's report. As yet the UK electricity grid is isolated, except for one interconnector to France – further interconnectors to Norway and the Netherlands are being investigated to help share electricity. As more renewable sources are connected to the grid electricity storage will become essential – our only current storage capacity is through hydroelectric storage schemes.

The Energy Review places great faith in wind energy and proposes installing 22,000 MW of turbine capacity by 2020. However, Meteorological Office data shows that the country's wind record is not dependable – the most likely power output in real life is less than 7,000 MW. To ensure the supply it would have to be backed up by 16–19,000 MW of conventional generation plant, adding an extra £1 billion to the cost. Biomass is another promising power source for the future but it needs more research to make it practical – the whole of Kent would have to be covered in coppiced willow to replace the output of Dungeness B power station.

In order to meet our commitments to reduce carbon dioxide emissions we must replace the nuclear reactors coming to the end of their lives with non-carbon emitting energy sources. The Energy Review conceded that the nuclear option should be kept open in case we cannot find alternative sources. But it takes so long to build new power stations that we need to commission them in the next few years if they are to be on stream in time to prevent supply shortages. Skilled people are also retiring so rapidly from the nuclear industry that we will soon be totally reliant on the nuclear expertise of other countries. Nuclear waste disposal is clearly a problem but we have to deal with it irrespective of any decision on new build. "Replacing the whole of the current UK nuclear capacity with new units would add only around 10 per cent to the existing volumes of waste over the 40-year lifetimes of the reactors," says the Academy's report.

The Academy is also very concerned about the Government's lack of attention to transport issues – 42 per cent of UK energy consumption goes on transport. Major support for research to develop the hydrogen economy is urgently needed. "The Energy Review appears to accept fuel switching, probably to hydrogen, as inevitable in the long term," says the Academy's report. "But it is unwilling to recommend early action or signal that this is the Government's preferred solution. Sustainable mobility is fast becoming a key political issue."

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Silsoe
Bedford
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BOOK & CD ROM

New Atlas of the British and Irish Flora

The 'New Atlas of the British and Irish Flora', which charts the distribution of every flowering plant and fern species across Britain and Ireland, has been published.

Sutton Park in Birmingham, which is the largest urban National Nature Reserve in Europe, celebrated the regional launch of the Flora Atlas, with DEFRA's Senior Ecologist for the West Midlands, Iain Diack. The national launch was held at Kew Gardens with Secretary of State for the Environment, Food and Rural Affairs, Mrs Margaret Beckett.

The 910-page volume, produced from nine million records, features 2,412 maps. The project was mainly funded by DEFRA and spearheaded by the Botanical Society of the British Isles (BSBI) and Centre for Ecology and Hydrology (CEH).

Mrs Beckett said: "The atlas is a huge achievement and a tribute to the dedicated volunteers who worked towards its publication for several years in partnership with the Government.

"The atlas will provide a tremendous resource as we consider how we can respond to major and strategic challenges such as atmospheric pollution, climate change and the decline of biodiversity and as we begin to chart the progress of our network of Sites of Special Scientific Interest (SSSIs) and agri-environment schemes. This study will provide a sound basis of information and scientific analysis on which to build our policies."

Sutton Park in Birmingham was chosen for the West Midlands launch because it is in an important area containing SSSIs. The park covers around 970 hectares and comprises heathland, unimproved grassland, woodland, bogs, marshes, pools and streams all in close proximity – which have survived since the 12th century, when originally a mediaeval deer park gifted to the people of Sutton Coldfield by King Henry VIII.

DEFRA's Senior Ecologist for the West Midlands, Iain Diack said: "Sutton Park has a remarkable range of vegetation and habitats, with at least plant species found here that are not present anywhere else in the county. Two species in particular, Grass of Parnassus and Round-leaved Sundew are both scarce in the West Midlands region and are also shown in the Atlas to have declined significantly in southern Britain.

"The decline of certain plants is due to a number of factors including urban development and changes in farming practice. The Atlas therefore, will be an invaluable tool, which will help DEFRA to target resources through agri-environment schemes, to those areas where scarce species are still present and to where we can encourage the recovery of disappearing species. A good example of this will be the use of data on arable plants to target action for species such as the cornflower and corn marigold."

The New Atlas will be a great asset to anyone involved in framing national, regional and local policies affecting wildlife and the countryside, as well as to botanists, conservation agencies, academics and amateur naturalists.

It will assist the Government's review of policy on non-native species and the implementation of the UK Biodiversity Action Plan, research into the impacts of atmospheric pollution and climate change and the development of biodiversity indicators.

The Government has done a great deal to slow down and start to reverse the decline in biodiversity during the past five years. Many plants are increasingly restricted to protected sites and Defra has established a Public Service Agreement to bring 95 per cent of English SSSIs into favourable condition by 2010. There are also 68 individual action plans covering priority flowering plants and ferns under the UK Biodiversity Action Plan. A Biodiversity Strategy for England is due to be published within the next few weeks which will integrate biodiversity considerations into all relevant policies and programmes.

The New Atlas builds on research carried out in the 1950s which was documented in the 'Atlas of the British Flora', published in 1962. The new atlas contains 750 species not listed in the previous volume. More than 5.5m records were made between 1996 and 1999 by 1,600 volunteers from the BSBI, who visited more than 99 per cent of the 3,880 ten by ten kilometre squares of the Ordnance Survey national grids in Britain and Ireland. They noted wild flowering plants and ferns throughout several seasons, but not those in gardens. Many volunteers spent 100 hours or more in each grid square.

One of the three editors, David Pearman for the BSBI, said: "The atlas reveals something of both the more subtle and more dramatic changes to flora across Britain and Ireland during the last four decades, and will provide a sound scientific baseline on which to chart future trends."

Professor John Lawton, Chief Executive of the Natural Environment Research Council (NERC), said: "This atlas is a shining example of best practice in partnerships between funders, researchers, specialists and enthusiasts. It provides us with valuable insights into the decline and fall of some plant species and the meteoric spread of others. I am very proud that NERC's Centre for Ecology and Hydrology has played such a major role in this remarkable publication."

Martin Harper, Plantlife's Conservation Director, said: "The New Atlas will allow the work of Plantlife and other organisations involved in nature conservation to take a giant leap forward. It will not only help to inform our work looking after the UK's most threatened plant species, but will also make a huge contribution to delivering the objectives of the Global Strategy for Plant Conservation."

DEFRA has also published 'The Changing Flora of the UK,' a 36-page summary of the main changes in the UK (not Republic of Ireland) illustrated by the New Atlas.

These include:

- decrease in species introduced to the UK in ancient times (Archaeophytes), especially arable plants such as Corn Buttercup and Corn Marigold;
- increase in species introduced in recent times (Neophytes – introduced after 1500), such as Butterfly-bush (Buddleja) and American Willowherb;
- increase in species with a Mediterranean distribution, such as Spotted Medick and Wild Leek;
- decrease in species with a northerly global distribution, such as Cowberry and Hare's-tail Cottongrass; and

• increase in species which thrive in nutrient-rich soil and decline in those that prefer low-nutrient habitats.

The summary also suggests some explanations for change, such as increasing levels of nutrients, habitat loss caused by intensive agricultural practices and deforestation, the decline of mixed farming and the spread of plants from gardens.

Although some wild species, such as butterflies, already appear to be responding to warmer conditions, the evidence presented in the new atlas does not demonstrate such a dramatic response among plants, which are less mobile and take longer to redistribute to a degree that would be detected by a survey of this scale.

The ten-kilometre square, which boasts the greatest number of plant species in the UK can be found in Dorset. The area, which includes Wareham, contains three National Nature Reserves and 15 other SSSIs; 844 species have been recorded since 1970.

The most species-rich square in Northern Ireland covers Belfast, whose parks, cemeteries, golf clubs, waste ground, playing fields and road and rail verges are home to a wide variety of plants and ferns; in Wales, it is west of Llanelli, which has a wide variety of semi-natural habitats and some post-industrial habitats of botanical interest; and in Scotland, it is at Dunbar, where the mainly coastal habitats contain 619 species.

MORE INFORMATION

Copies of the 'New Atlas of British and Irish Flora' cost £99.95 plus postage and packing. The atlas is supplied with a CD-ROM, which contains 940 additional maps as well as those in the atlas, and can be used to view and print distribution maps, captions and associated data tables as well as to manipulate the data to produce additional maps and species lists. Contact Oxford University Press. Tel: 01536 454534. E-mail: book.orders@oup.co.uk

'The Changing Flora of the UK' is available free. Contact: Martin Wilcox, Defra. Tel: 0117 372 8523. E-mail: martin.willcox@defra.gsi.gov.uk or access it at www.defra.gov.uk/wildlife-countryside/index.htm

OCCUPATIONAL STANDARDS

More help for employers to tackle violence and aggression in the workplace

A new resource for employers has been developed to help reduce violence and aggression in the workplace. The National Occupational Standards in managing work-related violence can be used by employers to draw up policies on managing work-related violence and also provide a framework for managers and staff to assess training needs.

The Standards are aimed at a range of different occupational and management roles. Among the topics they cover are how to investigate a violent incident in the workplace, developing procedures to control risks to health and safety and making sure your actions contribute to a safe working environment.

There are 1.3 million incidents of work-related violence a year according to the British Crime Survey. These incidents can result in physical injuries or anxiety and stress for the people affected. They also have serious consequences for their employers who have to deal with the resulting poor staff morale, high absenteeism, recruitment and staff turnover problems and poor business image.

The Health and Safety Executive has funded the development of the standards by the Employment National Training Organisation (NTO) as part of the Health and Safety Commission's three-year programme which has a target to cut incidents of violence at work by 10 per cent by the end of 2003.

Ann Harrington, of HSE's Health Directorate, said: "Violence at work is totally unacceptable and employers have a duty under health and safety law to take action to tackle this problem, which has devastating consequences on the victims, and real financial costs for their employers.

"HSE is pleased to support these National Occupational Standards. They have been produced in consultation with a wide range of industry sectors and interest groups and will provide a comprehensive, practical resource for all those who have an interest in tackling work-related violence and aggression."

Sheila Hawkins, who led the project on behalf of the Employment NTO said: "These standards will help to define good practice in managing violence in any workplace and can be used to develop policies, analyse incidents, specify training outcomes and evaluate the effectiveness of training. We see these standards as a means to reducing the likelihood of violence occurring – something of benefit for everyone."

MORE INFORMATION

'Violence at work, a guide for employers', INDG69(rev), is available free for single copies and priced packs of ten from HSE Books. A new publication 'Work-related violence, managing the risk in smaller businesses', HSG229, is also available. HSE Books, PO Box 1999, Sudbury, Suffolk, CO10 2WA. Tel: 01787 881165. Fax: 01787 313995. Priced publications are also available from good booksellers.

Copies of the National Occupational Standards in Managing Work-related Violence are available as a CD-Rom, priced £32.50, from the Employment NTO. Tel: 0116 251 9727. Web: www.empnto.co.uk

'TOTAL MACHINE CONTROL' IN MOBILE OFF-HIGHWAY EQUIPMENT

Nick Pridham

Introduction

Electronic control systems are now an everyday part of modern mobile equipment specification. Engines, transmissions and working hydraulics controlled by electronics, all have mature applications in the market place.

Machine designers have traditionally looked to electronics for a better and more cost effective way of improving existing mechanical designs. As a result, many machines can claim to have electronic solutions to all functionality requirements. More often than not, the progression to a machine being controlled by electronics is incremental and therefore stand alone electronic function blocks are added to machine specification, to carry out specific tasks. This often results in up to five separate electronic control systems. The nightmare engineering brief then descends from the engineering director: "In order to take machine functionality to the next level, we are going to consolidate all control systems into one and we need a prototype running in 4 months time!"

This article offers an experience based examination of what advantages can be gained from a 'total machine control' system approach. It also considers the best way to meet the engineering brief above.

BIO NOTE

This paper was presented at the IAgrE Annual Conference entitled 'Faster by Design' and held at Harper Adams University College on 15 May 2002. Nick Pridham is an IQAN Product Specialist at Parker Hannifin plc, Hydraulic Sales UK, 66 Wakefield Road, Ossett, West Yorkshire, WF5 9JS. Tel: +44 (0)1924 282200 Fax: +44 (0)1924 282299 E-mail: npridham@parker.com Web: www.parkerhannifin.co.uk

Control system requirements

Modern off highway mobile machines usually consist of the following three basic mechanical building blocks:

- Diesel engine; electronic or mechanical control
- transmission – powershift or hydrostatic
- working hydraulics

Customer demand for smart machine functionality continues to grow as machine buyers more frequently look for greater productivity, reliability and fuel economy. Manufacturers often meet customer demands by adding stand-alone control systems which has the advantage that it can be implemented quickly. Problem solving due to the new technology is easily isolated. A stand-alone system is not generally modular and therefore, as new functionality demands are made of the machine, a new controller has to be added. Typically a machine that has evolved in this way will have a controller to manage the:

- engine
- transmission
- hydraulics
- auxiliary functions such as overload

It can be seen that before long, the control systems on such a machine lead to very complex wiring designs. Spares inventory for all the different control systems have to be managed. Training for field service personnel has to take place on all the different control systems installed. Inflexibility is also a problem, when the functionality requirements cross the boundaries between the stand alone control systems.

Complex wiring + Spares inventory + Training + Inflexibility = High costs!

In order to provide a solution to the issues listed, practical day to day experience gained from many different field applications shows that machine manufacturers will always benefit from reviewing current control system solutions. The current control system solutions are considered in the light of what advantages can be gained from choosing a flexible electronic platform approach such as the Parker 'IQAN' System, the mobile control system for Parker Hannifin plc.

Typical appearance of hardware for a mobile electronic platform

Flexible electronic platform

Choosing a control system for one machine needs to be a decision made with respect to the total family of machines, produced by the mobile machine manufacturer. If the system chosen is not capable of being upscaled or downscaled,

Typical hardware for low complexity mobile control systems; IQAN TOC2 controller and analogue levers

Appearance of a controller for medium complexity machines; IQAN TOC 8 controller

then simple machines may have to be unnecessarily complicated. Consider the following groups of machines and the respective control system requirements.

Low complexity machines

This category contains machines that have low level requirements for a control system. Typically, the machine will have a mechanically controlled engine and transmission. Hydraulic functions are operated by proportional control for installation reasons. This type of system calls for simple analogue outputs, from linear joysticks and driver cards, to control the valves. No interlocks are required and therefore the functional capability is relatively fixed. Control system cost is a very sensitive issue with this type of machine.

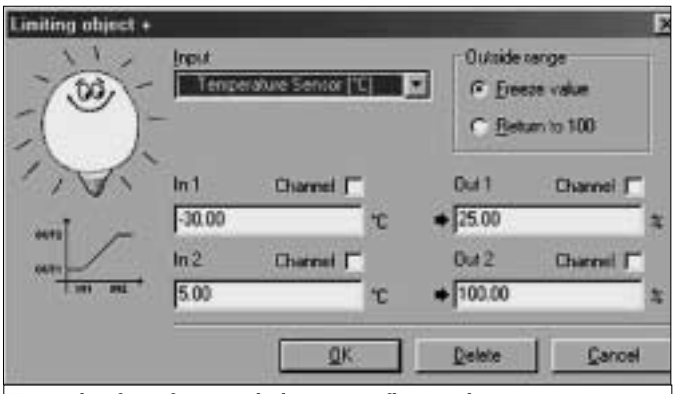
Medium complexity machines

This category of machine has a requirement for a small amount of complex functionality. The input/output (I/O) for this functionality set are connected to a controller with fixed I/O count. It is never envisaged that this machine will ever require anything other than this simple controller and, therefore, all other I/O is dealt with outside the system. Before selecting this type of controller, the machine manufacturer will have considered the possibilities of handling all the I/O through one controller. Cost and a concern not to over complicate the machine are usually factors deciding whether or not this is the control system of choice. In essence, this style of controller is a stand-alone controller type. The internal software for this type of system has to be open to customer configuration and be totally flexible.

High complexity machines

This category of machine generally handles all system I/O apart from automotive electrics. If the system functionality requires to be interlocked with automotive electrical functions, then the control system may well handle the I/O for this as well. This type of system will normally be a Controller Area Network (CAN) based system. CAN distributes the I/O around the machine with nodes that have the most appropriate I/O count. Node selection will also take

Hardware required for high complexity machines; IQAN master controller and various Controller Area Network (CAN) nodes



Example of a software window to configure a low temperature function: as system temperature rises from -30 to +5 degrees then progressively more system output is allowed

into account whether the unit is to be located in the cab or on the chassis. Total flexibility regarding node count and software is required for this type of machine.

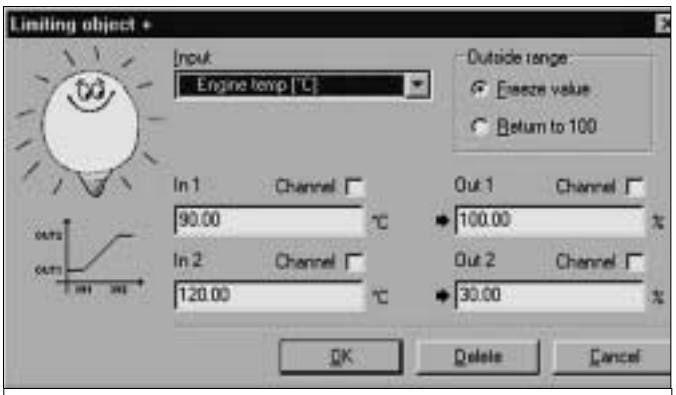
The reason for this consideration of machine complexity, that we find in the market place today, is that machine manufacturers need to consider carefully the complete range of electronic control options. It is important that when trust is gained of one particular control system, for a highly complex machine, then for simple machines an appropriate product family is available. Failure to consider these options carefully, may lead to costly market searches having to be carried out for the correct product. A new relationship and account has to be developed with another supplier, if the correct product is not available.

Total machine control

To illustrate total machine control where engine, transmission and hydraulics are all managed by the same control system, there follows some examples.

Low temperature engine protection

When the engine temperature is below a certain parameter, then the maximum engine speed in rev/min starts to be limited, according to a straight line curve of engine speed against temperature. The minimum temperature limitation will usually limit the engine's speed to idling speed. One other way in which we can protect the engine, in low temperature situations, is to limit the hydraulic power that can be demanded from the engine. With a load sensing pump and proportional control valves, we can easily implement a common reduction function, where all the hydraulic valve functions are reduced proportionally as the temperature drops. This has the effect of limiting the flow demand from the load-sensing pump hence limiting the total hydraulic power consumption. If we have control of the transmission in low engine temperature situations, then we can also limit the maximum speed of the vehicle by imposing a maximum gear when engine temperature is below a certain parameter value.



Example of a software window to configure an engine high temperature function: as system temperature rises from -90 to 120 degrees then progressively more system output is disallowed

High temperature engine protection

If we invert the functionality described above, then we have the possibility to protect the engine in high temperature conditions. When the engine temperature goes above a certain parameter, then we need to reduce the engine load being imposed by the transmission or working hydraulics. The reduction function is best applied when implemented according to a straight-line calculation. The reduction function increases in reduction, in direct proportion to the increase in temperature. As system temperature rises, then progressively more system output is disallowed. In practice, implementation of this functionality involves reducing the transmission and hydraulics with a common reduction function.

Engine protection prioritisation

Common reduction functions as described above are one way of providing engine protection. The machine may become unusable if a common reduction principle is applied. It may be desirable to implement more severe reductions on some functions than others. In this way, it may be possible to provide engine protection under severe conditions and maintain a high degree of machine productivity.

Electronic end stops on all hydraulic functions

Modern angle sensors provide a very low cost effective way of knowing the position of the hydraulic cylinders at all times. In the past, costly linear sensors internal to cylinders, were the norm for cylinder position feed back. Today, many thousands of cylinders on mobile machines, have costly mechanical devices to provide end damping. These mechanical devices are inflexible and adjustment to the damping characteristics is not easy. If we choose to transfer the control of this to proportional valves and sensors then we have a totally flexible end stop solution. The end damping will usually be the result of a linear reduction of valve output as a result of cylinder position, regardless of the command signal.

Consider if the ending damping function is taken to a higher level, in a simple end damping function a linear position will trigger the start of the reduction. This trigger point could be the result of a load. If a large load were being manoeuvred then the trigger point to start the reduction function would happen earlier, in order to balance the mechanical stresses due to end damping.

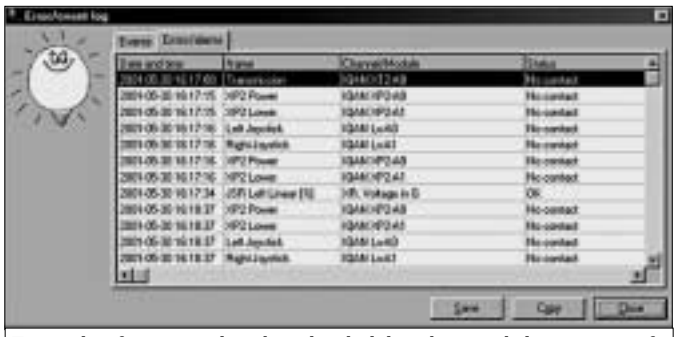
Consider then, if we took the same principle but made the reduction trigger point proportional to speed of movement of the function, or if we took the same principle and made the trigger point proportional to the angle of deflection of the joystick. In an ideal world, we would take all of these factors into consideration:

- linear position
- load
- speed of movement
- joystick deflection.

The trigger point for the end damping would then be the value that started the reduction earliest.

Joystick position engine speed demand

One advantage of having engine and hydraulics under the same controller is that the possibility exists for the joystick to make a demand for an engine speed increase. Instead of using the foot throttle every time a high flow demand is required, joystick deflection automatically makes



Example of an error log download giving date and time, name of faulty channel, hardware location and information regarding the nature of the fault

the demand. The characteristics of this function can be easily tailored to suit the demands of different manufacturers. For fine metering or low flow, then the joystick could be configured to only ask for an engine speed increase after a certain angle of deflection.

Hydrostatic transmission control

Hydrostatic transmission control calls for close control of both the engine and the transmission pump or motor. Most hydrostatic transmission applications have a 'corner' power demand that will stall the diesel engine in the vehicle. Power control and anti stall are therefore essential if good machine driveability is to be achieved. In order to provide good driveability, it is essential to sense engine load. Engine load measurement is gained from fuel governor mapping or an electronic parameter delivered by the engine controller. According to the degree of engine load, then the hydrostatic transmission starts to be reduced so that hydraulic pump flow is reduced and pump pressure then increases. Engine speed and vehicle motion is maintained, staying within the maximum available engine power.

A hydrostatic transmission can be considered a very 'rigid' system. It is very important, therefore, that precise control is maintained of the pump displacement. It then follows that, before selecting a hydrostatic pump, consideration needs to be given to stability of the displacement controller, displacement controller hysterisis and repeatability. If problems arise with these control areas, then the software has to have flexibility to compensate.

The way forward

The days of the customer relying on the supplier for control of the machine application file are numbered. More and more customers are requesting control of their own application file. Many systems on the market today require the employ of a trained programmer to manage a machine application file. This is expensive and means that the functionality of the machine is in the hands of an individual who does not necessarily have a machine design back ground. If the supplier controls the application file, then the issues are two fold.

The supplier has control over 'how the machine works'; this is a very commercially sensitive area as machines are sold on 'how they work'

Rapid application file development is at the mercy of whether the supplier has the resource at that time to make program changes. If not, then robust discussions about priorities take place which is not good for the business relationship.

The Parker IQAN system, developed by Parker Hannifin plc, provides a solution to this dilemma with the following objective: 'to put mechanical and systems design engineers in total control of machine functionality programming using a windows based application tool.'

The philosophy behind this is to expose the machine designer to every type of internal channel for both properties and function purposes. For example, 'three term controllers' which have the following attributes:

mathematical functions
internal conditioning
function parameters
timing and counting functions

With these tools at their disposal, then the machine designer's limitations are the extent of imagination or the cost effective hardware for delivering the required functionality. It follows, therefore, that Parker Hannifin plc has no wish to be involved in the application file development, as long as the required functionality is realised and the machine is safe.

System diagnostics

Effective system diagnostics are an essential consideration in total machine control. The system error log diagnostics can be divided into two main categories:

errors and events that refer to the system hardware
errors and events that refer to the machine application file.

Both must be recorded in internal error logs for field service interrogation.

System hardware errors usually refer to any electronic errors due to over and under supply voltage levels, sensors moving out of range, analogue output feed back errors, internal temperature issues and internal reference voltages.

The system event error log must be configurable from application software. An error according to machine functionality is defined and, when the error conditions are met, then a line of error log is created.

For effective system diagnostic analysis, it is desirable that each line of error log has a date and time stamp, together with a record of the channel on which the error was made. A record of the pin out details and node address is also useful.

Light emitting diodes (LEDs) mounted on system hardware and visible externally are a good way of giving a quick visual indication of the nature of the system errors. A simple sequence of flashes can be a good way of coding this to the service engineer. It is important that this method of communicating errors is not made too complex. Control systems exist in the market place where service engineers are required to count up to 25 LED flashes. Field observance of this method of diagnostics, reports that service engineers do not consider this user friendly.

One discussion that often surfaces in diagnostics considerations concerns the size of the machine user interface screen. A big screen is often provided for

Example of a master module screen display reading engine speed; note hardware module location, hardware pin number and the speed as scaled value (option to display the Hz value also available)

applications that are just one generation removed from a conventional multi-dial display. Operators still like to glance at a row of gauges and perform their own checks, in which case a large screen is required so that multiple channels can be displayed simultaneously. The other way is to use the 'pop up' philosophy which involves a small display and no channels permanently on display. Considerable work needs to go into the application file so that all the information that is absorbed and acted upon in a large display application has been taken care of within the code of the file. If the system information requires the attention of the machine operator then the information 'pops up' on the display. A small display is therefore all that is required.

Another popular criteria for machine diagnostics are that any I/O on the control system needs to be measured from the machine user interface. In effect the user interface now becomes a multimeter. If this is the case then I/O checks can be performed without the need for expensive diagnostic tools. The discussion then follows as to whether the field service engineers can fault find and fix with an error document and the user interface. Alternatively, are field service engineers required to dig deeper into machine functionality? If so, then a laptop or palmtop computer is required.

If field support regarding the application file is required, then remote modem access is a good way for engineering support to be rendered. It allows engineering access to all parts of the application file and error logs.

Short Message System (SMS) technology also gives the ability to request the value of any parameter in the control system. SMS is also discrete so machine operators never necessarily know when information is being demanded. SMS can also impact on diagnostics by conditions in the control system defined as to when a service interval is exceeded. When these conditions are met, then SMS messages are automatically sent to a service centre.

Once electronics are tested and installed in a mobile vehicle then they tend to be very stable. If the unthinkable happens and the system becomes unstable, then some sort of hardware quality references need to be accessed quickly. It is therefore desirable that all modules have a serial number, hardware version and software version reference available from the user interface. This will enable the electronics manufacturer to act quickly in relation to hardware issues.

A typical hardware requirement for remote modem communication.

System integration

The merits of total system control are unquestionable. The boundaries of a total control system are perhaps worthy of greater discussion. The total machine control concept is broadly confined to real time control operations. Other topics of machine control include data logging and crop management systems.

Data logging functions, to record millions of data points, is a process only normally carried out at machine prototyping stage. Mobile real-time control systems rarely possess the memory to take care of this type of function. If all mobile control systems had this capability, then there would definitely be a cost implication. High resolution data logging is not normally a function required for volume production machines and, therefore, most mobile control systems do not have this capability. There are situations, however, where this type of function is sometimes required; in which case, an external data logging system would have to be used, obtaining its information from the real time control system. In order to achieve this, an interface is required. The suggested method is via serial communication with the real time control system, over a standard protocol. One of the most developed and field tested protocols is CAN and more specifically the CAN protocol according to SAE J1939. This is a widely adopted standard among engine and transmission manufacturers. The mobile control system of choice must, therefore, have a CAN gateway and every channel that is used in the application software is available for logging purposes at the CAN gateway.

Crop management systems are now an essential part of modern harvesting and planting equipment. Crop management needs to have some way of implementing its command data. Information, according to yield, can be gathered by the real time control system with the aid of counters, timers, weight readings and mathematical calculations. Information for crop applications can be implemented in the real time control system by controlling positions, speeds and forces. The crop management system now needs to find a way of communicating this information with the real time control system. The suggested method for this is, once again, that it takes place over a CAN gateway with a field tested protocol, such as SAE J1939.

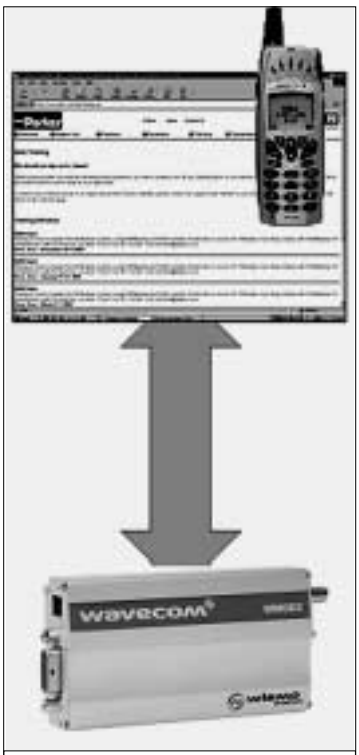
Remote communication with the machine, for driver issues and control system commands, is now a mature technology with SMS. Provided modem access is present, then messages can be sent to the driver via the user interface. The message can be interactive and demand a response from the driver. Command messages that control machine operational parameters are also easily implemented using SMS. The machine can, therefore, be easily shut down with SMS and, provided the modem connection is present, then an extra level of security is added.

Commercial considerations

Commercial considerations are vital when selecting a mobile control system. The Parker IQAN philosophy of a control system is that it should be made up of the following items.

Hardware

All control systems have to consist of a safe hardware design that takes care of irregular power supply with varying voltages. Reverse polarity and high temperature protection should be included. Each unit module must have test documentation for electromagnetic compatibility (EMC), vibration, thermal shock, humidity, salt spray, etc.



Remote communication with machine for driver issues is now a mature technology with the Short Messaging Service (SMS)

Operating system
A safe embedded operating system needs to be designed that conforms to relevant safety standards. Updating of this operating system needs to be simple and able to be carried out in the field.

Application software
There should be a totally open application software environment where the application file is in the control of the customer.

Diagnostics
A comprehensive diagnostics package is essential for problem solving.

Accessories
Modem access, radio remote control and SMS messaging should be easily integrated into the system if required.

Documentation
Extensive documentation should include instruction manuals for all software and hardware. The ability to document the application file in the form of text is useful for creation of machine error documents.

Product training & application support
The control system has to be supported by supplier personnel who can offer training and assist with the generation of the first application file

Type of organisation
It is recommended that the control systems supplier should be a large, stable and profitable organisation. The control system is such a pivotal part of the machine that supplier issues can cause major problems. Control systems tend to soak up engineering resources quickly. One major issue with a small electronics company, can quickly tie up all their engineering resources and it becomes a question of priorities as to which problem gets solved. Smaller electronic companies that control all the application software also suffer, in circumstances where urgent application file support makes impossible demands of the programmers. It is not suggested here that larger companies will have unlimited resources but if the control systems department is well funded, then the resource to tackle big issues will more likely be available. A larger company, with more people, also spreads the risk in situations where there may be a break down in personal relationships. It allows the machine manufacturer recourse to other personnel in order to solve problems

Conclusion

If machine manufacturers are to embark on fast, flexible and cost effective development of control systems, to implement total machine control, then a 'work out of the box' control system has to be purchased. If the offering from the supplier is a truly 'works out of the box' solution, then development costs for each of the areas will have to have been absorbed in advance. Field experience is teaching us that many companies have the ability to design hardware and go ahead and do this. They then start on the operating system and start to suffer, as the size of the undertaking becomes apparent. The vision of what is required, in terms of resource, to create an application tool also becomes clear. What seems to happen next is that the machine manufacturer then looks around for an operating system and software that will work with hardware they have designed and the whole process becomes an exercise to ensure the company concerned does not lose the investment in hardware design. A better way to handle this type of project is to research the market for a 'work out of the box' solution at the outset.

HEALTH & SAFETY REGULATIONS

HSE sets deadline for safety upgrade of wood

The Health and Safety Executive (HSE) has set a deadline of 5 December 2002 as the date by which all power-fed wood chippers must have improved standards of operator protection. After this date, inspectors coming across machines not meeting the standards given in HSE Agriculture Information Sheet (AIS) 38: *Power-fed mobile wood chippers – Operator protection at infeed chutes* will be taking increased levels of enforcement, including, in some instances, serving an immediate Prohibition Notice.

Two years ago, HSE undertook a review of operator protection at the infeed chutes on power-fed machines. The review found that while some designs provided better protection than others, all makes needed improvement. These improvements were discussed with UK manufacturers and suppliers during 2000, and, from 31 October of that year, manufacturers and suppliers agreed to supply new machines to the standards in AIS 38 and offer retrofit kits for the upgrading of existing units.

Neil Craig, from HSE's Agriculture and Wood Sector, said: "Wood chipper owners have had 18 months to bring their machines up to scratch. Many prudent users have already upgraded their machines, and, by setting this deadline, we hope to motivate the rest to come up to standard. Wood chippers are dangerous machines with the potential to cause horrific injuries unless fitted with the right safeguards."

The report AIS 38 sets out the minimum standards for these machines. Users should compare the protective measures described in the guidance with the existing measures on their machines and contact their suppliers for upgrading where necessary.

MORE INFORMATION

Copies of the free information sheet Power-fed mobile wood chippers – Operator protection at infeed chutes (AIS 38) are available from HSE Books, PO Box 1999, Sudbury, Suffolk, C010 2WA. Tel: 01787 881165. Fax: 01787 313995. Web: www.hse.qov.uk/pubns/agin-

TERRAIN VEHICLES

Massey Ferguson makes new additions to AgTV range

New MF 500 TBX go-anywhere load carrier

- New MF 400 Auto with 'Duramatic', constantly variable transmission
- Superior transmission durability and reliability
- Start in gear and reverse shuttle
- Higher torque at lower engine speeds
- A host of class leading features

Two new models, the MF 500 TBX range topping load carrier and the MF 400 Auto mid range machine, both with 'Duramatic' automatic transmission, have been added to the Massey Ferguson line-up of Agricultural Terrain Vehicles (AgTV).

Named AgTV because they are specially designed for rugged use in agriculture and allied industries, the MF range now comprises seven manual and automatic transmission quad bikes from 246 cc to 493 cc. The new models extend the already class leading load carrying capacity of the range, backed by the same outstanding engine, transmission and suspension features which make the MF machines more durable, reliable and manoeuvrable than others on the market.

Massey Ferguson's newest AgTV machine

New MF 500 TBX go anywhere load carrier

The MF 500 TBX combines the powerful 'go anywhere' four-wheel drive characteristics of the conventional of MF 500 AgTV, with the load capabilities utility vehicle, making it ideal for farm use, grounds care applications and utility company maintenance operations.

Instead of the conventional rear carrier, the MF 500 TBX is fitted with a moulded toughened plastic box over the rear axle with a carrying capacity of 136 kg. This is in addition to the front rack which can carry a further 45 kg. For easy emptying, the box tips on a gas strut by using a lever at the side of the operator's seat. The corrosion resistant plastic is easily cleaned with a pressure washer. Extra carrying and storage space is provided in two fully sealed bins in the rear fender moulding. Made from the same toughened plastic, they are ideal for carrying tools, valuables or a flask. Additional load transporting capability is provided by a towing capacity of 477 kg.

New MF 400 Auto with Duramatic transmission

The new MF 400 Auto is a mid range machine suited to a wide variety of work. It also leads its class in load carrying capabilities with combined front and rear rack capacities of 136 kg and a towing capacity of 477 kg.

It has the same 'Duramatic', automatic, constantly variable transmission as the MF 500 Auto and new MF 500 TBX machines, offering the same operator advantages of easy of use and manoeuvrability.

Superior transmission durability and reliability

The 'Duramatic' transmission is unique to MF AgTVs, providing superior durability and reliability compared to other systems.

A major advantage of it is that the massively strong Kevlar coated belt is always engaged and tight. Drive is engaged and disengaged by an automatic clutch rather than slackening the drive belt as on most other automatic transmissions. As a result, the belt on MF AgTVs with automatic transmission cannot be distorted or stretched by frequent engagement and disengagement. Since there is no slack in the belt, power take-up is always smooth when moving off, without any 'snatch'.

Durability and reliability of the transmission, which provides selectable two or four-wheel

drive with two forward and one reverse speed ranges, is aided two-fold. Firstly by the large support bearings on the drive clutch which keep the clutch centres constant and secondly by the fully sealed, rigid, cast aluminium housing which keeps out dirt and water.

Start in gear and reverse shuttle

On the MF 400 Auto and the MF 500 TBX, the engine can be started with the transmission engaged by squeezing the brake lever and pushing the starter, making the machines ideal for work requiring frequent stopping and starting. Both have a single lever forward/reverse shuttle on the right of the fuel tank.

Higher torque at lower engine speeds

Powerful, liquid-cooled, four-valve, four stroke engines – 371 cc on the MF 400 Auto and 493 cc on the MF 500TBX – provide the high torque at low engine speed that is needed for working in difficult conditions and to match the excellent towing and carrying capacities of the machines. The MF 500 TBX produces its maximum torque of 46 Nm at 3,500 rev/min compared to a competing 600 cc machine with a maximum torque of only 39 Nm at 5,500 rev/min.

High torque at low engine speed provides better performance on difficult terrain, whether steep hillsides or muddy fields. It means less noise, better fuel economy and less stress for the operator.

The engines and magnetos are fully sealed to keep out dirt and moisture for reliable running in all conditions and can operate in water up to exhaust depth.

A host of class leading features

Other leading features of the new MF 400 Auto and the MF 500 TBX are:

- Fully-independent wishbone front suspension and patented '4-link' fully floating, semi independent rear suspension providing class leading 18.3 cm of suspension travel and 23.3 cm of ground clearance, while maintaining a low centre of gravity and without making the seat uncomfortably high. When towing, the suspension systems transfers weight directly to the driving axle for a more comfortable ride
- All round hydraulic disc brakes operated by a single lever give impressive braking performance and are less prone to clogging and wear compared to the drum brakes still used on some ATVs. An additional rear foot break, mechanical on the MF 400 Auto and hydraulic on the MF 500 TBX, gives extra braking when used with the hand-lever brakes or allows braking while turning when used alone.
- Best in class fuel capacity of 18 litres.
- High-density polyethylene skid plate protects the underside of the MF AgTV.
- Compared to steel, it has the advantage of not denting, ripping or rusting.
- An electrical output socket provides power for equipment such as spreaders, sprayers, winches and the MF Fieldstar terminal for precision farming operations
- Top quality after-sales service for parts and servicing provided through the MF dealer network.

CONTACT

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FERTILISER SPREADERS

Top-line S60 broadcaster

A new machine, the Top-line S60 has been added to Teagle's range of UK built broadcasters. The S60, which replaces the TD50, has a basic capacity of 1300 *l* which can be increased to 1900 *l* and 2500 *l* by adding hopper extensions. A major feature of the machine is the extent to which stainless steel has been used in it's construction including the hopper and hopper extensions. Virtually all of the spreading and metering mechanism is stainless but the addition of a stainless steel hopper will greatly reduce corrosion.

As with most of the Teagle broadcaster range, the S60 carries a 2 year parts warranty in addition to the normal 12 months comprehensive warranty.

The spreading mechanism is a conventional twin rotor design, which spreads from the outside inwards to give a high degree of overlap. The radial feed system onto the rotor vanes minimises spread pattern variations and consequent striping in hillside work. Bout widths between 12 m and 24 m can be achieved by changing the gear ratios in the main drive gearbox. This operation does not involve the use of tools and it is not necessary to drain the gearbox.

A headland spreading facility, in the form of a tilt mechanism, is included as standard equipment. The tilt is operated hydraulically and produces a very short spread pattern on the field boundary side of the machine.

Cleaning and maintenance is made easy by the fully tilting hopper. This is held in place by a spring-loaded pin and when tilted, the whole of the spreading mechanism is exposed for easy access.

The generous specification includes hydraulic remote shutter, lights, hopper screens, boundary spreading system and test tray kit. The basic machine is priced at £3,410. Options include hopper extensions, folding hopper cover and extra gear sets.

Teagle's fertiliser spreader in action

The Top-line S60 is a British design and built alongside the rest of the range in Teagle's modern UK factory.

CONTACT

Teagle Machinery Limited, Blackwater, Truro, Cornwall. TR4 8HQ. Tel: +44 (0)872 560592 Fax: +44 (0)872 561166 E-mail: howard@teagle.co.uk Website: www.teagle.co.uk

FIRE PROTECTION

Jephson Gardens' temperate glasshouse safe from fire

The most sensitive smoke detection system has now been installed to protect Jephson Gardens' temperate glasshouse from fire as part of a £4.3 million makeover undertaken by Warwick District Council.

The historic gardens which are currently undergoing redevelopment, will feature a temperate glasshouse overflowing with exotic plants when it opens later this year. Consultants, Greenway & Partners Ltd, chose the Stratos-HSSD® which was manufactured by Queen's Award winning AirSense Technology Ltd, to protect the glasshouse, the adjoining riverside restaurant and the thousands of annual visitors from fire.

In 1999, AirSense Technology Ltd became the first manufacturer of fire alarm products to receive the Queen's Award for Technological Achievement. This award was in recognition of the innovative design of the Stratos-HSSD® detector and the effectiveness and reliability of its artificial intelligence (AI) system, known as ClassiFire®. They have recently added to their success, having been awarded the Queen's Award for Enterprise, for Export Achievement 2002.

The fire detection system was supplied and commissioned by F4 Ltd, taking great care to preserve the aesthetics of the glasshouse. Brian Morrison, Sales Manager for F4 said, "It was necessary to conceal aspirating pipes within the structure's girders and under the flooring, ensuring visitors will never know they are there."

Installing fire detection systems within exceptionally humid buildings such as glasshouses presents a number of technical challenges. Greenway & Partners Ltd worked closely with consultants from AirSense and F4 Ltd, paying particular attention to ensure aspirating pipes were installed in positions throughout the building where rising smoke is most likely to dissipate. Given the level of condensation that would be present in air samples, it was also necessary to install special piping that would collect and drain moisture present in the air. The Classifire® system contained in Stratos-HSSD® enables the system to adapt to climatic changes. It also allows for high levels of pollen or other non-related particulates thus preventing any of these factors from causing nuisance alarms. This ensures the best possible warning, to even incipient fires, can be provided throughout the year.

CONTACT

AirSense Technology, 1 Oak House, Knowl Piece, Wilbury Way, Hitchin, Herts, SG4 0TY. Tel: +44 (0)1462 440666 Website: www.airsensetechnology.co.uk

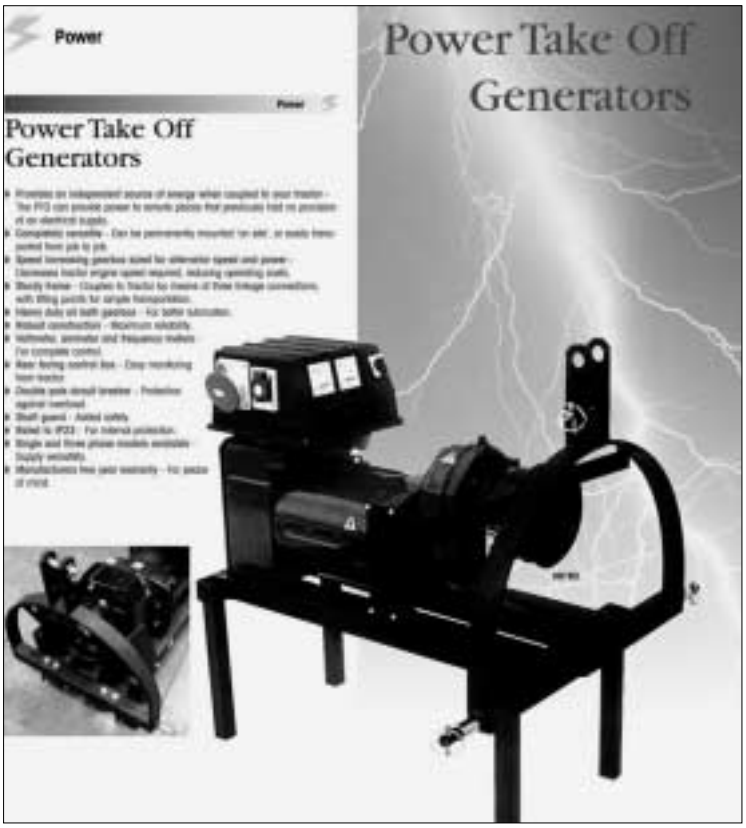
GRAIN STORAGE

When PTO doesn't mean please turn over

SIP (Industrial Products) Ltd have recently added a new range of power take-off (PTO) generators to their already vast range of products. The PTO generators can provide an excellent source of power to remote places that previously had no provision of an electrical supply

These impressive units are designed to be driven by the power take-off of the tractor, and are easily coupled to the three linkage connections, making them easily transportable from job to job across the farm.

Convenience, of course, is not the only issue and considerable thought has also gone into reducing running costs. These sturdy units have a special speed increasing gearbox, sized for alternator speed and power which decreases the tractor engine speed required thus saving money.



With models ranging from 13 to 40 kVA continuous outputs, single or three phase, there is something for all requirements, but the main issue is the convenience and time-saving that can be achieved.

CONTACT

Chris Wight, Marketing Executive, SIP (Industrial Products) Ltd, Gelders Hall Road, Shepshed, Loughborough, Leicestershire, LE12 9NH. Tel: +44 (0)1509 503154 E-mail: info@sip-group.com Website: www.sip-group.com

Biodegradable greases for bearings

New biodegradable grease from SKF (Photo: SKF)

A new biodegradable grease from SKF can match traditional grease performance in bearing applications. It also meets the increased demand for environmentally friendly products in the engineering industry.

SKF has launched its 'green' grease, LGGB 2 product, as a general-purpose lubricant. As such, it is suitable for many different types of bearing applications. This contrasts with other biodegradable and non-biodegradable greases which often require one particular type of grease per application. The grease is also a highly competitive alternative to traditional greases.

The development has come about through SKF working with its own suppliers to identify the suitable characteristics and performance requirements for environmentally friendly grease. The application of biodegradable lubricants and greases has been studied at the SKF Engineering & Research Centre for a number of years. This has led to a formulation that can meet the stringent demands of a range of engineering applications without adverse effects on the environment.

Although only a portion of lubricants used may pose a threat to the environment, this can add up to several millions tonnes worldwide. In particular, equipment users in the construction, earthmoving, forestry and farming industry are increasingly seeking 'green' solutions because environmental contamination may be an issue.

Until recently, it was thought that current generations of biodegradable and low-toxicity lubricants could not satisfactorily meet the requirements of rolling bearing applications.

SKF has managed to overcome the inherent disadvantages of biodegradable greases, which have led to premature bearing failure. LGGB 2 has been tested and approved for 'steel on steel' spherical plain bearings, ball and roller bearings. The grease is based on synthetic ester oil, lithium/calcium thickener and other biodegradable ingredients and it has low toxicity.

Study of requirements

The search for a suitable biodegradable and low toxicity lubricant involved a number of key issues. These included:

- current and proposed environmental legislation relevant to lubricants
- existing products on the market and their performance
- demand for the product properties for the product
- current research.

A central issue was to establish a clear definition of the term 'green' grease as most materials will degrade in some way over time. There are many processes responsible for these changes, mostly commonly biodegradation, oxidation and photolysis. Chemical and physical changes over time often occur simultaneously.

With regard to the development of clear parameters on material breakdown in the context of 'green' grease, the understanding of biodegradation is vital. In biodegradation, the material is gradually broken down through the metabolic action of such living organisms as bacteria, fungi, yeast and algae. Hydrocarbons, which are the main constituent of biodegradable lubricants, are transformed into carbon dioxide and water by this process.

Naturally, this process is not entirely predictable as it can be influenced by factors, such as the mix of living organisms present, temperature and humidity. It can happen that a material that may easily degrade under one set of circumstances may not readily degrade under others.

The minimum basic requirements are sufficient bacteria population, correct oxygen levels and a suitable temperature range. The rate of degradation is also affected by such factors as:

- fluid viscosity
- sunlight
- mineral salt content
- availability of nitrogen
- pH levels
- solubility
- ability of bacteria to adapt to the source of oil nutrient.

Ultimately, of course, the lubricant should be reduced to its simplest natural form while leaving no harmful by-products that could have a detrimental and long-term effect on the local environment.

Traditional lubricants based on mineral and synthetic oils are ultimately biodegradable though the slow rate of decomposition means, under some conditions, that they can exist as a contaminant in groundwater for close to a century.

Testing considerations

Any tests to establish the biodegradable performance of a new lubricant have to bear in mind the often unpredictable and complex processes at work. With no single universal standard that clearly defines biodegradability, SKF opted to use a number of existing tests. These were used to establish whether toxicity and biodegradability occurred within a reasonable length of time. Basically, biodegradability means that microorganisms in the soil, rivers and oceans can break down greases with relative ease.

From exhaustive studies, SKF has found that ester or vegetable fluids formulated carefully into lubricants perform well in real applications. In particular, SKF researchers found that a combination of synthetic ester oil and a lithium/calcium thickener resulted in good properties as defined in terms of water and corrosion resistance without the need to use toxic additives.

The LGGB 2 grease formulation, based on these constituents, performs well with ball, roller and plain bearings. This is a

Technical data for LGGB 2 biodegradable grease.

Environmental properties	
Biodegradability, CEC-L-33-A-94	> 80%
WGK (German Water Pollution Hazard Classification)	0
Basic characteristics	
DIN 51825 code	KPE2K-40
NLGI consistency class	2
Soap type	Lithium/calcium
Colour	Off-white
Base oil type	Synthetic ester
Operating temperature range	-40 to +120°C
Maximum temperature for continuous use	+90°C
Dropping point DIN ISO 2176	170°C min
Base oil viscosity	
40°C	110 mm^2/s
100°C	13 mm^2/s
Penetration DIN ISO 2137	
60 strokes	26.5 - 29.5 mm
100,000 strokes, change	< 3.0 mm
Corrosion protection	
SKF Emcor standard, distilled water, DIN 51 802	0 - 0
Water resistance	
DIN 51 807/1, 3 hours at 90°C	1 max
Oil separation	
DIN 51 817, 7 days at 40°C, static	1.6%
Grease life	
SKF ROF test, 10,000 rev/min at 120°C, L50	Approx. 500 hrs
Performance in plain bearing	
SKF 'steel on steel' spherical plain bearing test	Pass
Performance in roller bearings	
E DIN 51 819, 750 rev/min	Pass
Mechanical stability	
Roll stability, 50 hours at 80°C, change	< 5.0 mm
EP performance	
4 ball wear scar, DIN 51 350/5, 1,400 N	1.68 mm
4 ball weld load, DIN 51 350/4	2,500 N

significant development, as conventional lubricating greases are normally considered suitable for only one bearing type. Each bearing class has a different contact surface, which can affect lubricant performance. For instance, the lubricant film in ball bearings has a point contact; in roller bearings it is a line contact; and for plain bearings it is full contact over the area. SKF selected four different formulations that were subjected to stringent bearing tests. These included the:

- SKF ROF test to determine performance in ball bearings and determine the maximum operating temperature limit
- SKF EMCOR test which tests corrosion inhibition properties
- R2F test to establish grease lubrication performance in roller bearings
- SKF 'steel on steel' plain bearing test

From these tests, it was found that LGGB 2 offered superior performance over a range of operating conditions and bearing types and established a steady operating temperature set at 90°C.

Summary

Overcoming the limitations of biodegradable lubricants has been a goal of SKF for many years. Thanks to its specialist knowledge of bearing behaviour and the effects of lubrication, the Company has now launched its first 'green' grease, which is believed to be the first of its kind on the open market.

Developed to meet a range of bearing applications, the new grease, called LGGB 2, meets the strict criteria that SKF places on bearing greases. It has been tested and approved for 'steel on steel' spherical plain bearings, ball and roller bearings.

The new grease is part of the group's continued commitment to the environment and the adoption of sound environmental practices within the bearing industry.

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DATA CAPTURE

New barcode scanning feature for PocketGIS™

Positioning Resources Ltd, Aberdeen based data capture specialists, have been working closely with Netherlands clients, Geometius B.V. to further develop their revolutionary handheld mapping software PocketGIS™. In response to customer demand, PocketGIS™ now has the ability to scan bar codes in the field.

REMU, an electrical utility company in the Netherlands, are currently using this system to simplify the collection of asset information for more than 100,000 lampposts, each with it's own unique bar code. The bar code scanner is an optional, integral part of a Husky Fex21 hand-held computer. Running PocketGIS™ software on a Husky Fex21 in the field, the user scans each lamppost bar code and checks the asset information displayed by PocketGIS™ by way of a pop-up form. If the information is correct, the user moves on to the next lamppost. If the data is incomplete however, or needs updated – perhaps the lamppost has failed since it's last check – the user simply notes this on the pop-up form and moves on. The updated information will be dealt with on return to the office.

The user takes existing database files into the field, so the data shown on the hand-held computer is the same as is held on the central GIS database. Therefore changes, if made to data while in the field, link directly back to the main database when PocketGIS™ is uploaded on return to the office. This upload, updates the corporate GIS database in one step, without deleting existing files, ensuring that integrity and quality control are maintained throughout the process.

Positioning Resources has been providing field data capture and mapping solutions to public and private sector organisations for 18 years. PocketGIS Software was one of the first of its kind to run on hand-held computers when introduced in 1997. The bar code scanning feature will now add further value and capabilities to an already versatile software product.

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BAND SAWMILLS

Wood-Mizer's biggest band sawmills yet

Wood-Mizer UK revealed their biggest sawmills so far at the Association of Professional Foresters (APF) fair in September. This band sawmill has significantly larger cutting heads and an extra long main frame, for dealing with longer logs.

New band sawmill with larger heads and extra long main frame

Industrial band sawmill

The new mill, which can be used as stationary or mobile kit, becomes the biggest of Wood-Mizer's European range which now extends to eleven basic models all with differing engine options and other features.

Peter Burn, manager of Wood-Mizer UK explains: "We have added to our existing range of band sawmills to meet world-wide customers' often stated wishes by introducing this industrial sawing head and long bed for reliable, heavy duty, long term timber processing."

Limited edition sawmill packages

To celebrate the 20 years since the first Wood-Mizer band sawmill was invented, the company is offering three 'limited edition' packages at special celebratory prices. The anniversary discount applies to models: LT40HDG24S-1, LT40HDD30S-1 and LT40AHDE15S-1 which are essentially petrol, diesel and electric versions of the widely used, hydraulically assisted LT40.

Smallest Wood-Mizer

The model LT15 is Wood-Mizer's smallest band sawmill. Using the same narrow band saw blades as the larger mills, it can cut logs up to 71 cm in diameter or 5.4 m long.

Kilns and moulders

As part of its policy of assisting customers setting up small timber processing operations, Wood-Mizer is adding kilns and moulders to its product line.

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FORESTRY

'Wet preserving' storm-felled timber

A terrible European storm felled 300 million trees in France and Germany. In France 'wet preserving' these huge stockpiles of felled wood, using pumps, keeps the price of timber from collapsing.

When Hurricane Lothar blasted through France and Germany on the 26th December 1999, it damaged 500,000 ha of commercial forests. With winds of 200 km/h and higher, Lothar uprooted about 300 million trees – the equivalent of a three-year harvest.

After the storm; the Eiffel tower with one of many trees, felled in France and Germany by Hurricane Lothar, shown in the foreground

Like all hurricanes, Lothar disregarded the laws of supply and demand. The 300 million trees represent an estimated 140 million m^3 of timber. If this commodity were brought to market all at once, the over-supply would decimate forestry product prices. The solution is, therefore, to stockpile the logs and keep them wet, to protect against damaging fungus and parasites. The pump company chosen by France's Office Nationale des Forests (ONF) to keep the expensive inventory wet was Lowara.

Lowara pumps, boosters and compressors were used at three French timber stockyards – Mauvages, Bois de Sorcy and Jussarupt, where they pulled water from nearby rivers and lakes to keep nearly 100,000 m^3 of wood saturated for 24 hours per day. The Jussarupt operation was so successful that it was recognised as the pilot plant for the entire forest region to copy.

Lowara's pumps enabled the ONF to market the wood at normal prices which meant the agency gained more money to re-plant and re-forest the areas that Lothar devastated. In this way, Lowara technology is helping the French timber industry avoid economic and ecological disaster.

[Courtesy: Minett Media]

Energy and the Land Based Industries

This conference will encompass not only renewable energy but also energy efficiency and sustainability. Plenary session will be followed by parallel sessions focusing on energy.

Venue: Silsoe Research Institute

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The professional body for engineers, scientists, technologists and managers in agricultural and allied industries including food, forestry and biological systems

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For further information, please contact the Secretariat:
conferences@iagre.org

Anyone interested in preparing papers for the parallel sessions, contact:
Energy Efficiency – Chris Plackett
Renewables – Phil Metcalfe

Innovation, science and technology in **Ag**riculture and the **R**ural **E**nvironment

Keynote Speaker: **Dr Mary Archer**
Conference Convenor: **Gareth Ellis**

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