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Landwards

Volume 53 No. 2 Summer 1998

Agriculture • Forestry • Environment • Amenity

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Landwards

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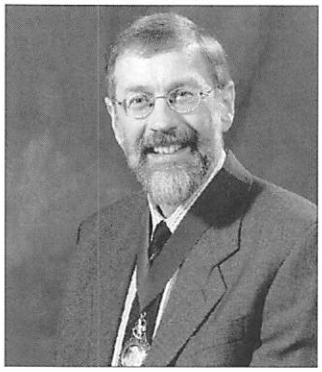

Agricultural Engineering: the centre of the spider's web

Brian J Legg

Networking, the essence of agricultural engineering

One of the joys of agricultural engineering is that one engineer or a small team is often responsible for designing, optimising, and building a complete solution to a problem. But this brings its own responsibilities, and to be successful we must understand the full needs of the ultimate customer, relate to numerous scientific disciplines that may be involved, be sensitive to the variable and delicate nature of materials being processed, bring the whole of engineering technology to bear on the problem, and produce a solution that can be manufactured and used bringing increased profit to all involved. This is not a trivial task!

I have tried to show some of these interactions in *Figure 1*, though the list is necessarily incomplete. Among the engineering disciplines, mechanical engineering was supreme for many years, but nowadays it usually comes with electrical and control engineering, and may need computer technology in the form of microprocessor control, or the use of intelligent interfaces. For other problems, a knowledge of chemical or civil engineering may be more important. Wherever you are in the agricultural engineering business, it is vitally important that you know what advances are being made across this broad spectrum of technologies, and that you are one step ahead in anticipating how these might be used.

In case you doubt the extraordinary advances that are still being made, let me quote a few examples. First from the world of microfabrication, where the Institute of Microfabrication in Mainz, USA, has built a helicopter the size of a peanut shell, and it flies! There are also micro heat exchangers the size of a dice that can dissipate 20 kW of heat, and micro pumps that can pump gases or liquids but are the size of a paper clip and cost only £1 each to manufacture. The ultimate in miniaturisation, for a while at least, comes from IBM who have, within the last few years, written the letters "IBM" using individual tungsten atoms on a nickel substrate. By using such a technique, it would be possible to store all the books ever written by the human

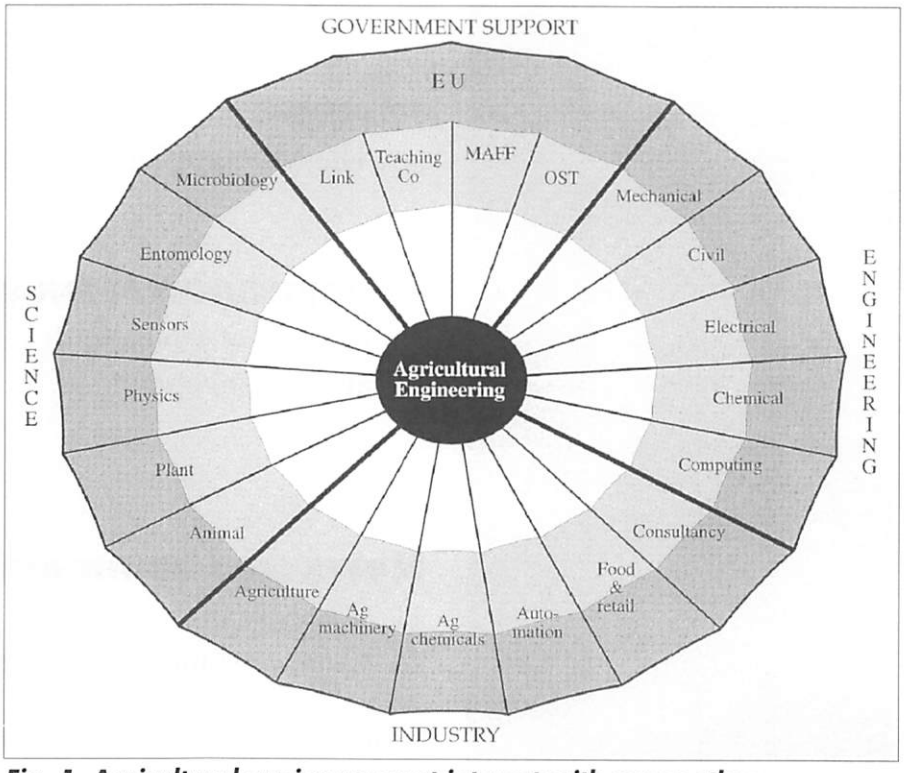

Fig. 1 Agricultural engineers must interact with many other disciplines to provide successful technological solutions to problems.

Professor Brian J Legg, FIAgrE, presented his Presidential Address on 12th May 1998 at the Diamond Jubilee Conference of the Institution of Agricultural Engineers, held at Silsoe College, Cranfield University, Bedford. Brian Legg is Director, Silsoe Research Institute, Wrest Park, Silsoe, Bedford MK45 4HS.

race within the volume of a wrist watch! And in case you worry about how we will ever manage to handle and transmit such enormous quantities of information, especially noting the desperate slowness of the Internet, let me introduce the "asymmetric receiving station" which is now being trialled in the USA. This technology relies on the fact that requests for information are usually very much shorter than the reply. Requests are thus sent in the usual way using land lines, but the reply is returned by satellite transmission. All the user needs is a standard satellite receiving dish, and information can be poured into the open memory at rates of several Mbits per second. At first sight, this might appear in danger of overloading the receiving station, but this is not necessarily so as satellite transmission is also extremely cheap, and it would be quite economical to sift through the information for the one item needed and then dump the rest. If you need the same information again, just ask for it. It will arrive within milliseconds and be guaranteed up-to-date. The question we should be asking is, "how can these new technologies benefit agri-food businesses?", and in particular, "how can I find a way of exploiting them?".

Agricultural engineers must also keep abreast of scientific developments. How will genetic engineering affect your business? If you manufacture spraying equipment, the need to target herbicides might become even more important, as total herbicides can be applied to herbicide resistant crops, but cannot be allowed to drift onto any non-target species without an obvious and disastrous effect. Links with entomologists and microbiologists are important if you design grain driers; and for almost any field equipment it is essential to be aware of agronomic developments.

There are also many industrial sectors that impinge on agricultural engineering. The most obvious are farming and machinery manufacture, but we must also relate to the agro-chemical industry, and specialist engineering industries that supply microprocessors, actuators etc.; and we must be very much aware of the food and retail industries that buy and use agricultural products.

Finally, we must remain aware of national and international government ideas and actions. This is partly because financial and business environments are so dependent on political decisions. For example, how will the European monetary Union (EMU), the Central Agricultural Policy (CAP), or the General Agreement on Tariffs and Trade (GATT) affect us? Those who are members of the AEA are well provided for here, as the Association distributes comprehensive information on current economic and political issues, and the annual conference provides an opportunity to hear excellent presentations and to join in the discussion. Governments also provide some financial aid. In the UK, this may come through government funded research in universities or research institutes, through joint academic/industry initiatives such as LINK, through development grants from the DTI, or through the European Union where research and development grants are also available. Perhaps the most valuable of the EU schemes is the CRAFT initiative designed to help small and medium sized enterprises (SMEs, defined as having 500 or less employees). All of these schemes aim to help British industry, including the agricultural engineering industry, and they will do so provided we remain well informed and use them.

Figure 1 has been drawn to represent a spider's web. This is because we, like the spider, wish to trap all progress made elsewhere as soon as it can bring benefits to agriculture. Our success depends on being well informed about developments in the political environment, as well as in engineering, science and other industries.

Networks in action

Before considering the role of the Institution of Agricultural Engineers, I would like to describe several recent developments, and trace the interactions that have made them successful. The three examples come from crop production, animal production, and from the food industry.

The agricultural engineering idea from this decade that is likely to make greatest impact on crop production is precision agriculture. The full concept of precision agriculture includes the selection and timing of farm operations, but here I will confine my discussion to spatially variable aspects. In a sense the concept is as old as agriculture itself, because a farmer removing weeds by hand directs his efforts to those areas where weeds are most numerous. But the recent interest has come from the observation that fields are almost always far from uniform, and that we now have the ability, supplied by IT research, to do something about it. It was agricultural engineers who spotted the opportunities that this presents. For some operations, such as primary and secondary cultivation, we can make measurements of variations in soil properties in real time, and use computer control systems to respond accordingly and adjust the operation of the tractor and implement. For other operations, we need to make a map of field variations before starting work - for example, a weed map. In both cases, collaboration with others is vital, and at the Silsoe Research Institute we have already worked with at least three commercial farms, four UK agricultural engineering companies, two agrochemical companies, and probably a dozen other research organisations throughout Europe. Funds to support this work have come from the UK Government, for strategic research, the EU for Europe-wide trials and development, from producer levy boards, notably the HGCA and the SBREF, and from private companies.

The potential of the idea, as we all know, is enormous as it brings environmental benefits as well as increased profits to the farmer. It may ultimately affect every field operation including: cultivation, sowing, fertilising, weeding, pest and disease control, and harvesting. But as agricultural engineers, we cannot deliver all the benefits on our own. We need more understanding of the underlying causes of spatial variability, which will come through collaboration with soil scientists, plant pathologists and agronomists, and we also need powerful mathematical techniques to provide robust analysis of field data, so that decisions on variable treatment can be made automatically. I should like to share one such analysis in which Lark and Stafford (1997) used maps of 3 years of Winter Barley yield to identify areas of the field that performed similarly from season to season compared with the rest of the field. The analysis used fuzzy cluster analysis, and the results, *Figure 2*, show zones that always yield well, always yield badly, and yield better than average in a wet season but worse in a dry season. These zones were found afterwards to correlate well with soil type and topsoil depth.

We also need industry, hopefully in collaboration with academia, to deliver complete systems including crop sensors, implements with automatic control, communication between tractor and imple-

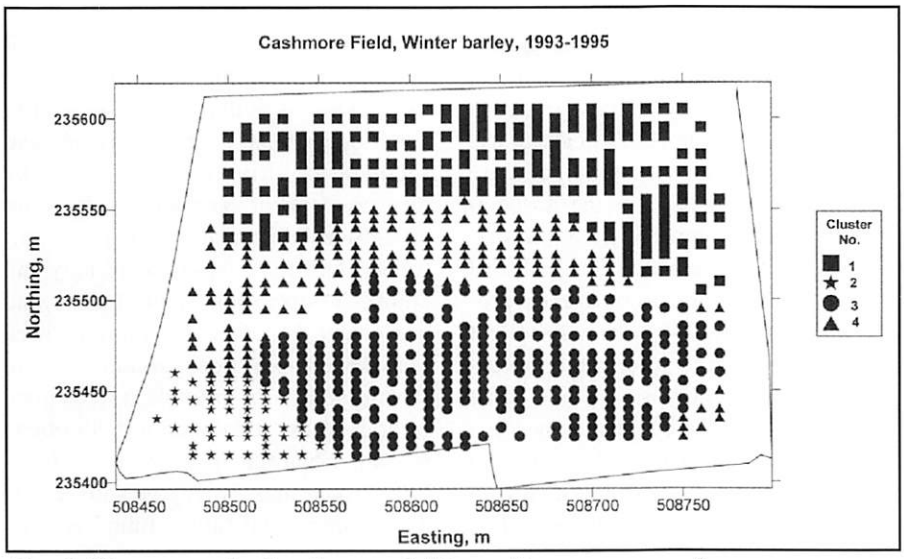

Fig. 2 Cluster analysis of crop yield results over several years can reveal areas of the field that behave in a similar manner. Here, the squares indicate areas with a better-than-average yield in wet seasons but a below-average yield in dry seasons. The stars indicate an area that always yields poorly. The circles show where good yields are always obtained. The triangles show where near average yields were obtained in each year.

ment, and fully integrated software to manage the complete operation. The machinery industry will also need to talk to the manufacturers of agrochemicals to ensure that chemical packaging and formulation are suitable, and that more sophisticated implements will operate reliably and safely.

Before moving to my next example it is interesting to speculate on possible future developments in precision agriculture. I suggest that these may come from satellite images sensing variation in the field, from even greater navigational accuracy, noting that surveyors already claim an accuracy of a few millimetres using GPS, or from the application of machine vision allowing individual plants to be monitored and tended according to their need (Tillett *et al.* 1998). It is essential that we monitor all these rapidly developing technologies and capture them for agriculture when the time is right.

My second example is the development of fully automatic milking systems. The potential benefits are large, as automation will allow cows to be milked more frequently giving higher yields, improved comfort for the cow, and the possibility of detecting oestrus or disease earlier. It will also give benefits to the herdsman who will spend less time on routine plumbing operations, and more time with the animals that need his skilled attention. The robot itself has obviously built on developments in IT research and on the automation of other industries, but cows, unlike cars and printing presses, are all unique individuals with minds of their own.

Successful development must, therefore, not only involve dairy equipment manufacturers, but also animal behaviour scientists. Research has shown, for example, that providing feed within the milking stall may encourage cows to come to be milked, but also may make it very difficult to persuade them to leave! It is better to provide feed beyond the milking stall (Prescott *et al.* 1998). Further development will need collaboration with scientists who can develop sensors for milk quality, cow health and oestrus.

Finally, I would like to consider hygiene and microbiological safety in the food chain. It is recognised that the quest for microbiological safety requires us to consider all points in the chain from field to fork, and the skills of the agricultural engineer as an integrator are very much needed. The broiler industry provides an excellent example where salmonella infection arises in the broiler rearing houses, and can then be spread very effectively from one bird to another by the feather plucking machinery in the processing plant. Indeed, it would be hard to imagine any machine that could be designed to spread microbial contamination more effectively than a feather plucker! Food security will come from much cleaner conditions in the broiler house combined with improvements in the processing plant.

Advances can also be made by considering the ventilation and air circulation patterns in food handling areas. It is possible to use computational fluid dynamics to simulate the movement of micro-organisms from low care to high care areas *(Fig. 3)* and then to use this to optimise the ventilation system (Harral and Brown 1997).

For the whole area of food safety there is the obvious need to work with microbiologists, but also a need for good mechanical engineering and for fluid dynamics.

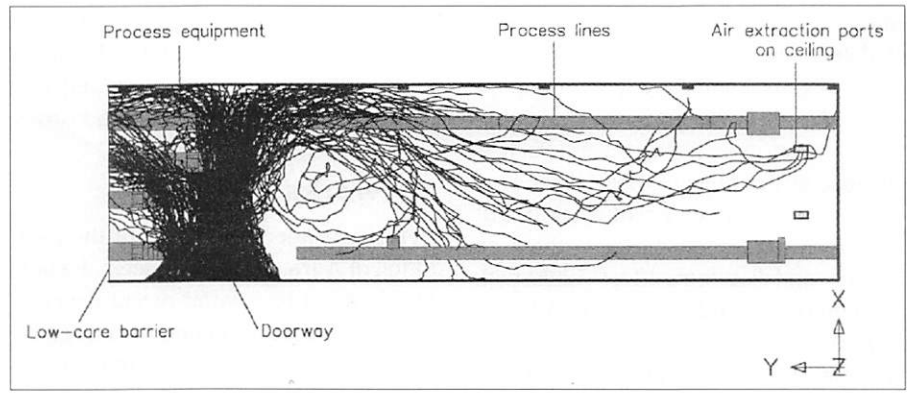

Fig. 3 Plan view of a high-care food preparation area showing the predicted random flight tracks of 10 mm particles entering through the doorway and dispersed by the mean air flow and turbulence.

The role of the Institution of Agricultural Engineers

I have tried to show the crucial contribution that agricultural engineers must continue to play. But what is the role of the Institution? Firstly, I believe that the traditional role of a professional institution to stimulate interaction between its members is still very important. I look forward, therefore, to the culmination of my presidency which will be AgEng 2000, the ninth European conference of agricultural engineering. We should be proud

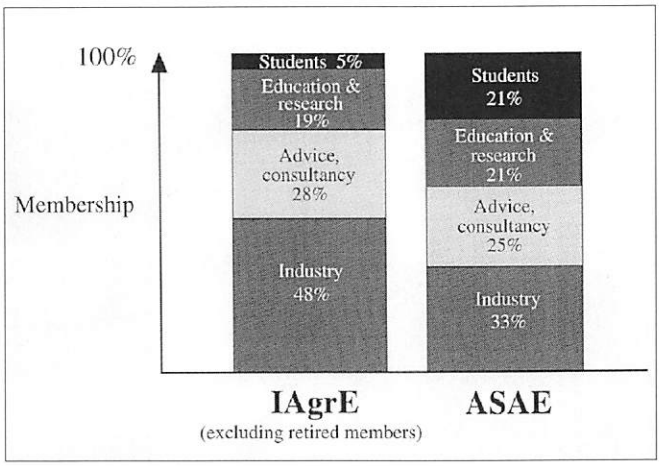

Fig. 4 Membership of IAgrE and ASAE.

that this series of conferences started in the UK in 1984, and that we are now being given the opportunity to set a new agenda for the third millennium. The conference will bring agricultural engineers together from all over the world, and the speakers and participants will comprise many of the occupational groups that need to meet and interact.

Analysis of our own membership, and that of the American society ASAE shows a most encouraging diversity *(Fig. 4)*, and we should also expect meetings of our own members to provide a useful exchange of ideas and expertise between those involved in education, research, consultancy, manufacture and sales. Similarly, our journal, *Landwards*, allows us all to read interesting articles by specialists in other branches of agricultural engineering. But how many of our members are agronomists, entomologists or microbiologists? Or how many are employed in the IT industry, the processed food industry, or even the agrochemical industry? Surely there is an additional role for the Institution in trying to facilitate interaction with this wider community that we all need to know.

One possible way to contribute is by helping to establish a network of contacts which could then be kept up-to-date through the internet. Another route is by encouraging local branches and specialist groups to organise joint events with other regional organisations. This is already done to some extent, for example the South East Midlands Region holds regular meetings with the Institution of Mechanical Engineers. Last autumn I gave a talk to a combined meeting of the Welsh Branch of the IAgrE with the Agricultural Society of Aberystwyth University, and I found them to be a very stimulating audience, with many of them surprised to learn of the wide influence agricultural engineering has on environmental problems, food safety and animal welfare as well as on the more traditional areas of crop production.

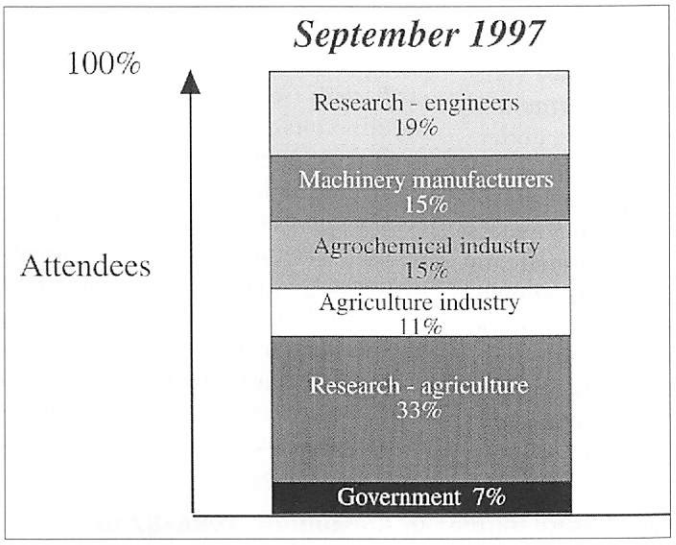

Fig. 5 The First European Conference of Precision Agriculture attracted a multi-disciplinary audience.

We should perhaps also seek to stimulate more multi-disciplinary conferences. It is not chance that one of the most stimulating conferences that I have attended recently was the First European Conference of Precision Agriculture. Although the convener, John Stafford, is an agricultural engineer, the conference attracted a very wide audience (*Figure 5*) including the machinery manufacturing industry, agrochemical industry, and scientists from many disciplines, including agronomy, soil science, and crop pathology.

The second conference will be jointly organised by the European Society of Agricultural Engineers (of which the IAgrE is a founder member), the Society of Chemical Industry, the British Society of Soil Science, the Danish Institute of Agricultural Sciences, the European Weed Society, the Fertiliser Society, and the Nordic Association of Agricultural Scientists

My mission for the next two years of the Institution, therefore, is to build on the existing links between agricultural engineers worldwide, and to develop closer links between all those others, in industry and academia, with whom we must interact more closely. The spider's web is at present incomplete, and must be extended if we are to deliver all that our members will need in the 21st Century.

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Lift truck - lateral instability.

A risk-based approach to vehicle safety

Mark J Cooper

Abstract

Agricultural engineering research has made a significant contribution to the understanding of accident causation involving tractors working on slopes. In particular, the work at the Scottish Institute of Agricultural Engineering (Hunter and Owen, 1983; Spencer, 1978) has led to the identification of the different modes of tractor instability and their technical causes. This primary research has focused on the *technical* causes of instability. However, the instances of vehicle accidents in the agricultural sector continue to be a cause for concern (HSE, 1997). The challenge is to reduce yet further the accidents and dangerous occurrences resulting from all vehicle-related accidents on farms and holdings. This requires an understanding of the types and causes of human error together with an appreciation of risk control in general workplace situations. Significant experience of these matters already exists in other industry sectors, some of which is described here.

These matters are highly relevant to all engineers in that they relate to the Code of Professional Conduct "Engineers and Risk Issues" (Engineering Council, 1993).

Accident statistics

Agriculture is not unique in having vehicle hazards (see title photograph). Taking all sectors of industry, the percentage of all vehicle-related accidents is small - accounting for less than 5% of reportable accidents in 1995/96 (HSE, 1996). However, the fatalities that result are disproportionately large. Some 20% of fatalities in 1995/96 were due to being struck by a moving vehicle and 10% of fatalities resulted from overturns and collapses. As engineers, we tend to focus our research and development on the engineer-

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Table 1 Accidents by type - fatal injuries in Agriculture, 1986/87 to 1995/96 (HSE, 1997).

Accident classification	*Employees*	*Self employed*	*Total*
Struck by moving vehicle	40	47	87
Trapped by something collapsing or overturning	27	41	68
Fall from a height	30	38	68
Contact with machinery or material being machined	31	36	67
Struck by moving, including flying, or falling object	18	37	55
Contact with electricity or an electrical discharge	28	13	41
Asphyxiation	17	14	31
Injury by an animal	10	13	23
Other	5	16	21
TOTAL	206	255	461

Table 2 Struck by moving vehicle - fatal injuries in Agriculture, 1986/87 to 1995/96 (HSE, 1997).

Accident Classification	*Employees*	*Self employed*	*Total*
Excavator	2	2	4
Private vehicle	3	0	3
Tractor	16	35	51
Trailer, plant or equipment associated with vehicle	7	4	11
Fork lift truck	5	2	7
Other	7	4	11
TOTAL	40	47	87

ing control aspects of vehicle safety. This can lead to concentrating activities on *mitigation* rather than *causation*.

Agricultural Fatalities

Statistics for the 10 year period 1986/87 to 1995/96 (HSE, 1997) show that the largest single cause of deaths that were reported to HM Agricultural Inspectorate were due to being struck by a moving vehicle *(Table 1)*.

Table 2 shows the types of vehicles involved in fatal accidents for the period 1983/84 to 1995/96. These included tractors, excavators, private vehicles, lift trucks, together with trailers and ancillary equipment.

Other accidents involving vehicles are classified separately. In the same period, overturns of plant (including vehicles) accounted for another 54 fatalities and falls from vehicles another five. The most common *specific* cause of death was collapsing or overturning plant (tractors, excavators and lift trucks overturning). **Vehicles represent a significant risk to safety whether it be through overturns, falls or collisions.**

Terminology

A whole range of vehicles are now found working in agricultural, forestry and amenities sectors, including:

- telescopic materials handlers
- rough terrain counterbalanced fork lift trucks
- combine harvesters
- agricultural and horticultural tractors
- all terrain vehicles
- other dedicated vehicles such as potato/sugar beet harvesters, tree transplanters *(Figure 1)*, forestry equipment, specialised horticultural machines and self-propelled crop sprayers *(Figure 2)*

For convenience the term *farm vehicle* includes both *self-propelled* and *field machinery*.

Many farm vehicles are multi-purpose. Strict distinctions between different vehicle types are, from a safety point of view, unhelpful. For example, a counterbalanced rough terrain fork lift truck has many of the characteristics of both an agricultural tractor and an industrial lift truck. A telescopic materials handler can be considered as a small mobile crane capable of 'light on-wheels' duties. It also incorporates many of the features of a four-wheel drive agricultural tractor.

Other industry sectors also use agricultural-type vehicles. For example, adapted tractors are used on construction sites.

Human Error

Human error is a factor in many accidents. The following are three examples selected from the eight 'struck by moving vehicle' fatalities reported in 1994/95 (HSE, 1995a):

(i) 74 years old - self employed small holder

"He was believed to have been run over by the nearside wheel of his own tractor which was fitted with a front-end loader. There were no witnesses but he possibly knocked the tractor into gear when mounting/dismounting or started it from the ground whilst it was in gear. The tractor stalled when its loader dug into the ground shortly after running over him."

(ii) 60 years old - self employed farmer

"He sustained multiple head injuries when he was run over by a telescopic materials handler in the doorway of a building on his tenanted farm. The deceased had difficulty walking and it is thought he tried to walk out of the building as the machine reversed, that he

Fig. 1 The hazard of non-standard loads carried by tree transplanters.

Fig. 2 Lateral stability limits operation of high clearance vehicles, such as self-propelled crop protection equipment.

Overturning accident

"A farmer died when his tractor without a cab overturned on a steep gradient on a track from a beach to his farm. He missed a gear change (skill-based error), the tractor ran backwards, mounted a slope at the side of the track and overturned throwing him onto the road. The driver's seat was in poor condition and he was carrying three passengers on a temporary platform (violation) at the rear which would have affected the steering."

Fig. 3 Example of a skill-based error and a violation (HSE, 1986).

tripped, slipped or lost his balance and was struck by the offside rear wheel."

(iii) 69 years old - self employed farmer

"He was found dead in his farmyard by a neighbour. His injuries indicated that he had been run over by his own tractor and attached four-wheeled trailer. He had probably slipped when mounting the tractor and in an attempt to save himself, pulled the gear lever in a forward gear. He then fell under the tractor rear wheel."

and from 1996/97 (HSE, 1997):

(iv) 54 year old - self employed farmer

"He was trapped by a runaway tractor. He was moving big round silage bales in a stacking area in a field with a tractor, front-end loader and a single bale spike. He was working alone and was found trapped between the loader and a bale. It seems that the tractor ran down the 6 degree slope towards him. It was found with the engine running and the parking brake not applied. He died of internal crush injuries.

In each of the above cases, the underlying cause could be described as *human error*. In fact, each falls into a well-recognised category of error. The importance of identifying error types is that each has different characteristics leading to different detection and control strategies.

Error classification - slips, lapses and mistakes

It is not the purpose of this paper to provide a detailed critique of the role of human error in accident causation. In the context of vehicle safety, however, there is one particularly relevant approach to understanding the nature of human error. Rasmussen, a distinguished researcher in this area, describes three types or categories of human error; those that are skill-, rule-, or knowledge-based (Rasmussen, 1974). Skill-based errors - *slips and lapses* - occur where the intended action does not go according to plan. Rule- and knowledge-based errors or *mistakes* are where the plan itself is inadequate to achieve its objectives.

Skill-Based Errors

A simplistic view is that skill-based errors are the slips or lapses *(Figure 3)*. These errors tend to be related to highly routine activities in familiar circumstances: omissions, repetitions, reversals, interference errors and double-capture slips. Examples of slips include:

- failing to apply the handbrake on leaving a vehicle (omission);
- failing to disengage the gears before starting the engine (omission).

The next two categories of error have to do with problem solving.

Rule-based errors

Rule-based errors are concerned with the misapplication or inappropriate use of problem-solving rules *(Figure 4)*. Individuals have a complex array of specific and general rules that they use to deal with everyday problems. Rules are of the type *if* <event> *then* <action>. Some simplistic examples are:

- *if* <machine blockage> *then* <disengage PTO, switch off engine and investigate>
- *if* <pallet or stillage insecure> *then* <re-secure>
- *if* <towing a trailer on slopes> *then* <connect trailer brakes>

Sometimes our rules are incomplete:

- *if* <emergency> *then* <apply handbrake, switch off engine, and dismount>

This is a perfectly good rule under most circumstances. However, with accidents involving contact with high voltage overhead lines, remaining in the cab provides protection against electrocution (principle of the Faraday Cage). A better additional rule would be:

- *if* <emergency involving electricity> *then* <stay in cab until supply isolated>

The role of training in providing individuals with a set of safe rules is crucial. This is especially true when faced with *counter-intuitive* information. For example:

- counter-balanced fork lift trucks are *less* stable when unladen than when laden and the load properly stowed.

Example: Crop Sprayer

SKILL-BASED ERROR - REDUCED INTENTIONALITY

"A tractor driver was spraying a field of carrots when the 24 m spray boom came into contact with 33 kV overhead cables. He had been trying to move around an electricity support post when he accidentally raised the booms into the cables."

RULE-BASED ERROR - INAPPROPRIATE USE OF A NORMALLY GOOD RULE

"As he tried to leave the cab, he was electrocuted."

Fig. 4 Examples of rule-based errors (HSE, 1995b).

Combine Auger

KNOWLEDGE BASED ERROR

"A farm worker was employed to drive a tractor and trailer to haul grain from the combine to the farm. While his trailer was being filled by the combine, the driver of the combine left his cab to clean the window by standing on the header auger. After a short time the combine driver saw that the trailer was overflowing and asked the tractor driver to disengage the unloading auger. The tractor driver was inexperienced; faced with three levers, he moved the wrong one. He had operated the header auger which trapped the combine driver's leg. His leg was broken below the knee in two places."

Fig. 5 Example of a knowledge-based error (HSE, 1995b).

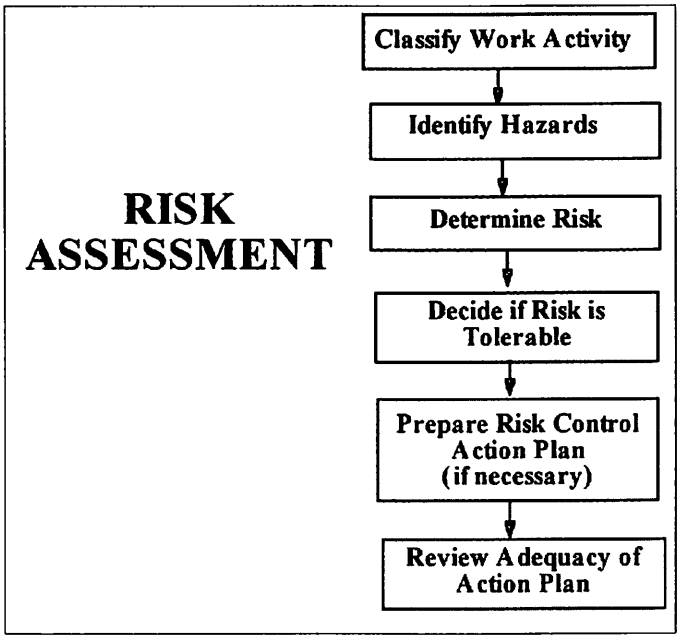

Fig. 6 The process of risk assessment (BSI, 1996).

Knowledge-Based Errors

Knowledge-based errors are concerned with performance in novel or new situations *(Figure 5)*. Actions have to be planned 'on-line'. The process is intellectually demanding. The problem-solver will only resort to this type of activity when they have run out of rule-based solutions.

An example of knowledge-based performance is that of first learning to operate a piece of machinery. The hydraulic controls of a back hoe being a good example. Experimentation will help the operator to build a mental model of how the controls can be coordinated to achieve the desired movements. Eventually, the operator will adopt a set of rules derived from that mental model. With practice, the task will become skill-based.

Violations

In an authoritative text (Reason, 1986) on the subject of human error, Reason defines a violation as follows.

"Errors described as violations occur when an individual or individuals deliberately contravene(s) established and known safety rules."

Violations can occur for a number of reasons, of which three are particularly relevant to vehicle safety:

- the rules may be known but not fully understood;
- the rules may be, at least in part, impractical or extremely difficult to implement;
- there may be inadequate understanding of the risk and/or consequences of breech of the rules.

Figure 3 cited the case of a tractor driver carrying three passengers on a temporary platform. The presumption is that the driver failed to appreciate the consequences of his actions.

Human behaviour in the face of danger

A major contribution to the understanding of accident causation has been the work of Hale and Glendon, (1987) *'Human Behaviour in the Face of Danger'*. The research linked the modes of human error with the stages in the cognitive process. Importantly, it provides a risk assessment framework in which hazards are identified and risks are controlled.

Risk Assessment

Current thinking is that a risk-based approach needs to be adopted for vehicle safety (HSE, 1995c) in the workplace. BS8800: 1996 (BSI, 1996) advocates six steps to the risk assessment process *(Figure 6)*.

Work activity

The following example, provides an illustration of the approach as it might be applied to a rough terrain FLT working in a storage yard.

Hazard identification - general hazards

Some hazards will be common to certain types of operations or tasks. For exam-

General Hazards

Falls of objects
- Insecure loads
- Dislodging of adjacent pallets during stacking/destacking

Proximity hazards
- Contact with overhead power lines
- Running over of cables and hoses
- Collisions with racking and other fixed objects

Collisions with other vehicles and striking of pedestrians
- Low forward visibility when carrying bulky loads

Fig. 7 General hazards for rough terrain lift trucks (Cooper, 1997).

Specific Hazards

Lateral (sideways) instability due to:
- harsh acceleration
- harsh steering
- travelling with a raised load
- travelling *across* inclines or falls over edges
- mounting kerbs, striking pot-holes

Longitudinal (rearing or tipping) instability due to:
- travelling *uphill or downhill*
- overloading
- excessive braking or acceleration
- heavy use of the controls

Control loss due to:
- poor tyre-surface friction
- worn tyres
- tyre-surface contamination (esp. diesel)
- working on excessive inclines
- turning at speed

Collisions and striking of pedestrians
- vehicle blind spots
- failure to see or hear vehicles (by pedestrians)
- failure to see pedestrians

Fig. 8 Specific hazards for rough terrain lift trucks (Cooper, 1997).

	Slightly harmful	Harmful	Extremely harmful
Highly unlikely	TRIVIAL RISK	TOLERABLE RISK	MODERATE RISK
Unlikely	TOLERABLE RISK	MODERATE RISK	SUBSTANTIAL RISK
Likely	MODERATE RISK	SUBSTANTIAL RISK	INTOLERABLE RISK

Fig. 9 A simple risk estimator (BSI, 1996).

ple, the movement of pallets whether by fork lift truck or materials handler will have the following common or general hazards *(Figure 7).*

Hazard identification - specific hazards

Specific hazards for a rough terrain counterbalanced fork lift truck are listed in *Figure 8.*

Evaluating/assessing the risk

A semi-quantitative assessment can be carried out using a risk estimator *(Figure 9).* Likelihood and consequences are each divided into a small number of categories. Definitions are agreed for each division. For example, an 'Extremely Harmful' consequence would be a fatality. A 'likely' event could, for instance, be an event estimated to occur once in every 100 working hours. The matrix can be used to categorise the seriousness of the risks and decisions can then be made about the implementation of control measures.

Control Measures

The control measures available are predominantly safe systems of work, (including planning) together with engineering controls where appropriate *(Figure 10).*

Limitations

Whilst risk assessment represents a significant step forward in Safety Management terms, one of the criticisms, of *workplace risk assessment* is that they concentrates on the hardware and procedural issues and less so on matters of human error.

Conclusions

Much effort has been rightly directed at mitigating the consequences of vehicle accidents. In particular, the development of strategies to reduce fatalities and serious injury resulting from tractor overturns. Increasingly, however, other types of vehicles are being encountered which may give rise for concern.

A systematic approach to risk assessment (using tools and methods based upon well-founded research into human error) offers the opportunity to reduce both overturning and non-overturning accidents.

Further improvements in vehicle safety will need to incorporate the possibility of human error into workplace risk assessments.

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Control Measures
(Not a complete list)

PLANNING FLT OPERATIONS
- selection and availability of equipment
- availability zof trained personnel
- assessment of weight of load and its centre of gravity
- frequency of transfers

LATERAL INSTABILITY
plant layout
- edge protection
- traffic systems
- corners/obstructions
- evenness of surfaces
- parking areas
- loading/unloading bays

safe systems of work
- adequate training & supervision
- avoidance of traveling *across* inclines

LONGITUDINAL INSTABILITY
plant layout
- edge protection
- traffic systems

safe systems of work
- adequate training & traveling with forks directed *uphill* when negotiating slopes (preferred method)
- only travelling with load raised at *creep* speed

Fig. 10 Control measures for rough terrain lift trucks (Cooper, 1997).

Graduate engineers' pride of place in earnings league

Two new surveys tracking the employment patterns and salaries of graduate engineers reveal that they are among the country's highest paid graduates in their age groups.The first report - 'What do graduates do next' - compiled by the Institute for Employment Studies surveyed 585 students who had graduated from the University of Sussex in the years 1991 to 1993, following their progress up to 1997.

The survey reveals that after up to six years in employment (from 1991-97), graduates with mathematical science degrees, in subjects such as computer science, computer systems engineering, and mathematics, top the earnings league. Of the 74 graduates surveyed who were in employment, 47 were in the £20,000 plus bracket. Engineers follow closely behind - of the 31 employed engineering graduates surveyed, 17 earn in excess of £20,000.

The report demonstrates that engineering as a career compares favourably with other professions. Of graduates in employment, only 26 of the 97 with humanities, languages and creative arts backgrounds; 12 of the 51 with biological science degrees; and 60 of the 154 graduating in social sciences, earned more than £20,000.

The survey also found proportionately more engineering graduates in Standard Occupational Classification 2 (the classification for 'professionals' developed by the Employment Development Group and Office for Population Census and Surveys) than any other discipline.

Levels of job satisfaction were high, with greater numbers of graduates across the disciplines reporting considerable satisfaction with levels of responsibility and enhanced skill development over the six year period. One in three are working in small to medium sized companies with under 200 employees and one in eight are in firms with 20 or fewer employees.

The positive findings are supported by another report – 'Graduate Salaries and Vacancies 1998'- published by the Association of Graduate Recruiters.

The Association asked 264 of its members (which include some of the UK's biggest companies), how much they paid newly qualified graduates in 1997. Auditing proved to be the most lucrative function, with the organisations paying graduates a median starting salary of £16,500. Those recruiting for scientific, technical, engineering and R&D jobs followed closely behind with a median starting salary of £16,000. In this particular category, 10 per cent paid £18,000 or more but the lowest paying 10 per cent offered £15,000 or under.

The report illustrates that organisations paid new recruits into engineering jobs more than their counterparts in accounting, personnel and even management. However, it also indicates that the greatest areas of recruitment difficulty continue to be in science, technical, engineering and R&D jobs. Of the 264 companies surveyed, 44 reported a recruitment shortfall in those areas.

Commenting on the findings, the Engineering Council's Director for Engineer's Regulation, Andrew Ramsay, said: "It is heartening that both surveys prove that from the outset engineering is a well paid and secure career comparing favourably with other professions.

"The Engineering Council is taking positive steps to reverse the shortfall of quality engineering recruits in some sectors of the profession. In the meantime, employers wishing to recruit graduate engineers should be aware of the need to pay competitive salaries. In addition, they should bear in mind that graduates will be looking for employers able to support the training and experience they need to complete their formation as professional engineers."

1998 Tillage events to be staged on farms in Cambridgeshire, Hampshire and East Lothian

Dates and venues have been set for the 1998 series of national Tillage working demonstrations, organised and managed for the seventh successive year by AEA and ADAS/SAC.

The three post-harvest events will take place during September at venues in Cambridgeshire, Hampshire and East Lothian, Scotland. Dates and locations are as follows:

- Tuesday, 8 September
  Weybridge Farm, Alconbury, Cambridge shire
- Thursday, 10 September
  Broadlands Estate, Romsey, Hampshire
- Wednesday, 23 September
  Begbie Mains Farm, Haddington, East Lothian

Once again, the Tillage organisers welcome the continued support of sponsors, ING Farm Finance and Arable Farming magazine. This year, for the first time, the series of three working demonstrations is being presented in association with The Royal Smithfield Show. Discounted Show tickets will be offered to Tillage visitors as well as the opportunity to win free admission to The Royal Smithfield Show, tickets for a West End show and an overnight stay in London for two people.

1998's Tillage demonstrations will follow the successful format established over the past six years, as event secretary, Ron Saunders, explained: "We aim to stage three no-frills local events which give farmers and contractors the opportunity to compare at close quarters an extensive range of cultivation and crop establishment equipment operating in similar conditions.

"Early signs indicate that at least 30 leading tractor and machinery suppliers will be demonstrating products at each of the three venues, supported by local dealers with static exhibits. The organisers and sponsors look forward to building on the excellent attendance of 1997, when a total of more than 4,000 visitors supported the three Tillage events held in Oxfordshire, North Yorkshire and Fife."

All three Tillage events will run from 8am until 3pm. Entry charge, at the gate, is £10 per car, or £5 for vehicles with a single occupant. Refreshments will be available during the day at various locations on each demonstration site, each of which averages close to 65 ha in size.

Contact: **Richard Schofield or Ron Saunders, AEA, on 01733 371381.**

Scottish Centre of Agricultural Engineering potato harvester share with power-driven, dished, double digging discs and scraper discs.

Potato damage during harvesting

Douglas C McRae

Introduction

The demand for better and better quality potatoes, by both the retailing and processing sectors of the potato industry, shows no sign of slackening. The damage to potatoes that occurs at harvest time can have serious implications for their health in storage and for weight loss especially at the wound healing period.

This paper was presented at the IAgrE conference entitled: "Potato Machinery Heading for the Millennium" organised by the Scottish Branch and held at the Stakis Hotel, Dundee on 18th February 1998. Douglas McRae, FIAgrE, who was the formerly Head of Crop Handling, SAC and who also acted as the conference convenor, is now a Consultant, 19 Broomhill Avenue, Penicuik, Midlothian EH26 9EG.

Since potato damage at harvest represents an engineering design challenge and also a challenge for the harvester operator, any improvement will be brought about by addressing both strands of the problem. Whilst breeding 'tougher' potatoes is a possibility, it could be argued that much greater benefits would come by further improvements in machinery design and operation.

Unless potato damage can be quantified, improvements to the harvester design and the incorporation of easier settings for the operator cannot be achieved very easily. The damage index used for many years in the UK and first developed at the National Institute of Agricultural Engineering, Scottish Station, has been a useful tool. A more accurate way of measuring damage is now needed.

The original damage index divided damage into 'scuffing', 'peeler', to a depth of 3 mm and 'severe' beyond this depth. The formula for the index was based on the weight of potato removed when peeling away each category of damage. Damage Index = % scuffed + 3 x % Peeler + 7 x % severe. The index applied only to damage such as cuts, slices, or gouges - not to bruises. Each category represents a big step, rather than a smooth transition. A new index was developed by Stephen Evans at the Scottish Centre of Agricultural Engineering (SCAE) in 1995. Though it is somewhat tedious to carry out an assessment, the system requires only a potato peeler, a paper and pencil and very little arithmetic.

Evans peeled many thousands of slices to remove damaged tissue from samples of potatoes and analysed the volume removed. He used data from 10,000 potatoes to enable a mathematical model to be made, predicting the cumulative loss for a number of slices, from key areas of tubers. The following formula for the New Damage Index (NDI) was established:

$$NDI = \frac{\text{No. of slices} \times 1.25 \times 100}{\text{No. of tubers in sample}}$$

The constant 1.25 relates to the weight of potato lost in removing the damage.

A simplification is to omit the constant 1.25 and just count the slices. When bruising is also being measured, the first slice can be discarded.

Not only does the index quantify external damage, but bruising as well. The

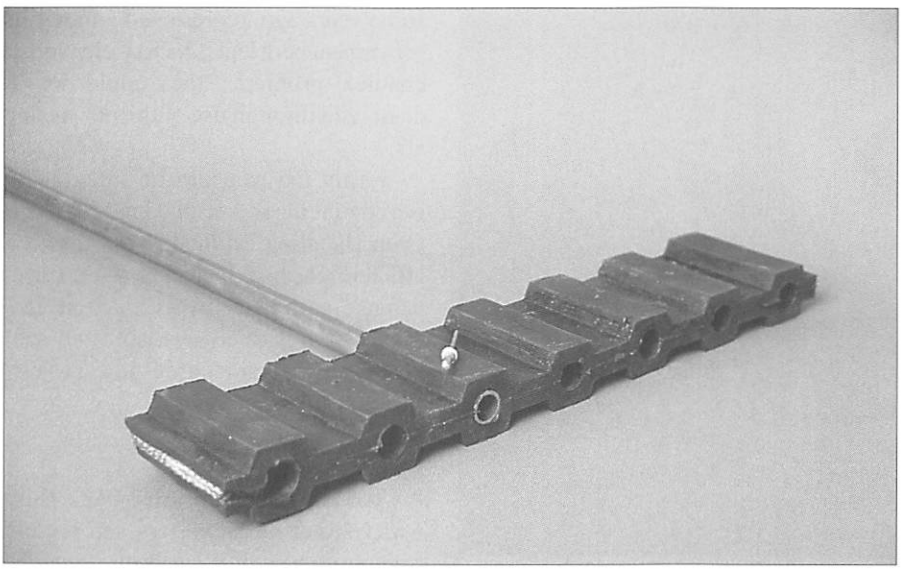

Fig. 1 SCAE moulded web with hollow web rods.

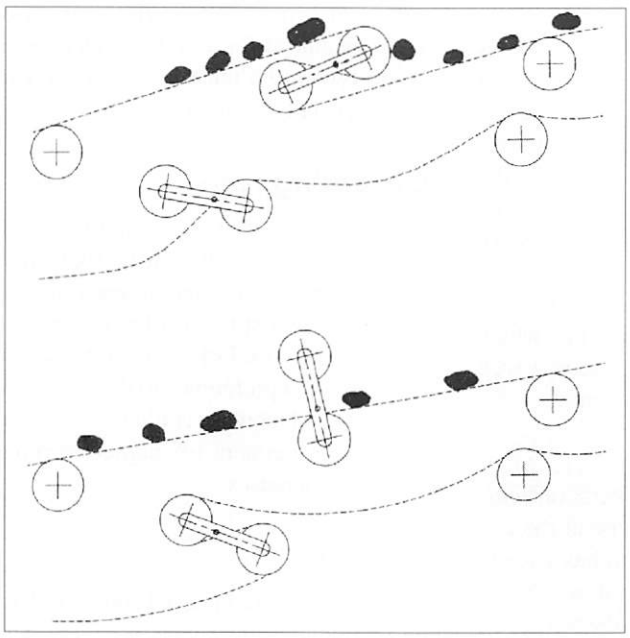

Fig. 2 SCAE removable step for harvester primary web.

two can be added to produce total damage. Already the index has shown promise for ranking damage tolerance of varieties. It will also be useful for machinery assessment. It could become the European Standard for damage assessment.

Harvest damage

Turning now to the business of damage caused by harvesters. The key areas are: the share; the transfer to the web; the sieving process; the haulm rollers/belts; the cleaning mechanism; the transfer to the cross conveyor/cart elevator; and, finally, the drop into the trailer.

A lot of research has been carried out on each of these key areas, but some of the interactions are not yet fully understood.

The basic objective is to sieve about 500-1200 tonnes of soil clods and small stones from say 40 tonnes of potatoes per hectare and deliver them to the trailer safely.

The share

Provided depth control is carefully adjusted and there is no out-of-phase reaction by automatic depth control hydraulics, cutting damage is minimal unless tubers are very deep on the stolons. The transfer to the web involves a step which may be adjustable. At this point, web rods are rising vertically at nearly 3 metres per second. Because the lift at this stage is small, the front of the web is usually 'drowned' in soil and wear on rods and web can be significant.

At speed, in wet conditions, especially if there is weed, or on downhill slopes, the flat share tends to bulldoze.

Powered disc shares *(Title Figure)* have had a long history, but since they are not currently used to any great extent, the advantages of this dynamic share are easily forgotten. With the vital addition of a powered scraper disc, a two-row unit can: operate at up to 10 km per hour; deposit the ridge at a height of 400 mm above the ground; avoid the problems mentioned above and reduce 36% more of the soft clod to easily sieved fragments. The draught can be up to 80% less and damage to potatoes attributable to the share 17-38% less. With all these gains, why are they not being used? The two main reasons that they are more costly and they lift quite a lot more soil which can necessitate longer sieving webs.

A revamp of the original SCAE disc share, with a drive beneath each disc and perhaps two smaller digging discs per row to reduce soil uptake, could revive the prospects for this design.

The web

The web has the twin functions of transport and soil sieving. In spite of the risks, it can also be a means of shattering soft clods by impact. The line between shattering clods and damaging potatoes is thin. McGechan's research at the Scot-

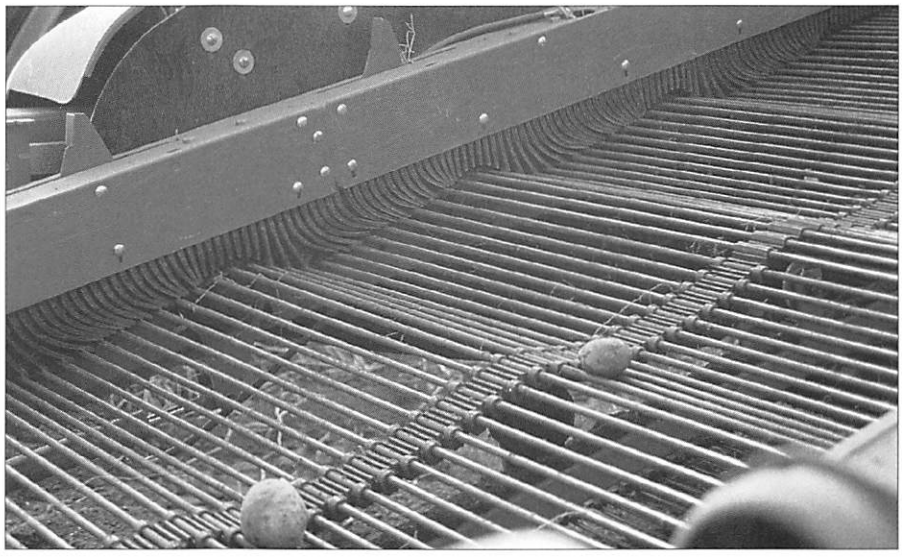

Fig. 3 Grimme "cascade" variable configuration web.

Fig. 4 SAC fall breaker attachment for harvester delivery conveyors.

tish Institute of Agricultural Engineering showed that potatoes in some situations could survive accelerations of up to 4 g. At the more plastic end of the range of soil conditions, impacts could be enough to break up clods, without also damaging potatoes, but reforming clod is a possibility if it is too wet. Research by McGechan showed that horizontal agitation was much less destructive than vertical and achieved more rapid sieving. This principle was shown on the SCAE Pulsar harvester, which caused 22% less tuber damage than other machines, but has not been commercially exploited. A possible way forward here, would be to provide horizontal agitation for a secondary web, where the crop is normally more vulnerable. An orbital motion, with a small vertical component could further improve sieving, without much increase in damage, by discouraging soil build up between rods.

The use of moulded webbing and hollow web rods enables substantial damage reductions to be made. Both these developments were fitted on the Pulsar *(Figure 1)*. Moulded webbing, with solid or hollow rods is now being made available commercially (Reekie), and this represents a major step to opening up potential changes in the sieving arrangements. A removable step in the web is also a possibility, which is an SAC patented design exploiting the tighter wrap round small rollers which is a feature of moulded webs *(Figure 2)*. It enables the web to have a cleaning and re-positioning zone for sticky conditions and a 100 mm drop, which can be removed for light sandy conditions by rotating the carrier rollers.

A recent commercial development is use on a current Grimme harvester of a cascade configuration. The web is caused to adopt a series of sine waves, producing a moving pocketed web, the amplitude of each wave can be adjusted depending on soil conditions *(Figure 3)*.

As a general comment, the centre web on 2-row machines is often characteristically fitted with steel clips which present a hazard to tubers - the new web eliminates this damage potential.

Cleaning systems

Removal of haulm by rollers, or belts, is necessary, but tends to be at the end of a web where the haulm has already impeded the sieving operation. Some improvement is needed on the haulm fingers, especially when counterbalanced by weights rather than springs. Hollow fingers and springs would reduce the impact inertia and could diminish possible bruising at this point.

Cleaning rollers and star rollers have increased the potential for a much cleaner crop. Care must always be taken however to ensure that skin quality does not suffer when potatoes pass over fast moving surfaces, which may have picked up a coating of sand granules. The cross conveyor is sometimes fed now by rollers of varying length to spread tubers more evenly for delivery. Depending on their diameter, the drop to the flighted belt can be considerable. Though the fixed flights may have cushioned edges, most tubers will fall the full distance to the belt surface. The folding flight system from USA, used by KeyAg some years ago, represented a major improvement here and if there were any mechanical problems, they could now be dealt with through use of the new materials.

Lastly, the drop into the trailer, or box is a continuing source of damage. At SAC Crop Handling, Milne has developed an efficient, cheap, fall breaker which can cut damage at transfer by as much as 78%. This design is freely available and could be used to advantage on any harvester *(Figure 4)*.

Cushioning

A word in passing on cushioning. This is widely used on harvesters and the efficiency of some of it has been researched at SAC. It cannot be assumed that the cushioning on a brand new harvester will still be effective after several years' use. There is a need for a system (such as on motor tyres) of a tell tale colour layer to reveal visually worn areas.

Operating rate

Though 2-row harvesters dominate the UK market, 4-row self propelled machines are available. The time appears now to be ripening to explore further increments in operating speed of 2-row harvesters - the cheetah in preference to the dinosaur! Such a speed increase could be an advantage, if the demand for higher working rates/day increases.

Controls

The potential for improved control of harvesters, using electronics is clear. The driver has much to do and requires assistance. Control of web/forward speed ratio, sieving levels to maximise soil cushioning; the control of the speed of webs and delivery conveyor to maximise conveyor occupancy by potatoes to avoid rolling, are all likely to improve efficiency.

Conclusion

In order to bring further reductions in damage, there may need to be a return to questioning the design of each of the key components and there are signs that this is beginning to happen. For the farmer, quantifying damage during harvesting and re-setting the main adjustments, where the damage assessment shows the need, will make a real improvement in saleable yield. Damage reduction is a cheap fertiliser!

Tractor-implement longitudinal stability

Geoffrey F D Wakeham

Manufacturers of tractors and fully mounted agricultural implements often need to be able to predict the safe handling of a tractor-implement system without having access to the necessary hardware. The calculation of static stability is relatively easy and gives a reasonable representation of the real world. However, predicting dynamic stability of vehicles presents a far more difficult problem.

A particular aspect of stability and safety is the longitudinal control of vehicles on public roads and under off-road conditions. It was felt that though this relates to static stability, the dynamics of the system are also important.

To discover the relationship between perceived handling characteristics and the rotational energy introduced into a tractor-implement system when traversing a bump, a Harper Adams engineering student carried out an investigation into tractor-implement dynamics (Ollerenshaw, 1991). The main outcome of this work was the problem of accurately calculating the moment of inertia of the system and the work involved providing the raw data before any meaningful calculations could be carried out.

Subsequent work on the location of the centre of gravity of vehicles, tractors and implements reinforced these findings (Beere, 1992; Walmsley, 1993) and it was concluded that the general thrust of the enquiries would not yield results of use to the average marketing department of an agricultural engineering organisation.

P Wilson (1993) showed that computer software was available to provide a reasonable prediction of the location of centre of gravity for complex systems and used this to predict vehicle stability on slopes. Once again, however, this was not felt to be of value in providing an easy route to predicting handling characteristics.

What was required was a simpler model that was a reasonable approximation of the real world. It was proposed that the stability of a vehicle-implement combination depended on the ratio between the static stability and the kinetic energy induced into the system in rotating the system backwards. The static stability was closely related to the moments about the rear axle of the tractor and the dynamic component might be simplified as the sum of the energy due to the vertical (upwards) motion of the tractor mass (located at the tractor's centre of gravity) and vertical (downwards) motion of the implement mass (located at the implement's centre of gravity). This is illustrated in *Figure 1*.

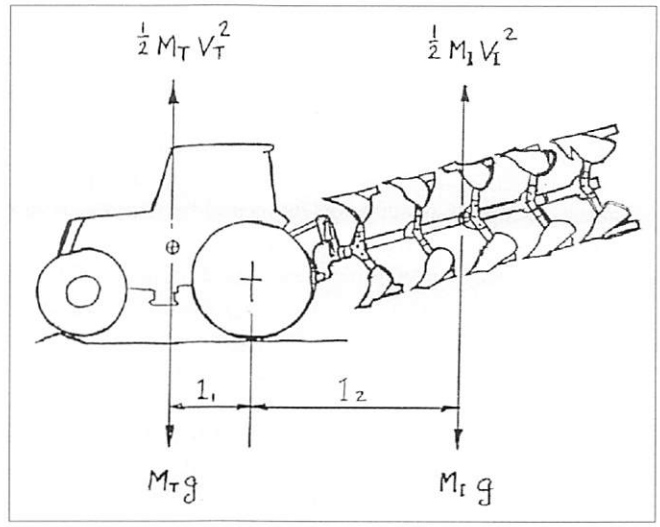

Fig. 1 Tractor-implement model.

The restoring moment
$= g(M_T l_1 - M_I l_2)$
and an approximation of the rotational energy is
$= {}^1/_2 (M_T V_T^2 + M_I V_I^2)$
where

M_T = mass of tractor
M_I = mass of implement
l_1 = distance from rear axle to c of g of tractor
l_2 = distance from rear axle to c of g of implement
V_T = vertical velocity of tractor mass due to front wheel disturbance
V_I = vertical velocity of implement mass due to front wheel disturbance

The ratio between these two expressions is dimensionless and, for a given tractor-implement and road surface, dependent on fixed masses, distances and a variable of forward speed.

It was proposed that, above a given speed, drivers would perceive that the vehicle system was unsafe and it should be possible to calculate the stability ratio using relatively easy to obtain data. This figure could then be used to predict vehicle steering stability or at least indicate where stability problems might be present to a greater level of confidence that from simple static calculations.

To investigate the validity of this simplistic model, a final year Engineering Project was carried out using four tractors, four implements and two surfaces (Carson, 1996). The model was developed into an easy to use format that produced a ratio for any given forward speed over a designated (standard) bump. Four drivers were used to judge at what speed the tractor-implement combination was considered unsafe when traversing the standard bumps. It was found that for all tractor-implement combinations the ratio that separated safe from unsafe was in the order of 0.024. Any variation from this figure was attributed to the fact that test speeds were carried out in steps of 1 km/h and some drivers selected the

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test speed that produced a ratio above 0.024 while others choose the speed below as marking the transition from safe to unsafe. Typical results are shown in *Table 1*.

Table 1 "Stability" ratios for a given tractor and a range of implement

Speed, km/h	*"Stability" ratio*			
	Implement 1	*Implement 2*	*Implement 3*	*Implement 4*
5	0.007	0.017	0.008	0.010
6	0.010	0.024****	0.012	0.015
7	0.014	0.032	0.016	0.020*
8	0.018	-	0.021**	0.027***
9	0.023****	-	0.027**	0.034
10	0.028	-	0.033	-

*speed at which test drivers perceived control was lost.

The precision of the results was a surprise. Also the usefulness of the findings to the prediction of stability had not been fully addressed. To confirm that the ratio was relevant and related to perceived stability a further series of tests with new drivers and a different tractor were carried out (Stoychev, 1997). This work confirmed the previous results.

It is now intended to check on the relevance to real road and farm surfaces and to develop a simple stability predictor for any given tractor-implement combination.

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Are your electronic components safely packaged against ESD?

Field effect transistors (FETs) and other small semiconductor devices can be damaged by electrostatic discharge (ESD) arising from normal handling operations. Shielding bags are widely used in the electronics manufacturing industry to protect sensitive electronic components and assemblies from ESD. This is particularly important for devices that cannot incorporate protection without compromising their performance. However, the protection provided by the bags is uncertain.

ERA Technology has just released an extremely useful evaluation of shielding bags used for the prevention of electrostatic damage. This report will be particularly useful for those working with high sensitivity, high cost devices for high reliability applications (e.g. satellite) where the need for clarity in shielding package specification is perhaps most urgent.

The report reviews and appraises the standards in use for specifying and testing the performance of a range of currently available shielding bags. It evaluates a recent shielding bag standard test method. A novel test developed by ERA provides a practical demonstration of the protection afforded to a bagged MOSFET test component, subjected to standard levels of ESD, and expressed as an ESD withstand voltage. The report also highlights where existing test methods may be insufficient. It is primarily concerned with shielding bags for protecting components which have a Human Body Model ESD sensitivity of 100 V to 4000 V. This covers the majority of electronics components currently being manufactured that are considered to be ESD sensitive, and fails within the broad scope of the EN 100015:1 1992 standard and draft IEC 1540-5-1 and -2 technical reports. Recommendations are made concerning the status of shielding bag performance and test methods.

'Evaluation of shielding packaging for prevention of electrostatic damage to sensitive electronic components' (Report 97-1079R) is available priced £150 (free by voucher to ERA TSS members) from: **Publications Department at ERA Technology, Cleeve Road, Leatherhead, Surrey KT22 7SA. Telephone: +44 (0)1372 367014.**

Graham Howling joins AEA

Graham Howling has been appointed Technical Director of the AEA, with effect from May 1st, when Ron Saunders retires after 10 years with the Association.Graham joins the Association from Case United Kingdom Ltd in Doncaster where he has taken the lead on Technical, Homologation and Safety matters since the acquisition of International Harvester by Case. Prior to this he had filled a similar capacity at David Brown Tractors from 1978.

Graham was, until recently, Chairman of the AEA Technical Committee. He served for 4 years as Chairman of the CEMA (Committee of European Agricultural Trade

Associations) Technical Committee, bringing together differing national interests and has led British delegations in meetings with the European Commission in Brussels, particularly aimed at harmonizing European technical standards and legislation.

Membership Matters

Quarterly The Newsletter of the Institution of Agricultural Engineers Summer 1998

Brian J Legg: President of the Institution

Professor Brian Legg's first degree was in physics at Oxford University, and immediately afterwards he spent a year in the Gambia teaching mathematics and chemistry at Secondary School level. He then joined the staff of Rothamsted Experimental Station, where his research included a PhD in micrometeorology registered with Imperial College, irrigation research and studies of the interaction between air movement and crops, including the effect on evaporation and on dispersing diseased spores. From 1980 to 1982, he was seconded to the CSIRO Division of Environmental Mechanics, Canberra, to pursue theoretical and wind tunnel studies of dispersion in very turbulent natural boundary layers.

In 1983, he was appointed Head of Horticultural Engineering Division at the National Institute of Agricultural Engineering at Silsoe, which subsequently became Silsoe Research Institute (SRI). After a spell as Deputy Director and Head of Process Engineering Division, he was appointed as Director in 1990.

Brian was appointed a Fellow of the Institution of Agricultural Engineers in 1984, a Fellow of The Royal Academy of Engineering in 1994 and a Fellow of the Institute of Biology in 1996. He is a member of the BBSRC Strategy Board and the National Foresight panel for Agriculture, Horticulture and Forestry.

As Director, he has piloted SRI through a period of rapid change in the research environment. MAFF has substantially reduced its funding for commissioned research at all agricultural research institutes, and moved towards a system of funding through Open Competition. There has been a series of Government reviews of research. Throughout, SRI has successfully maintained its reputation as a national centre of excellence in engineering research for the agri-food industries, by energetically extending its activities and winning contracts from a wide range of industry sources as well as from MAFF. The emphasis is now on sensors, control and robotics, precision agriculture, environmental engineering, animal welfare and hygienic processing throughout the food chain.

During this period of change, Brian has demonstrated the importance of a multi-disciplinary approach at SRI to solving customers' problems. He aims to extend this to the Institution during his two years as President. In his Presidential Address, he showed how agricultural engineering sits at the centre of a spider's web of science and engineering disciplines. "Wherever you are in the agricultural engineering business," he stresses, "it is vitally important that you know what advances are being made across a broad spectrum of science and technology from genetic engineering to microfabrication; you need to be able to stay one step ahead in anticipating how these might benefit the agri-food industries."

Honorary Fellowship 1997

John Brian Finney CBE

Brian Finney FIAgrE joined the Institution in January 1955 as a Graduate following his graduation with a BSc in Agriculture from Reading University in 1954, a Diploma in Tropical Agriculture and National Diploma in Agricultural Engineering in 1955.

The early years of his career were spent in Northern Nigeria based in Kano working mainly on soil and water conservation and land reclamation schemes.

He returned to the UK in 1963 and joined the National Agricultural Advisory Service as a Mechanisation Advisor in Berkshire and Oxfordshire. In 1971 he became a Regional Mechanisation Adviser in the Eastern Region based in Cambridge and in 1981 became Senior Mechanisation Adviser, which brought him to Silsoe to the ADAS office at Wrest Park and also into the Fellow grade of the Institution in 1982.

During his career as a mechanisation advisor, Brian

continued overleaf

Brian Finney (left) receives his scroll from Brian Legg

always commanded the highest respect and became a recognised authority on the practical aspects of soil management, on which subject he authored a book.

Throughout the 1980's Brian served on the Council of the Institution, becoming Vice President in 1988, President Elect in 1990 and President in the period 1992-94.

Over the same period he attained the most senior technical post in ADAS having responsibility for all products and services.

He is currently the Secretary of the Douglas Bomford Trust and continues to serve on Council, Executive, the Awards and Finance panels.

Throughout his career and in his work for the Institution, Brian has become renowned for his unfailing support and wise counsel.

Award of Merit 1997 Brian Fraser-Smith

Brian Fraser-Smith CIAgrE describes himself as a farmer with strong engineering interests, who farms 350 hectares in North Devon. His achievements are numerous and illustrate his enthusiasm for introducing and developing new ideas in agricultural engineering.

In 1955, he pioneered slatted floors for dairy cows. In the 1960s, he was the first to design adjustable integral cubicle housing. He was the second person in the country to make vacuum silage, producing up to 2000 tonnes per year. He was the first to investigate and use a butyl liner for the storage of slurry; the store he built is still in use today.

By 1968, he had installed a rotary drum grass drier. Today, his grass drying business produces 10500 tonnes of dried grass and specialist animal feeds.

Brian became a member of the Institution in 1974 and was made a Companion in 1985. He has been Chairman of the South Western Branch and served two terms on Council during the 1980's. He is still an active member of the Branch Committee and supporter of events organised in the South West.

He served as President of the European Technical Commission for dehydration plants, from 1986 to 1989.

From 1989 to 1996 he was a working President of Commission Intersyndicale des Deshydrateurs Europeans (CIDE) - a 14 nation European Dehydrators Association.

In 1996, Brian was appointed Chevalier de l'Ordre de Mérite Agricole by the French government in recognition of his services to European agriculture.

Brian was a founder member and director until 1978 of a farmer co-operative, Mole Valley Farmers, which now covers the South West region. He also founded and still chairs Dry Grass South Western Ltd - a regional marketing co-op for dried grass products.

Brian is also a Freeman of the City of London.

In conclusion, Brian has given outstanding service to agricultural engineering at local, national and international levels and fully deserves the recognition of the Institution through the Award of Merit.

Michael Dwyer Memorial Prize awarded to Tim Dowdeswell

The prize is awarded to a 'mid-career' engineer who has made outstanding progress in the agricultural engineering industry and was established following the untimely death last year of Michael Dwyer during his Presidential term of office. The first recipient of the award is Tim Dowdeswell, Managing Director of Dowdeswell Engineering.

Tim was educated at Oundle School and at Exeter University where he graduated in Accountancy. Following some experience with the accountancy firm of Ernst Whinney (now Ernst Young), he returned to Warwickshire to assist with running the family businesses. He attended a course at Midland Training Services, Coventry, which introduces engineering to graduates and then worked briefly at Sanderson Fork Lift Trucks in order to gain some experience of another manufacturing environment.

After a brief spell as a horticultural machinery sales representative in Dowdeswell Engineering, he became increasingly involved in senior management and eventually became Managing Director of all the family companies in 1992, following his mother's retirement. Earlier this year, he was nominated as Chairman of the AEA Farm Equipment Council. He also sits on the Court of Cranfield University, is a member of the Council of the Royal Agricultural Society of England, and is a trustee of a local charity, Castel Froma, which is the Royal Midland Counties Home for the Disabled.

Tim is married with two young sons.

Running a seminar — and keeping within the law

I found the seminar very useful, I learnt a lot".

This comment from the feedback sheet summarises the day. The West Midlands Branch, wishing to provide a special speaker for its AGM, booked Mike Braithwaite, formerly of Humberside Police Force and an expert on agricultural traffic law, to come and talk on Fast Tractors and the special legislation and requirements that apply when travelling above 20 miles per hour. This is in addition to all their recent changes when 'Tractors' became 'Agricultural Motor Vehicles'.

We decided to take advantage of having asked a speaker to travel a long way to run a seminar open to the public on the following day. This was very successful. (You will have seen the publicity poster in the last copy of *Landwards*.)

We were very pleased by the response, with some 26 people attending. Everyone learnt a lot about speed limits, permitted size of vehicles and weights, lighting regulations and many other things. One seminar member was very embarrassed to discover just how illegally he had been taking his seven furrow reversible semi-mounted plough on the road! "Why were there not more dealers present", was one question someone asked.

We have a number of the special edition of Mike Braithwaite's 110 page hand-out available. This is a complete guide to what is required when taking agricultural vehicles on the public highway. It is available at £8.00 including post and packing from the Institution Secretariat. Included is the notepad and the additional hand-outs issued for the seminar.

Mike Braithwaite and some of the delegates at the seminar.

The 'how to do it' section

During the early planning stages, we had an enthusiastic reply from the Secretariat. They would be very pleased to help and to look after the administration and finance: they emphasised that they were pleased to offer this assistance to the Branches. We were very grateful for this support. We handled the venue and other local arrangements. The seminar was costed on a break-even basis, so we did not need to involve VAT. As it turned out, we made a small surplus which was included in our donation from the branch to the Mike Dwyer Memorial fund.

If you are planning such an event, it must have publicity and people. In addition to publicising it widely throughout the Institution, we invited two sponsors: the NFU Mutual Insurance; and The Guild of Agricultural Contractors, which is supported by Farm Contractor magazine. Their input was to give the event publicity and we also offered them a chance to give out and publicise their services. Look out for the feature in Farm Contractor magazine. A special thanks must also go to AGCO Ltd for allowing is to use one of the Massey Ferguson training centre rooms.

There you are colleagues, anyone can run a seminar. We still have a way to go to catch up with the Forestry Engineering Group, but it is a very honourable start. Your turn next.

William Waddilove

Branch Meritorious Awards

Denis Cartmel MIAgrE completed 25 years membership of the Institution in October last year and, during that time, has attended a large proportion of the winter programme meetings and visits organised by the Wrekin Branch. But the award is not for tenacity alone! He has served on the Branch Committee for a number of years in the late 1970s and 1980s, holding the post of Branch Secretary from 1979 to 1981. In 1983, he became Branch Chairman, serving through to 1986. Soon afterwards, he became the Editor of the IAgrE Newsletter which was circulated nationally as an independent publication which received widespread acclaim. He continued in the role until 1994, while also sitting on the Journal Editorial Panel from 1991 to 1994. In 1995 and 1996, he held the position of Vice President of the Institution. He has remained an active member who has encouraged others to become involved with the Institution and has promoted its presence and purpose. The Wrekin Branch enthusiastically supports his nomination for the Branch Meritorious Award.

John Maughan joined the Institution in 1964, achieving the grade of Fellow as well as being registered as a Chartered Engineer. He has been an active member of the Yorkshire Branch for most of this time, work commitments allowing. John is easily approachable and actively encourages the younger members, the life blood of our profession, to take part in Institution activities. John continues as a valued member of the Yorkshire Branch Committee, although ill health now constrains the level of his involvement. This brief summary does scant justice to his 34 years service and commitment to furthering the aims of the Institution, and the Yorkshire Branch acknowledge John's contribution through this nomination for the Branch Meritorious Award.

Young Engineers' Section

Welcome

The Diamond Jubilee Conference at Silsoe College has seen the reinstatement of the Young Engineers' Group of the Institution of Agricultural Engineers. This section is intended to serve the needs of those of us who are completing courses or starting out on our careers, and be the voice of the Young Engineers' Group within the Institution. In order to do this effectively, contributions to this section would be very welcome.

This edition's section has been put together very quickly, in order to make the copy date for this issue of Landwards. Future issues will continue to have short, informative articles, but will gain some amusing tales of technical misadventure, news of young member's achievements and a regular round up of books, videos or web sites that have caught our eye, so expect a little more next issue! Meanwhile, I hope you find the section in this issue interesting.

Chartered Status

Chartered status is something many of us will eventually aspire to, and to find out more about the steps involved, I went along to the Institution's offices in Silsoe to meet the Secretary, John Neville.

John explained that chartered status is becoming seen, more and more, as a licence to practise, indicating to future employers that an individual has been working at a professional level for some time. Forward thinking companies are making efforts to get their young engineers chartered at the earliest opportunity.

So, what steps are involved along the road to becoming a Chartered Engineer? At present, there are three main stages to chartered status. John summarises them:

Stage 1: The engineering degree (one which is accredited by the IAgrE, IMechE or ICE).

Stage 2: Two years of industrial training.

Stage 3: Two years of experience in a position of responsibility, which offers some managerial experience.

This is followed up with a professional interview, which assesses your professional 'formation' or experience and is the final hurdle to becoming chartered.

Having had a good discussion with John, the main tips for smoothing the way seem to be to:

- make sure you record any sandwich year experience and get it signed off by your employer;
- keep up your CPD (Continued Professional Development) records throughout your career (the Institution recommends a regular six monthly update), as CPD can count towards your application for Chartered Engineer.

It is true that many people in Agricultural Engineering find it difficult to achieve chartered status in the shortest possible time, because of the nature of their work. However, it is becoming more and more necessary to gain this sort of professional recognition during the early part of a professional engineering career.

The Institution has recently been surprised at the number of their members making their applications later in their careers, when they clearly could have become chartered sooner. Many members feel the need for chartered status in today's climate, where perhaps they might not have before.

Eye catchers

Those of you who have access to the Internet might find some of the following sites of interest.

http://www.silsoe.cranfield.ac.uk/iagre/default.htm

The site of the Institution of Agricultural Engineers. How many of you have actually logged on and had a look? I hadn't until recently, and was pleasantly surprised to find what I felt was really a very good 'shop window' for our Institution. Information about the different specialist groups abounds, as does information about forthcoming events. There are also many links to other sites of interest, notably the Engineering Council.

http://www.engc.org.uk

The site of the Engineering Council. This site is well worth a look around. Particularly good, is the interactive guide called 'Engineering Our Future', which is billed as a definitive guide to good practice in the career development of engineers. This feature is aimed both at individuals and companies and I will definitely be making use of it, as the Engineering Council suggest, as a 'road map' whilst studying or starting a first job. Full of tips for making yourself more employable and for making a better start on your early career, it has much to recommend it.

http://www.inventors-world.com

The site of magazine 'Inventors World'. Full of the main features of past issues (there are six issues a year of the magazine), the site is full of patent question and answer pages and how to get your ideas into production. It also covers stories of weird and wonderful creations that haven't made it, as well as the history behind some more well known success stories.

Contributions

We need your news, stories, achievements and comments to make this section work. Please send any contributions for the Young Engineers' Section to me, Robert Merrall by e-mail or post to the following addresses: <R.Merrall@Cranfield.ac.uk>

R Merrall, Silsoe College, Cranfield University, Silsoe, Bedford MK45 4DT

Jubilee greetings

Dear Mr President

Diamond Jubilee

I should like to take this opportunity to send good wishes on the occasion of the Institution's Diamond Jubilee celebrations. May the good work started 60 years ago, continue to the benefit of the Industry and its Members.

I am reminded that I have been a member for the past 50 years, having joined, as far as I know, in 1949. I wonder how many of us who were members of the industry then, are still in active membership?

Best wishes to all,
Sincerely yours,

John E Colman FIAgrE

Cobhains House, Long Sudbury, Suffolk, C010 9JQ

Eleven members have reached the "Golden Club" on the date of the Diamond Jubilee Conference, and a goodly throng are not far behind. Editor

Dear Sirs,

Golden glimpses

I am writing at the suggestion of Prof R.J.Godwin who recently sent me a 50 years Membership Certificate, which I very much cherish. Many thanks!

In his letter he invited me to send you some anecdotes of life during the past fifty years. Not very easy on the spur of the moment!

At the outbreak of war in 1939 whilst I was with the College of Agriculture, we were encouraged to run "on the farm" courses in tractor maintenance for groups of farmers. It was, of course, blackout time and not a light was to be shown. Such a course took place in a little tractor shed in Peeblesshire. Inevitably, the tractor was being started and stopped as I demonstrated various checks. The next thing that I knew was that I was lying on the ground outside as an anxious colleague bent over me as I recovered from inhalation of exhaust fumes. It was a painless experience about which I have pondered ever since!

During the war I was engaged in armoured plating Caterpillar DB tractors for beach recovery work. Again blackout conditions prevailed. The shed in which we were working had low doors from which a low loader with a D8 aboard could not exit due to insufficient headroom clearance. Those which were completed by the night shift had to be loaded and sent on their way. There was no loading bank and the Cats had to be side loaded in the dark in the yard. The armoured plating, to provide protection for the driver, was above head height when he was sitting on the seat. Side loading, turning and lining up on a narrow low loader deck was precarious!

In Balluchistan in 1944, I commanded an L.A.D. "On the back road to Russia". Supplies were unloaded at Karachi and taken by train over the Bolan Pass towards Quetta then westwards through Nushki to Zaidahn. They were then transferred to lorries for the remainder of the journey to Meshed. The lorries ran in convoy; drivers fell asleep and their lorries rolled off the road into a gorge; others missed their gears or forgot that they had a hand brake, coasting back

Douglas Bomford Paper Awards

The Douglas Bomford Paper Award is presented to the author(s), at least one of whom is an Institution member, who demonstrate originality and technical excellence in a scientific paper published during the previous year in either the Institution Journal *Landwards* or in the *Journal of Agricultural Engineering Research.* Assessment criteria include: engineering content; potential for practical and commercial use; relevance to the current problems and needs of industry; as well as quality of presentation and the authors' authority in the subject material.

The Board of Trustees were pleased to announce two awards this year, one to Mr Erroll Coles FIAgrE from Indonesia, and the other to Dr John Randall FIAgrE and his co-authors of Silsoe Research Institute.

The paper (in two parts) by **Erroll Coles** records a wealth of practical experience gained from a career in irrigation design and installation projects. It provides an excellent step-by-step guide to the design procedures for the construction of a tertiary irrigation system. With much of the preparatory work being completed during contract assignments in the field and between assignments at home over an extended period, rather than in an office/laboratory environment, the manuscripts contain between the lines an enthusiasm to transfer acquired knowledge and considerable determination to overcome communications problems.

Coles E D (1997). Improving the effectiveness of tertiary systems. Part I Planning the tertiary units. *Landwards,* **52** (2): 6-13.

Coles E D (1997). Improving the effectiveness of tertiary systems. Part II Water supply, delivery and drainage. *Landwards,* **52** (3): 8-12.

The paper by **John Randall and his three co-authors, J A Duggan, M A Alami and R P White**, presents an investigation of the aversion of broiler chickens to horizontal and vertical vibration by placing their urge for food in conflict with their desire to avoid unpleasant vibrations – a sort of Devil's teaparty. The authors have used the results to derive combinations of frequency and root mean square accelerations which are aversive to chickens in varying degrees. Further, although chickens and humans are very diverse species and have different responses, the authors have also attempted to relate these aversions to perceptions of discomfort experienced by the human subject. The results make an important contribution to animal welfare through the definition of acceptable treatment during the transport of chickens.

Randall J M, Duggan J A, Alami M A, White R P (1997). Frequency weightings for the aversion of broiler chickens to horizontal and vertical vibration. *Journal of Agricultural Engineering Research*, **68** (4): 387-397.

and crashing into the one behind. On other occasions, a sharp night (or day) frost resulted in a cracked cylinder block. Inevitably chaos reigned! In some of the nullahs, however, there was a variety of pasty mud which could be worked into the frost cracks. If the patch was exposed to the sun, it baked hard and made an effective water tight seal!

Back home after the war, a Claas Super combine was sold to Seafield Estates, Banff and delivered ex the wet 1950 Highland Show at Hazelhead Park, Aberdeen where the mud was ankle deep and more! I set off at 4 pm towing the combine behind a lorry. One was allowed to tow an "agricultural implement" on the road in those days! All went well as far as Turriff railway bridge which was twelve inches too low. There was no option but to deflate the tyre, and inch forward past the girders. It was then a matter of finding the first friendly filling station to reinflate the tyres.

In the 1950's, the Institution sought to extend its influence throughout Scotland and, as a result, I arranged an evening meeting in Inverness and took a car-load of farmer customers from Forres. As we looked north across the Moray Firth beyond Nairn we saw a complete "moon rainbow". I have never seen one since.

Winters seem to be milder nowadays! Gone are the days when it was too dangerous to travel by car to a nearby loch to skate and play ice hockey. Instead one just skated a mile or two along the road to the loch. Early on a winter's morning, one often made it to the nearest snowplough only to find that its diesel fuel pipes were frozen. It was then a case of lighting oily rags and judiciously warming the pipes until fuel flowed again. One has recollections of negotiating Drumochter Pass at New Year and encountering drifting snow south of Dalwhinnie. Should one turn and probably get stuck in the process or continue on and chance it? Continue was the decision and, by maintaining enough speed to charge through each snowdrift, the summit was reached and the road was almost free of snow on the south side. On another occasion, travelling north from Helmsdale to Wick, the front wheels lost traction. There was nothing for it but to return to Helmsdale, draw up beneath a street lamp and change the rear wheels, with a better tread, to the front and so make it safely over the Ord of Caithness!

One becomes less daft as one becomes older! I enclose also a brief account of my various activities over the years, which I had prepared for another purpose.

With kind regards,

Yours sincerely,

Ian J Fleming *FIAgrE*

3 Dick Place, Edinburgh EH9 2JS

Gleaning machines for SAM

Ian Fleming was born in London in 1915 and was at school at U.C.S., Hampstead, until 1933 though his home was in Blairgowrie, Perthshire, where he spent all his holidays. Following three years at the University of Edinburgh and a year as a mudstudent, he graduated BSc (Agric) in 1937. He was employed by the Edinburgh and East of Scotland College of Agriculture as Assistant Lecturer in Agricultural Engineering until 1940, at which point he joined the Army and served in REME both at home and overseas.

After the war he joined Scottish Agricultural Industries Ltd as manager of their agricultural machinery depot in Haddington, East Lothian where they were distributors for Claas combines in Scotland. In 1953, he took charge of William Reid (Forres) Ltd (another SAI company) which, besides being IHC and Claas dealers, undertook a lot of millwright work on farms, distilleries and sawmills in the north of Scotland.

1960 saw a return to Edinburgh to investigate ways of handling SAI's products in bulk, from factory to farm and on the farm. That led to the development of several hundred free standing 1 ton bins in which, with the legs folded for transport, bulk fertiliser could be delivered to farms. A number of ex WD FWD trucks were modified to carry a specially designed fertiliser spreading unit. These were allocated to selected contractors throughout Scotland. Thus an integrated contract bulk spreading service was built up which, by the late 1960s, was handling about 25% of SAI's total fertiliser manufacture. About that time, SAI expanded its grass seed business and he added contract sowing of grass seed to my responsibilities.

Following early retiral in 1970, he became training adviser to the agricultural machinery trade in Scotland and the north of England.

Retiral in 1980 provided an opportunity to play a more active (voluntary) part in the Scottish Country Life Museums Trust of which he was and still is Joint Secretary, as well as the activities of the Scottish Agricultural Museum (SAM). It has been an interesting and rewarding challenge to seek, find and oversee the restoration of many significant agricultural machines including tractors and combine harvesters. SAM now has one of the most comprehensive collections of combine harvesters in Europe and these will shortly be on display at the outdoor museum which will be opened in about two years time, in collaboration with the National Trust for Scotland, at West Kittochside in Lanarkshire.

Ian was Chairman of the Scottish Branch of the Institution during the two seasons 1962-3 and 1963-4, as well as serving on the committee for many years before and after that time. He continues to regularly attend Branch events and the Scottish Branch conferences. The President gave a special welcome to Ian and his wife who both mingled with 'the youngsters' (and with one or two other 'almost golden' members) at the Diamond Jubilee Conference.

Long Service Certificates

50 years

Name	*Grade*	*Date of Anniversary*
Ian Johnston **Fleming**	FIAgrE	16 Mar 1998
Donald **Macmillan**	CIAgrE	13 May 1998
Robert Harington **Litton**	AIAgrE	14 May 1998

35 years

Kenneth Arthur **Merriman**	IEng MIAgrE	10 Mar 1994
Robert John **Hart**	IEng FIAgrE	11 Jan 1998
Malcolm Ross **Kennedy**	FIAgrE	11 Jan 1998
Robert Robertson **Rattray**	IEng MIAgrE	11 Jan 1998
David Anthony **Skinns**	IEng MIAgrE	11 Jan 1998
Theodore John **Willcocks**	MIAgrE	11 Jan 1998
Richard William **Whittall**	EngTech AMIAgrE	11 Jan 1998
Thomas David **Angier**	MIAgrE	28 Mar 1998
Colin **Dilley**	MIAgrE	28 Mar 1998
Maurice Arthur **Keech**	FIAgrE	28 Mar 1998
Colin Davenport **Shaw**	AIAgrE	28 Mar 1998
Anthony John **Walters**	MIAgrE	28 Mar 1998

25 years

Andrew Aurel **Metianu**	IEng MIAgrE	23 Jul 1995
Brian Hugh **Webb**	IEng FIAgrE	04 Apr 1998
Michael John **Fraser**	IEng MIAgrE	04 Apr 1998
John Charles Lewis **Welwood**	IEng MIAgrE	04 Apr 1998
James Edgar **Moore**	AMIAgrE	04 Apr 1998
Robert **Booth**	IEng MIAgrE	04 Apr 1998
Paul Robert **Brooks**	EngTech AMIAgrE	04 Apr 1998
Denis James **Welstead**	AIAgrE	04 Apr 1998
Stephen John **Hasell**	IEng MIAgrE	04 Apr 1998
Terence **Kernahan**	IEng MIAgrE	04 Apr 1998
Brinley **Davies**	IEng MIAgrE	04 Apr 1998
Robert St Barbe **Wayne**	AIAgrE	03 May 1998
Timothy John Haldane **Hannah**	IEng MIAgrE	07 May 1998
David Hugh Charles **Spratt**	IEng MIAgrE	07 May 1998
Keith Howard **Shelbourne**	IEng MIAgrE	07 May 1998

Long service certificates by special request:

45 years

William **Haywood**	IEng MIAgrE	24 Mar 1998

40 years

Harold George **Poole**	FIAgrE	11 Mar 1998

News of **Members**

Michael Bird who has moved to Stroud will be continuing to work as a freelance journalist and press and public relations consultant. His writing and publicity services span the agricultural, horticultural and turf management sectors and he will be pleased to hear from members requiring help in publicising and promoting their own activities and products or those of their company or organisation. Michael can be contacted at Yew Tree Cottage, London Road, Stroud, Glos. GL5 2AJ, Tel: 01453 755790 or Fax: 01453a767107.

Stuart Pearson who is an independent consultant is working for BKH Engineers, Delft, the Netherlands as Technical Liaison Officer for the Royal Netherlands Embassy in Delhi, India, where he is overseeing various water supply projects. His base is Cochin in Kerala State which he says is a dramatic change from Nigeria where he was previously and he would be pleased to meet any members passing through. Contact telephone numbers are:- Work: 370476, Home: 318418, Mobile: 9846011458 and Email: tlobkh@md2.vsnl.net.in

After being made redundant last year, **Martin Parkes** has set up his own business as an Irrigation and Wastewater Consultant, based in Edinburgh. He says that he hopes to retain irrigation customers in Scotland and will be advertising his services in China where he hopes to attract business in providing training in environmental management. He may be contacted at Technology Transfer Centre, Alrick Building, Kings Buildings, Mayfield Road, Edinburgh, EH9 3JL Tel: 0131 472 4708 or Fax: 0131 662 4678.

Eric Siecker is now employed by Claas Teleporters Ltd of Little Saxham, Suffolk as Technical Service Adviser for Europe.

Following the completion of his MBA at Lancaster University, **Iain Livingstone** has taken up the post of Operations Specialist with Scottish

Electricity Settlements Ltd (SESL). SESL is a joint venture company owned by Scottish Power and Hydro Electric and is responsible for developing and overseeing new trading arrangements for the fully de-regulated electricity market that will be introduced in Scotland later this year.

Christopher Meek has recently moved from Malaysia to the Philippines where he is continuing to run his own Technical Consultancy Service. This service covers design and development, training, planning, marketing, management and writing technical manuals. Christopher may be contacted at Apartment 1, 2622 Cabrera Street, Pasay City, Philippines 1300 Tel: 639 17 529 5716 or Fax: 632 893 6696.

Brian Webb who has spent the last 14 years working for the Asian Development Bank in the Philippines, has now moved to New Zealand and set up his own consultancy business. During his time with the ADB he was involved in the implementation of 22 rural, credit and agro-based projects with an average cost of about US $50 million, located mainly in Indonesia, China, Malaysia, Philippines and Sri Lanka. He played a major role in reformulation of project designs to improve technical, institutional, sociological and environmental aspects of these projects. During his tenure with ADB he was involved in all phases of the project cycle, using logical framework planning techniques. In his earlier career he has had extensive hands on experience in the development of agriculture and agro-industrial education. Brian's new consultancy service is aimed at providing (a) project design, planning and assessment, (b) project management, monitoring and evaluation, (c) technical support of project design and sociological and environmental aspects and (e) the development of niche bio-product markets. Brian may be contacted at 27B Rosehill Drive, Papakura 1703, Auckland, New Zealand, Tel: (64 9) 297 7879, Fax:(64 9) 297 7850, Mobile: (64 21) 633 867 and Email: bhwebb@ihug.co.nz

Stephen Temple has recently returned from Malawi after being there for almost 22 years, apart from a break of one year from 1977-8. For the first 9 years he was at the University of Malawi, Bunda college of Agriculture, as a lecturer (later senior lecturer) in Farm Power and Machinery in the Agricultural Engineering Department. Whilst there he had several research interests, including building a simple soil cone penetrometer based on a Bourdon pressure gauge and a car clutch master cylinder, the use of ethanol/diesel blend in tractors and optimisation of disc ploughing to reduce fuel consumption. He says that whilst working on the last project he developed some skills in electronics and instrumentation.

In 1985, Stephen was recruited for a job with the World Bank/UNDP Tobacco Industry Energy Efficiency Project, working under the Malawi Government Department of Forestry. This project was aimed at reducing the massive deforestation caused by the fuel cured (Virginia) tobacco industry. During the 4 years of the project, the national average fuelwood consumption was reduced from 42 to 22 cubic metres per tonne of cured leaf. The project was led by Eur Ing Mike Bernard (CEng, FIAgrE) and Stephen's role was instrumentation, which included designing and building a data logger to run unattended for 4 weeks at a time, totally self contained and away from any mains power supply.

In 1989, Stephen moved to the Tea Research Foundation (Central Africa), based at Mulanje in the south of Malawi. TFA (CA) are responsible for research in tea in the SADDC region specifically for South Africa, Zambia, Zimbabwe and Malawi. When he moved there, they were commissioning a new research tea factory, termed the Manufacturing Research Facility and he was initially involved with instrumentation and later development and commissioning of tea processing machinery. This involved producing a data logging system which was used initially for research but later for factory systems. The mark 2a version of this system, called 'Slogger' for Serial Logger, is now installed in the majority of tea factories in Malawi. Stephen developed the software to run under Windows, with a mimic diagram of the factory showing what is happening and the data is updated every few seconds.

For the last 3 years he has focused on the control of fluid bed drying of tea. This has involved some fundamental studies, leading up to mathematical modelling and computer simulation of a fluid bed dryer. The outcome was a set of recommendations on dryer control for optimal operation.

For the last 14 years, Stephen has been a member of the Board of Engineers of Malawi, which is the body responsible for the registration of the engineering profession. He has now returned to Norfolk, where his plans are to write up his work on the drying of tea for publication. He also expects to get more involved in the family farm, but will still be available for work involving instrumentation, modelling and control of agricultural processing.

We were sad to hear of the sudden death of **Norman Smith** in the USA, where until his retirement, last year, he was Dean of the College of Engineering at the University of Maine. Norman grew up in England and went to the University of Maine in 1958 for a year of study as a graduate student. In 1962, he moved with his family to Maine and began teaching in the agricultural engineering department. He chaired the department for more than 20 years before becoming Dean in 1985. We extend our sympathy to his widow and family.

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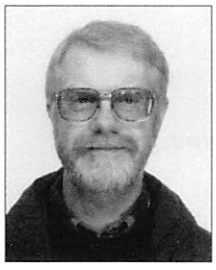
The Montgolfier hydraulic ram

Malcolm Carr-West



A monograph on a simple pump

If you look at an old county series OS map of England you will come across the word 'ram' printed alongside streams. This indicates the site of hydraulic ram pumps. These pumps, which were invented by Joseph Montgolfier and sometimes named after him were, far more frequently used earlier in the century than they are today. At present, the only UK manufacturer appears to be Blake Hydrams who sell about 6 a year.

The ram pump as it was known is a simple water operated pump. It requires little maintenance and is powered by energy from the water flowing down a stream. The principle of operation is very simple. Water flowing down a pipe is brought to a sudden stop, an action which results in water hammer. This hammer is used to provide pressure to pump water.

The construction of a typical ram is shown in *Figure 1*. Water travels down the injection or drive pipe and flows out through the outer or pulse valve. As the water speed rises, it reaches a velocity at which the pulse valve is slammed shut. It is this rapid closing action that causes a pulse of high pressure to travel back up the water in the drive pipe. This pressure wave forces water through the delivery or inner valve. With the passing of the pressure wave the inner valve closes, and with the water in the delivery pipe now stationary, the pulse valve falls open. The process can then be repeated.

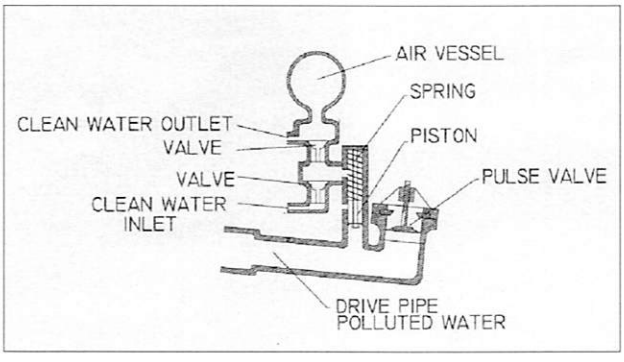


Fig. 1 ram pump construction.

An air vessel mounted on the delivery side prevents damage by the shock loads imposed in the system. As the air in this vessel is removed by being dissolved in the delivery water it is replaced by air entering through the shift valve. This ensures that the air vessel remains filled with air at all times.

Installation of the pump requires that it has a minimum of 1 m head on the drive pipe. The maximum height of the drive head is determined by the construction of the pump, but is of the order of 1 5 m. Delivery head can be as much as 300 m. As a rule of thumb, the head of the drive pipe should not exceed one third of the delivery head. A typical installation layout is shown in *Figure 2*.

The working head H and the rate of flow Q_w determine the discharge of the pump Q_d and the efficiency of water delivery E is related to the ratio of working head H to the delivery head h. The general equation for delivery is:

$$Q_d = Q_w EH/h$$

where

Q_d = delivery flow
Q_w = working flow in drive pipe
H = drive head
h = delivery head

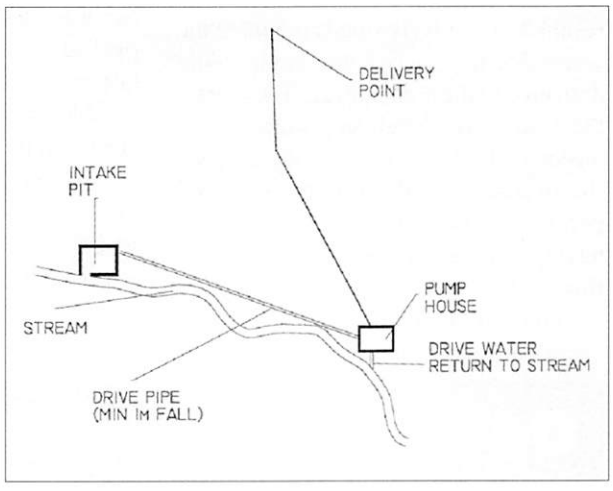


Fig. 2 Installation layout for a ram pump.

E = pump efficiency

Efficiency is dependent on the ratio of heads and Kemp (1966) quotes the following table (table 1)

The effect of the delivery equation, coupled with the change of efficiency,

Table 1 Efficiency of a hydraulic ram for different ratios of the delivery to drive head, h/H.

h/H	*Efficiency*
2	0.85
3	0.85
4	0.80
5	0.75
6	0.75
7	0.70
8	0.65
9	0.65
10	0.60
15	0.55
20	0.40
25	0.40

Malcolm Carr-West MIAgrE developed his interests in Appropriate Technology while lecturing at the University of Botswana, Lesotho and Swaziland. He is now Head of the Department of Agricultural Engineering at Writtle College, where he teaches a course for BEng students on Appropriate Technology, and continues to be actively involved in world-wide agricultural engineering through consultancy work.

Table 2 Delivery as a percentage of drive flow.

Delivery head,m	*Delivery rate, l/min*	*Delivery / drive flow,%*
5	4.08	34.00
10	1.80	15.00
15	1.07	8.93
20	0.72	6.00
25	0.57	4.72
30	0.44	3.67
35	0.31	2.57
40	0.24	2.00
45	0.21	1.78
50	0.19	1.60

results in a relatively small amount of the water flowing through the pump being delivered to the higher level. The greater the head to which delivery is made, then the lower the delivery rate. *Table 2* shows the delivery head, delivery rate and percentage of total flow for a pump having a drive head of 2 m and a drive flow of 12 l/min.

The rate at which the pulse valve opens and closes varies from machine to machine. In some cases, the number of cycles per minute or beats may be as high as 200 but is more normally set at about 40 to 60. This can be set by adjusting the washers on the outer valve. To stop the pump, the outer valve is pulled up to close off the flow; and to restart the pump, the outer valve is pushed down.

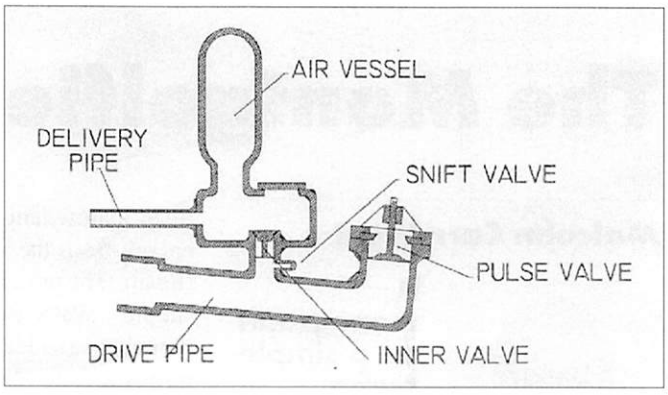


Fig. 3 Modified ram for indirect pumping.

Maintenance of the pump is limited to occasional cleaning and to even more periodic replacement of valves. Otherwise the pumps tend to give a reliable service. With negligible running costs and no power supply needed, ram pumps lend themselves to use in remote areas for domestic and small scale irrigation.

A modification of the pump where the pulse of delivery water is made to drive a spring loaded piston allows the ram to be used to pump clean water using a polluted source. In this version, the delivery valve is replaced by a piston. The, piston is pushed up by the pressure pulse under it. The upward stroke is completed when the piston uncovers an exhaust port. The spring above the piston then pushes the piston back to its starting position venting the water into the drive pipe. This arrangement is shown in *Figure 3.*

Reference

Kemps engineering year book 1966.

Open University, Master of Engineering degree

The Open University now offers a 480 point, Master of Engineering degree for professional development. The degree programme development was guided by a Steering Group including representatives from the Engineering Council, the Engineering Employers Federation and the Institutions of Mechanical and Electrical Engineers.

The degree was planned to be equivalent in the standard reached by candidates to that of the four year full-time Meng degree offered by conventional Universities.

The degree provides candidates with the opportunity to undertake part-time study with the aim of meeting the Engineering Council educational requirements described in SARTOR 97 for registration as a Chartered Engineer by the Individual Case route.

The programme is designed to allow relevant previous study to count for up to 330 points, making this degree an ideal SARTOR, "Matching Section" for BSc/BEng graduates of conventional Universities. Candidates are able to work and undertake professional development whilst following a 150 point, part-time route to the MEng degree and the opportunity to met the new Engineering Council educational requirements for registration as a Chartered Engineer.

Candidates may join the programme, which starts and finishes with compulsory 15 point courses at any time during their studies. These compulsory courses aim to develop in candidates the skills of Reflection, Communication, Working with Others, and Improving Own Learning and Development.

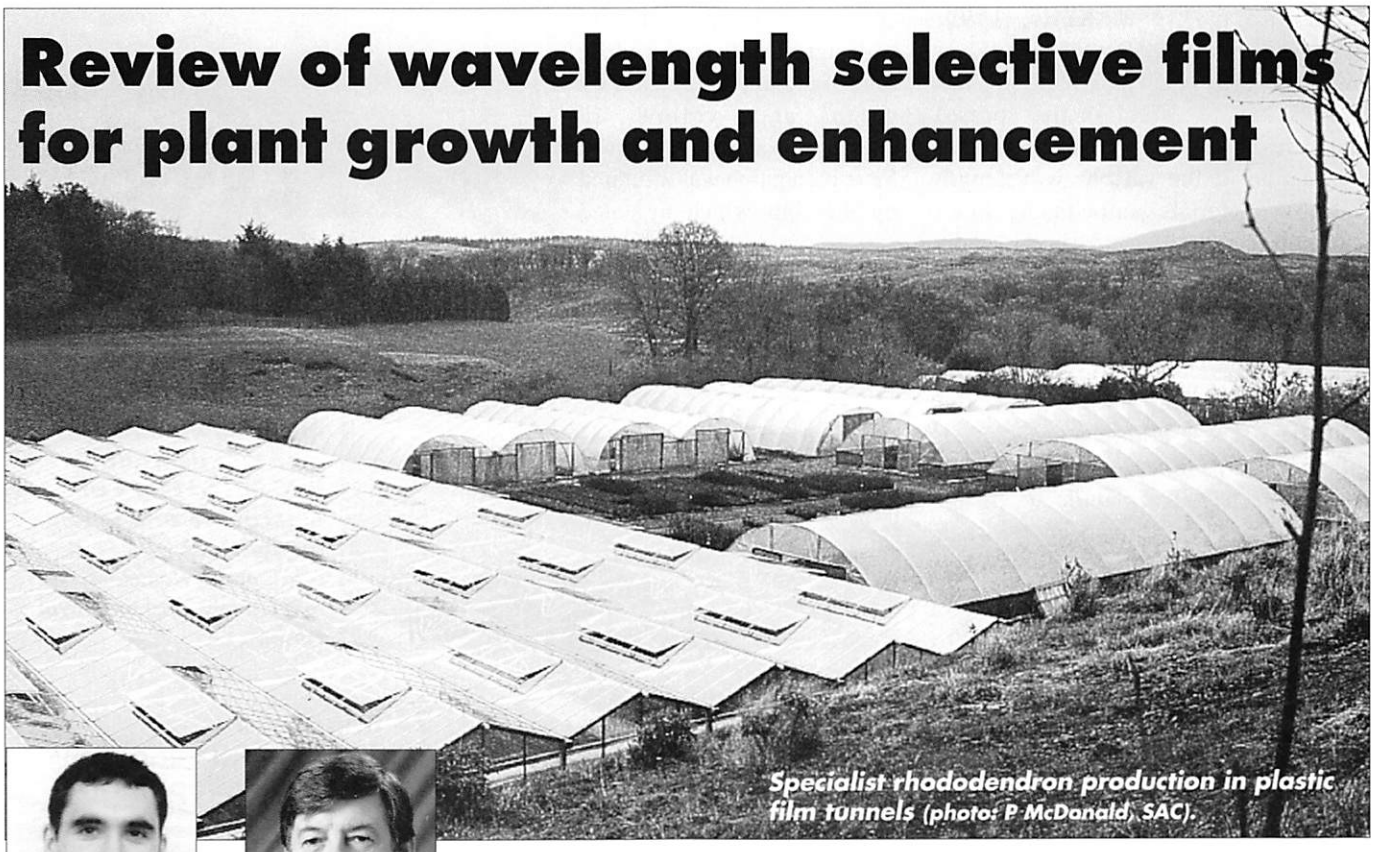
The first compulsory course T191, *Personal and Career Development in Engineering,* helps candidates to identify their own learning styles, plan their individual degree programme, start a "log-book" and develop the skills to manage their own lifelong learning.

The other compulsory course in the programme, recommended to be the final course studied is T397, *Key Skills in Professional Engineering.* T397 aims to revisit some of the PCD material met in the study of TI91. The course requires the student to make plans for continuing professional development and then to compile a portfolio of evidence gained from work and study over the whole period of MEng study against level 5, Key Skills standards.

To qualify for the award of the MEng degree, candidates must draw the majority of their courses from an "Approved" list of engineering related courses published by the University, including a minimum of 255 points at level 3 or 4, a 60 point individual project and the two compulsory courses. A maximum of 120 points of level 1 study may be counted.

Contact: **Mrs Rebecca McCormack, Faculty of Technology, The Open University, Milton Keynes, MK7 6AA, tel: 01908 652970.**

Review of wavelength selective films for plant growth and enhancement



Specialist rhododendron production in plastic film tunnels (photo: P McDonald, SAC).

Roddy Angus and Roy Morrison

Plants rely on the sun's energy for growth and development; this energy is divided into several distinct sections of the solar spectrum with each section having a profound effect on plant welfare. With an increasing number of crops being grown under plastic covers which can be spectrally modified, it is of great importance to understand the interactions between plants and bands of the solar spectrum in order to select a particular plastic cover to achieve the desired effect.

Recent studies have shown the benefits to plants from wavelength selective cladding materials in areas such as yield, quality and disease control. In addition, selective cladding materials have played an important role in the control of the enclosed environment with respect to heat gain reduction and non-drip surfaces.

Dr Roddy Angus undertook this review when he was Lecturer, Engineering and Mechanisation Department, Scottish Agriculture College, Auchincruive, Ayr, KA6 5HW. He has recently taken up a new post as Technical Sales Engineer with South Scotland Valve and Fitting Co., 9-11 Macadam Place, South Newmoor, Irvine KA11 4HP.

Roy Morrison, MIAgrE, is Head of Engineering and Mechanisation Department, Scottish Agriculture College, Auchincruive, Ayr, KA6 5HW.

1. Growth enhancement of plants

The region of the solar spectrum between 400 and 700 nm is the most important for plant growth, around 45% of the sun's energy being concentrated within this visible band. This region is often referred to as photosynthetically active radiation or PAR. High levels of PAR are essential for photosynthesis. The total spectrum includes the visible region and covers from 400 nm to 2500 nm, this band being responsible for the heating properties of the sun as it includes far red and infra-red radiation wavebands. Careful manipulation of the particular wavelengths of light and radiation that a plant receives can have a major effect on its growth and development (Smith, 1982). To this end, there is a great benefit to be realised by utilising wavelength selective polyethylene covers which provide controlled environments for crops.

One of the sought after benefits of using wavelength selective cladding materials is the direct reduction in the use of chemical growth regulators. This reduction has major implications in the areas of cost, environmental impact and health and safety of workers. In addition, it provides the market place with a product which is seen to be more naturally grown, complementing the current trend of supplying 'greener' produce to the consumer.

A significant amount of work has been undertaken to examine the manipulation of spectral quality for growth control, primarily for ornamental plants. The effects of light quality on the growth of *Chrysanthemum* has been studied by several authors (Khattack & Pearson, 1997; Mortensen & Strømme,

1987; Rajapakse & Kelly, 1992; Rajapakse *et al.*, 1993), with significant similarities in results. Great care has been taken to establish the control measures against which the comparative evaluation of the various wavelength selective materials can be made. In all cases, the control measures involved the use of a clear or non-selective cladding material.

The measure of plant performance under various covers utilised common growth recording techniques and statistics. These in the main included: plant height, number of leaves, stem elongation, leaf area, plant/leaf/stem dry weight, number of breaks, and time to flowering. The significance of each measure will vary with plant type, e.g. stem elongation in pot plants and number of breaks in tomato plants.

With respect to the growth of *Chrysanthemum*, recent studies concluded that green light enhanced plant height whilst blue light did the opposite in comparison with a clear control cladding material. Khattak and Pearson (1997) also observed that light quality had little effect on time to flowering except in the presence of blue light which delayed flowering, a phenomenon that was also observed with Campanula by Mortensen (1990). Khattak and Pearson (1997) also studied the influence of temperature on plant growth and concluded that temperature does indeed affect plant height and internode length in proportion to temperature rise. It was also concluded that spectral filter performance would not be affected by temperature over a wide operating range.

In a not too dissimilar set of experiments, Mortensen and Strømme (1987) employed a 'fluid roof' system to modify the quality of natural daylight. The system (Weichman, 1981) consisted of a double acrylic greenhouse construction in which coloured liquid is circulated around the roof and walls. Copper sulphate was commonly used as it provided a blue light and absorbed wavelengths above 700 nm. This would then result in a high red: far red ratio (R: FR ratio) which is responsible for many of the growth regulation properties being investigated. Mortensen and Strømme (1987) examined the effects on *Chrysanthemum*, tomato and lettuce plants against various colours and a pure water control system. Their results concluded that plant height was significantly reduced by blue light and increased by green and yellow in comparison with the control. Stem elongation was inhibited by blue light which, as stated earlier, gives a high R: FR ratio, and this is thought to be regulated by phytochrome (Smith, 1982). A similar reduction in stem elongation had been reported with the use of artificial lighting by two authors (Mortensen & Strømme, 1987). They also concluded that the regulation of stem elongation is of particular significance, especially for pot plant production as compact plants with many shoots are most desirable.

***Maize sown through moisture degradable PVC based film – at emergence and when established** (photos: K Leach and A Hamelees, respectively, Crichton Royal Farm).*

Other work on *Chrysanthemum* by Rajapakse and Kelly (1992) produced results comparable with those obtained by the previous authors and it was concluded that plants grown under copper sulphate filters were similar in many respects to plants treated with chemical growth retardants such as gibberellic acid.

In identifying the variations in time to flowering between plant species (*Chrysanthemum* and *Begonia*), Mortensen (1990) showed that individual plant responses to light quality exist, making an overall generalisation difficult although some key responses can be predicted, e.g. plant height. Hence, the ability to model plant response to light quality is very desirable. This approach has been examined by Khattak and Pearson (1997) who derived semi-empirical models to predict plant responses - such as final height, internode length and time to flower - to different spectral qualities. The results of these models could then be used to assess the potential benefits of spectral filters for growth control.

2. Improved environmental conditions for plant development

2.1 Cooling

Greenhouse cladding materials can be modified readily not only to obtain particular growth enhancement and retarding properties, but also to reduce the infra-red contribution of the sun in an attempt to control temperatures inside the growing environment. This is of particular importance for locations with warm growing climates, it is also becoming increasingly important for horticulturists in the UK with the increase in use of CO_2 enrichment for plants. The most common methods of CO_2 enrichment currently in practice are bottled gas distribution and direct or indirect flue gas utilisation. In both instances, CO_2 enrichment occurs when adequate levels of daylight are available. Where this causes a problem is when temperatures inside the glasshouse rise due to high levels solar radiation and, as a consequence, ventilation is required. This, in turn, will reduce the CO_2 concentration required to aid plant growth and reduce the effectiveness of the enrichment system. This scenario is of greater significance when the method of enrichment is by means of flue gas, as the temperature inside the glasshouse will increase more rapidly, leading to earlier and more frequent opening of the vents.

An improvement to the status quo would be the use of greenhouse cladding materials that allow PAR whilst

eliminating infra-red solar radiation. The difficulty here is to strike a balance between PAR transmission loss and infra-red reduction so as to maximise plant growth.

The use of greenhouse cladding materials is very much site dependent. The requirements of growers in the UK will vary greatly from that of growers in more Mediterranean climates. High latitude locations and, in particular, Scotland require cladding materials with very specific properties that transmit as much incident solar radiation for photosynthesis and heat retention. Only in extreme conditions are protective or shading screens ever employed. In sunnier climates, the emphasis changes towards a cladding material that conserves water whilst reducing excess heat gain.

Hunt *et al.* (1997) developed models to predict the effect of the properties of various cladding materials on the glasshouse energy balance. The model is used to predict internal air temperature, soil temperature and light availability from measured meteorological parameters such as external air temperature, wind speed and solar radiation. Commercially available cladding films alongside a prototype film were examined and their heat reducing effects assessed. The models demonstrated a very close correlation with measured trial results and highlighted the differences and hence the potential uses of the various cladding materials. The ideal performance of a heat absorbing material was identified as having absorbent/reflectant properties at wavelengths greater than 700 nm. Results from this study indicated that a particular cladding material, Luminance THB, came closest to meeting the ideal criterion by transmitting 62% of the total solar radiation and 86% of PAR. Another product in the Luminance range achieved a PAR transmission of 90% but had a total solar radiation transmission of 70% which would lead to overheating well before the Luminance THB film. This study emphasised the usefulness of a modelling approach to assess cladding materials, particularly prior to undertaking experimental trials work.

In a similar study Benoit and Ceustermans (1997) examined the effect of using photoselective greenhouse films on several vegetable crops. The two films used were Hytilux and Astrolux: the former has anti-fog characteristics and absorbed UVa rays; and the latter absorbed UVa and UVb whilst also reflecting short wave radiation (1000 - 3000 nm) and green light (495 - 535 nm). The properties of Astrolux are such that the maximum temperature would be reduced together with transmitted light being more diffuse than for Hytilux, leading to a more favourable climate for the plant.

Three vegetable crops were included in the trial, Lollo Rossa crinkly lettuce, melon and tomato. Results for the lettuce crop indicated that plant weight was not affected by plastic type and that in corroboration with the findings of Reuter *et al.* (1994), there was no indication of an increase in yield. It was interesting to note that the shading effect of Astrolux meant that the plants received 13% less solar radiation compared to Hytilux, but this had no detrimental consequences for plant weight.

The production levels of melon under Astrolux were 12% lower, correlating closely with the reduction in solar radiation. Schultz (1996) mentioned that UVa had a positive effect on taste and Polydress (1996) indicated that UVb raises the sugar content of Charantais melon. With Astrolux absorbing both UVa and UVb, this may explain the lower sugar levels found in this trial. Tomato plants grown under the different films showed that harvesting was significantly delayed using Astrolux although fruit quality was not influenced by film type. Benoit and Ceustermans (1997) concluded that Astrolux was successful at reducing temperatures. However, the relative humidity of the air under Astrolux was 11% higher which may have been responsible for a higher incidence of *Botrytis cinerea* found in tomato.

The overall benefits of employing solar radiation absorbent/reflectant films would be borne out by the growers' ability to grow crops at cooler temperatures to optimise plant quality and reduce ventilation. This ability has the additional benefits of reducing the rate of water loss, saving electricity costs and allowing for longer periods of CO_2 enrichment.

2.2 Anti-fog

Greenhouse covers, whether they are glass or plastic, suffer from the formation of condensation. A hydrophobic surface is a serious disadvantage for many plastic films. It leads to dropwise condensation which can impair heat and light transmission and cause plant disease by dripping. To avoid these affects, some plastic covers incorporate no-drip or anti-fogging additives to create filmwise condensation on the inner surface. Anti-fog covers do not remove the incidence of condensation but alter the formation of the water droplets. Instead of droplets appearing, a layer of water is created. This reduces the instances of droplets failing onto the crop and can also enhance the light distribution inside the greenhouse. This phenomenon of an improvement in light transmittance with anti-fog plastics has been reported by several authors, such as Schultz and Bartnig (1996). Overall, the results of these studies conclude that an increase of light transmission from 69.5% to 93% was possible by utilising an anti-fog plastic as compared to a standard plastic covering.

3. Disease control

The blackening of red rose petals has become a major problem to the industry. This phenomenon which occurs both before and after marketing causes the rejection or downgrading of flowers and the financial loss associated with the wastage. Ozone depletion is partly blamed for the increase of this problem and the resultant increase in UVb radiation has been identified as a major contributor to the blackening of petals. This insight has lead to the development of improved UV absorbers in PVC and PE plastics. A dramatic reduction in the severity of blackening was reported by Raviv (1989) due to the use of such plastics.

Diseases caused by *B. cinerea* have come under examination in a effort to assess the potential of modified plastic covers to reduce instances of the disease. Raviv also discovered that changing the blue to UVb ratio of the transmitted light was effective at reducing the sporulation of *B. cinerea* and also grey mould incidences on cucumber and tomato plants. This was achieved with no reported loss in yield as a result of the reduction in PAR caused by the plastics.

4. Conclusions

This research has examined spectral qualities of greenhouse cladding materials for optimal growth of crops, the

most common of which being *Chrysanthemum* and salad crops.

With respect to the growth of *Chrysanthemum* recent studies concluded that:

- green light enhanced plant height whilst blue light did the opposite in comparison with a clear control cladding material;
- light quality had little effect on time to flowering except in the presence of blue light which delayed flowering;
- a high red to far-red ratio, a property typical of a blue cover, influenced growth regulation and produced similar results to chemical growth retardants such as gibberellic acid;
- stem elongation was also inhibited by blue light.

When considering disease control the following points are noted.

- Plastic covers with high UV absorption are necessary to reduce instances of blackening of rose petals.
- Diseases such as *B. cinerea* and grey mould on tomato and cucumber are inhibited by the use of plastics that utilise a high blue to UV ration in their makeup.

Also concerned with disease control, plants benefit from the correct environmental conditions hence the use of specialist films is beneficial in several circumstances.

- Anti-fog films prevent dropwise condensation which can impair heat and light transmission and cause plant disease by dripping.
- Heat absorbing or reflecting cladding materials can have a significant impact on the growth and development of crops. By filtering out wavelengths greater than 700 nm, they reduce internal temperatures, conserve water, reduce the need for ventilation and allow for improved CO_2 enrichment.

Acknowledgements

Dr Richard Henbest of British Visqueen Ltd and Dr Robin Szmidt of SAC are thanked for their help and advice. Dr Mike Smith and Dr George Marshall of SAC are also thanked for their contribution and support to this programme. Acknowledgement is also made to SOAEFD for their funding of the research.

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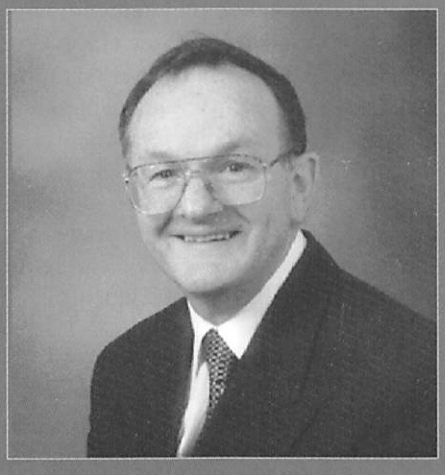
New President for the AEA

Alec McKee, Managing Director of John Deere Ltd, was elected President of the AEA at the Association's Annual General Meeting held at the Savoy Hotel today, 21st April.

Alec has been Chairman of the Farm Equipment Council of the AEA for the past two years and has been a Board member since September 1992.

After graduating with a National Diploma in Agriculture from Harper Adams and with a National Diploma in Agricultural Engineering from the Essex Institute of Agriculture at Writtle, Alec joined a John Deere distributor in Africa before moving to the British base of John Deere in Langar, near Nottingham. A series of promotions followed culminating in Alec's appointment as Managing Director of John Deere Ltd (a wholly owned subsidiary of Deere & Co) with responsibilities for UK and Ireland.



Golf, sailing, caravanning and gardening are his main interests and he is married with two sons.

Safeguarding agricultural machinery - HSE launches new guidance

Following wide consultation with the agricultural industry, and associations representing manufacturers of agricultural machinery, the Health and Safety Executive (HSE) has launched a revised version of its guidance 'Safeguarding Agricultural Machinery'

With agriculture continuing to be one of the more dangerous industries in the UK, all parties have a role to play in improving safety, urges David Mattey, HSE's Chief Agricultural Inspector. "Manufacturers can help to prevent accidents, for example, by attention to safe design, including incorporation of protection from moving parts and other safety devices. Provision of adequate information on safe use of the equipment is also critical. In addition, suppliers can ensure that adequate practical instruction is provided at point of sale," he said.

Guidance given in this revised booklet is based on current good practice and HSE's experience following investigations into accidents. The book deals with machines on a component by component basis. Basic concepts of risk assessment and the suitability of guards and safety devices to control risks are discussed.

It also explains what the law requires, how machinery accidents happen, risk assessment, mechanical hazards of agricultural machines and how guards and safety devices can be used to protect operators. Manufacturers will find the booklet useful for helping them comply with their legal duties.

The guidance is written primarily for manufacturers and suppliers of agricultural machinery. It will also serve as a source of reference for relevant educational establishments as well as machinery owners and agricultural engineers who maintain or modify agricultural machinery.

Copies of *Safeguarding Agricultural Machinery*, ISBN 0 7176 2400 5, price £6.95, are available from: **HSE Books, PO Box 1999, Sudbury, Suffolk, CO10 6FS, tel: 01787-881165.**

Don't turn your back on the uplifting news

Back problems and lumbar pain can account for 59 million lost working days in the UK, according to the Health and Safety Executive. These days can be substantially reduced with help of proper training in lifting techniques.

Initial Health Personnel offers safe-handling training courses which are designed as workshops lasting from four hours to two days. Basic format includes back care, manual handling regulations, and ergonomics - with the emphasis on practical demonstrations and safe practice.

Course instructors are experienced, registered nurses who are on the Royal Society for the Prevention of Accidents (RoSPA) register of approved manual-handing instructors and risk assessors.

"The courses are designed for each clients' specific needs," said Sue Aston, Training Co-ordinator, Initial Health Personnel. "We conduct the workshops on-site, so that we understand the problems employees face during their routine working day."

Initial Health Personnel, part of Rentokil Initial plc, has an envied reputation for providing its clients with skilled and knowledgeable nursing staff. All trainers have many years hands-on experience and are able to understand the challenges that workers face.

Contact: **Sue Aston at Initial Health Personnel on 0345 232425.**

Buyers beware - HSE warns of second-hand Japanese tractors

The Health and Safety Executive (HSE) has warned tractor dealers and farmers that they may be breaking the law if they sell or use certain imported second-hand Japanese tractors.

Following complaints from a tractor dealer, HSE is currently investigating the sale and use of these tractors, of which at least 65 have recently been directly imported from Japan and sold through machinery auctions. Most of these tractors do not comply with UK safety standards.

The shipments include well-known makes such as: Kubota, Shibaura, Iseki, Hinomoto, Sato and Yanmar. The official UK importers of these tractor makes have no involvement in these particular batches and also advise farmers and dealers to have nothing to do with these vehicles.

Greg Bungay, Head of HSE's Agriculture and Wood sector, said: "Many of these tractors weigh more than 560 kg and therefore are subject to the Agriculture (Tractor Cabs) Regulations. They cannot be used by farm workers without an approved cab or roll bar. However, there are unlikely to be any approved frames available for these tractors as these models have not previously been sold in the UK.

"Farmers buying these tractors and then allowing employees to use them in agriculture are likely to be breaking the law."

Further problems exist as there are no operator manuals or instruction books, the control markings and the decals are all in Japanese; and guarding does not meet current standards. These problems alone mean that any auctioneer or dealer selling one of these tractors for use at work may be breaking the law. For the same reasons, anyone using one of these tractors for a work activity, including self-employed people, could be at risk of injury and could be breaking the law.

Any farmers or dealers who suspect they are being offered part of these shipments should contact their local HSE office.

Trees and peopleVSO urgently seeks 'Social Foresters'

Are you willing to cultivate relationships between trees and people? Development charity VSO (Voluntary Service Overseas) urgently seeks forestry professionals to work as volunteers on community-based forestry projects.

Opportunities in Asia, Africa and the Pacific offer the chance to share your forestry expertise and experience life in a stimulating new environment. Often volunteers' counterparts are managing their own forest. Volunteers help by sharing ideas on conservation, advising on preventing soil erosion, promoting the benefits of and maximising the potential of forests which people rely on for day-to-day survival.

VSO currently has 1,950 volunteers working in 60 countries. The range of opportunities in forestry is wide, and includes forestry research and management, social forsetry and agroforestry. Volunteers are promoting sustainable farming methods in Papua New Guinea, training and encouraging the participation of women in community forestry in Nepal, advising thousands of farming families in Ghana, and assisting the development of forestry teaching as lecturers in Guyana and Malawi.

VSO Placement Adviser Jane Sandland says, "We currently have 15 jobs for people with a forestry qualification, and what our overseas employers need most is someone with community-based experience. These are challenging and rewarding job opportunities which just don't exist in the UK. Most placements will require a degree in Forestry or a related subject, and two years relevant work experience, although occasionally an HND in Forestry, and three years experience may be acceptable."

VSO volunteers usually spend two years living and working with poorer communities. This allows them to pass on vital skills which will remain behind after they return home. VSO pays National Insurance contributions, air fares, medical insurance and various grants, and accommodation and a local level salary are provided.

To find out more, contact: **VSO Enquiries Unit on 0181 780 7500** (24 hours).

Safety at work when using welding and other hot work processes

Regulation II (1-3) Management of Health & Safety at Work requires that provision is made for the training and/or re-training of employees and self-employed persons in safety and basic skills training.

Esab Group (UK) has introduced a series of welding courses which are both comprehensive and cost-effective for individuals and for those companies who need to have their welding staff properly trained in the safe use of hot work processes to meet the regulations.

The training can be carried out at Esab's purpose-built Group Training Centre at Aston, Birmingham, or on site. The training can be at craft and engineering levels with presenters who are fully qualified and registered as master craftsmen and welding education engineers by The Welding Institute.

Esab Group (UK) training can also offer certification of accreditation up to and including coded approval to all national and international standards, BSEH 288/287, ASME Section IX, CAA, etc.

Courses offered include: Oxy/Fuel Gas Safety Training - one day; Electrical Safety Training - half-day; Oxy/Fuel Gas Inspectors Training - two days; Safety Conferences - half to two days; Oxy/Fuel Gas Hazard Awareness Seminars - one day; and Craft Process Training - one + days.

Training courses can also be developed to fit in with training plans being developed by the Training Manager for re-skilling or multi-skilling of company personnel or welders at all levels.

Contact: **The Esab Group (UK) Ltd, Hertford Road, Waltham Cross, Hertfordshire EN8 7RP, tel. 01992 760698.**

Spreading adhesives

To increase user confidence and provide engineers with tools to predict the performance of adhesives in bonded joints, the DTI is sponsoring a series of national adhesives events targeting UK manufacturing industry. To support this activity, an 'Adhesives Helpdesk' has been established at the Centre for Adhesive Technology at TWI.

The events are low-cost, 'clinic' style workshops raising awareness and offering advice on using adhesives to improve UK competitiveness and innovation. The objective is to disseminate results of the Performance of Adhesive Joints programme funded by the DTI's Measurement Technology & Standards (MTS) budget. Partners in the dissemination programme are AEA Technology, NPL and TWI. The partners have worked with industry and academia on the programme which comprises 5 projects:

* ADH I : Measurement of Basic Mechanical Properties of Adhesives for Design Use
* ADH 2 : Failure Modes and Criteria for Adhesive Joints
* ADH 3 : Environmental Durability of Adhesive Bonds
* ADH 4 : Measurement of Characteristics to Define Surface Condition
* ADH 5 : Measurement of Optimising Adhesive Processing

Industry can benefit from the results of the programme in an 'easy-to-digest' form, for example, 'best practice guides' and case studies on CD ROM.

The 'Adhesives Helpdesk' has been established at TWI to answer enquiries. The helpdesk is a focal point where UK companies obtain details about forthcoming events, discuss technical and commercial opportunities, purchase CD ROMs containing electronic copies of the reports and details of adhesive bonding training courses.

Contact: **Clare Rushforth, Adhesives Helpdesk, The Centre for Adhesive Technology, Abington Hall, Abington, Cambridge CBI 6AL. Tel/Fax: 01223 894615**

Sisis Ecospray is Millennium Product

The Sisis Ecospray drift-free sprayer, has been selected for the first tranche of Millennium Products.

In September 1997 the Prime Minister, Tony Blair, launched Millennium Products and began the search for the country's most innovative products and services. The challenge went out to submit for consideration ground-breaking products that will change the way we live in the 21st century. The aim is to have 2000 examples of British business ingenuity by the new millennium.

The selected products are allowed to carry the Millennium Products marque, will go on display in national and international exhibitions and will be a major feature in the Millennium Dome at Greenwich. They will also be featured on the Millennium Products website which went live on 2nd April.

The Sisis Ecospray was seen as an environmentally responsible sprayer, solving one of the major problems with conventional sprayers.

Most sprayers are based on agricultural models, with the attendant problems of spray drifting from the intended target. Spraying contractors, and indeed all users of spraying equipment, have to take great care to protect people and environment alike and should only spray when weather conditions permit. A slight breeze can cause a pesticide application to be abandoned; even on a still day, a freak gust of wind can cause damage to adjoining vegetation or watercourses.

Each unit on the Ecospray, therefore, is enclosed by a shroud to reduce 'drift' to an absolute minimum. Solid covers can alter the spray pattern; the Ecospray has specially designed and patented, perforated shields developed in conjunction with an experienced spraying contractor and Cranfield University, where computer modelling and wind tunnel tests were implemented to achieve the optimum design. Bubble jet nozzles were fitted to give a more uniform droplet size, which also reduces drift and improves leaf contact. Sisis subsequently developed the original idea into a viable, commercial product.

The Sisis Ecospray is available in two models, 5-unit towed gang and 3-unit fully mounted. Other models will be available shortly. The first production models are now in use with spraying contractors Complete Weed Control Ltd.

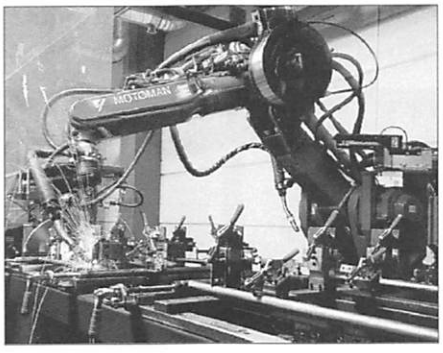
Contact: **Sisis Equipment (Macclesfield) Ltd, Hurdsfield, Macclesfield, Cheshire, SK10 2LZ, tel. 01625 503030.**

Robotised animal stabling

Two Motoman robotic cells are helping a family concern meet the exacting requirements of Alfa Laval Agri in the supply of high quality fencing used in the construction of stabling for horses, cattle and pigs.

The first of these cells, commissioned in 1994, comprised a six-axis Motoman SK6 welding robot with a Yasnac MRC 32-bit micro-processor control. To cope with the size and length of components being welded, the robot was mounted on a servo track (seventh axis) providing the required reach of 1500 x 4000 mm. This installation formed part of a major technological up-grading programme which also embraced a CAD facility, steel cutting machine, computer network and in-flow production techniques.

The venture into robotics proved highly cost-effective. Productivity was increased; quality, consistency, accuracy and speed of welding were significantly improved; and down-time previously required for setting was reduced.



As a result of its increased capability, the company secured a major order for pig boxes, one dictating a 33% increase in production capacity. To meet the demand, and in view of its earlier experience with Motoman, it was decided to invest in a second Motoman robotic welding cell and this was installed in January, 1997.

In this instance, a different configuration was considered more appropriate. The Motoman SK6 was ceiling mounted above a Motoman RM2-50OSE2; a standard, servo-driven two-station 180° rotating 'H' frame welding positioner. A highly versatile unit, it is capable of accommodating components up to 500 kg per station and from 2 m to 3.5 m in length by fixed increments.

Operating on a two-shift basis, it is expected that the combined Motoman cells will have produced a targeted 1,000 tonnes of fencing during the year.

Contact: **Robert Lewis, Sales & Projects Manager, Motoman Robotics (UK) Ltd, 1 Swan Industrial Estate, Banbury, Oxon OX16 8DJ, tel. 01295 272755.**

HRH The Princess Royal opens new John Deere premises

HRH The Princess Royal officially opened John Deere Ltd's new training centre and office premises on Wednesday May 13, 1998, at the company's UK headquarters in Langar, near Nottingham.

On arrival by helicopter, Her Royal Highness was greeted by the Lord-Lieutenant of Nottinghamshire, Sir Andrew Buchanan Bt. Following formal introductions to the local civic dignitaries, HRH The Princess Royal was then invited to tour the new premises by John Deere Limited managing director Alec McKee, accompanied by Robert Lane, senior vice president & managing director of Deere & Company, Region II (Europe, Africa & the Middle East), and Paul Enz, director of marketing, Deere & Company, Region II.

During the tour, HRH The Princess Royal was presented with a commemorative gift of two model tractors, mounted on a plinth, by Marjorie Watchorn, John Deere Ltd"s longest serving employee. Marjorie, who lives in Barkestone Le Vale, Nottingham, has been the company's receptionist since joining in May 1966.

The models represent John Deere's oldest and newest tractors: a 25 hp Waterloo Boy from 1917 and a modern 260 hp 8400 tractor, introduced in 1994. Waterloo Boys were sold in the UK in the early part of this century under the Overtime name; they were given credit for helping win World War I by putting in many hours of overtime producing food for the war zone and the home front. Full-size versions of both models were on display during the official opening, alongside a wide range of other John Deere equipment.

A group of third year John Deere Ag Tech engineering apprentice students in one of the new workshops – L to R behind them are Richard Trevarthen, Ag Tech course tutor at Brooksby College, which runs the course in association with John Deere Ltd; John Deere AMPS (area manager product support) Mark Smith, with John Deere service manager Peter Leech just behind him; Robert Lane, HRH The Princess Royal, Paul Enz and Alec McKee.

HRH The Princess Royal concluded the tour by unveiling a plaque commemorating the Royal visit. The plaque has been fashioned by local blacksmith Stuart Spence of Hose, near Langar, to match the original steel plough share designed in Grand Detour, Illinois in 1837 by another blacksmith - John Deere himself. This revolutionary self-scouring steel plough helped pioneer farmers open up the American prairies, and led to the establishment of Deere & Company at Moline, Illinois, where John Deere's worldwide headquarters are still based. Both the plaque and model tractors were mounted and engraved by Caliba of Nottingham.

The training centre replaces the company's previous facilities at nearby Bingham, which were established 17 years ago. Together with the existing premises, the new building allows John Deere Ltd to have all its office, training, workshop and parts storage facilities on one site, for the first time since the company was established at Langar in January 1966.

Full training on all aspects of management, sales, parts and service support is available to John Deere dealers at the new training centre. There is also some technical training offered to customers, such as fleet owners who have their own workshops. Each year the company delivers around 5000 training days covering 40 different courses, for both the agricultural and the commercial & consumer equipment (groundscare) businesses.

Wind powered heater

The wind energy is transferred into kinetic energy of a water (or oil) churn by a principle known as liquid friction. Although the principle as well as wind power generation are nothing new, the combination of the two is unique in the UK and possibly in the world. The Wind-Heater has been granted a UK patent and European and US patents are pending.

A small scale machine will be capable of producing 10 kW of power in a moderate wind and is completely autonomous and self-governing. On average, it means that almost anywhere in the UK one Wind - Heater will generate and save between 9,000 and 11,000 kWh per year. The machine requires very little maintenance and will give many years of pollution-free service. The machine is designed to have a pay-back period of between 2 to 4 years depending on its application and location.

We believe that the Wind-Heater will be of interest as a complementary heater to great many industrial applications such as food processin plants, dairies, whisky distilleries, breweries, fish farms and horticulture where it can bring a substantial contribution to profits.

Wind- Heater principle will be applied at a later stage to waste water treatment as an aerator where it can potentially save a substantial part of the current cost of £5 per head of UK population. The principle has also a great potential for water desalination and water pumping in areas with no electricity.

Contact: **Charles Madden, Wind-Ways Ltd, P.O.Box 14613, Leven, Fife KY9 1 YB, tel/fax 01333 330 084.**

Euromach 6500 mobile walking excavator - first in UK

To satisfy industry's growing requirement for specialised plant, which can operate in areas inaccessible to standard units, Angle Plant Ltd, UK distributors of the Euromach range, have a new mobile walking excavator. Adding mobility of travel of up to 10 km/h, from site to site, to its many attributes, the Euromach 6500 mobile walking excavator, famous for its ability to work, and climb, on slopes where it is difficult for a person to stand, can operate on gradients up to 10%.

Mobility is provided by rear wheel drive while the two front wheel are steered through a hydraulic joystick controls in the operator's cab. When climbing, the mobile walking excavator utilises its two front 'stabiliser legs' which are equipped with claw feet for additional stability on all forms of terrain.

Configuration of the chassis, with four independently adjustable legs further enhance flexibility of the Euromach 6500 as they maintain low centre of gravity and eliminate the need for a cumbersome counter weight, thereby improving slewing and machine manoeuvrability - particularly on steep slopes and in situations inaccessible to other machines.

Able to span 4.3 m across the wheels, and 5.5 m across the stabiliser legs, the Euromach 6500 can raise itself 1.52 m above normal ground level. It also features a sliding boom which extends the standard machine digging depth of 3.5 m by a further 1.8 m.

Weighing 7.5 tonnes, the machine is powered by a low emission Kubota 5 cylinder turbo charged diesel engine which produces 85 hp. It is piped to accept hydraulically powered dipper attachments.

Because of its ability to 'walk' over obstacles by raising itself 1.52 m and spanning 4.3 m, the 'digging envelope' of the Euromach 6500 extends under the machine to the rear - behind the sound proofed and fully ROPS cab. Teamed with a PowerTilt, TT9 hydraulic attachment swing unit, the versatility of the Euromach 6500 mobile walking excavator, cannot be matched by any standard machine for work in inaccessible areas.

With a max. 'leg spread' of 5.3 m from front to rear and 4.3 m across, the Euromach mobile walking excavator has continuous slewing and is equipped, as standard, with a 60 cm bucket.

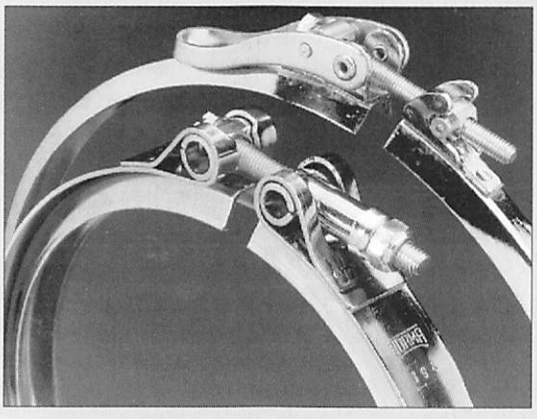
Contact: **Angle Plant (UK) Ltd, The Mount Buildings, Tunnel Hill, Upton-Upon-Severn, Worcs WRS OQS.**

Norma 'V' clamps now manufactured in the UK

For 25 years Norma's 'V' clamp production has been concentrated in Germany. Now with a more global manufacturing policy, Norma UK's parent company Rasmussen GmbH has transferred manufacturing and world-wide distribution to UK subsidiary, Norma Products based in Newbury.

Norma 'V' clamps are suited to a large number of applications, both high pressure and low/no pressure. They are currently used in various areas of container, pipeline, automotive and chemical plant construction. Here they reliably connect transportation containers and water conditioning containers, filters, supply line systems and pipeline systems for air cooling, water cooling, turbochargers, exhaust gases and many others.

Compared with traditional bolted flange joints, Norma 'V' clamps offer a number of advantages. Easy assembly and disassembly, compact dimensions and low weight. Simple bolt operation makes the clamp ideal for assembly in places that are hard to access. As the axial load is uniformly distributed over the flared metal flange, even thin-walled pipes and containers can be jointed safely.



The profile clamps can be manufactured in mild or stainless steel, and in a diameter or profile to cover every possible application. Other options include multi-segment and hinge design for greater flexibility. A variety of closures are also available, bolt or quick-release types for applications which require frequent closure and release.

Norma has a dedicated, experienced team of design, application and production engineers. Norma's strip rolling, welding and test equipment is the latest and being updated all the time. Recently set up is a 'sample cell' for rapid production of samples from existing tooling. Quotations can be turned around in hours.

Contact: **Norma Sales Department, Arnhem Road, Newbury, Berkshire RG14 5RU, tel. (01635) 574000.**

New bed makers have independent adjustment of working depth at front and rear

A four model range of powered bed makers designed for vegetable growers needing to prepare high quality seedbeds of uniform shape, size and structure has been introduced by Dowdeswell Engineering.

Based on the company's Powavator rotary cultivator, the Bedvator Bedtiller is a tractor-mounted machine available in four working widths to match virtually all precision drills, seeders and module transplanters. An important design feature on all four models is the powered rear spiked rotor which can be adjusted for height independently of the rest of the machine. This ensures consistent bed production across a range of depths, irrespective of soil type or conditions, to suit individual crop requirements.

The Dowdeswell Bedvator 1600, 1700 and 1800 are single bed machines spanning 1.61 m, 1.7 m and 1.86 m, respectively. The top-of-the-range Bedvator 3600 has an overall working width of 3.6m and has a double split rotor designed to till one complete bed plus two half beds per pass making it particularly suited for high output work ahead of an eight-row transplanter.

The three smallest models are equipped with a pair of adjustable disc openers which gather stray soil from the tractor's wheelings, directing it towards the front rotor which is turning in the same direction as the direction of travel. A choice of three different front rotors is offered by Dowdeswell to suit specific seedbed requirements and soil conditions. The 'Vege' rotor is recommended for most vegetable beds, having gently curved blades which give a cutting action on the soil without smearing. The Speed-Bladed rotor has more aggressively curved blades which produce a similar cutting, turning and lifting action to traditional 'L' shaped rotor blades, yet without the associated smear at depth. The Spiked rotor comprises straight tines designed for work in tougher, drier soils where a percussive action is needed to eliminate clods.

At the rear of the Bedvator, a contra-rotating spiked rotor breaks down any remaining clods and leaves the surface consistently level ready for planting. Independent height adjustment of the rear rotor provides precise control over the depth of the finished bed to suit different crops, soil conditions and soil types. Working depth of the front rotor is altered on a pair of adjustable wheels at the rear of the machine. These two wheels can also be moved laterally to match the tractor's wheel track.

The Bedvator 1600, 1700 and 1800 are suitable for tractors of between 60 hp and 100 hp with Category 2 or 3 rear linkage and 540 rpm PTO speed. The Bedvator 3600 requires tractors of 150 hp to 180 hp with Category 3 linkage and 1,000 rpm PTO speed. An optional four-leg subsoiler can be supplied to fit between the tractor and Bedvator. Hydraulic or disc markers are also available. Prices range from £7,285 to £12,312

Contact: **Michael Alsop, UK Sales Manager, Dowdeswell Engineering Co. Ltd, Blue Lias Works, Stockton, Nr Rugby, Warwickshire CV23 8LD, tel. (01926) 812335.**

Amazone Ground Care launches new range of slitter/aerators

Amazone Ground Care has launched a new four-model range of slitter/aerators which incorporate a unique blade configuration that ensures high point pressure across the full width of the implement at high operating speeds, while exerting 91 kg/point pressure for entry into the thickest thatch. Designated the Amazone SL, SLC and SLS series, they replace the current SL range.

The SL forms the base of the new range and is intended for working on flat ground. It's fully enclosed 1.2 metre-wide ground-driven rotor is fitted with 40 blades, each of which, uniquely, is mounted with a 10 degree offset. With that pattern, all the points in contact with the surface penetrate the ground to an equal depth when the slitter is driven forward, so eliminating the 'walking' effect associated with some blade layouts and ensuring the implement remains level at high forward speeds. A solid bar supports the rear of the implement and depth of penetration, up to 12 cm, is set by means of a hydraulic ram.

Both the 1.2 metre wide SLC and the 2.4 metre wide version also feature contour following through a floating chain and bar support at the rear of the implement. Penetration depth on these models is by means of weights around the rotor axle.

At the top of the new slitter range is the 1.2 metre wide SLS. This model features a new contour following mechanism, comprising a front-mounted hydraulic depth ram connected through an arm to a pre-loaded spring anchored to the frame at the rear of the implement.

When crossing an undulation the operating depth is maintained through ram pressure, while the spring releases to enable the tractor's rear wheels to remain on the ground, so maintaining traction.

Contact: **Rod Baker, Managing Director, Amazone Ltd, Rowse, Pillaton, Saltash, Cornwall PL12 6QU, tel. 01579 351155.**

New mounted sprayer range from Benest Sprayers

A new range of mounted sprayers has just been announced by Benest Sprayers. Featuring the unique Benest dropleg system and the air driven Ventura® system, the sprayers feature a novel twin tank design with a total capacity of 1000 litres and boom widths up to 24 metres wide. The twin tanks allow the booms to be mounted much closer to the tractor, aiding stability and also visibility. Prices start from £9800.00

Aimed at those users who use a lightweight tractor for their spraying, this innovative design brings the centre of gravity as close as possible to the rear axle of the tractor. The tanks line up with the rear pillar of the tractor cab leaving a relatively clear view to the rear and the side. In normal use, the tanks are linked and operate as one, but the facility to run them individually is also offered, allowing growers to carry two separate chemicals. The booms fold up gullwing style on top of the tractor cab. The result is a very compact and versatile sprayer appealing to small scale vegetable farmers and professional growers alike.

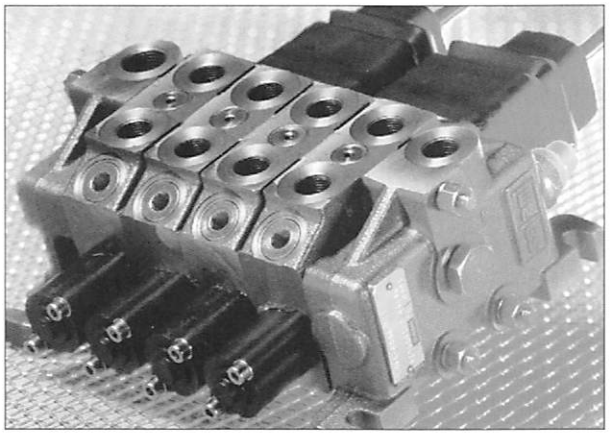
The new sprayers are available as conventional sprayers, conventional dropleg type sprayers or with the Ventura® system. Prices range from £9800 for a basic 12 metre machine to £25000 plus for a full specification 24 metre Ventura® sprayer.

For the 1998 season, the air output on the Ventura system has been increased to a minimum of 200 cu.ft/min. The Ventura system launched last year has proved very popular with growers, and in fruit and vegetable crops in particular, the extra air will provide an extra boost to coverage. Compressed air is fed down the centre of the Benest dropleg and meets the conventional hydraulic water supply in a specially designed nozzle at the tip of the dropleg. A powerful blast of water and chemical is produced, which, because of the unique and patented design of the nozzle, can be targeted in any direction. Crops may either be blanket sprayed or band sprayed at water rates ranging from 60 l/ha to 600 l/ha. A particularly interesting feature of this system is a characteristic whereby the droplet produced by the nozzle retains its shape and size throughout its trajectory. This makes chemical application far more definable, as well as giving greater control over spray drift.

Contact: **Benest Sprayers, Manor House Farm, Rue De Bas, St. Lawrence, Jersey JE3 1JG, Channel Islands, tel. (01534) 27548.**

New 3/8 BSP hydraulic sectional valve

In response to the increasing demand for more compact controls for hydraulic systems in mobile applications, Berendsen Fluid Power have introduced the new VD6A valve from one of their Italian suppliers, Salami. These new directional control valves are a development of Salami's existing range so users can be confident of the valve's performance and reliability. Each section or slice has been reduced in width and the number of sections it is possible to mount in one block has been increased to ten making for a more compact installation. The design of the new valves permits components to be interchanged and reversed, giving the same number of possible valve configurations as Salami's existing range but with fewer parts which will enable Berendsen to supply from stock a greater range and reduces the cost of the valves.



Salami's 3/8 BSP hydraulic sectional valves are designed for flows up to 50 l/min and pressures up to 350 bar. The metered spools can be lever, solenoid, cable, pneumatic pilot or hydraulic pilot operated. All the normal mobile valve spool configurations are available as are main relief sections and relief and anti cavitation valves on the service ports.

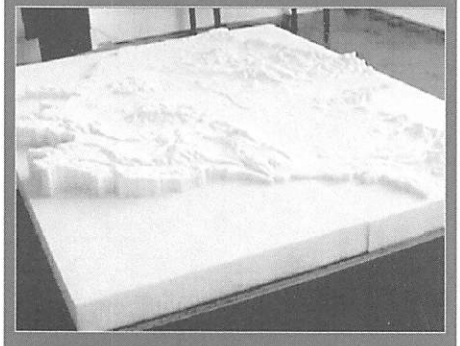
In addition to the compact dimensions, these valves offer very low internal leakage due to tight control the body/spool clearances without sacrificing lever effort which has also been reduced.

Contact: **Paul Hensman, Berendsen Fluid Power Ltd, Sandy Way, Amington Industrial Estate, Tamworth, Staffordshire B77 4DS, tel. 01827 69369.**

Leewood milled landforms

Leewood have developed a system for producing accurate 'LANDFORMS' by computer control. These Landforms are manufactured using 'digital elevation data' from sources such as the Ordnance Survey or from Satellite data. The landform models can be of land areas or seabed areas and can be used for many applications including artistic displays, military planning , county planning , conservation , highways planning, petrochemical exploration, ocean research, agriculture, forestry planning, water management, education etc.

The 'digital elevation data' is usually first processed by the client or bureau who has GIS software which needs to be able to produce a 256 level 'greyscale' representation file of the area to be milled. Leewood then further process that data to drive the milling machine.



The 'landform models' can be made in materials such as Styrofoam , High Density Urethane , or small models in MDF. The models can then be painted or if need be an artist could be employed to add visual detail.

The models can be in sizes from only 50 mm across in fine detail for making other moulded copies from or up to 1200 mm high by 2500 mm wide for use in displays or planning roles.

Contact: **Leewood Works, Upton, Huntingdon, Cambs, PE17 5YQ, tel. 01480 890860.**

The thief-proof car is here

Skynet 2001 puts a car, van, or truck into the ultimate hi-tech protective package. It 'wraps' a vehicle in an invisible net of radio, electrical, electronic, mechanical, ultrasonic, telematics, and ever-watching satellite protection that spans continents. A lone woman motorist or truck driver attacked on an isolated road or parking lot is protected within 15 seconds automatically. For more than a year, over 200 vulnerable trucks, high risk vans, and top people's cars have been proving the system. While some have been attacked, not one has been snatched or its occupants harmed.

Danish invented Skynet has proved itself at a cost of £7.5 million, that broke its initiators. Now new owner US-quoted Peripheral Connections Inc (PEPC) is adding more protection to launch the invention world-wide as Skynet 2001. PEPC, that has bought Skynet from receivership, is headed by business visionary Tomas Wilmot, 51, a Lloyd's name who has taken many companies public including London's Hard Rock Cafe. He also owns a Canadian gold mine.

'Tom' has introduced updated telematics, added more protection, is replacing existing vehicle security systems free of charge if/as necessary, has 'cleaned up an administrative mess' - and is now in action.

His enhanced 21st century Skynet 2001 can instantly convey a driver's medical essentials, like blood group, allergies, and current medications, to doctors at a crash scene. It alerts police and the nearest hospital the moment an accident or incident occurs because it knows the instant help is required, of what sort, and where.

Operating by satellite and mobile phone throughout Europe, the Middle East, America and beyond, it 'sees' a thief , hi-jack, or crash in action. For small fleets it offers a DIY laptop vehicle position monitor. This remotely shows vehicle movements without reference to Skynet's nerve centre control

Skynet Control will talk to a thief in the act, through the vehicle's phone, saying he is being 'watched' and reported, or it will tell a trapped driver and passengers help is on the way. Simultaneously it immobilises all vehicle systems and fuel supply. It reacts to any suspected pre-theft tampering, has an instant response panic button, provides talk-you-there route guidance, and will 'steer' a driver round traffic jams.

Costing £999 fitted and tailored to requirement, Skynet 2001 protects doors, bonnet, boot, glass, interior, cab and its tilt mechanism, engine electronics, ignition, fuel system, brakes, tow linkage, trailer, and load. An annual £150 incl. VAT (£15 a month by standing order) monitoring fee covers 24hr surveillance costs.

The whole vehicle is never out of satellite vision that watches it constantly, voice and message contact is maintained wherever in the world there is a compatible GSM network. Both GPS and GSM are linked to the vehicles sophisticated anti theft system. Even by snatching a vehicle's keys, thieves cannot get far because remote immobilisation activates as police are guided to the spot. The system sends out its own 999 alert to the 24hr multi-lingual nerve centre.

Skynet 2001 uniquely creates 'a thief's nightmare' by combining key features of bank, home, and vehicle security - each insurance approved - into one package to which is added Medi-Care DataPlus™, route guidance, and a message service. All are operated and activated by hi-tech monitoring using GPS satellite and GSM cellular systems. Hence the monitoring fee.

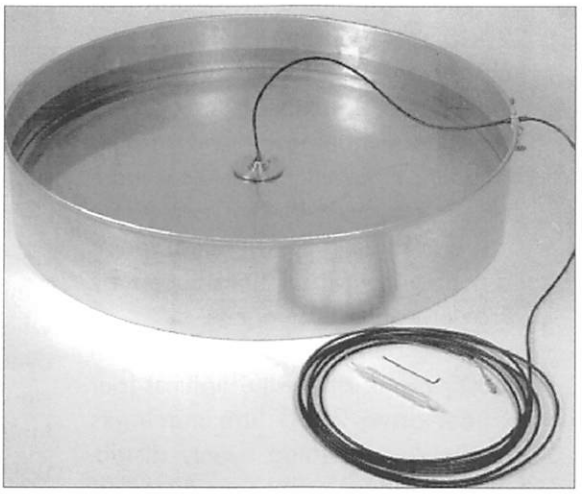
Contact: **Tomas Wilmot, Chief Executive, Skynet 2001 Ltd, Link House, 259 City Road, London EC1V 1JE, tel. 0171 490 7900.**

ELE's new automatic evaporation sensor saves time and money

ELE International has launched a new electronic low range water level sensor, which can be used in combination with a standard Class A measuring pan and a datalogger to achieve the accurate, automatic calculation of evaporation levels throughout a range of environmental, meteorological and agricultural applications. Operating in 0-200 mm of water with an accuracy of better than 1 mm, the sensor provides both a time and cost effective alternative to traditional manual evaporation measurement methods.

Influenced by air temperature, windspeed and relative humidity, evaporation is one of the most difficult phases of the hydrological cycle to quantify: typically, it is calculated by measuring the drop in water level in a collecting pan at a set time each day, using a stilling well and micrometer, in conjunction with rainfall level measurements taken in the same area.

Placed in a Class A pan, however, the new sensor takes the required water level measurements automatically using a precision pressure transducer. With a low power requirement and accepting a variable voltage input, the provides a mV output proportional to the depth of water above it.



Data recorded by the sensor can be stored on an ELE M900 datalogger, which can also be linked to a rain gauge, allowing measurements to be taken simultaneously. Data can then be collected from the logger using a number of methods ranging from direct connection to a portable computer on-site, to the transfer of data from site to computer using a DIALOG-Psion data collection system, or even by downloading information via modem.

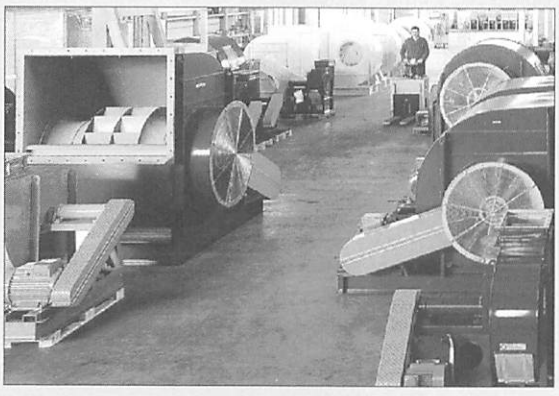
Once held on a PC with the DIALOG software, information can then be further analysed and displayed in either graphical or tabular form, or printed out as a hard copy report.

Constructed of stainless steel, the sensor can be left on the base of a measuring pan for extended periods, enabling easier monitoring in remote or difficult to access regions. The sensors have also been adapted to operate accurately in warm climates, and compensate automatically for swings in temperature which can occur between night and day in such environments.

Contact: **ELE International Ltd, Eastman Way, Hemel Hempstead, Herts HP2 7HB, tel. 01442 218355.**

Imofa enhances performance with addition of Ferrari

Imofa UK, the Colchester-based fan and air-handling specialist has added the Ferrari range of high performance centrifugal fans to its product range.



With a track record in meeting the specific needs of agricultural customers within the UK, Imofa offers a wide range of own-manufactured products, including: direct and belt drive centrifugals, single stage and multi-stage axials, and bifurcated fans for high temperature and contaminated air systems. It also supplies the comprehensive Thermo Air range of air-handling units.

The introduction of the Ferrari products into its portfolio will expand Imofa UK's capability, enabling it to provide centrifugal fans of varying design and volume flow/pressure characteristics to meet the needs of many agricultural applications and equipment manufacturers.

Ferrari has been producing agricultural centrifugal fans for more than 30 years, precision engineered to close tolerances and robustly built to ensure excellent reliability and consistent, accurate performance. Fans range in size from 250 to 2000 mm impeller diameter, providing flow rates from 0.002 m^3/s to 200 m^3/s and pressures from 0 to 25 kPa.

A wide variety of impeller designs are available to suit different applications within the agricultural industry, including environmental, crop storage and drying, dust and fume extraction, milling and conveying.

Contact: **Colin Humphreys, Imofa UK Ltd, Coach House, 49 East Street, Colchester, Essex CO1 2TG, tel. 01206 794606.**

Frazier launches 2000 litre self-propelled sprayer

T J Frazier Ltd, the low ground pressure sprayer manufacturer, is now entering the 2000 litre self-propelled sprayer market with the launch of two new models based on the company's Stealth and Phantom chassis units. One of the first production machines will be exhibited at this year's series of shows.

The Phantom and Stealth TDI 2000's are both lightweight machines and are aimed at growers wishing to upgrade from a small machine without losing low ground pressure capability. The new models are powered by the Land Rover 111 hp TDI engine with dual range automatic gearbox, introduced by Frazier earlier this year.

"We believe that the new TDI 2000 range offers the lightest four wheel drive 2000 litre machines available, providing evenly distributed weight of well under 6 tonnes. The new engine is extremely flexible and the auto gearbox makes driving in tricky conditions a real experience instead of a chore," said managing director, Tony Frazier.

All proven features such as the mechanical four wheel drive, all round suspension and latest cab range have been retained plus additions including dual transmission to give eight forward speeds, a lockable centre differential and a wider axle.

The new Frazier 2000 litre demountable sprayers feature aluminium booms up to 28 metres wide, which have been used and proven over many years and new stainless steel tanks, designed and manufactured in-house by Frazier. Prices begin at £49,700.

Contact: **Tony Frazier, The Airfield, Seaton Ross, York YO4 4NF, tel. 01759 318703.**

UK trade 1997

Total exports of products of AEA members rose 5.6% to £1,636 million. The major component of the total was tractors which increased 8.4% to £1,082 million.

Total imports declined 2.1 % to £ 840 million.

The overall favourable balance of trade increased 15.2% to £796 million.

These are good results which confirm the industry both as a major exporter and as one of the most important balance of trade earning sectors. Indeed, taken alone, tractors are expected to again feature in the top 10 net export earning industries.

The results are especially impressive given the burden placed on exporters by a strong, currency. However, the raw figures can hide the difficulties which companies face in competing on overseas markets. Toward the end of the year, the trade performance was showing signs of deterioration and these export levels cannot be expected to continue in 1998, certainly not in the face of a continuing strong pound. The AEA is concerned that not only are sales volumes falling but margins have reduced to the point that both jobs and even businesses are put at risk. In common with the rest of the UK manufacturing industry, British producers seek a more competitive currency.

FOR YOUR DIARY

BIO–ENGINEERING IN NEPAL

Developing an institutional capacity in biological techniques for slope stabilisation and erosion control in road construction in Nepal.

An early evening meeting jointly sponsored by:-
The Institution of Agricultural Engineers (Overseas Development Specialist Group)
The Institution of Civil Engineers (Appropriate Development Panel)
The Tropical Agriculture Association

WEDNESDAY 14th OCTOBER 1998
18.00 hrs
(Refreshments from 17.30)

at
The Institution of Civil Engineers
1, Great George Street
London

Speakers : Dr Jane Clark, Forestry Adviser, DFID
Mr John Howell, FRR Consultants

Further details from:
Rob Petts at Intech Associates 01372 458955, rob@intech-consult.demon.co.uk
Derek Sutton, 01525 860000, derek.sutton@bbsrc.ac.uk

advertising feature

FORESTRY CIVIL ENGINEERING

Forestry Civil Engineering (FCE) has been launched as a Service Unit to Forest Enterprise. For the first time, Forest Enterprise's civil engineers will operate as a single group under this new management structure.

From April 1998, FCE will continue the provision of civil engineering support for its forestry customers but with the added benefits of economy of scale for optimum utilisation of specialist skills and a more streamlined management structure. But more than this, FCE will aim to become a centre of excellence and expertise in all matters relating to low-cost civil engineering and to forest engineering in particular.

FCE has its Head Office at Peebles (24 miles south of Edinburgh) where a small team of Chartered Civil Engineers and an Administration Unit provide support for the Area Offices around Great Britain. Each Area Office has an experienced Area Civil Engineer with support staff and a range of operators and plant. This focussed team of civil engineers will have the objective of providing well engineered solutions at competitive costs.

Although the planning, design, construction and maintenance of low cost roads and bridges is the mainstay of its work, FCE is able to offer much more than this. As the largest group of civil engineers in Great Britain dedicated to low-cost civil engineering and forest engineering, it is well placed to provide the industry with innovative designs for a range of rural structures, amenity projects, water features, restoration of derelict land, mineral development etc; in fact, a full consultancy service for rural engineering projects.

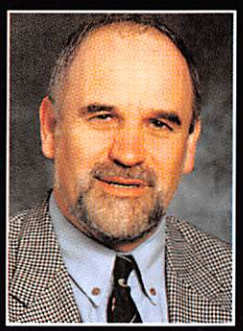
With the ever increasing complexity in regulations, legislation and liability, it is important that competent engineers are used to ensure that specifications are 'fit for the purpose'. FCE can provide this service and with project certification customers can be confident in the standard of work.

FCE already manages the 10,000 km of forest road and 1,800 bridges on Forest Enterprise's estate but can also respond to requests for help from others. This is all good news for the private sector who will be able to tap into FCE's vast source of knowledge and professional expertise at a competitive cost.

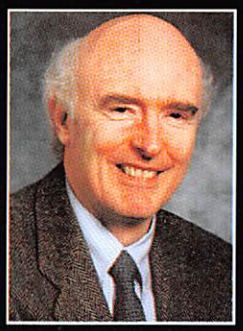
FCE looks forward to the challenge ahead and hopes to be a service to all in the forestry industry.

For more information contact: David Killer, Forestry Civil Engineering, Greenside, PEEBLES EH45 8JA
Tel: 01721 720448 Fax: 01721 723041 E-mail: David.Killer@forestry.gov.uk

David Killer FIAgrE, Head of FCE, has a diverse background in civil engineering ranging from large steel bridges to motorway projects at home and abroad. In recent years, David diversified his interests and became responsible for Harvesting and Marketing in Forest Enterprise, Wales. Having spent much of his career in the private sector, he has experience in management and looks forward to leading a successful team specialising in the provision of low-cost solutions to a wide range of rural engineering problems.



Geoff Freedman FIAgrE is a Chartered Civil Engineer with 30 years experience in the design of structures and small contracting. He will provide the internal consultancy for FCE and take the lead in offering FCE's engineering design and construction services to the private sector. His particular expertise is low cost bridges and roads. He is President Elect of the Institution of Agricultural Engineers and is heavily involved in promoting the Forestry Engineering Specialist Group.



Iain Hampson FIAgrE has been in the forest industry for 20 years. He is a Chartered Civil Engineer with experience in bridge design, design and construction of forest roads, and the design and construction of small dams. He will provide the technical backup to FCE on standards, specifications and legal matters. He is also a member of the Supervising Engineers' Panel under the Reservoirs Act 1975.

INSTITUTION OF **AGRICULTURAL ENGINEERS**

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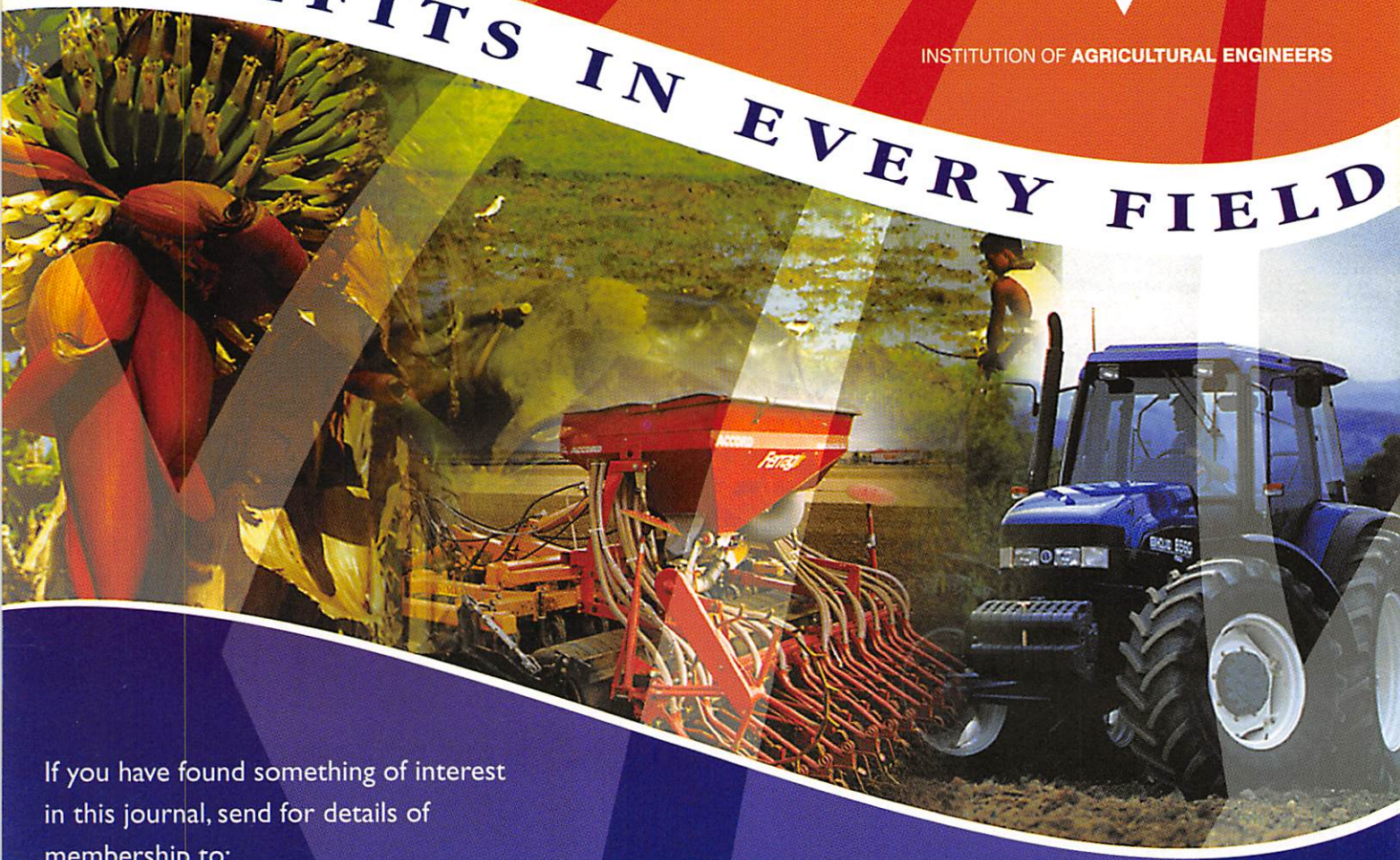

If you have found something of interest in this journal, send for details of membership to:

The Secretary,
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West End Road, Silsoe, Bedford,
MK45 4DU.
Tel: 01525 861096
Fax: 01525 861660

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