IAgrE Journal

Landwards

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Agriculture • Forestry • Environment • Amenity

The Year of Engineering Success

Institution of Agricultural Engineers

National Conference AGM
Annual Dinner Awards Ceremony

Tuesday, 13 May 1997, 10 am, at Silsoe College

Year of Engineering Success

Keynote Address: *Dr Mary Harris*

Parallel Technical Session

Machinery Management
Precision in Farming
Vehicles
Forestry Engineering
Livestock Production Engineering

Renewable Energy
Soil & Water Management
Agro - industrial Products
Horticultural Engineering

Annual Dinner & Awards Ceremony

Guest Speaker - *Michael Astor*

Details from: The Secretariat,
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Landwards

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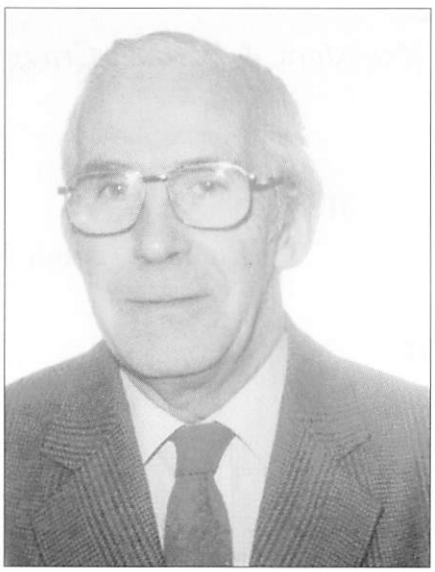
Benefits from traffic control

Excellent soil conditions under long term controlled traffic

Gordon Spoor



This paper was presented at the IAgrE conference entitled: "Profit through Controlled Traffic?", organised by the Soil & Water Specialist Group and held at Silsoe College, Cranfield University on 20th November 1996. Gordon Spoor who received the IAgrE Award of Merit in 1996 is Professor of Applied Soil Physics in the School of Agriculture, Food and Environment of Cranfield University at Silsoe, Bedford, MK45 4DT.

Efficient and profitable crop production is dependent upon achieving appropriate soil conditions for both the crop and associated machinery operations. Unfortunately, the optimum conditions required for crop growth are very different to those required for efficient trafficking. Plants require a relatively mechanically weak, open soil condition, conducive to easy and extensive root development, good aeration and water supply, when subsurface drainage is satisfactory. Conversely, much more compact conditions are desirable for good traction and the support of wheels and tracks.

To date, the major approach to satisfy these two requirements has been to provide a compromise soil condition which has proved possible and largely satisfactory through the use of low pressure tyres and tracks. As equipment size and weight increase, achieving a satisfactory compromise condition becomes increasingly difficult and, since the wheeling effects dominate, this approach incurs additional effort to overcome associated soil compaction problems.

The present compromise approach may continue to be the choice for the future, but with current equipment sizes and weights, and possible increases in the future, together with tightening profit margins, it is well worth considering alternative approaches. One alternative is to separate the cropping and wheeling areas, allowing optimum soil conditions to be prepared for both. In this approach wheels are confined to their own traffic lanes and never encroach into the cropping zone. These prepared traffic lanes may be short term, being retained through the life of one crop, or more permanent, lasting for many crops, if not forever. This system of machinery operation and control has been termed 'controlled traffic'.

This paper reviews the potential benefits arising from controlled traffic systems. Many of the benefits in themselves tend to be relatively small, but when combined together can, in many situations, add up to a very significant whole.

Operational benefits

Figure 1 shows the changes in soil surface elevation, due to weathering over winter periods on autumn ploughed and uncultivated stubbles and to a single wheel loading with a 52 kW tractor in spring (Spoor *et al.*, 1977). In both the wet and dry winters and on both the silt and clay soils, the wheel loading returns the soil practically to its starting condi-

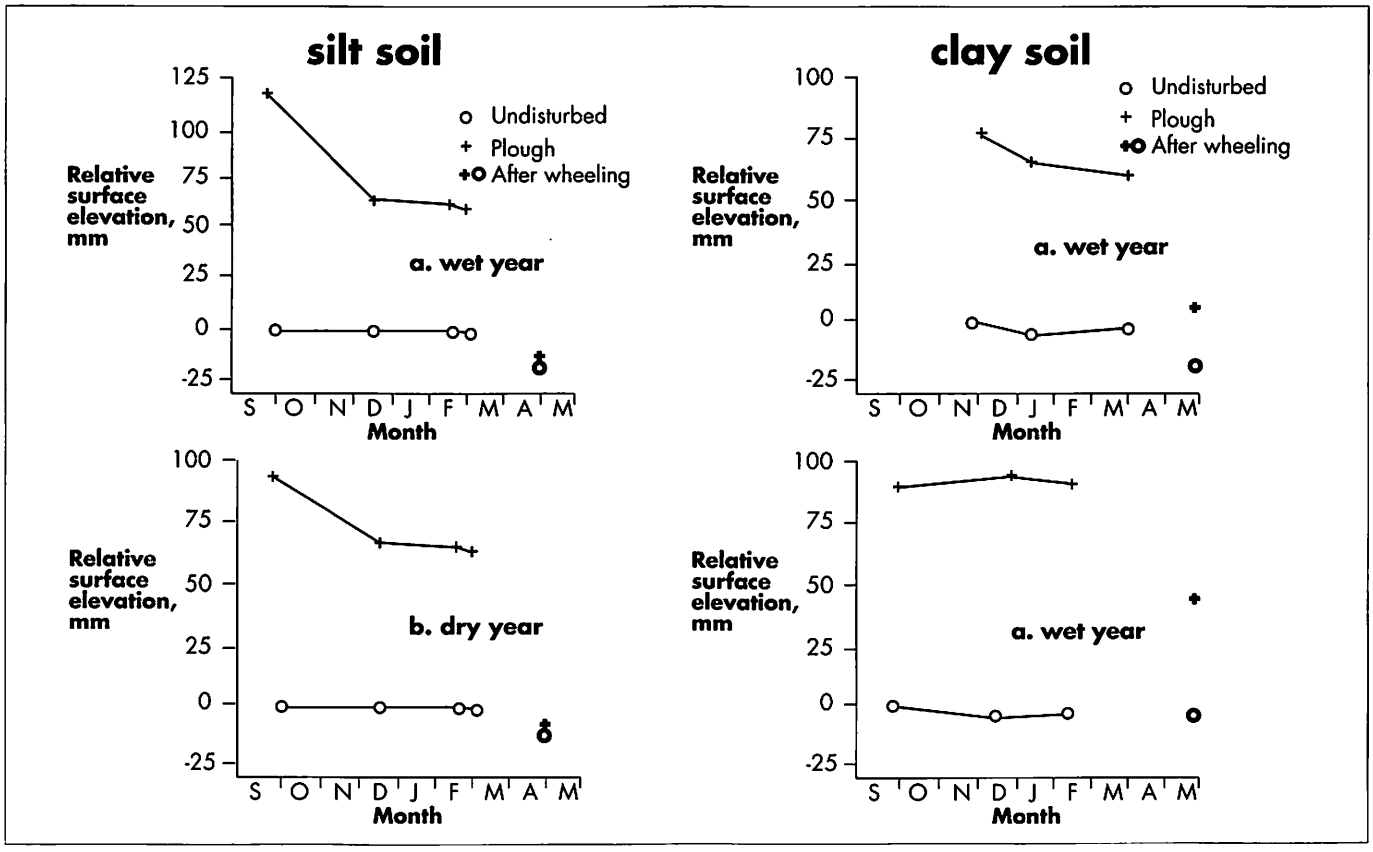


Fig.1 Changes in surface elevation with time.

Table 1 Draught and energy requirements for shallow ploughing on trafficked and untrafficked fields.

System	Ploughing depth, mm	Draught, kN/m²	Energy requirement, kJ/ha
Trafficked	95	107	117
Untrafficked	98	42	47

tion. Similar findings are regularly found after subsoiling operations, particularly on the sandy and silty soils. Here, soil densities after subsequent wheeling operations are often as high or higher on the subsoiled area than they were before the operation. Wheel control or absence, therefore, ensures maximum benefit from cultivations and minimises the waste of effort put into previous operations.

The avoidance of wheelings and hence of unwanted compaction initially, in some cases, could avoid the need for further tillage. In other situations it would allow shallower operations or reduce draught and energy requirements when working at the same depth. This would allow the use of wider equipment, thus achieving higher outputs with the same power available. *Table 1* shows a measure of the draught reduction achievable, in this case 60%, on a clay soil when shallow ploughing a stubble on untrafficked rather than trafficked areas (Chamen *et al.*,1992). Draught reductions of between 50% and 60% are very common across different soils, following the adoption of controlled traffic systems.

Shallower operations and the avoidance of the need to work deeper to take out tractor wheelings during seedbed preparation, offer other benefits. These include reduced moisture loss and greater benefits from soil weathering, particularly in overwintered situations. Natural weathering and drying produces an ideal soil condition for direct seeding *(Figure 2)*. The undisturbed soil condition has a dry surface layer good for machine operation, a moist layer below at seeding depth for rapid germination, and large supplies of water at depth for later use. Any wheel rut formed in this situation, even if shallow, would require deeper working to eliminate and thus destroy this ideal condition which nature has provided free of charge.

Short term controlled traffic lanes need loosening if they are to be aban-

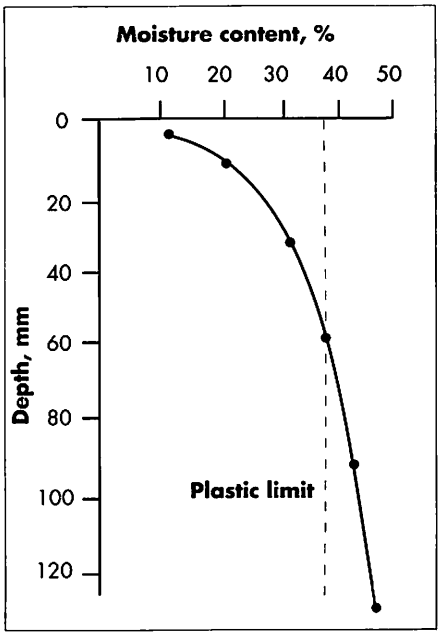


Fig. 2 Moisture profile after three days drying.

Table 2 Trailer towing force within and between traffic lanes during sugar beet harvesting.

Soil	Trailer towing force, kN		
	Trailer wheel within traffic lane	Trailer wheel on unwheeled soil	Trailer wheel in crop area after random traffic
Silt loam (yr1)	4.0	8.9	5.7
Silt loam (yr2)	4.2	6.5	5.5
Sandy loam	4.8	9.2	6.7

doned for the next crop. This tillage need is, however, local and its location readily identifiable. Problems, therefore, can be rectified much quicker than if the whole field has to be cultivated, as would be the case with random traffic.

Compacted traffic lanes provide excellent support for harvesting and crop transport operations and minimise the extent of soil damaged when harvesting under wet conditions. *Table 2* shows the differences in towing force required to haul a 12 tonne, four-wheeled trailer within and between existing traffic lanes, during sugar beet harvesting (Spoor & Miller, 1989).

The traction penalty, in addition to soil damage, from running trailer and harvester wheels on unwheeled soil is very apparent, the forces being effectively doubled.

Table 3 Cultivation operations and energy requirements for seedbed preparation.

Operation	Energy requirement, MJ/ha	
	Trafficked	Controlled traffic
Spring tine	57	-
Power harrow	108	-
Harrow	29	25
Drill	31	27
Roll	30	27
Total	255	79

Crop benefits

Crop benefits from controlled traffic can be achieved from better seedbeds, more uniform drilling depths and seedling establishment, and better timeliness of operations. These factors can lead to significant quality and yield benefits. Under ideal moisture and weather conditions, good seedbeds can be achieved almost regardless of the wheel control system, although input requirements will be less with controlled traffic. The major benefits from longer term controlled traffic, in terms of seedbed preparation and quality, will be obtained, therefore, in the more extreme seasons, particularly on the heavier soils. *Table 3* illustrates this, showing the controlled traffic field requiring much less work and energy to produce a better seedbed in a difficult spring following autumn ploughing (Chamen *et al.*, 1992).

Variable soil conditions, with differences in soil density across a field, cause difficulties in adjusting seed-drills to sow at a uniform depth. This can cause non-uniform emergence and with short duration crops in particular, can create final quality problems. Similar quality problems can arise with root development and shape, through increased fanginess and misshapen roots. Root snapping problems can also occur in dry seasons at harvest, when roots have grown into compacted zones.

Following rain, the delay time for drying, before seedbed preparation and drilling can commence on cultivated areas, is significantly affected by the traffic system. With controlled traffic, the starting time depends on the soil condition required for satisfactory tillage or drilling, whereas with random traffic, it is controlled by the effect the wheeling will have on the final seedbed. On drying, condi-

Table 4 Available drilling days between 20 March and April in difficult springs.

Cultivation System	Drying time before drilling, days	Available drilling time in difficult springs, days						
		1989	1977	1986	1967	1962	1964	1959
Random traffic	5 - 6	0	1	3	4	5	7	8
Controlled traffic, tine + crumbler	3 - 4	4	6	7	8	10	13	16
Controlled traffic, tine only	2 - 3	9	11	11	11	16	18	22
Direct drilled	1 - 2	17	22	21	16	23	23	30

tions suitable for cultivation are always reached before those for wheeling. Extra drying is required before wheeling to improve the chances of generating some seedbed in the wheeled area. The additional delay time can be 1 - 3 days depending upon the amount of subsequent soil working required. To illustrate and quantify this timeliness difference, the estimated numbers of work days available for sugar beet establishment in the Lincolnshire/Cambridgeshire area in recent

Fig. 3 Short term controlled traffic in sugar beet.

wet springs are identified for both controlled and random traffic systems in *Table 4* (Spoor & Miller, 1989).

The calculated numbers of available work days in *Table 4* are most probably less than those actually achieved. This is due to the tendency to work under slightly more unfavourable conditions if drilling is delayed. Nevertheless, the potential benefits from controlled traffic are considerable in difficult years, the improved timeliness giving a significant yield benefit.

Yield differences between controlled and random traffic systems will vary depending upon the crop and circumstances. Reviewing experiments in Europe with cereals, sugar beet and potatoes since 1983, it is very rare for zero or controlled traffic grown crops to yield less than those grown with random systems. At worst, the yields have been similar and frequently they have been higher. In the Silsoe Research Institute cereal trials, controlled traffic yields have on average been 15% higher than random traffic (Chamen & Longstaff, 1995).

In current sugar beet production with wide equipment, the number of wheelings produced during seedbed preparation is usually relatively few. Yield benefits from controlled traffic in this situation will, therefore, come largely from improved timeliness of establishment in the more difficult springs. Further benefits will also be achieved in the following crop, through this traffic control reducing soil damage at sugar beet harvest in wetter years.

Soil benefits

The major potential soil benefits arising from the adoption of controlled traffic are associated with soil structure and compaction damage. Soil structure is most vulnerable to damage under the loading and shearing action of highly loaded wheels and tracks under moist and wet conditions. Confining the wheels to a localised prepared traffic lane will significantly reduce the risk of this type of damage, which occurs largely in the topsoil.

Subsoils are most susceptible to damage from large axle loads which increase the extent of soil compaction at depth. Soils most vulnerable to this type of damage are the weaker structured sands and silts. The mechanically stronger prismatic and blocky subsoil structures in many of the clay soils, tend to be much more resistant to compaction under these loads. The swelling and shrinkage properties of many of the clays also assists in overcoming or minimising the overall deleterious effects of these loads. Whilst controlled traffic offers the opportunity to minimise the overall area of field influence by these loads, to protect subsoils in the long term, traffic control must be supported by additional controls over axle loads.

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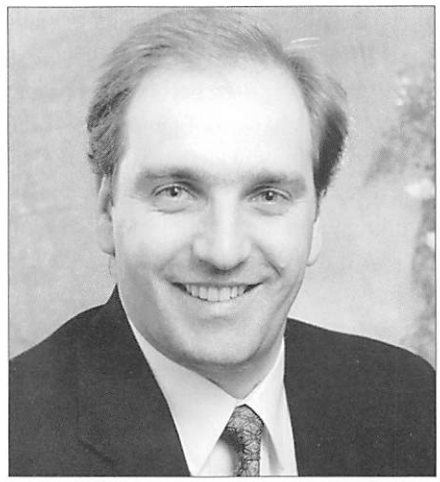
Mobile computing - engineering data capture and information management



Mark Ketteman

This article considers the impact of the latest technology computing systems for field use (pen computers) and their impact on the use of location based information. Included is a brief description of the role of mobile computing and a discussion on typical field engineering applications and their potential benefits.

2. Requirements for engineering data capture and retrieval

When considering the requirements to meet the needs of field engineers, it is useful to think through the typical nature of how data can best be collated and then used.

Most existing engineering features are positioned in relation to other objects to which they relate. This is most commonly achieved against a map background *(Figure 1)*. Information is then noted and associated with each feature including, for example, the maintenance record or physical description. This data will usually be periodically reviewed and, if necessary, updated. Should a problem occur with a particular feature, then access to all of this information is required as quickly as possible.

When planning a new feature, the primary objective (for example, guaranteeing proper access to a forestry region) will be considered against the physical and economic constraints. Typically, this will also involve assessment against a background map and access to other relevant information.

In short, the requirements could be summarised as follows:-

- the ability to store and retrieve background map information
- the ability to position engineering features within the context of the map data
- the ability to store, update and retrieve data associated with engineering features
- the ability to perform analysis and calculations based on the geographic and data attribute information.

These capabilities can be provided through the adaptation of a sub-set of the functionality associated with Geographic Information Systems. In this way, a con-

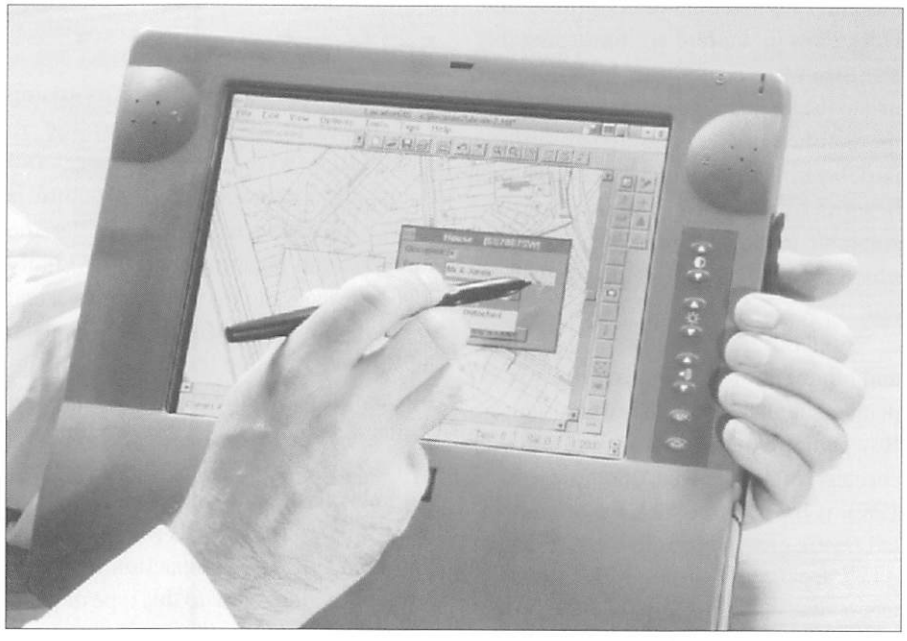


Fig. 1 A typical application for a pen computer.

This paper was presented by Mr David Brien, on behalf of the author, at the IAgrE conference entitled: "Computers in Forestry Production", organised by the Forestry Engineering Specialist Group and held at Newton Rigg College on 5th September 1996.
Dr Mark Ketteman is Business Development Manager, Sokkia Ltd, Datum House, Electra Way, Crewe Business Park, Crewe, Cheshire CW1 6ZT

trolled and managed environment is provided which facilitates:

•view of map data in either raster or vector form

• view of digital photographs (including aerial photos or orthophotos)

• the ability to amend (add, delete, change) graphic information

• association of data attributes to any feature

• the ability to retrieve or amend (add, delete, change) any of this data information

• analysis and calculations derived direct from the graphic or data information

• production of hard copy plot output or printed reports.

3. The role of data in GIS

Many organisations now recognise the potential benefits of using geographic referencing as a common denominator across many of their information sets.

Fig. 2 Pen computer technology for field use.

Typically this involves referencing either company assets or information against a map background with a Geographical Information System (GIS).

Over the past decade a very large investment has been made in the adoption of GIS. This provides the proof of the commercial need for the availability of such data. As with all Information Systems, the key to realising benefits is the ability to derive, with confidence, results from the information stored within the system. This is applicable to the Local Government Department responsible for the maintenance of street lighting, the Electricity Company in relation to its Overhead line Management or the Superstore trying to decide where to place its next store from the geodemographic data available.

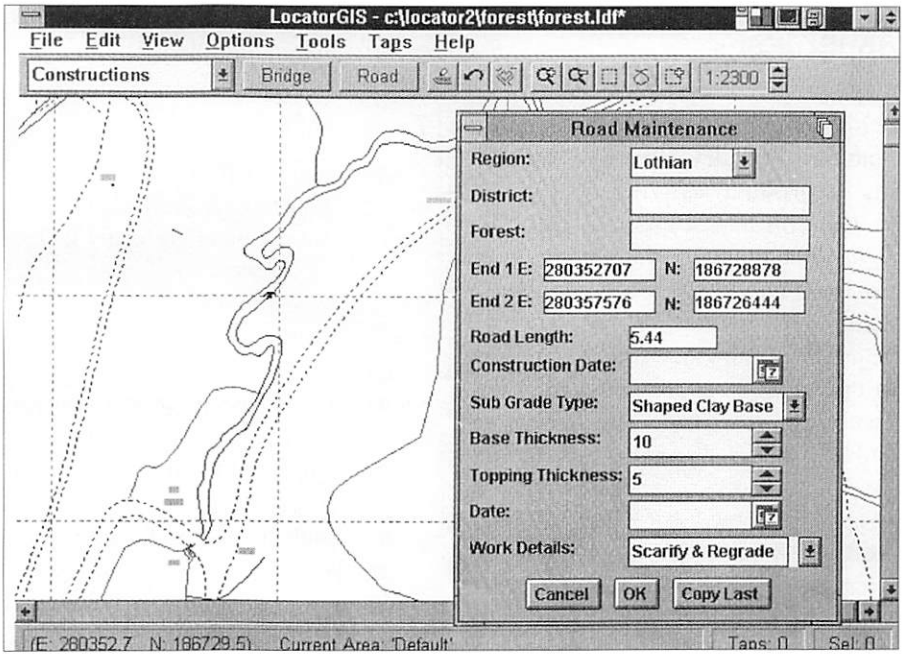


Fig. 3 Vector background map - screen display of forest road maintenance data.

Two of the key points in attaining this confidence in the results from your GIS are:

• the accurate initial collection of data

•the ability to maintain the accuracy, concurrency and integrity of this information.

4. Mobile computing

In all aspects of life today, we are confronted by the growing use and dependency upon computer technology, whether it be in our personal or professional lives. Recently, this revolution has encroached to hand held or mobile systems - consider, for example, the widespread use of personal organisers such as the Psion or hand held data logger recording stock status in the supermarket. The market has also blossomed for lap-top personal computers, battery driven, allowing access to applications such as word processing or spreadsheets whilst away from the office.

The move to mobile systems has been facilitated by the rapid rate of technological advances and followed by the realisation of the numerous benefits which can exist for the availability of data or information wherever you require it.

The latest stage in the development of mobile technology has been the introduction of pen-driven personal computers with the capability for displaying and editing both graphic and data attribute (text) information.

This technology is now being widely adopted within engineering and surveying disciplines to either provide an efficient primary data capture environment or to allow the field person access to accurate mapping and database information together with the ability to modify (add, change or delete) any of this data - all whilst actually in the field.

5. Pen technology

When it comes to gathering, viewing or editing GIS type data in the field, pen computers offer a very attractive technology. Most of them are roughly the size of a thick A4 sketch pad incorporating a large mono or colour LCD screen *(Figure 2)*.

This new generation of battery driven portable machines has all of the storage capacity of standard lap-top computers and most desktop PC's. Pen computers can therefore run GIS type applications including raster and vector data, photographs, form-based input screens and database attribute information. The key difference is that they are controlled using a pen input device rather than a keyboard or mouse. The removal of dependence upon the keyboard makes these devices the first general purpose computer that can be used anywhere.

6. Sample engineering applications

To prove the concept of utilising GIS for field engineering purposes, two applications have been developed by Sokkia using a product called LocatorGIS. LocatorGIS has been specifically designed to allow GIS functionality to be taken into the field on penbased PC technology.

Figure 3 shows the entry screen with in this case, a vector background map. Two applications have been developed and are accessed via the two buttons (bridge and road) on the function panel. It should be noted that the applications are driven from a Windows interface. The interface has been designed to be as easy to use as possible as it is recognised that this is a tool for engineers, not software analysts.

6.1 Bridge engineering/ inspection

To position a bridge, the location is identified on the screen using the pen pointing device and the 'Bridge' button then clicked. This automatically places the bridge symbol in position and produces a series of forms which can then be filled in giving relevant data concerning the structure.

Once all of this information has been added this data is then stored in a database/feature itself. This data can be retrieved by simply enquiring on the bridge symbol positioned on the map. In this way inspection can include reference to the previous information, highlighting any alterations in state.

6.2 Road maintenance/ costing

The application allows either a new road to be defined on the screen by planning its position, or a section of existing road to be considered.

Upon selection of the road, a series of forms are automatically displayed to cover information such as material type, thickness etc. The length of road is automatically derived from the graphic position. The inspector can assess how much maintenance will be required and a cost for the work generated.

As with the Bridge example above, it is possible at any time to interrogate the road data to assess previous inspection or maintenance information.

7. Benefits

The potential benefits from the introduction of having this capability available in the field environment are many including:

- on-line access to data
- increased efficiency in data capture and retrieval
- removal of the need for paper records in the field
- seamless update of office based information systems removing the potential problems of data being misread or misinterpreted from field notes
- ability to store data between individuals or departments
- streamline of workflow by use of improved information management
- improved quality of data
- access to accurate archive data and job notes.

The derivation of such capability for a GIS also provides the possibility to develop other requirements from within the same environment for example, production planning through the use of area analysis or visual impact assessment for proposed plantations. The ability to also incorporate a digital photograph as part of the record systems has considerable potential, a picture painting a thousand words.

Pen computers include the ability to use gesture on the screen. In this way, the pen writes on the screen to produce content functions, for example, a + sign will zoom in on a point, a - sign zoom out. The simplification of the user interface is the key to the successful adoption of this technology, as is the ability to reflect the actual job being undertaken and not provide spurious, unwanted, functionality.

8. Conclusions

The technology now exists to allow engineers access to vital location and engineering information whilst in the field using the new generation of pen computers.

These systems can 'mimic' existing work practices and yet provide significant benefits over traditional pen and paper.

Video review

Seven Centuries of the English Windmill

Narrator: Janet Suzman

Producer: Farming Press Videos

Running time: 55 minutes

Price: £15.99

This is quite simply a treat, beautifully produced and filmed, delightfully narrated with attractive and informative documentary.

It is scripted by windmill expert, David Birt who traces the technical developments from medieval post mills through to the grand tower mills of the nineteenth century. The workings of the mill and how their technology was developed over the centuries is also covered in fascinating details.

The video visits a dozen or so restored windmills of all types. Janet Suzman relives the work of the millers, and contemporary millers give fascinating insight into how they restore mills and subsequently operate them.

In short, the programme is a delight, and to sit and watch these majestic machines harness the wind with a backdrop of beautiful countryside was a great pleasure. I can recommend this as 55 minutes well spent.

MJH

HSE issues warning on new power harrow standard

The Health and Safety Executive (HSE) has issued a warning to agricultural machinery manufacturers and suppliers over a new harmonised standard on power harrows produced by the European Committee on Standardisation (CEN). HSE, which has consistently objected to the standard, believes it will allow a lower level of guarding than that used in Britain for over ten years and will continue to take appropriate enforcement action to maintain current levels of safety.

The English language version of the new standard, BS EN 708: 1997 *'Agricultural Machinery: Soil Working Machines with powered tools - Safety'*, was published recently by the British Standards Institution (BSI). BSI themselves recognise that the standard is deficient and their National Foreword contains a warning about its use.

Power harrows are dangerous machines. The soil-working tools - long blades (tines) that cultivate the soil - can cause amputation injuries to the feet and legs. In Britain, even with current guarding levels, there are up to five serious injuries a year, some of which prove fatal. If machines were manufactured to the European Standard, HSE believes that the number of accidents would increase.

David Mattey, HSE's Chief Agricultural Inspector, warned: "Unless guarding levels on these machines are maintained, HSE will not hesitate to take enforcement action to prohibit the supply of machines that are made to the bare minimum of BS EN 708. Power harrow manufacturers and suppliers cannot rely on the standard to comply with their legal duties under the Supply of Machinery (Safety) Regulations."

"The cost of providing guards that meet UK safety requirements is small in comparison with the cost of the machine and unless current guarding levels are maintained there is an increased risk of serious accidents occurring", he added.

"To meet UK safety levels, the front and rear distance guards must be capable of withstanding a vertical and horizontal force of 1.2 kN (equivalent to the weight of a 121 kg worker) and the infill to the barrier must meet the distance requirements of EN 294 *'Safety of Machinery - Safety distances'*. We shall also expect to see the adjustment system fitted within 550 mm of the side barrier."

HSE considers BS EN 708: 1997 to be deficient in three respects.

- It does not specify the minimum strength of the stand-off guard (barriers in front of and behind the blades). The guard must be able to take the weight of a worker who is likely to need to stand on, or rest against it when operating the machine. It should also be strong enough to ensure that it does not buckle whilst in use. If the guard gives way, the worker could be drawn into the tools.
- Although the standard sets the distance between the stand-off guard and the blades, it does not specify that this gap should be filled in. If a worker stands on the guard and slips through the gap, their feet could come into contact with the tools.
- The standard lacks precision over positioning of the adjustment handle, whose use can be a contributory cause of accidents.

"HSE will continue to press our concerns with the European Commission in Brussels", Mr Mattey said. "We enjoy the support of the majority of Member States. The European Commission agreed at a meeting on 11 December not to publish the reference to the standard in the Official Journal until it had considered the objections which had been raised. The Commission is also seeking the advice of CEN on our concerns about the guarding levels.

"I hope that the positive results we have achieved so far in arguing our case at Brussels means that our concerns will be successfully resolved. The problems with BS EN 708 must be addressed in order to avoid accidents to workers across Europe in an industry that is widely known to be dangerous."

For more information, call HSE's InfoLine, tel: **0541 545500**.

New European agricultural engineering MSc at the Royal Agricultural College

In response to increasing multinational requirements and expectations of agricultural engineering graduates, the Royal Agricultural College has launched an MSc in European Agricultural Engineering.

The postgraduate course will be run in conjunction with partner universities at Hohenheim, Vienna and Milan and students wishing to follow the MSc will be expected to be engineering graduates with a good working knowledge of a relevant EU language.

Students who successfully complete the course are expected to follow careers within multinational agricultural machinery companies, international advisory agencies in both the public and private sectors, government agencies and European administrative authorities.

Commenting on the new course, Royal Agricultural College Course Director, Nigel Warner said: "European employers are becoming increasingly selective in their search for the engineering managers of the future. Students who take up the Royal's MSc will have a rare opportunity to improve their knowledge of engineering and enhance their language skills at the same time."

Anyone interested in studying the MSc in European Agricultural Engineering should call the Admissions Office on **01285 652531**.

Gantry tractors as a basis for traffic control?

W C Tim Chamen

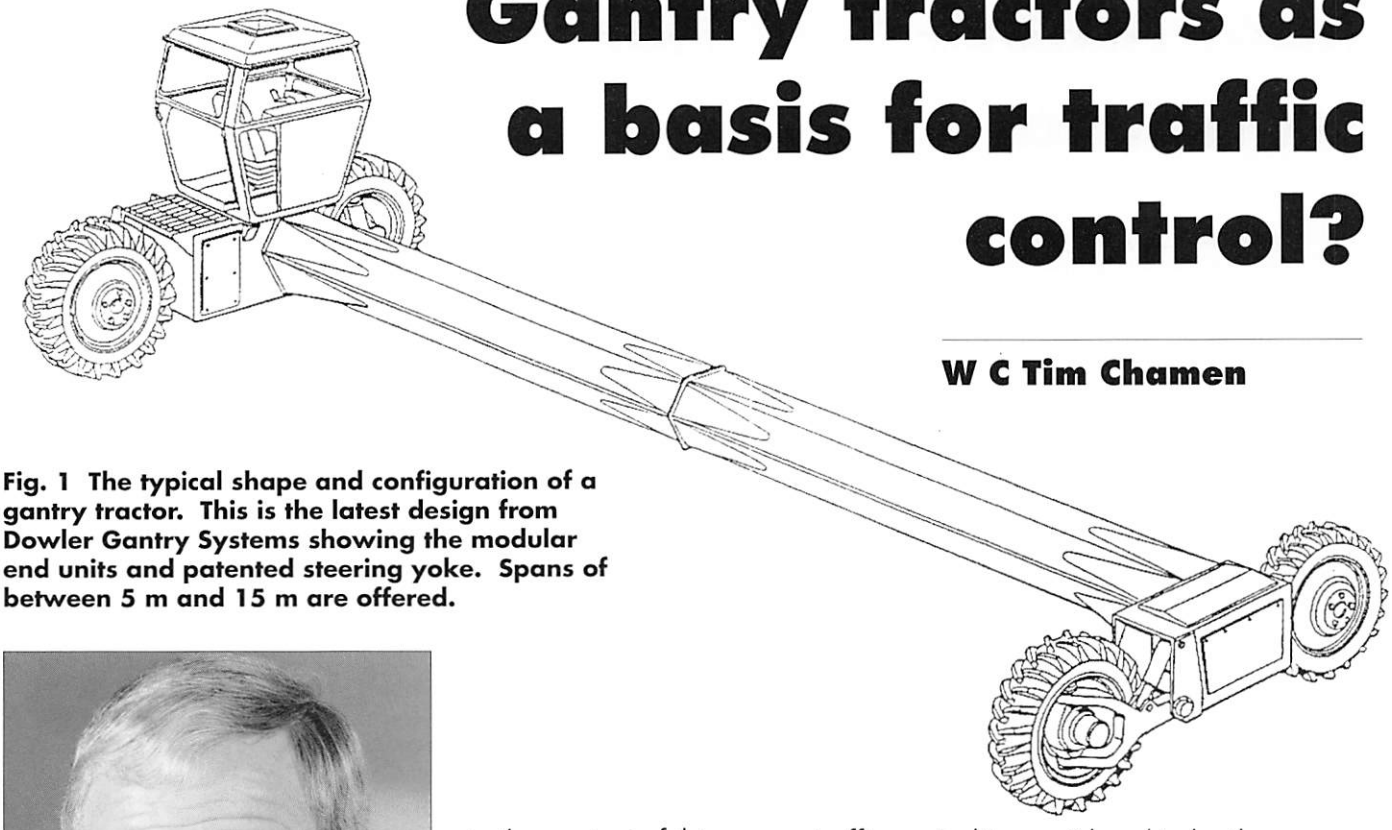
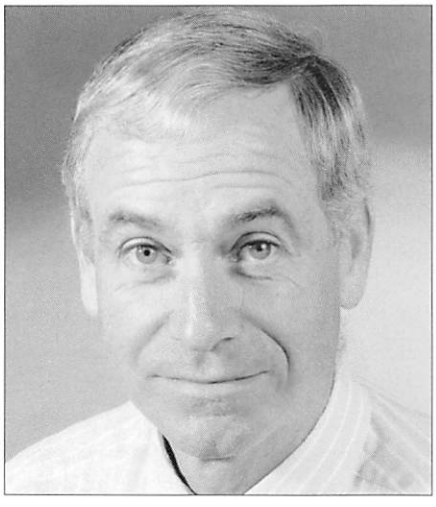


Fig. 1 The typical shape and configuration of a gantry tractor. This is the latest design from Dowler Gantry Systems showing the modular end units and patented steering yoke. Spans of between 5 m and 15 m are offered.



In the context of this paper, traffic control is considered to be the permanent separation of wheeled and non-wheeled areas of land within a crop production system, i.e. the wheels of machines are confined to permanent, (usually non-cropped) soil-based wheelways in the field. The title of my paper also poses a question. During the following paragraphs, I hope to provide enough information for you, the reader, to form the basis of an answer to it. My first task, however, is to try and dispel some of the misconceptions which are commonly held about the gantry tractor (Figure 1).

Experience over the last 12 years has shown me that these misunderstandings are a serious obstacle to impartial consideration of the system. The most common misconception is that gantries are only suited to large, regular and level fields. Nothing, in fact, could be further from the truth. A 12 m span gantry, for example, can be introduced wherever one might use a 12 m boom sprayer, and there are few farms in the UK where such an implement cannot be used. As gantries automatically mark out fields with no need for measurement or drill tramlining systems, they can be used in odd-shaped and small fields more easily than conventional equipment.

The other poorly understood aspect of gantry tractors is how they travel along the road. Although gantries are wide, they normally have a fairly conventional wheelbase (distance between front and rear wheels when viewed from the side). Consequently, gantries normally travel lengthways (sideways in field mode!) along the road. Front and rear steering effectively cuts their fixed length in half, and wide, custom-built implements can simply be raised and transported within the gantry's width, without the need for folding.

I will consider my paper to have achieved some success if, in the following sections, I am able to dispel some of the myths about gantry operation. Hopefully, this will allow greater discussion about their potential, particularly in relation to improvements in soil structure, and most importantly, to farm profit.

What is a gantry tractor and how does it work?

A gantry is simply a tractor whose implements either match or are direct multiples of its wheel track width *(Figure 1)*.

This paper was presented at the IAgrE conference entitled: "Profit through traffic control?" organised by the Soil & Water Specialist Group and held at Silsoe College, Cranfield University on 20th November 1996. Tim Chamen who organised the conference runs an engineering consultancy, 4'C'easons, Church Close Cottage, Maulden, Bedford MK45 2AU.

Track width is usually 5 m or more and up to 21 m has been known. When using implements which match the track width, successive bouts across the field allow one wheel track to be used a second time. *Figure 2* shows how a field may be set out with a gantry using such an implement. Once the wheel tracks have been established in this way, the gantry can be used in any manner, providing the driver keeps the vehicle within the wheelways. This can be achieved with a conventional steering wheel and may perhaps be likened to driving a motor bike along a narrow track, but without the fear of overbalancing! The driver is not aware that differential wheel speed (normally provided by a hydrostatic transmission), or a combination of wheel speed and wheel steering is keeping the vehicle on course. Headland "turns" can be made by a number of means, e.g., by moving the vehicle lengthways and traversing the field in reverse, by rotating the vehicle through 180 degrees (either centrally or around one end), or by two 90 degree pirouette turns. The permanent soil-based wheelways are normally kept in trim by spilling soil into them during cultivation operations. This maintains them close to the surrounding soil level in all but the most extreme conditions.

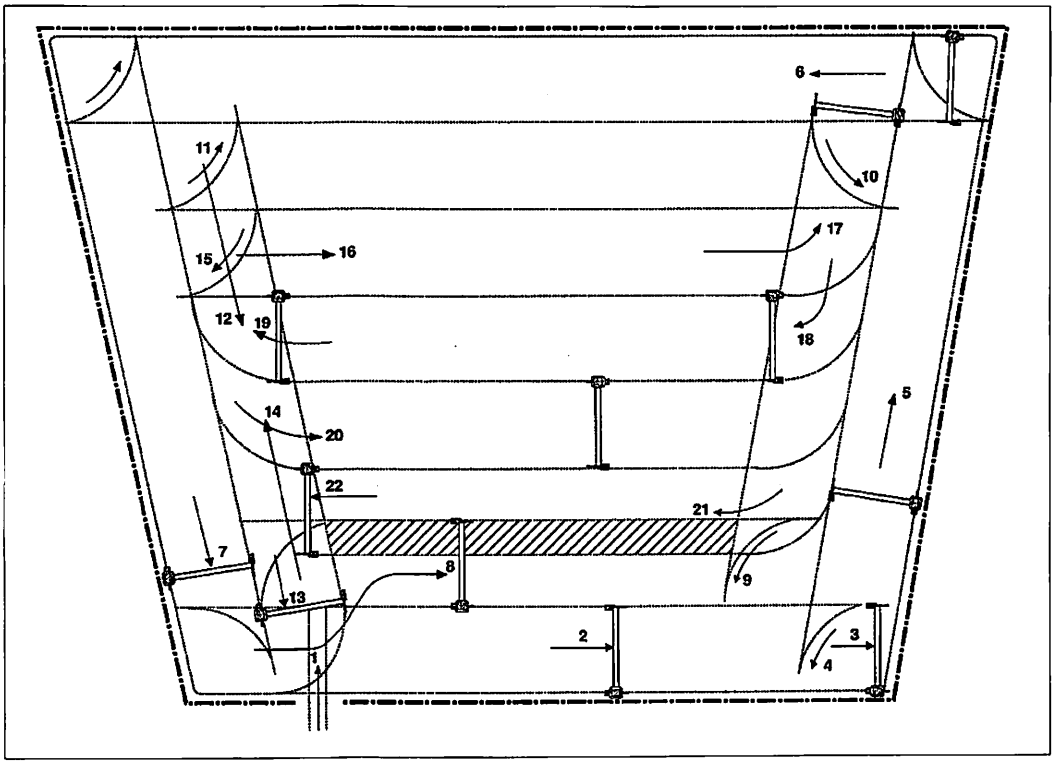


Fig. 2 Setting out a field using the gantry as a marker system. Marking in this way means the gantry has to be carrying out an operation which allows it to travel both "backwards" and "forwards", e.g. spray or fertiliser application.
(Picture: Soil and Tillage Research)

As the vehicle is very wide, it can't normally be driven on the road in what would be termed "field mode". However, the wheelbase of the gantry is little different from a conventional tractor, and therefore road use is simply a case of driving it lengthways. In this mode, the wheels are steered conventionally. This steering can be fully co-ordinated, such that movements at the front of the vehicle are exactly mirrored by steering movements at the rear. In the initial stages of a turn, however, this is not always desirable because the rear of the vehicle can move outside the desired steering line. A delay can therefore be built into the rear steer to prevent such an eventuality. For closer manoeuvring, each end of the vehicle can be steered independently.

Can I use existing equipment on a gantry?

The simple answer is yes, but with some restrictions. Fixed or cross-sliding three point linkages allow short implements such as power harrows and some soil-driven cultivators to be mounted within the transport width of the gantry. Sprayers and fertiliser spreaders can also be mounted in this way. However, longer implements, although still readily mountable, may need to be removed before driving on the road. Full advantage of a gantry system can be realised by gradually introducing custom built equipment.

Why use custom built equipment for the gantry?

The advantage of buying or building equipment specifically for gantry operation comes down simply to one of cost. The most recent evidence of this was a 40% reduction in the cost of a 6 m power harrow, simply because folding was not required. With other implements, not only is folding generally unnecessary, but sections can be lighter because support can be provided from the gantry frame wherever it is needed. Thus, a 12 m gantry, for example, can support a 24 unit precision drill which, at the end of field working, is simply raised and driven straight out of the field.

Why use a gantry rather than a tractor for traffic control?

As may be gleaned from the definition of traffic control, such a system can be achieved with a conventional tractor as well as with a gantry. However, here I would like to highlight *only* those advantages which a gantry can offer in traffic control that a tractor cannot.

1. Firstly, the gantry marks out fields precisely and automatically without the need for measurement or additional equipment. This means that no under- or over-lap occurs with any operation and no judgement is required by the driver. At present, markers are rarely used on cultivators; yet, with many being 6 m wide or more, how well do successive passes match up? An overlap of just 30 cm equates to a 5% loss in work rate, equivalent to around 1 ha per day in lost output!
2. As there is only one wheel mark per

implement bout, the land lost to wheelings is minimised compared with a tractor-based system. Thus, in cereal cropping for example, a 6 m span gantry on permanent non-cropped wheelways would lose only the same area of land as a tractor tramline system operating on 12 m (assuming the same tyres are used). These advantages are also realised in vegetable cropping, but their extent relies closely on row crop spacing (see below).

3. The gantry offers a stable platform from which existing or wider application booms can be supported without the need for suspension systems. Such increases in boom width minimise the loss of cropped area and reduce the compaction imposed during chemical applications. Future row and plant scale technology will require precise crop and/or soil engaging components of the machine system. The gantry is ideally placed to offer the platform from which this technology can be applied.
4. As mentioned in the previous paragraph, the wide frame of the gantry provides full width support for implements. This allows savings in implement weight and production costs, while its transport system largely negates the need for heavy and costly folding mechanisms.
5. The use of multiple or wider units mounted on the gantry, particularly in vegetable production, could save significantly on labour costs. Thus, where several tractors and planters are currently needed to satisfy production targets for example, one driver could operate three planters in parallel.
6. In vegetable production, crop quality and evenness is improved due to fewer wheel passes per unit area. This reduces crop damage both above ground in physical terms and below ground from soil compaction effects.
7. In the event that ploughing is needed on a regular basis within a completely controlled traffic regime, a gantry can carry out this operation without compromising the system. Thus, even with a gantry span of 12 m, ploughing can still be carried out without wheeling the bed. Lateral movement of soil can be counteracted either by ploughing in the opposite direction on alternate occasions, or perhaps by introducing a plough-mounted furrow cultivator. The latter tends to shift soil back in the direction from whence it came.

Fig. 3 A 75 kW, 12 m span gantry ploughing to 200 mm depth on a 60% clay soil using two 2 furrow ploughs with opposite handed mouldboards. A 75 kW four wheel drive tractor on conventionally trafficked plots could only pull 3 identical furrows.
(Picture: Silsoe Research Institute)

Table 1 Track settings and rows/m of field width for tractor and gantry systems with crop rows spaced at 275 mm and 850 mm.

Row spacing, mm	No of Rows	Track width[1], m	No of rows/m track width	increase in area available, %
Tractor on 14.9 R 36 tyres				
275	6	2.1	2.90	
850	2	2.1	0.94	
Gantry on 16.9 R 34 tyres				
275	28	8.1	3.43	18.3
850	9	8.1	1.11	18.1

[1] Track width = No. of rows x row spacing + loaded sectional width of tyre

Examples in vegetable cropping

As a means of assessing the differences between a gantry and a tractor system, let us look at crops grown on a row spacing of 275 and 850 mm. Within limits we can customise both gantry and tractor track widths to provide the optimum for each. *Table 1* shows the differences between the systems and indicates a potential 18% increase in cropped area with the gantry, for rows spaced at both 275 and 850 mm.

If the gantry is used for all post ploughing cultivation and planting operations, we have the further advantage that over the gantry track width, only two crop rows are effected by soil compaction compared with eight rows in the tractor

system. (Most growers are using around 1.8 m track settings, so the actual situation is probably less favourable than this).

Why use a tractor rather than a gantry for traffic control?

1. The capital cost of a tractor is less than a gantry. Obviously a certain minimum farm size or production output is needed before a gantry becomes economically viable. This is particularly true if interest rates are high, when return on capital will be much quicker with a tractor-based system.
2. If all the gantry's implements are custom built, one has all one's eggs in one basket. In a tractor system, another tractor can almost certainly be obtained in the event of a breakdown. Until gantries are well established, a similar situation is unlikely.
3. The tractor is tried and trusted technology with well known performance characteristics, reliability and second hand value. Gantries have not yet reached the stage of development where all these characteristics can be claimed.

What have gantries been used for already and by whom?

The first record of a gantry tractor is in the mid 19th century. It was used for vegetable production on the farm of Alexander Halkett in the Kensington area of what is now part of London. The steam propelled vehicle, which ran on rails, was introduced to avoid soil compaction, or perhaps more accurately, to maintain access to the field when other machines were sinking out of sight! The modern agricultural tyre means that such a situation now rarely occurs.

The Field Power Unit (FPU) made by Ashot Ashkelon in Israel was first commercialised in about 1984. This 5.8 m span, 175 kW four wheel drive vehicle has been used for subsoiling, heavy cultivating, rotary cultivation, planting, spray and fertiliser application, cotton picking and mowing. The Dowler gantry was commercially available from 1989 and this 12 m span, 69 kW two wheel drive vehicle has been used for light cultivation, power harrowing, cereal and row crop drilling, as well as for spray and fertiliser application. It is the only vehicle which has been used on a commercial basis on an arable farm in the UK It has also been used for research in the UK, The Netherlands, Germany and Australia.

Other more specialised gantries have been available commercially for some years. These are generally used as harvesting aids for crops such as lettuce, tomatoes, calabrese and cauliflower. Wheels and tracks have been used for these vehicles and both electric and hydrostatic propulsion systems. A wide range of "one-offs" have also been built by individual farmers and growers across the world. Gantries built for research have also been widespread. In California, a 270 kW four wheel drive vehicle was used within a soya bean, cotton, alfalfa rotation, while in Alabama, a 249 kW, 7.6 m track gantry has been used within a similar rotation. Only in Alabama was cereal harvesting attempted,

Table 2 Tillage requirements and crop responses to gantry and conventional tractor operations on a 60% clay soil in England.

System	Year	Plough draught kN/m²	Crop yield, t/ha at 85% dry matter	Crop
Tractor	1988/89	107	6.0	winter wheat
Gantry		42	7.2	
Tractor	1989/90	122	5.2[1]	spring oats
Gantry		97	5.0[1]	
Tractor	1990/91	46[2]	4.9	spring barley
Gantry		62[2]	5.5	
Tractor	1991/92	125	n.r.	
Gantry		72	n.r.	
Tractor	1993/94	135	8.5	winter wheat
Gantry		85	10.1	

[1] Yields from single replicates only
[2] Differences not significant - the second of two dry seasons

and this was with a small combine which could be lifted and carried by the experimental gantry. In the UK, gantry research has centred around Silsoe Research Institute where a 9 m vegetable harvesting gantry on 3 m long tracks was developed, as well as a 12 m gantry for arable crops. The vegetable gantry formed the basis of a number of commercial units produced for individual growers. The arable 75 kW, 12 m two wheel drive machine was used for ploughing *(Figure 3)*, part and full width cultivation, rolling and chemical application and part width power harrowing, drilling, and cereal harvesting.

Soil and crop responses to traffic control

Over the last couple of decades, the weight of field machinery has steadily increased and has led to the insidious build up of soil compaction. Insidious because we rarely have a datum from which we can compare today's soil conditions and crop yields with those of perhaps twenty years ago. Although automation may eventually allow us to go back to smaller machines, the continuing high cost of labour means that the trend towards larger equipment will continue, at least for the foreseeable future. Traffic control is the one means by which we can continue to do this, but without the penalty of rising soil compaction in the cropped area. Research in Sweden (Håkansson & Petelkau, 1994) has suggested that we are already doing damage to our subsoils which it is uneconomic to repair, and this was with fairly modest axle loads compared with some equipment now available. MAFF funded research in the U.K. showed that clay soils were about 50% more difficult to cultivate *(Table 2)* under a random traffic system (Chamen & Longstaff, 1995, Chamen *et al.*, 1994) This means time and energy are being wasted simply because damage is having to be repaired from season to season. It also means that forces on implements are higher than necessary, leading to more wear and greater downtime. These poor soil conditions also cause drainage problems and accelerated erosion in areas at risk. Traffic control was shown to provide better seedbeds with fewer passes and less moisture loss than conventional systems, and led to improved crop germination and growth. This was reflected in cereal crop yields which on average were 15% greater than their conventionally produced counterparts *(Table 2)*.

Where does this leave us?

Existing gantry systems are capable of carrying out most post ploughing operations with full spans of up to 12 m. Such operations provide a homogeneous, level seedbed with the minimum of energy and labour input. Research has shown that ploughing, subsoiling and both cereals and cotton harvesting are also possible with these vehicles, as are many other operations. Harvesting with root crops has not been attempted but, in theory, spanning booms can easily accommodate the loads involved, as can the wheel or track systems which support them. Providing the demand is there, current technology can provide a practical and cost effective solution based on the gantry tractor.

Therefore, the answer to "where does this leave us?", is really up to you the reader. Is the gantry system worth a second thought? I think the evidence speaks for itself, and put together with favourable economics assessments for cereals (Chamen & Audsley, 1996), makes the gantry system an attractive and healthy alternative for the future.

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Chamen W C T, Dowler D, Leede P R, Longstaff D J (1994). Design, operation and performance of a gantry system: experience in arable cropping. *J. agric. Engng Res.*, **59**: 45-60.

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Tales of the River Bank Visitor Centre

Bookings are now being taken for group visits to one of Lincolnshire's lesser known visitor centres. The Tales of the River Bank Visitor Centre is a purpose-built interpretative centre, run by North Kesteven District Council, which explains the formation and history of the surrounding fenland.

It is next to the Timberland Pumping Station on the banks of the River Witham, just north of Tattershall Bridge. The Pumping Station is owned and operated by the Witham First Internal Drainage Board and forms an important link in the drainage system, helping to keep this part of the Lincolnshire Fens free from flooding. Since 1976, any excess water has been lifted from the drain into the river by electric pumps. These replaced the system worked by the 1938 Ruston and Hornsby engine, driving a 1924 Gwynne's pump.

The diesel engine and pump have been kept in working order by the Drainage Board and can be seen in action at the Centre's special theme days. A demonstration can also be arranged, for a small charge, for group visits outside of normal opening hours.

The Visitor Centre is open:

November to April on Saturdays and Sundays, 1 - 4 pm
May to October on Wednesdays to Sundays, 2 - 5 pm
Special theme days are:
Sunday, June 1 -
"Messing about on the River"
Sunday, July 13 -
"Country Fayre and Engine Day"
Sunday, September 7 - *"War Years"*
Sunday, November 23 -
"Winter Warmer"

For further information contact: **The Tales of the River Bank Visitor Centre, Walcott Bank, Tattershall Bridge, Lincoln, LN4 4JP. Tel: 01526 345718.**

Making waste work on the farm

Enviro-Fair Limited has launched Enviro-Fair '97 - the first working exhibition to cover all areas of the waste industry in the UK. It is expected to be of particular interest to farmers and farm managers.

The exhibition, which will be held at the East of England showground, Peterborough, from 3rd to 5th June 1997, will attract both exhibitors and visitors from the USA and throughout Europe. It will provide space for working equipment and demonstrations, giving visitors the opportunity to see equipment in action and examine the latest techniques of recycling and disposal of farming by-products.

"Enviro-Fair '97 will be the UK's first working exhibition in the waste industry and, as such, will provide an excellent opportunity for farmers to examine all the latest methods of waste disposal," explained exhibition organiser, Terry Hall, who previously organised the Waste Management Exhibition in Torbay.

"It will include external and internal static displays, working demonstrations and a purpose-built arena that will be used by exhibitors who wish to display, and provide a commentary on, equipment which requires a high degree of mobility.

"In the past, the industry has been served by a number of different exhibitions at often inaccessible locations throughout the UK, and there has been no single, central, venue at which potential buyers can view the complete range of products and services available. That has now changed," added Hall.

Exhibitor prices for the event start at £15/m² for external space, £75/m² for internal space and £99/m² for space and a shell scheme. Water, power, telephones and metal roads are available throughout the site for all exhibitors.

For Enviro-Fair, **THE FIRST WORKING EXHIBITION TO COVER ALL AREAS OF THE WASTE INDUSTRY - AIR & NOISE POLLUTION, SOLID & SPECIAL WASTES, RECYCLING & SCRAP, WASTE WATER** - tel: **01536 513501.**

New leaflet warns of damage to drivers' backs from vibration and jolting

Whole-body vibration can cause drivers of industrial vehicles to suffer back injury, the Health and Safety Executive (HSE) warned in a new free leaflet, *"In the Driving Seat"*.

Launching the leaflet, HSE's Christopher Bowden, said: "There is evidence of a link between back problems in drivers and 'whole-body vibration' which is the vibration or jolting from a vehicle, transmitted through drivers, seats into their spines.

"This is particularly prevalent in tractors, dumper trucks, lift trucks and quarry vehicles which are driven over rough ground or poorly paved surfaces. Where this sort of exposure goes on for several hours day after day, it can cause drivers to suffer back injury and back pain.

"Sufferers may have to take long spells off work and, in some cases, may have to give up work altogether. The costs to employers in lost production time, re-training and general disruption can be substantial, especially to small firms and owner drivers."

The leaflet suggests a number of practical and inexpensive things employers can do to reduce their employees' exposure to whole-body vibration. These include:

- ensuring that suspension seats, where fitted, are properly maintained and adjusted;
- ensuring that drivers know how to adjust them properly;
- planning work site routes to avoid rough ground;
- repairing pot holes and bumps and instructing drivers to keep their speed down where rough ground cannot be avoided;
- choosing the right vehicle for the job;
- advice on training for employees.

Mr Bowden added: "This leaflet would also be valuable to operators who experience whole-body vibration transmitted through their feet from the platforms of some types of powerful machinery, for example, large hammering or punching machines."

Copies of the free leaflet "In the Driving Seat" [INTD(G)242L] can be obtained from: **HSE Books, PO Box 1999, Sudbury, Suffolk, CO10 6FS. Tel: 01787 881165.**

Free video from Stanhay

The important role played by accurate seed drilling in the food production chain is illustrated in a new video from Stanhay Webb available free of charge to agricultural colleges, universities and educational establishments.

The full colour video spotlights the growing of vegetables, maize, sugar beet acid salad crops. It links the attention given to the production of such crops with the care taken in the design and manufacture of precision drills for planting them.

As well as shots of various drills in action in the field, there is a look behind the scenes at Stanhay's Exning factory, with visits to the factory floor, R & D department, drawing office and stores. The testing process for each seed metering unit is shown and the computer-aided design team is also seen in action.

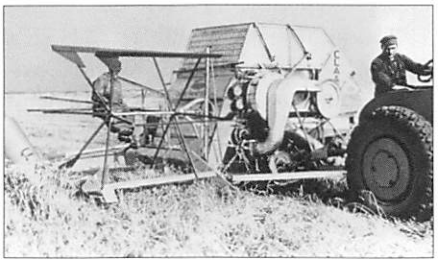
The film also looks at Stanhay's sales and marketing operation which covers over 50 countries worldwide.

For free copies of the video contact: **Geoff Horrex on 01638 577206.**

Diamond Jubilee for Claas combines

Throughout the past 60 years, names such as Super, Matador, Hercules, Senator and Dominator have been synonymous with the name of Claas, each marking a milestone in the Company's history and the development of the combine harvester. To begin at the beginning, however, you have to go back to the early 1920's when a number of American combine harvesters were sold into Europe. These proved unable to cope with the long straw, high moisture content and weed infestation that characterised European harvest conditions so they were not a success. Rather than help the cause for improved mechanisation, they had the reverse effect by convincing most practical farmers that the ideal method of harvesting was to continue cutting with a binder and, after storage, for the sheaves to be threshed during the winter.

One man who had the foresight to see that the problems of the European conditions could be overcome was August Claas who, working Dr Walter Brenner of the University of Bonn, highlighted the reasons why the American combines had been unable to cope. In 1930, they set to work designing and making a prototype harvester built around a Lanz Bulldog tractor. Unfortunately, the technology of tractor tyres, hydraulics and electrical systems was not far enough advanced to cope with what was, at that time, a brilliant concept. Unable to convince the German Agricultural Machinery Industry,



In 1937, the Claas MDB became the first mass-produced combine harvester in Europe.

and with no one willing to manufacture the combine harvester, August Claas said: "We will produce it ourselves."

Abandoning their first idea, August Claas and Walter Brenner set about designing the MDB which, in 1937, was to become the first mass produced combine harvester specifically designed for European conditions. It was a transverse flow machine with a side mounted cutterbar which could be towed behind a tractor. Compared with the early American machines, it had a wider threshing drum (1.25 m) matched by increased straw walker width to improve the flow of straw. The cutterbar was similar to that used on binders. Under optimum conditions, the MDB could harvest 30 tonnes of wheat in a day.

Production of the MDB continued up until 1941, although most of the 1,450 machines built were exported as the prejudice against combine harvesters in Europe continued until long after the war. Ten were imported into the UK. One of these has been restored by the Scottish Agricultural Museum and is currently housed at Claas UK's Saxham headquarters.

The next new model to be produced was the Claas Super in 1946 which, in 1953 was followed by the first self-propelled combine to be built in Europe - the SF. By the mid 1950's, Claas had become the largest manufacturer of combine harvesters in Europe, a position which it has retained to this day.

New standards for agricultural machinery

BS EN 706: 1997

Agricultural machinery. Vine shoot tipping machines. Safety.

Specifies safety requirements and means of verification for design and construction of self-propelled, mounted or semi-mounted machines. Does not cover machines for free standing bushes, walk-behind pedestrian controlled and hand-held machines. No current standard is superseded.

Price: £47.00 (BSI members £23.50).

BS EN 708: 1997

Agricultural machinery. Soil working machines with powered tools. Safety.

Excludes spading, pedestrian-controlled ground-driven machines and machines fitted with a retractable device for working between successive plants. No current standard is superseded.

Price: £47.00 (BSI members £23.50).

Contact: **BSI Customer Services, tel. 0181 996 7000.**

Membership Matters

Quarterly The Newsletter of the Institution of Agricultural Engineers Spring 1997

On top of the soil, and the opposition

Mud-plugging with a Warrior *(photo: GKN Defence)*

The topic for the October meeting of the Wrekin Branch clearly demonstrated an area of overlap twixt our profession and 'The Professionals' - fighting vehicles.

Based in Telford, Shropshire is GKN Defence, a major player in the world of armoured vehicles for civilian and military use. It is a sad fact of human nature that few news bulletins on TV do not feature one or more of GKN's products.

The paper presented was entitled: "The Influence of Soil Characteristics on the Design of Armoured Fighting Vehicles". Philip Osbourne was their principal speaker, ably supported by Howard Panton, Engineering Director, and Brian Gregory, Project Engineer.

A brief video opened the proceedings depicting the range of products from GKND and sister company. Glover Webb, and ranging from modified Land-Rovers through Aquatrak amphibious personnel carriers to the far end of the scale - the Warrior light tank family and the Piranha 8 x 8 assault vehicle. Within this range, are a huge number of options, variants and configurations.

The over-riding aim of any of GKND's products is to GET THERE! Get there, with personnel in a fit, fighting condition (a platoon of travel-sick soldiers is a definite no-no!); get there, over all imaginable terrain from shifting sands to wet, ploughed fields. Beyond these aims the vehicle must be able to defend itself with adequate fire-power. The result of these conflicting aims is a constant battle between weight and mobility (every pun intended)!

Turning to cross-country mobility, Philip outlined the factors that have to be considered, the main one being rolling resistance. This leads to a soil classification system based on the frictional and cohesive properties of the land. For tracked vehicles the classic 'grouser' track gives best overall performance but is somewhat anti-social - it tends to make a mess of the host country's black-top! Wide tracks

Piranha 8 x 8 at speed *(photo: GKN Defence)*

obviously improve flotation but seriously reduce the carrying capacity of the 'tub'. Long tracks don't last long, especially when turning sharply - a trait of other armies you understand, not the British Forces! So there is forever a compromise.

Tyred vehicles pose equal dilemmas. Large tyres lift the overall height - not recommended as commanders don't appreciate the undivided attention they subsequently receive from the opposition. Small wheels give inadequate ground clearance - a 'beached' Piranha is more vulnerable than its marine equivalent and more fun for the enemy!

The tyres themselves have on-the-move pressure adjustment and a cunning 'run-flat' facility comprising an inner tyre of multiple compartments filled with high-pressure nitrogen - a feature that has been regularly employed and much appreciated by crews in conflicts around the world. No longer is it worth the opposition shouting: "Get the tyres!", twill be to no avail.

Engineering detail of the suspension and transmission and the design of the winch/earth anchor of the Warrior recovery version completed the presentation - all good stuff. Philip even ventured into a description of the double-differential steering system used on tracked vehicles - a complex use of planetary gears and hydrostatic drives. I understood it at the time, which speaks volumes for Philip's presentational skills.

The latter point was well acclaimed that evening and the questions that followed from the gathering clearly demonstrated the interest generated. It is to the credit of the speaker and his colleagues that very few of the requests for more information were 'classified'. However, many of the enquiries, such as the use of rubber tracks, were met with the answer: "We're looking into that." So consider the consulting opportunities there, ladies and gentlemen!

This was an excellent paper to start the winter series. If you missed it, you missed an entertaining evening and you'll be forever in the dark on how to stop a Warrior - now admit it, you always wanted to know that didn't you!

SDC

Two major engineering organisations consider merging

The Councils of The Institution of Electronics and Electrical Incorporated Engineers (IEEIE) and The Institution of Mechanical Incorporated Engineers (IMechIE) have agreed to consult their members about an amalgamation of the two Institutions.

Earlier in 1996, both Councils set up a Working Party to consider how such an amalgamation could take place and the Working Party Report has now been accepted for publication and discussion at a series of meetings across the country.

The proposal is to merge the two Institutions into one organisation The Institution of Incorporated Engineers in electronic, electrical and mechanical engineering - resulting in a new Institution with a membership of 35 000 catering for Incorporated Engineers and Engineering Technicians across the three disciplines.

For a number of years both Institutions have enjoyed a close and useful working relationship culminating in the signing of a Memorandum of Understanding which has enabled them to develop collaborative activities of benefit to members and to the electronic, electrical and mechanical engineering profession in general. Examples include joint Student membership and careers literature; joint accreditation in industry and academia; joint meetings and the establishment of completely integrated Regional Committees in South Wales and Northern Ireland. There has also been a co-ordinated approach and response to many policy issues affecting Incorporated Engineers and Engineering Technicians especially in relation to the policies stemming from the new Engineering Council. But more importantly, it is becoming increasingly evident to both Councils that the technologies are converging and there is a growing demand for Incorporated Engineers and Engineering Technicians to be educated and trained to serve multidisciplinary industries.

The 35 000 members of the two Institutions will now be consulted on the proposed merger, after which the Councils will decide whether to make a formal recommendation, during Summer 1997, that IEEIE and IMechIE merge.

Institution membership changes

Admissions - a warm welcome to the following new members:

Member
J F Robertson (Scotland)

Associate Member
A G Butler (Oxon)
S P King (Gloucs)
A S MacGloinn (Beds)
C J W Rylands (Spain)

Associate
K N V Barrowcliff (Leics)
A J Garnett (Cheshire)
A R Johnson (Worcs)
J H Milnes (Yorks)

Student
M S Atyeo (Dorset)
S J Brown (Beds)
P Bryden (Scotland)
R W Causer (Essex)
J J Dale (Hereford)
I M Fenton (Oxon)
T J Lane (Hants)
S A Lawlor (Tyne & Wear)
G McIntyre (Scotland)
J P O'Neill (Shrops)
I R Petts (Surrey)
G D Price (Wales)
T J Reidy (Essex)
J E Rigby (Shrops)
C Saunders (Beds)
E J Siecker (Beds)

Transfers - congratulations on achieving a further phase of your professional development:

Fellow
G H Fletcher (Kent)

Member
A L R House (Avon)
R D Wilson (Scotland)

Associate Member
J C Carr (Lincs)
B A P Crenn (Warwicks)
A T Glazebrook (Bucks)
R Jackson (Lancs)
S D Vaughan-Jones (Beds)

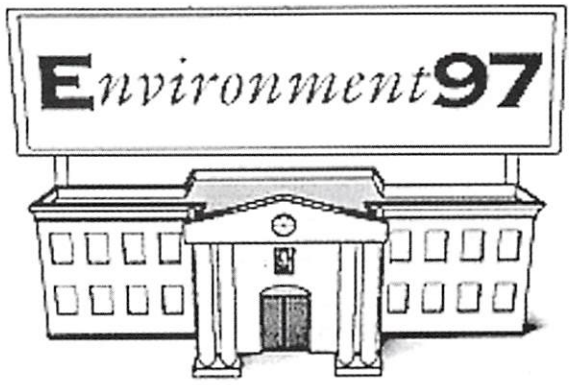
Associate
E J Siecker (Beds)

Deaths - with great sadness, we record the deaths of:
L J Carey (W Midlands)
I E Shield (Staffs)

Engineering Council Registrations

CEng
D A Mutuli (Kenya)

EngTech
S P King (Gloucs)



Environment97

CALL FOR PAPERS

The Institution of Chemical Engineers with the Institution of Agricultural Engineers are working with the UK Engineering Council to organise an internet based environmental conference called Environment 97. (www.environment97.org)

Papers are invited for this event to be held from the 3rd to the 14th November 1997.

The conference themes are:

Philosophy and principles
(eg. sustainable development)
Toolkits and techniques
(eg risk assessment, cost benefit analysis)
Solutions
(ie. case studies)

An abstract (no more than 200 words) is required by 28 April 1997 at the latest.

Please send your submission to
The Secretary
Institution of Agricultural Engineers
Silsoe

IChemE

The Institution and the Internet

Many members will know that the Institution has a presence on the Internet at:

http://www.cranfield.ac.uk/safe/iagre

The information has recently been extended to include details of branch meetings and visits, to accompany the existing details of conferences. The information is presented in chronological order and gives dates and times, subjects, venues, and the names of contacts.

If you want to know what the branches are up to, the information will be there. Equally, branch secretaries are urged to send me details of branch activities so that they can all be included. The email address is:

secretary@iagre.demon.co.uk

but letters and faxes are just as good.

Michael Hurst
Secretary

More time for the MART equipment challenge

The closing date for the *MART equipment challenge* (for details, see Winter 1996 issue of ***Landwards***, p16) has been extended from 31st March 1997 to **31st July 1997.** If you have some good ideas on roadmaking equipment, why not submit your concept design and try for the first prize of £500?

Long service certificates

35 years

Name	Grade	Date of Anniversary
James **Adams**	MIAgrE	22 Mar 1997
Lewis David **Ambler**	EngTech AMIAgrE	27 Mar 1997
Arthur David **Barber**	IEng MIAgrE	9 Jan 1997
Jonathan Martyn **Beeny**	CEng FIAgrE	9 Jan 1997
Peter Heming **Bomford**	CEng MIAgrE	27 Mar 1997
John B **Cameron**	AIAgrE	27 Mar 1997
William Robert **Catt**	IEng MIAgrE	27 Mar 1997
Ian Clement **Draper**	CEng MIAgrE	27 Mar 1997
Lionel Patrick **Evans**	IEng MIAgrE	9 Jan 1997
Ian David **Gedye**	FIAgrE	1 Jan 1997
John Philip James **Munson**	CEng FIAgrE	27 Mar 1997
Harry James **Nation**	CEng FIAgrE	9 Jan 1997
Laurence Ernest **Osborne**	IEng MIAgrE	9 Jan 1997
John Reid **Pollock**	CEng MIAgrE	27 Mar 1997
Geoffrey James **Shaw**	IEng MIAgrE	9 Jan 1997
Mungo John **Steele**	IEng MIAgrE	27 Mar 1997

25 years

Name	Grade	Date of Anniversary
Christopher John Edward **Adlard**	AIAgrE	26 Jan 1997
Hugh Lempriere **Back**	CEng MIAgrE	26 Jan 1997
Michael Edgar **Brogden**	CEng FIAgrE	26 Jan 1997
Jan Petr **Cermak**	CEng MIAgrE	26 Jan 1997
Malcolm George **Cluett**	AMIAgrE	26 Jan 1997
John Skidmore **Cooke**	IEng MIAgrE	26 Jan 1997
Dennis Chong Phoe **Khoo**	CEng MIAgrE	26 Jan 1997
Andrew John **Landers**	CEng FIAgrE	26 Jan 1997
Hugh John **McIlvenna**	EngTech AMIAgrE	10 Mar 1997
Graham **Ovens**	MIAgrE	26 Jan 1997
John Lawrence **Richardson**	EngTech AMIAgrE	26 Jan 1997
Brian **Scantlebury**	CIAgrE	26 Jan 1997
Brian Gilbert **Sims**	IEng MIAgrE	26 Jan 1997
Richard Christopher Maurice **Smart**	AIAgrE	26 Jan 1997
Stuart **Storey**	IEng MIAgrE	26 Jan 1997
James Anthony **Sweetman**	IEng MIAgrE	26 Jan 1997
Alan **Thorpe**	IEng MIAgrE	26 Jan 1997
Kenneth Noel **Tullett**	MIAgrE	26 Jan 1997
Robert Michael **Voss**	EngTech AMIAgrE	26 Jan 1997
Bernard Robert **Wynn**	AMIAgrE	26 Jan 1997

B M B

BIOTECHNOLOGY MEANS BUSINESS
INITIATIVE

The DTI are running a series of free technology roadshows as part of their Biotechnology Means Business Initiative. Although agriculture is not one of the 10 primary target areas, the food industry is, and the main thrust behind the initiative is in the control of pollution and the reduction of waste sent to land fill.

There are four roadshows in the series and each is about a + day in length, with a buffet lunch provided as part of the package. There are about six speakers and the general format is:

part 1 - legislation and other forces which provide the incentive for change;
part 2 - technical lectures on the subject;
part 3 - sources of finance for development of research results to a commercial stage.

The next in the series is in East Anglia at the end of March and the subjects are:

1. cleaning
2. effluent treatment
3. solid organic waste
4. VOC & odour control.

There is a lot of free advice, expertise and literature available from the DTI on biological control, conversion and use of organic wastes, rehabilitation of contaminated soils, etc. If members have problems in these fields, then it is worth contacting them on the free helpline number: 0800 432100.

John Gregory

Top export award for crop storage company

Crop storage specialists, F J Pirie and Co. of Irvine, Ayrshire, won a prestigious Scottish Council Development and Industry Gold Award for export achievement.

The Company is currently exporting refrigeration and ventilation equipment to New Zealand, France, Japan, Denmark and Eire, as part of an overseas business which has increased five-fold over the last three years.

"Modern transport and technology is making the world market increasingly accessible, provided you produce what the customer wants", said Frank Pirie, the Company's Managing Director. "We have always worked closely with UK farmers in the design and development of our storage equipment, basing all new products on strong home market requirements. Ironically, that basic foundation to our business has also helped us to create storage units with genuinely international appeal.

"The Gold Award is a most welcome recognition for all the staff at F J Pirie where we run a totally in-house operation from original design through to completed manufacture."

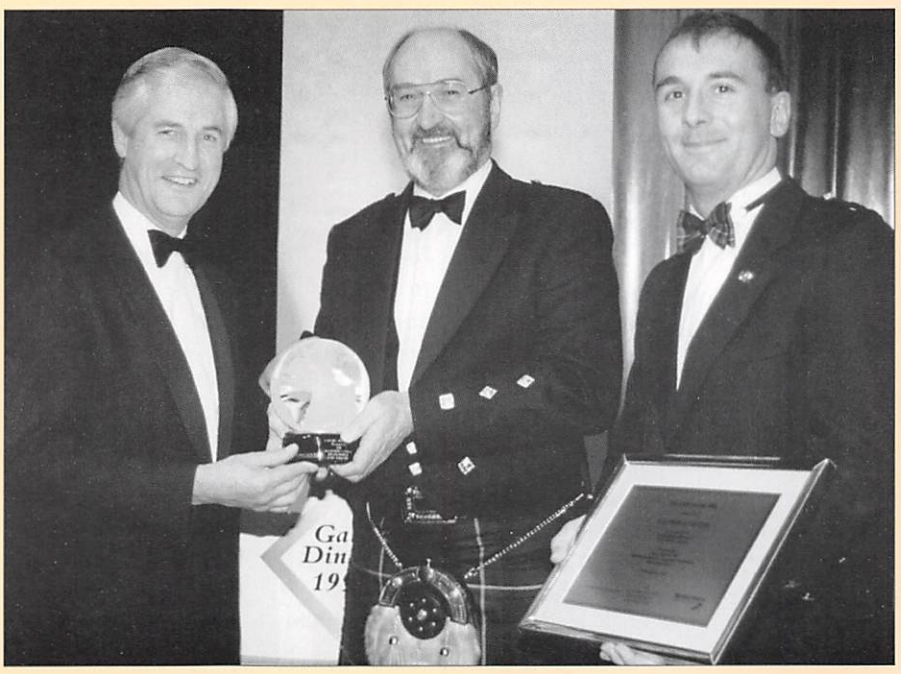
We send our congratulations to Frank Pirie and his son, Iain, who are both members of the Institution, Frank being a past Chairman of Scottish Branch.

Membership movements

Mem No	Name	From	To
6057	P K **Afful**	Lancashire	Kenya
5258	P W **Ashendon**	Hertfordshire	Buckinghamshire
6209	C J **Booty**	Leicestershire	Cambridgeshire
4514	N A **Dodd**	Cambridgeshire	Powys
5082	L B **Goonetilleke**	Buckinghamshire	Sri Lanka
6359	N A L **Gunn**	Suffolk	Bedfordshire
2402	P V **Hartley**	Nigeria	Norfolk
4128	R W **Hill**	Bedfordshire	Yorkshire
5582	D N **Hinchcliffe**	Worcestershire	Cornwall
6321	B **Hurtley**	Buckinghamshire	Cheshire
6569	R **Jackson**	Northern Ireland	Lancashire
6174	P J **Longley**	Kent	Oxfordshire
3814	D J **Mattey**	Scotland	Staffordshire
6404	J P **Middleton**	Kenya	Uganda
6361	V P **Redfern**	West Midlands	Kent
6582	S A **Short**	Wiltshire	Hampshire
6485	T M **Varga**	Canada	London
5417	B P **Weston**	Papua New Guinea	Swaziland
6015	M **Whiting**	Avon	Surrey
6008	S N **White**	Shropshire	Hertfordshire

Gone away

Name	Last known address
H S G **Cholmeley**	Carpentaria, Station Yard, Heckington, Sleaford,Lincolnshire NG34 9JH
K **Dignan**	ADAS Cockermouth, Strawberry How Business Park,Lorton Road, Cockermouth, Cumbria CA13 9QX
G J **Field**	6 Ashford Drive, Kingswood, Maidstone, Kent
J C **Puddifoot**	22 Bower Street, Bedford MK40 3RE



Frank Pirie (centre) receiving the Company's award from Scottish Office Minister, George Kynoch, with Iain Pirie holding the plaque.

One year in

Mike Heath, Director General of the Engineering Council

The new Engineering Council was formed on New Year's Day 1996, so the beginning of another new year is an appropriate time to review progress. And I believe there is much progress to report. We set out with a number of clear aims. They included a more effective promotion of the profession and also a raising of standards to stay world class.

On the promotional side, we were convinced that registered engineers wanted us to stimulate a greater appreciation of engineers and engineering. They wanted us to set about changing the national culture. It meant engaging the interest of the public to appreciate the tremendous achievements being made regularly by Britain's engineers. It also meant seeking Government and Whitehall recognition of the key contribution engineers make to the national economy, wealth creation and problem solving. This in turn would lead to attracting more of our bright young people into the profession.

On the regulatory side, it meant leaving much more of the mechanics of registration to licensed Institutions. It also meant a root and branch revision of the 'bible' on national registration as an engineer, known as 'Standards and Routes to Registration' or SARTOR. Like painting the Forth Bridge, this subsequently has to become a continuous process.

But you cannot effectively promote something on which there is not some basis of agreement and equally you cannot regulate a profession (in a non-statutory sense) unless the leaders of the profession are broadly content to be bound by such regulation. Public disagreements are seen by Government and public as evidence that the engineering profession has yet to be ranked with the other great professions in national esteem. We have in the past 'shot ourselves in the foot' in this way.

So we began with the basic premise at the heart of the unification process: that the Engineering Council would operate in partnership with the engineering Institutions. We have to remember that unification was preceded by fifteen years of at best non co-operation and at worst antagonism between the Institutions and the Engineering Council, so partnership did not come naturally.

We have therefore worked hard at the mechanisms to make it a reality. First, we have had the Senate and the two Boards, BEP and BER. They include Senators elected by Institution Councils as well as directly by registrants. There are also six Senators nominated by the Privy Council to give the Government a stake in the process. A great deal of work has been put in to ensure that this mechanism works well. It may need further refinement but is now quite well established.

But although the Institution Council elected Senators may have the interests of their own Institutions at heart and can be lobbied and briefed by them, they do not, in any formal sense, represent them. They are not delegates. So the system of Senate and Boards is not in itself sufficient.

We therefore set up a system of what we called Institution Working Groups (IWGS) to address major issues. Their findings result in reports or papers to be taken by the Boards/Senate and later by Institution Councils where necessary. The IWG outcomes are not themselves inter-Institution agreements but make it more likely that proposals will subsequently find favour with Institution Councils.

Additionally, the 20/20 Vision Initiative has brought together the Institutions to contribute to the national debate in four key areas: communications, energy, environment and transport.

We have an Annual Conference of all Institution Presidents, Secretaries and Senators. The Chairmen of the new regional organisations, the Professional Engineering Institutions or PEIs, will be invited in 1997. In addition, there is to be an annual 'Council of Presidents'. Institution Secretaries have regular meetings, chaired by the Council.

None of this replaces another vital mechanism which is the co-operation and personal contact between key members of staff of Institutions and the Council. I believe this has been genuinely transformed and now provides a platform on which we can move forward confidently. Much of the contact is informal but we now, for example, regularly see an Institution taking on the task of co-ordinating a profession-wide response to a Government consultation document. As a result of the co-ordinated response, the Government pays much greater attention to what is said.

Much of this is enabling and readers may be thinking that it is all talk. There has indeed been a lot of talk and not a little disagreement about the way ahead. I would argue, however, that the greatest weakness of the profession in the past has not been too much talk but too little. Communication is the weakest skill in most human beings and it is not one for which engineers are renowned. So we have to work harder at it.

But the first year has not been all talk. The profession has played a full part in the Government initiative 'Action for Engineering' and retained substantial responsibilities for implementation. We now find a ready audience in Government who have asked us to take the lead in setting up a national grouping of engineering bodies. We aim to play a larger part in the now well-established annual Science, Engineering and Technology (SET) Week. We are discussing a draft Memorandum of Understanding between the Government and the Council. We have also held discussions with all the major political parties.

Internally, we are well on the way to a resolution of the old duplication between the Council and the Institutions at regional level through the new PE1s. This has brought unification to the regions to mirror that in the centre although it will inevitably take some months to settle down. Much useful work has also been done on a new version of SARTOR. We should not underestimate the challenge of resolving the difficulties associated with this but they are certainly now better understood.

And we have worked to make 'Engineering First' a better vehicle for communicating with registered engineers.

The Public Affairs staffs of the Council and Institutions now regularly meet and, instead of aiming only to promote their own organisations, now look to promote the profession in a wider sense. A Public Affairs Task Group of the BEP has been formed to enable Senators to advise directly on our strategy. On many occasions during the past twelve months, when engineering has been brought to the attention of the public, the unseen hand of Institutions and Council has been behind it. That will increasingly be the case.

The Council, helped in most cases by institutions, has played a direct promotional role in running the Young Engineer for Britain Competition, the national Environment Award for Engineers, the Neighbourhood Engineers scheme and the Women Into Science and Engineering (WISE) campaign. The Council and a number of Institutions now have an important presence on the Internet. Potentially more important, however, have been our growing links with the media and other organisations with an interest in engineering. We are all putting our shoulder behind the Year of Engineering Success which we trust is going to be an outstanding success.

This year, among many other initiatives, we will see important development work on SARTOR heading towards completion. We will also see a major drive to communicate more effectively with industry. I see these as our next key priorities. There is a great deal of work still to be done. By itself, the Engineering Council would have neither the resources nor the credibility to carry it out. In partnership with the engineering Institutions, however, and given the enthusiastic and willing support of registered engineers throughout the nation, we will surely be able to make 1997 a landmark year in the history of the engineering profession in Britain.

News of Members

Francis Coleman, who is now 83 tells me that he joined the IBAE in August 1947 and became a member of Council in 1950 or 1951 and served thereon until he joined FAO of the UN in 1955 and went to Egypt as a Field Engineer. Francis started reading Natural Sciences at Cambridge University in 1931 and, after graduating, did some teaching until he joined the Royal Navy in 1939. In 1946, he was concerned with promoting electricity supply to rural areas and introducing electrically powered equipment on farms in the Glos/Wilts area. From 1947 to 1955, Francis was at the Royal Agricultural College, Cirencester where he set up the Department of Agricultural Engineering. From 1955 to 1965, he worked in several developing countries. In 1965, he moved to Cardiganshire where he planted 50,000 trees and set up his own business as a grower of vegetables and nursery stock. In 1971, he moved to Dorset to redesign a 3 acre garden which had a chalk stream flowing through it. In 1981, when this became too big to manage, he moved again and spent his time looking after his wife who died in 1993. In 1996, Francis moved to Wilton where he designed and built a small flat overlooking the Wylie chalk stream. He tells me that at present he is busy designing a water-ballast system for a racing boat being built for a nephew and his son. Francis is also having a new boat built for himself on the Norfolk Broads. As he says, there is never a dull moment. Together, with his letter he enclosed copies of two papers which he presented on his return from work overseas which illustrate his concept of what an agricultural engineer should do in developing countries. He says he feels very strongly that it is the poorer developing countries which need our services most, but that we must go to them with lots of basic knowledge of all aspects of agriculture as well as physics, chemistry and plant physiology and no rigid copying of the sort of agriculture so successful in highly developed countries. Thank you Francis for your very interesting and informative letter and we wish you well with your new ventures.

Robin Jackson, who graduated from the University of Aberdeen with an MSc in Agroforestry, in November 1996, has now started a PhD research studentship at the University of Salford where he is conducting research into remote sensing of forest canopy gaps. This is a three year NERC-CASE studentship which is being sponsored partly by the Forestry Commission. Robin says that he would be interested to hear from any fellow members who are interested in his work, or who could give advice or information. He can be contacted in the Department of Geography on 0161 745 5000.

Congratulations to **Stephen Hawes** who has received his 50 year membership certificate. In his letter of thanks, he says that he came across the Institution's address whilst trying to relax in the heat of the Iraqi desert. He says that little did he realise at the time that the experience he was gleaning in providing the Army installations with air-conditioning, electricity generation and water supply would be of such importance in the development of insulated and ventilated stock buildings and of floating pumping stations for irrigation and land drainage. The latter were commonplace on the Tigris and Euphrates rivers, and the principle solves all the problems with leakage on pump suction lines. Stephen's main interests have been in drainage and irrigation and he is Hon. Treasurer of the UK Irrigation Association. He runs his own company, Stephen Hawes Associates, and say that he is lucky to have his son in the practice.

Richard Bond has returned home after serving four years with the Moneragala District Integrated Rural Development programme in SE Sri Lanka, which is one of the poorest areas of the country. He was the Senior Adviser to the Sri Lankan project Director, helping to realise the programme's ambitious attempts to follow a 'process approach' to planning

and implementation. Before he left, the donor agency, NORAD, financed Richard to do some research on the implementation of process approaches which he will complete shortly. He is now working half-time as a lecturer at Manchester University in the Institute for Development Policy and Management, where he is teaching project and programme planning and management, mostly to overseas mature students doing postgraduate courses. The other 'half' of Richard's work is to the occasional short-term consultancy. Since leaving Sri Lanka in May, he has been back there for a short assignment in September and he may be going to India shortly.

Congratulations to **Ralph Alcock** who was appointed Principal of Rodbaston College, Staffordshire, last August. Ralph says that the College has excellent potential and his main function is to set the direction which will result in its development over the next few years. Before taking up his new appointment, Ralph spent a year on sabbatical leave at Teagasc in Carlow, Ireland where he was involved with precision farming with particular emphasis on the development of a sensor for a precision chop forager harvester. He was also involved in a project at UCD (University College Dublin) examining the potential of using GPS technology, as an aid to the management of peat harvesting operations. Previous to this, Ralph was for 6 years, Head of the Department of Agricultural Engineering at South Dakota State University, where, in addition to his management responsibilities, his research work was concerned with the development of off-road electric vehicles, traction studies, and the effects of impeding forces on root development. Ralph is looking forward to getting to know fellow members of the Institution.

Iain Livingstone has started a full-time Master of Business Administration (MBA) course at the Management School of Lancaster University. This course covers a 12 month period in which 9 months are taught with the remainder spent on an industrial project. Before going back to full-time education, Iain spent seven years with SEEBOARD, the regional electricity company in the South East. Initially, he was employed as the Agricultural and Horticultural Engineer for the Kent area. Following deregulation of the electricity market, he negotiated electricity contracts for larger farmers and growers. After a spell negotiating contracts with industrial customers across the country he became responsible for SEEBOARD's large industrial customers in Kent.

Peter Waggitt who is based in Darwin, Australia is responsible for oversight of environmental protection in the uranium mines of the NT, management of research into aspects of redemption options for areas damaged by mining in Tasmania and general management of environment protection for the Indian Ocean Territories of Christmas and Cocos (Keeling) Islands. Peter says that this involves lots of travel and plenty of erosion control in a wide range of climates and eco-systems. If any member is passing Darwin, Peter would be interested in meeting them, but please telephone first. Office Phone - 01 89814230.

Shamseldin M I Elazhar has returned to the Sudan after completing a PhD course in England and has rejoined the University of Khartoum as Senior Lecturer in Agricultural Engineering.

We are sorry to report that **Harold Poole** is seriously ill and we wish him a speedy recovery so that he can continue with the development of his Miklink Project (The Bike-Power Transport System).

Andy Poole is now Technical Advisor at Burmah Castrol Headquarters at Swindon. This job involves providing technical and product support for the various marine departments in the Castrol operating units around the world and he has specific responsibilities for gas engine lubricants. He says that it has been a big change from working with commercial vehicle engines with power outputs in kW (at the Technology Centre at Pangbourne) to larger engines with outputs measured in MW. Typically, the gas engines run on natural gas or biomass gases. Most power plants are in the form of CHP (Combined Heat and Power plants) for local power generation and district heating schemes, especially in Holland where the heat and power goes to greenhouses. Andy started his career at the age of 17 with a 4 year apprenticeship in agricultural engineering with Watson and Haig. After the completion of his apprenticeship, he went to Rycotewood College and obtained a Higher National Certificate in Agricultural Engineering. He then spent a short period with Watson and Haig in Alton working on grain installations before joining Castrol International as a Shift Technician at the Technology Centre at Pangbourne. His career progressed at Pangbourne and he became Project Engineer Heavy Duty Diesels before being promoted and transferred to his present position. Although Andy has moved away from agricultural engineering, he is a Corporate member of the Institution and is registered as an Incorporated Engineer with the Engineering Council. Andy say that he has lost touch with many of his friends and lecturers at Rycotewood but he expects that some of them will remember him.

Erroll Coles has been working in the Wadi Hadhramaut region of Republic of Yemen on the design of irrigation systems. He says that the history of the Wadi Hadhramaut and its people reach back into antiquity and Arabic, Swahili and Indonesian are the languages which are spoken. Groundwater is frequently used for irrigation now. In the past, mainly because of the cost of drilling and well development, groundwater was not often used for irrigation but reserved for domestic and stock water supplies. However, groundwater is seldom a renewable resource and the irresponsible development of well systems can lead to environmental disasters. Another fundamental problem with the use of groundwater for irrigation is the high concentration of salts in the water. Erroll says that a more holistic approach is required to achieve the objective of sustainable agriculture in the arid environment using groundwater and the type of soils occurring there. The farming community are traditionalist and introducing an improved water management system for irrigation will prove difficult. It will also be imperative to have a regional groundwater management system to sustain water extraction in the future.

AAWC

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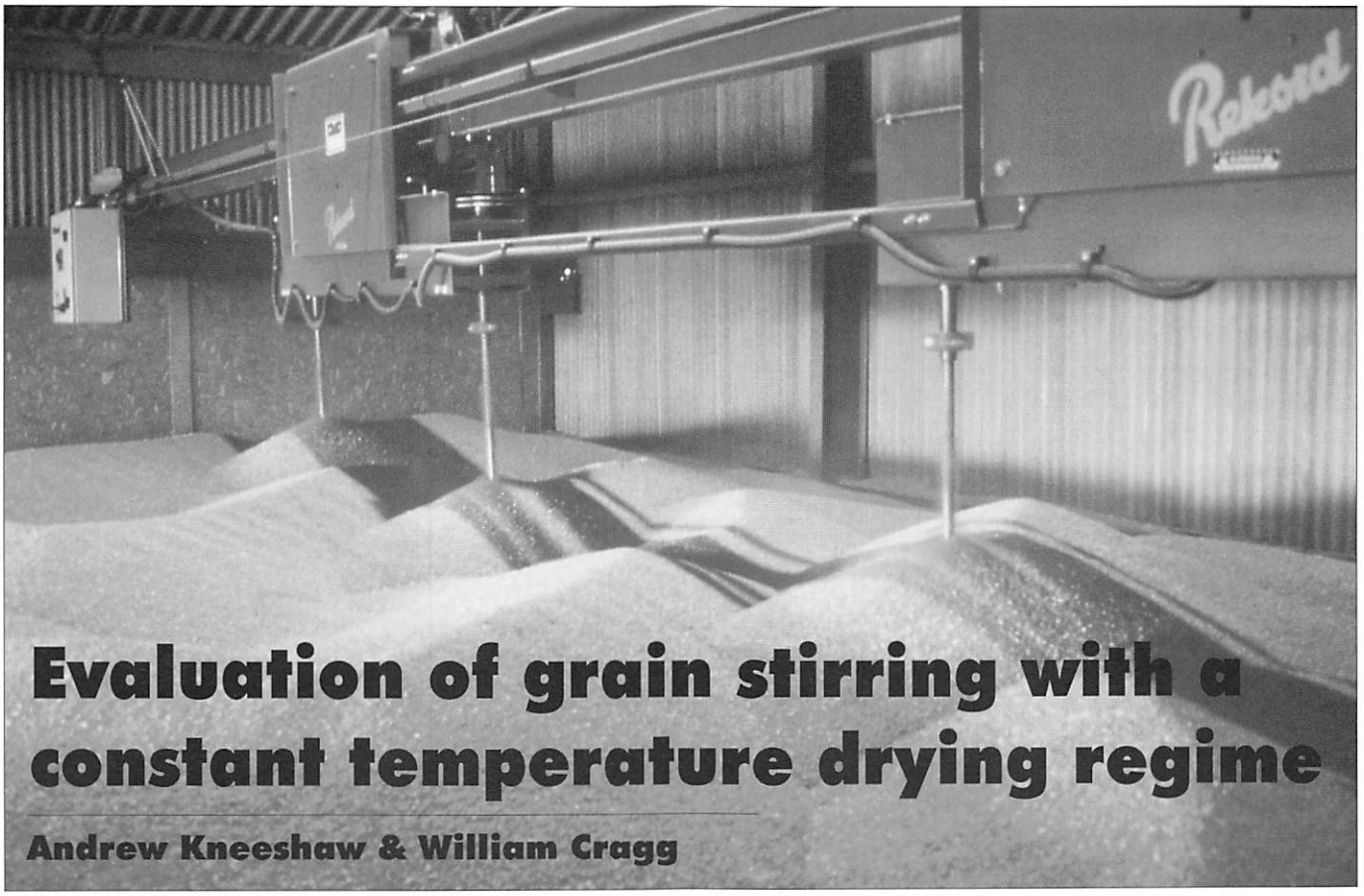
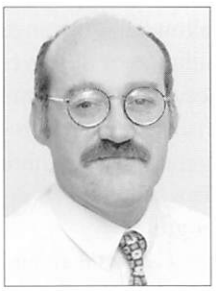


Evaluation of grain stirring with a constant temperature drying regime

Andrew Kneeshaw & William Cragg



A Kneeshaw

W Cragg

A 1,000 tonne floor store drier equipped with fan, grain stirring equipment and gas burner was operated using a constant drying air temperature control regime of 25°C. Drying down to 14% - 15% moisture content was successfully achieved on two batches of grain - 170 t and 575 t. Drying time on batch 1 (170 t) was 100.2 hours with 3.1% moisture removal. Total energy consumption for fan and heater was 29.8 kWh per % m.c. reduction per tonne. The second batch produced figures of 187 hours, 3.04% moisture removal and 18.44 kWh per % m.c. reduction per tonne.

Introduction

On-floor or in-bin drying using relative humidity control regimes are the conventional practice in the UK. When such systems are well maintained and correctly operated, they can successfully dry grain in most years. Having said this, RH controlled stores are to a greater or lesser extent weather dependent, with management being a critical factor if long drawn out drying times are to be avoided.

Andrew Kneeshaw is an Energy Consultant with E A Technology Ltd, working at the Farm Energy Centre, National Agricultural Centre, Stoneleigh Park, Kenilworth, Warwickshire CV8 2LS. Bill Cragg is an independent Agricultural Engineer working from Grantham in Lincolnshire.

Problems can occur in maintaining the accuracy of RH measuring equipment. This is often caused by electronic sensors being left in their operating position over winter. Due to the damp, cold conditions, they drift out of calibration. Accuracy of such sensors should be checked as a matter of course prior to each harvest.

In North America, where grain stirring equipment has been incorporated into grain silos, a different approach to drying has been made. For many years, a simple constant air temperature control system incorporating a gas burner has been popular. Drying air temperatures of 35°C or more are common. The temperature control equipment in use is, by nature of its basic design, more robust, accurate and reliable than RH measuring instruments. As a result, it tends to remain accurate under the rigours of the farm environment.

For this project, a temperature control regime similar to the American system was adopted. An air temperature of 25°C was used. Earlier theoretical studies have shown that although higher temperatures produce quicker drying, they will result in higher running costs.

Experimental procedure and results

The objectives of the work were as follows.

- Determine the drying rate and characteristics of grain using constant air temperature and grain stirrer.
- Monitor ambient and main duct air

Table 1 Store details.

Store dimensions	18.3 m x 24.4 m
Drying area	Centre main duct with drive-over timber floor
Capacity	1,000 tonne approx.
Fan	30 kW Typhoon centrifugal fan, 17.9 m^3/s of air at 75 mm w.g. back pressure
Heater	Rekord 263 kW output gas burner with electronic temperature control; 2 static gas tanks
Stirrer	Rekord grain stirring equipment (see Farm Electric Bulletin/Wheat 10.94 for further details)

Table 2 Monitoring work.

Main air duct pressures	Measured at the start and finish of each drying stage
Ambient and main duct air temperatures and relative humidities	Logged at 10 minute intervals throughout the drying period
Grain moisture	Sampled with an averaging spear in at least 3 positions in the bed
Grain temperature	Measured manually with a temperature spear periodically during drying
Equipment performance	Records taken
Gas consumption	Derived from rated airflow, ambient and duct temperatures, and gross figure checked against bulk delivery records
Fan electricity consumption	Derived from rating and running hours

temperature / RH during the drying period.

- Determine the performance of stirrer equipment and dryer at increased grain depth.
- Determine the effect of lower than 'conventional' dryer air flows and the introduction of heated air on an initially high moisture content crop.

Work was carried out on two batches of winter wheat, 170 t and 575 t, in a 1,000 t floor store. The store details and the test parameters are presented in *Tables 1 & 2*, respectively.

Test 1

After the initial grain samples were taken, the dryer was switched on at 18.00 hours on 22/8/96. The dryer ran overnight until 14.00 hours on 23/8/96 when grain samples were retaken. (The dryer was stopped during this period for 2 hours to make mechanical adjustments to the stirring equipment and to the gas burner). The samples showed that the grain moisture content now ranged between 14.1% - 17.6% (15.45% av. m.c.). Grain temperature had also reduced to 18°C. Drying was then continued, with regular grain samples being taken. The grain was dried to an average moisture content of 14.1% in 100.2 hours total. An average of 3.1% moisture removal was achieved. Data on test 1 appear in *Table 3.*

The air conditions for a typical drying day on test 1 are shown in *Figure 1.* The drier was switched on just after midday and the related increase in duct temperature and reduction in duct RH can be seen. In the early afternoon, ambient temperatures were high and duct RH was low, even without heat. As the day progressed, more heat was applied and final conditions at night gave a duct RH of around 55%.

For grain entering the store at a 28°C, the moisture content, temperature and energy consumption is shown in *Figure 2.* Ventilation during the first day reduced temperature quickly. The rapid grain moisture content drop at this stage is aided by the energy given up in the cooling process. Note the high energy use to finish off the drying process in the last few days.

Test 2

Loading commenced on side 2 of the dryer on 28/8/96, and 1½ bays were full by 1/9/96. The moisture content of the grain ranged from 17.7% to 21% (19.2% av. m.c.). The stirrer equipment was transferred to side 2 of the dryer. Drying commenced at noon on 1/9/96, covering approximately 9.14 m of side 2. The constant air temperature regime (25°C in main duct as described in test 1) remained unchanged. The crop was stored to a height of 3.65 m. The dryer continued to be filled over the ensuing days as the weather allowed. The range of the stirrer and ventilation of the dryer floor was extended accordingly until the dryer was full. The subsequent incoming grain moisture content was as high as 19.4%. Side 2, when full, held an estimated 575 tonnes of grain.

Initial grain samples were taken and drying commenced on 1½ bays of side 2 at noon on 1/9/96. Main duct air pressure measured 1000 Pa w.g., with 9.14 m of the drying floor being ventilated. In 103 hours on the first 1½ bays, 2.6% moisture was removed. Drying continued and, by 1500 hours on 5/9/96, the whole of side 2 floor was full and being ventilated. The stirrer range extended to the whole length of the dryer and the results of drying this batch to completion are presented in Table 4.

The graph in *Figure 3* shows a full days drying. Note that during the cold night and early morning period, the heater could not sustain the required 25°C duct temperature. Nevertheless, duct RH was still maintained at below 50%.

Moisture reduction in test 2 was fairly linear and sustained down to just above 14% *(Figure 4).* The temperature profile may be a little misleading as it is based on just 2 readings. Final cooling

Table 3 Results from test 1.

Batch quantity	170 t
Average initial moisture content	17.2% (varied from 13.8% to 20%)
Average final moisture content	14.1%
Moisture reduction	3.1%
Floor ventilated area	9 m (floor width) x 8.22 m
Initial grain temperature	28°C
Final grain temperature	20°C
Duct pressure	1200 Pa w.g.
Estimated air flow volume	13.5 m^3/s
Total electricity consumed	3006 kWh
Total gas consumed	1767 litres (12 567 kWh)
Electricity consumption	3.68 kWh/% m.c.r. t
Gas consumption	2.16 litres/% m.c.r. t (15.40 kWh/% m.c.r. t)
Total drying cost	£2.65/t
Specific drying cost	£0.85/% m.c.r. t
Drying time	100.2 h
Specific drying time (av.)	32.3 h/% m.c.r. t
Air flow	0.079 m^3/s t
Target drying air temperature	25°C
Stirrer operation	Constant over the area to be dried
Fan operation	Manual control

Table 4 Results from test 2.

Batch quantity	575 t
Average initial moisture content	17.6% (varied from 15.3% to 19.4%)
Average final moisture content	14.56%
Moisture reduction	3.04%
Floor ventilated area	9 m (floor width) x 24.4 m
Initial grain temperature	21°C
Final grain temperature	17°C
Duct pressure	630 Pa w.g.
Estimated air flow volume	13.5 m^3/s
Total electricity consumed	5622 kWh
Total gas consumed	3741 litres (26 607 kWh)
Electricity consumption	3.22 kWh/% m.c.r. t
Gas consumption	2.13 litres/% m.c.r. t (15.22 kWh/% m.c.r. t)
Total drying cost	£1.52/t
Specific drying cost	£0.50/% m.c.r. t
Drying time	187 h
Specific drying time (av.)	61.51 h/% m.c.r. t
Air flow	0.026 m^3/s t
Target drying air temperature	25°C
Stirrer operation	Constant over the area to be dried
Fan operation	Manual control

achieved the 17°C in the last couple of days quite quickly.

Discussion of results

The two trial periods show the contrasting performance of the drying systems at two extreme ventilation rates (0.026 m^3/s t and 0.079 m^3/s t). As predicted by earlier work, the drying time with reduced airflow was increased (by 87%), but the energy use was significantly lower (40% reduction in cost). Overall running costs are in line with those predicted by computer simulation work.

It seems reasonable, therefore, to suggest that where stirrers are installed and where a constant air temperature of 25°C is used for drying, fan capacity of 0.026 m^3/s t would be sufficient to dry grain by 5% in around 13 days - probably faster as higher moisture content grain tends to dry faster.

Other observations and comments

Stirrer auger alignment

During the initial passes of the stirrer through both batches of grain, it was observed that the stirrer augers angled back in the stack. The auger angle became so acute on several occasions that the alignment safety device on the stirrer became activated. This was attributed to:

- the way the grain was loaded in the dryer because grain 'pushed up' with a front loader blade presented considerably more resistance to the stirrer travel than grain loaded in by auger;
- grain with a high moisture content and high temperature because grain in this condition tends to adhere together in a solid mass and requires a greater effort to mobilise it.

In both cases, however, after a few passes of the stirrer, and as drying progressed, the problem gradually diminished.

Gas tank configuration

At the trial site, two static gas tanks were installed to produce a sufficiently large evaporative surface area to match the demand from the gas burner. The tanks were each fitted with their own regulator with a common supply pipe to the burner. Although the gas burner was rated at 219 kW (750,000 Btu/h), it was noted early in the trial that the maximum output only reached 100 kW. The burner

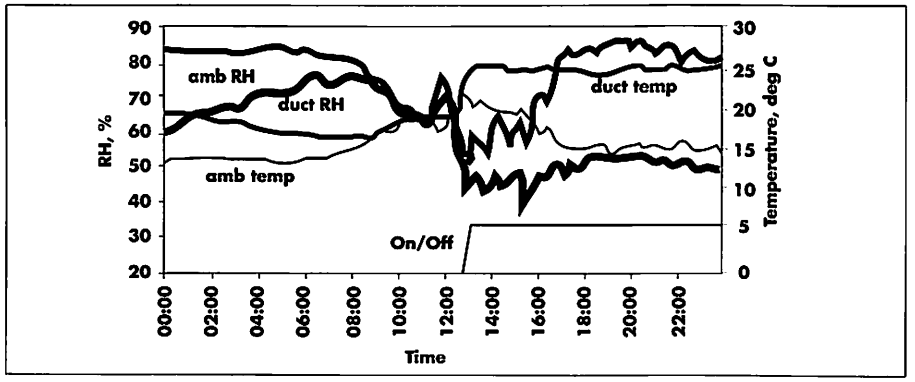


Fig.1 Test 1 - example of daily data (24/08/96).

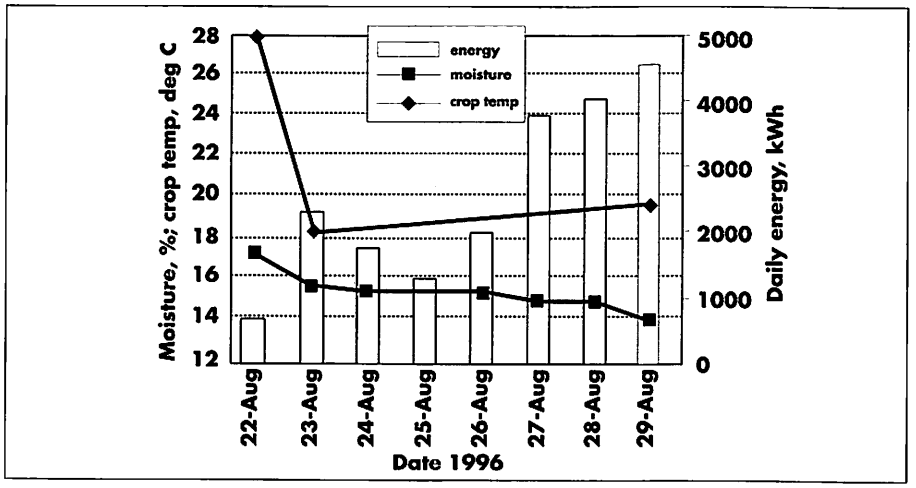


Fig.2 Test 1 - moisture content, temperature and energy consumption.

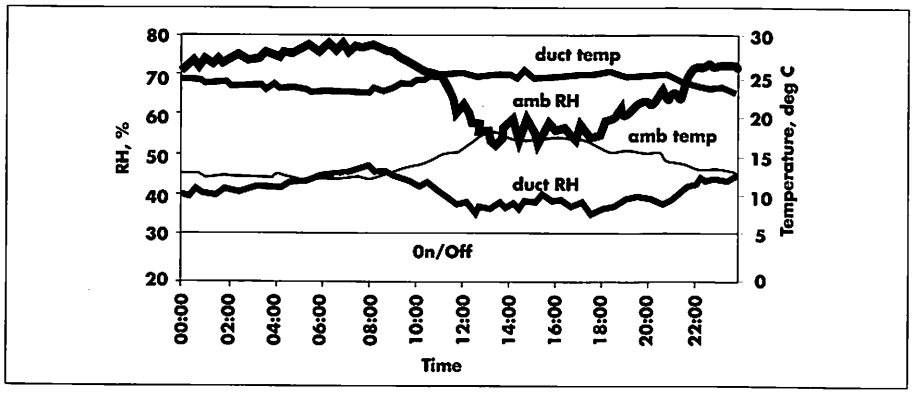


Fig. 3 Test 2 - example of daily data (7/9/96).

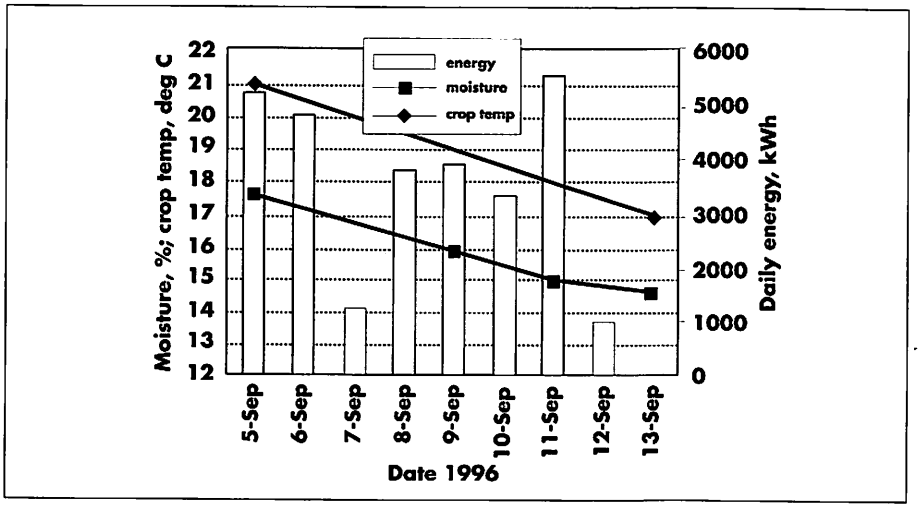


Fig. 4 Test 2 - moisture content, temperature and energy consumption.

jets were uprated to 263 kW (900,000 Btu/h) but output still failed to reach the rated level. It later became apparent that gas was only being drawn from one tank at a time. This was due to marginal differences in the setting of the two gas tank regulators. Modifications were carried out so that both tanks fed gas through a common centrally mounted regulator. This ensured an equal draw of gas from both tanks and maximised the evaporative surface of liquid gas.

Stirrer used to blend in wet grain

The grain brought into side 1 of the dryer early in harvest was very dry (typically 12.5% m.c.). In order to keep grain varieties separate, it was necessary to load 10 - 12 tonnes of 17% m.c. grain in a small area on top of the dry crop. The stirrer was then used to blend and mix the grain together. After 20 hours of stirring, grain moisture samples were taken. The results showed that the wet grain had mixed in well, with the surrounding drier grain absorbing the moisture of the wet load.

Evaporative cooling

In test 1 where grain was brought in at 28°C and ventilated with air at 25°C, it was interesting to note that the effect of evaporative cooling reduced the grain temperature to 18°C in a day.

Conclusions

The trial demonstrates the practical application of the use of grain stirring equipment operating under a constant air temperature regime under UK conditions.

- Bulk drying using this technique was no longer weather dependent. Drying time was therefore predictable.
- Management of the drying process was simplified, with no need to worry about the humidity conditions of the duct air.
- Where grain came into store at temperature/high moisture content, the evaporative cooling effect of ventilating the crop increased the initial drying rate.
- The running cost of a constant air temperature and grain stirring regime compared favourably with conventional bulk drying systems.

Acknowledgements

Thanks to Mr D Needham for the dryer site, and Rekord Sales for help with equipment.

Book Reviews

Farm Machinery

by Brian Bell

Publisher: Farming Press

ISBN 0852363192

I have enthused in the past about Brian Bell's books, which have always been aimed at instructing those who require a sound basis in the technology of agricultural engineering.

Farm Machinery is of course his 'flagship' and now regarded as a standard work in the field, providing a sound knowledge in tractors and farm machinery.

It is pleasing to be able to report that the fourth edition is if anything an improvement on its earlier format. Many of the plates and drawings have been updated. New sections dealing with mechanical handling, irrigation and dairy equipment have been included.

The important issues of computerisation control and monitoring systems are considered throughout the text.

In short the updating has enhanced what I have already suggested is an important reference work for all requiring basic knowledge of farm machinery.

MJH

Roadless - The Story of Roadless Traction from Tracks to Tractors

by Stuart Gibbard

Publisher: Farming Press

ISBN 0-85236-344-3

Hardback

It certainly seems to be the season for books recounting the history of companies manufacturing tractors and associated machinery. This particular volume tells the story of Roadless Traction and encompasses over sixty years of innovation in the field of transport and agricultural engineering.

It is a very well researched and crafted book, one of the four of its type which one can truly say is informative as well as entertaining.

I judge it to be particularly well presented with over 370 illustrations, many very rare and yet still of high quality. The text is organised such that it is easy for the reader to follow the company's technical development.

It is of course a documented history aimed at enthusiasts, but I think it is rather more than most of its type. I can therefore recommend it on a technical level as well as a pictorial potted history.

MJH

Environmental Engineering

by G Kiely

Publisher: McGraw Hill

ISBN 0-07-709127-2 Edition 1

Price: £24.95 (paperback)

Environmental engineering is a comparatively new discipline whose building blocks are essentially civil, chemical & agricultural engineering drawing on the basic sciences of chemistry, physics, biology and economics.

It is therefore particularly pleasing to report the publication of a very useful text - covering these very blocks. It has been developed by Gerard Kiely, who teaches environmental engineering at University College, Cork. The book is therefore designed as an undergraduate text book. As such, it has been divided into sections roughly equating to semester teaching books.

It is a volume with an extensive amount of material. The author has had the good sense to co-opt colleagues to write components that equate to their particular expertise. This approach results in very good coverage of the subjects which is divided into four parts:

- essential scientific, ecological and legal backgrounds;
- polluted environments, water, air and soil;
- environmental engineering technology;
- environmental management.

Within this framework a range of related topics are considered including:

ecology & microbiology,

hydrology & ground water physics,

farm waste & agricultural pollution,

noise & air pollution.

As one would expect, it is a well presented text with processes, etc., very well explained. There is also an excellent index and reference section and the text is accompanied by numerous valuable tables and plenty of problem solving.

My one minor criticism would be that the writing style is sometimes rather waffling, but please do not be put off by this minor flaw.

It is an excellent work, and I suppose I can pay it no greater compliment than I now recommend it to students taking our Environmental Engineering courses.

MJH

Final Years on the Tractor Seat

by Arthur Battelle

Publisher: Farming Press

ISBN 085236-355-9

Price: £5.95 (paper back)

Regular readers of our book reviews will be aware that this is the third and final part of the authors biographical 'Tractor Trilogy'.

The two preceding books having been considered in earlier journals. Suffice to say this follows much in the footsteps of the earlier books. Basically, it is a funny book recounting events that have occurred between the 1960's and the author's retirement in 1984.

There are some technical details but they are of limited importance; the value of this book is in the character of its writer. To him, most things happened and, like all good country 'characters', he is able to recount the story (exaggerated, of course) with humour and interest.

Buy it as a relaxing read, I'm sure that was the aim of Arthur when he wrote it.

MJH

CONFERENCE REPORT

"Fast Tractors .....50 km/h and all that"

Conference held at Writtle College on 6 November, 1996 - Summary of Proceedings

Richard W Langley

1. Chief Inspector R Anderson & Police Constable R Young, Essex Police, Traffic Division

Ralph Young commenced his talk by referring to the "Road Vehicle Construction and Use Regulations" and the definition of an agricultural motor vehicle (AMV). The AMV is basically a vehicle constructed or adapted for use off roads and primarily used in agriculture (horticulture and forestry). The AMV is limited to a maximum speed of 32 km/h unless it meets further requirements. That is, **under** 32 km/h, tractors are exempt from many requirements of the law.

However, Ralph Young stressed that as soon as the tractor exceeds 32 km/h, and this includes **any** tractor, the machine must meet certain requirements. These include:

braking - as for HGVs, to include dual circuit braking systems with a minimum efficiency of 50%;

suspension - all wheel suspension required;

tyres - requirements regarding tread pattern and overall design for high speed use.

Other special requirements for high speed tractors include: safety glass, speedometer, horn, mudguards, windscreen washers, mirrors, engine noise limits.

Mr Young also mentioned that there are **no** special requirements for vehicle licensing nor driver licensing and age limitations. Although **plating and testing** are currently **not** requirements for any tractors, perhaps this will change? The tachograph is not required on high speed tractors, and thus there are no restrictions on maximum driver's hours.

Provided the tractor meets **all** the special construction and use requirements, it may be driven at a maximum speed on the highway of 64 km/h. It was also pointed out that high speed tractors **can** use motorways, provided that: they are fitted with wheels and pneumatic tyres; capable of at least 40 km/h on the level; and are **not** using rebated (red) diesel fuel.

During discussion that followed, Dr Steve Smith (NFU) remarked that if the tractor was more than 25 years old, it was exempt from a road tax licence. He also said that as long as the movement of livestock was to the "nearest available market", the exemption from the use of tachographs remained valid.

When questioned about the use of amber beacons on fast tractors, the speaker from JCB advised **not** to use them when in "fast mode". Although not strictly to do with fast tractors, a question was raised on the confusion of licensing "materials handlers". Dr Smith agreed there was confusion in the law regarding these machines. They are **not** tractors and thus should not be taxed as such. He said the Department of Transport **was** aware of this anomaly.

A local farmer commented that the law relating to fast tractors (or any modern tractors) is now out of date, and should be looked at anew with a clean sheet of paper.

2. R Stayner, Research Engineer

Mr Stayner gave a broad overview of tractor suspension and ride characteristics and requirements. He began by outlining that suspensions are fitted to tractors in the first place to give a better ride and to make more money by going faster. When the machine goes faster, time is saved, costs are reduced and there will be advantages in timeliness. Time is especially critical at harvest, autumn cultivations, etc. A better ride will lead to better health of tractor drivers with hopefully less days off work.

Mr Stayner emphasised that, for a good tractor **ride,** the objective was to minimise body movement leading to less fatigue and greater comfort; i.e. a **soft** suspension is ideal. On the other hand for good tractor **handling,** the objective was to keep all wheels firmly in contact with the ground and to enable the vehicle to go safely around corners; i.e. a **hard** suspension is ideal. Therefore, there is often some conflict here.

The speaker outlined the features of tractor suspension systems and referred to wheel travel, load distribution, roll response, damper durability. He said that any springs used must have a large load range; mechanical springs were not suitable. "Air springs" were cheaper and less "messy", but take longer to adjust. Gas/oil systems give integral damping with a faster response.

Mr Stayner gave a brief resumé of tractor suspension history and said that either the axle, cab or implement could be suspended. Silsoe worked on cab suspension back in the 1970s; in those days, it was suggested, tractors bounced less anyway. Many years ago, the "Trantor" was developed, perhaps ahead of its time, "Unimogs" came along, followed by the "MB Trac" having front wheel suspen-

Mr Richard W Langley who is based at Writtle College was conference convenor and prepared this report.

sion. (This tractor has now disappeared). The Fendt tractors were also very much a part of this tractor evolution.

In summary, the speaker reiterated that the suspension system must:

- be effective off road and on road;

- give good damping to maintain tyre contact;

- give good height control within a large load range.

One or two questions were asked about tyres and tyre safety regarding fast tractors. It was agreed that for safe road operation, the pressure **must** be kept up (regardless of what may happen for field use).

3. K Wootton, Managing Director of Wootton Trailers Ltd

Ken Wootton began his talk with a profile of his company and stating that, as Wootton Trailers were around 20 years old, they did have considerable experience in this field. He defined a trailer as a platform on wheels which literally anyone could make. The trailer could be balanced or unbalanced. The maximum weight that can be carried depends on the number of axles.

Mr Wootton stated that any trailer designed to be towed faster than 32 km/h, is a "commercial trailer". This type of trailer is fitted with: a sprung drawbar; increased nose weight; side safety plates in the case of 4-wheel trailers; brakes that come on progressively, and a handbrake capable of holding on a 16% slope; larger brakes and stronger brake lining to avoid brake fade; "ABS" as an optional feature; axle with a 3-leaf spring and parabolic suspension, as well as drag links on the axle to stop the axle trying to turn over when stopping; and three axles available on the larger trailers.

The speaker commented on tyres and tyre choice on his trailers. Flotation tyres could be fitted but these were **not** designed for haulage; he outlined the numerical data that is commonly found on tyre sidewalls. Mr Wootton emphasised that pressure can be reduced if speed is also reduced; he also said that tyre "blow-outs" are often due to over-inflation rather than under-inflation.

Commercial trailers were fully "plated" according to requirements, and both air brakes and oil brakes were fitted as standard. The whole chassis was built to a higher specification, in order to cope with the higher road speeds.

Answering a question, Mr Wootton commented that driver licensing needs looking at again. A boy of 16 or 17 years old was far too young to be put in charge of a fast tractor plus trailer, etc. A member of the audience, from the HSE, pointed out that whoever the driver was, he or she **should** be adequately trained, and fully competent.

4. P Hemingway, JCB Landpower Ltd

Paul Hemingway commenced his talk by stating that, before a tractor such as the "Fastrac" could be sold on the market, it has to have "Type Approval". The 1974 Directive (74150) which has been amended, was aimed at speeds of 30 km/h. The 40 km/h approval may be coming along soon. "Fastracs" did, in fact, meet EC truck brake standards. Mr Hemingway used basic theory (kinetic energy = + $m.v^2$) to illustrate that if the speed of the tractor is increased from 30 to 40 km/h, the speed difference is **squared** and, hence, there is a **lot** more energy to get rid of. Therefore, the brakes are air brakes, powered by an engine mounted compressor. The brakes themselves are external discs since this helps to dissipate heat quicker; the brakes were bigger on the front compared with the rear, in order to maintain a 60:40 balance.

As was mentioned earlier, full suspension is required, with springs being used. The rear suspension is hydrodynamic utilising Citroen components (also as used on Rolls Royce).

Mr Hemingway commented that tractor drivers of "experienced age are deaf with bad backs". Quiet cabs came out to alleviate noise problems, but nothing was done for many years on suspension.

"Fastrac's" pickup hitches are tested to EC standards, carried out at Silsoe. In the speaker's opinion, this test was very severe. A ring hitch allows the trailer to tip over without pulling the tractor with it; it also permits easy replacement. In order to sell machines abroad, compliance with different standards may be necessary. Interestingly, France takes many "Fastracs", but they are only used at 30 km/h, for increased comfort!

Twenty years ago, research suggested that tractors of 75 kW plus, spent 60% of their time in transport tasks. With the overall numbers of tractors sold per year falling but with average power increasing, the speaker thought there was a bright future for suspended tractors used at high speed.

Responding to questions from the audience, Mr Hemingway said that tyres **must** be made to a high standard and uniformity; he also agreed that some form of tractor "MOT" testing and inspection should occur, but **not** just for high speed machines. The speaker commented that there had been a few problems with certain machines being trailed behind "Fastracs", e.g. balers and foragers. Some farmers had successfully overcome problems by putting drawbar springs onto the trailed appliances.

5. I Sharpe, Fendt Tractors

Ian Sharpe began his talking by saying that all Fendt models have 40 km/h capability, and some can travel at 50 km/h. Features on the tractors include brakes with 35% braking efficiency, and suspended cabs with air suspended seats. Exhaust brakes are incorporated and the steering utilises a dual pump arrangement and is a mechanically linked system. Tractor front suspension (with nitrogen accumulators) is available and is standard on some models. Mr Sharpe commented that, in Germany, tractor brakes have to be tested frequently, as a safety test; the brakes themselves are of the dry disc variety.

The speaker stated that back in 1982 Fendt tractors had the capacity of 40 km/h, although top gear was meant for "economy use" i.e. the ability to reduce engine revs in order to save diesel.

The detail of the front suspension was outlined, including reference to the auto-levelling system which was awarded a silver medal at a Royal Show. The system fully copes with 50 km/h requirements, and has shock load stabilisation (which can be switched on and off). Mr Sharpe said that this facility makes a vast difference, offering more comfort with greater safety.

Reiterating on the brakes, the speaker remarked that they were multi-disc types, lubricated, and were present on all four wheels. The brakes are external but, as

they heat up, they become **more** efficient (the opposite to what would normally be expected).

The Fendt tractors are fitted with a fluid flywheel which takes out shock loading and judder otherwise experienced. The "Xylon" has a load-carrying platform, will travel at 50 km/h, and weighs 12.5 tonnes "all up" maximum.

Mr Sharpe added that he thought current UK agricultural vehicle legislation was "behind the times". To them, safety is the main issue and Fendt tractors were designed with this factor uppermost. He also said that tachographs could be fitted if wanted by the customer. As a previous speaker had said, Ian remarked that increasing speed from 30 to 40 km/h, contributed tremendously to increased output per hour or per day.

A question from the audience was asked about the legality of driving Fendt tractors on a highway at more than 32 km/h when the machines were **not** equipped with all wheel sprung suspension. Mr Sharpe answered by comparing the situation with a high performance car on the road - just because it is **capable** of breaking the speed limit does not mean that it **has** to be driven illegally.

6. J Jinks, Farm Manager

John Jinks began by telling the audience that he bought two JCB Fastracs and has succeeded in putting around 3,000 hours on them since new. He suggested that these tractors offer a significant step forward in road safety. The speaker also wondered how long it would be before the likes of New Holland, John Deere etc. had similar tractors on the market. They would need to design new brakes and a suspension system before any vehicle could go at "high speed" on the public highway.

The speaker outlined his older "slower" tractors and said that by comparison, the "Fastrac" would stop quicker when loaded even when initially travelling a lot faster, i.e. emphasising the greater safety. When on the roads, Mr Jinks suggested that most general road users were reasonably content to follow a tractor doing 64 km/h but were most definitely **not** when it is travelling at 32 km/h. The risks they take to get past tractors is quite unbelievable.

As far as disadvantages were concerned, the speaker said that equipment hitched onto the fast tractors was put under greater stress, and in many cases had to be "upgraded". He also said that the turning circle of his "Fastracs" was a limitation, but admitted that this was being improved on newer models. Another disadvantage was that some members of the public had complained to him that the tractors were travelling too fast, and could they please slow down past their premises!

Mr Jinks then continued with some costings to demonstrate to the audience the justification of buying a "Fastrac" in the first place. He used his own computer-based costing system to show that by disposing of a conventional tractor plus Bateman self-propelled sprayer, and buying a "Fastrac" plus Airtec sprayer in their place, he would most probably be financially better off. (He based interest rates on 10% and had to make assumptions on depreciation, repairs, etc., since his recording system has only completed 12 months with the "Fastrac" so far). A summary of the costings is given in *Table 1.*

The speaker concluded his talk by saying that the name "Fastrac" was not, in his opinion, the most appropriate title. He said that "Safetrac" would have been a better name. The speed of these machines was a bonus to be used as and when appropriate, but was not the **main** feature. The main features were reiterated as **flexibility** and **safety.**

7. Conference arrangements

The conference was chaired by Mr B Collen, a farmer from Suffolk and NFU Technical Services Committee Member, and was attended by around 160 people.

Table 1. Using costs to make a decision.

Old

Machines	Original purchase price (pp), £	Average annual cost, PP %
John Deere 4255 tractor	32 150	17.96
(112kW) Bateman Hi-Lo sprayer	43 417	20.75
Total expenditure	**75 567**	

Direct replacement

Machines	Replacement price, £	Average operating cost, £/yr*
John Deere 112 kW tractor	40 000	7 184
Bateman sprayer	50 000	10 375
Total expenditure	**90 000**	**17 559**

* Using rate of depreciation from old system

New system

Machines	Purchase price, £	Average operating cost, £/yr*
JCB Fastrac tractor	42 900	10 804
Airtec sprayer	24 962	6 452
Wheels	7 500	1 000
Total expenditure	**75 362**	**18 256**

* Using depreciation at 15%; expected depreciation £1 000 less

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Old dogs need new tricks

Latest Plimsoll Analysis shows new entrants outperforming established companies.

Old established **landscaping and agri-contracting companies** are under threat from new entrants to the industry. Even with favourable economic conditions, the dynamic cycle of business is still claiming its victims and there are plenty of new aggressors hungry for extra market share. The latest Plimsoll analysis of the industry highlights a tremendous diversity in company performance and also reveals that the newcomers to the industry can teach the more established companies a thing or two.

The current edition of the Plimsoll Portfolio Analysis, "Landscapers & Agri-Contractors", covers the full spectrum of the industry. Using the last four years of audited accounts, the financial performance of each of the 1320 companies included are individually analysed - including 229 companies new to the industry, having been incorporated since 1990. The performance of these companies merits special attention.

In comparing sales growth, it was found that the older companies could only manage an average 7.7% increase in the period reviewed, whilst the new entrants turned in an average 35.6% increase in sales. This superior performance is further emphasised when looking at the proportion of high growth companies. Some 53% of the new companies were able to increase sales by 25% or more, compared to just 22% of the more established companies. Converting sales to profits, though, did not prove as easy for the new players who reported an average 2% pre-tax profit margin compared to a profit margin of 2.6% of sales for the older companies.

Selecting companies to trade with that are growing at an above average rate can increase prospects for those with the foresight to do so. The new companies analysed here would make ideal trading partners for those seeking growth, especially when considering that 8 of the new companies identified have a turnover in excess of £5m.

The upshot of these findings is that the new companies are forging themselves a path to success, and trading with these companies can increase prospects for your own company. Although this is the case, care must be exercised as new businesses can be unstable. Indeed of those newly founded companies analysed, it was found that 53% were rated caution or danger, indicating that they are experiencing financial difficulties of some form. This compares to just 42% of the older companies. In contrast, the proportion of financially healthy companies, those rated strong or good by Plimsoll was 43%, compared with just 25% of the newly incorporated companies.

Clearly there are benefits to be gained from identifying and trading with new aggressors, provided they have a certain degree of financial stability. What often eludes the busy manager in his day to day dealings is a tool that can quickly identify such opportunities. The Plimsoll Portfolio Analysis, using the standard Plimsoll model to analyse each of the companies included, allows for rapid comparisons to be made between companies. This allows the user to quickly identify suitable trading partners, potential acquisition prospects and to assess the competition.

Main Report Invoiced/Credit Card @ £305 and the supplement report @ £205. Queries to: **Mark Haynes, Plimsoll Publishing Ltd, tel. 01642 230977.**

Improved laterals for new SCN grain dryer

Law-Denis Engineering Ltd, the leading British grain dryer manufacturer with the successful SCN range of mixed flow grain dryers, is to introduce a new version for the 1997 season. The new dryer, which was announced at the Royal Smithfield Show, will have several advanced features and options.

The heart of any grain dryer is the drying section, and the mixed flow type of dryer is fitted with drying laterals within the drying section which introduce the hot air and exhaust the saturated air from the grain, and their shape and form have a crucial effect on dryer performance. Usually for ease of production, these inlet and exhaust laterals are identical.

So, foremost amongst the changes, is the introduction of the new "EP Combination" laterals which represent a significant advance in lateral design, providing improved air flow and therefore improved throughputs. Extensive research, development and testing have resulted in this new lateral design which, for the first time in a mixed flow dryer, is a combination lateral, i.e. the inlet lateral is different from the exhaust lateral.

A Law-Denis spokesman commented that the design criteria for inlet laterals was not the same as that for exhaust laterals so it was to be expected that a lateral system with a dissimilar but complementary design would have a performance edge and this proved to be the case.

The heart of the new system is an inlet lateral fitted with an "equalisation plate" (hence "EP") which effectively divides the entering airstream between the front and rear of the lateral, and an exhaust lateral balanced to this air flow.

This has shown to be highly effective on both light crops such as oil seed rape and linseed, where the use of higher than normal airflows results in much higher throughputs than has been the case, and heavier cereals such as wheat and barley. Other changes include a new discharger assembly (still with the advanced positive discharge design), air volume control, etc.

The UK built SCN range is renowned not only for unequaled drying performance, but also for its high level of weather protection with the exterior skin of PVC coated, profiled steel cladding. For the 1997 season, this high level of protection has been further extended to include the option of an enclosed upper roof providing unparalleled weather protection for a dryer which is required to be sited outside.

Since the introduction of the SCN dryer, not only has it become the leading dryer sold in the UK, it has also been a tremendous success overseas with over half the production now being exported to countries all over the world.

For further details, contact: **Law-Denis Engineering Ltd, Millstream Works, Station Road, Wickwar, Wotton Under Edge, Gloucester GL12 8NB. Tel: 01454 299700.**

Portable power from a matchbox

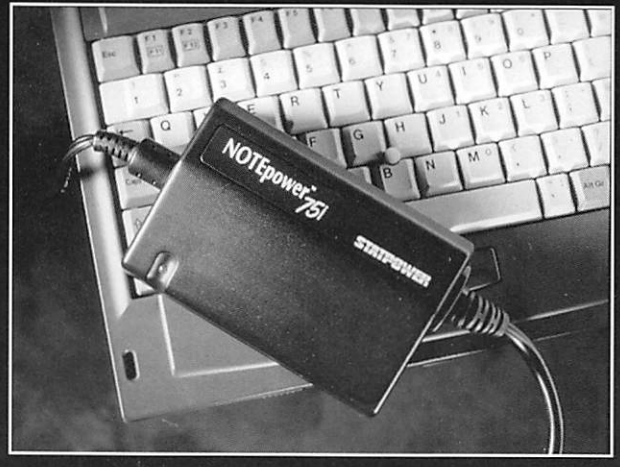
Merlin Equipment's new *NOTEpower 75i* inverter simply and silently converts a vehicle's 12 V battery power to 230 V a.c. mains electricity, enabling vehicle operators to run televisions, computers and test equipment without the need of a generator or expensive 12 or 24 V equipment.

Specifically designed for sensitive electronics by a leading computer manufacturer, the *NOTEpower75i* is safe to use with all machines available on the market and simply plugs into the car cigar lighter socket for easy connection. Output is then available directly from the a.c. socket on the side of the unit.

The *NOTEpower 75i* can also be used to free notebook computer users from battery life restrictions by allowing them to 'charge and drive', and to power peripherals such as bubblejet printers for a complete mobile office. Fully overload & overheat protected, the inverter employs state of-the-art electronics to provide a power source which is more than 90% efficient, thus making best use of the vehicle's battery power. The unit is smaller, lighter and easier to use than any other on the market. Useful features, such as a battery alarm, will warn that the vehicle's battery is low and turns the inverter off to allow re-starting of the car.

The NOTEpower 75i is CE approved, conforming to EU directives for electrical interference and safety, and allowing the units to be confidently used in many applications involving sensitive electronics.

Contact: **Merlin Equipment, Unit 1, Hithercroft Court, Lupton Rd, Hithercroft Industrial Estate, Wallingford, Oxfordshire OX10 9BT. Tel: 01491 824333**



***Notepower 75i* d.c. to a.c. power inverter**

Twin disc broadcaster

Teagle Machinery have launched a totally new twin disc broadcaster, the TD50. The machine has two contra-rotating rotors giving a fully overlapping spread pattern. Bout widths, adjustable by fitting different gear sets, are from 12 to 24 metres with reputable brands of fertiliser.

The basic machine has a hopper capacity of 1200 litres (1.2 t) and can be fitted with extensions to increase the capacity to 1700 litres (1.7 t) and 2200 litres (2.2 t). Standard features include hydraulic shutter control by double acting cylinder, hydraulic tilt for boundary spreading, hopper screens and high lift hitch points for top dressing. The TD50, like the XT range, has a 3 year parts warranty on non wearing items.

Considerable attention has been paid to corrosion resistance and serviceability. The rotors and most of the metering system are made of stainless steel. The hopper and mainframe are finished using two pack acrylic paint and the hopper hinges back to give easy cleaning and maintenance.

Optional extras include hopper extensions, hopper cover for wet weather working, additional gear sets for various bout widths and calibration trays for checking the spread pattern. The recommended retail price of the basic TD50 is £3,925.

Contact: **Teagle Machinery Ltd, Blackwater, Truro, Cornwall TR4 8HQ. Tel: 01872 560592.**

A desert wind at your fingertips

Wherever and wherever fast and gentle drying is needed, that's where the allpurpose, high-speed TG 100 utilises the bed principle to provide a practical alternative to the drying cabinet.

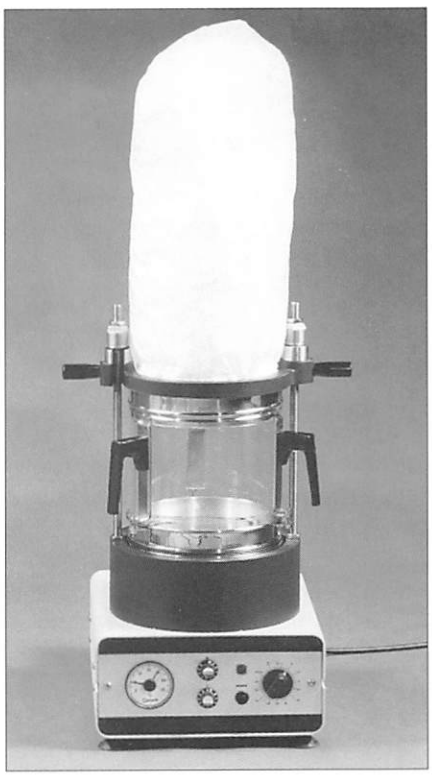
Just as in industrial fluidized bed dryers, this laboratory model draws in air through a filter, heats and blows it from below, through the perforated base and into the drying container. The product being dried is bathed in warm air. The surface area involved in the drying process is significantly greater than when using a drying cabinet. What's more, the product is agitated during fluidized bed drying and that both prevents agglomeration and loosens any clumps which may be present. The warm air, laden with moisture, escapes through a filter bag - when dealing with fine grained product it will pass through a felt filter disk in located in the cover.

The TG I00 is suitable for use with bulk goods, plant parts, textiles and components made off plastic, glass and metal. The 6 litre drying chamber is made of glass to facilitate observing the drying process. An alternate model is made of stainless steel.

Also available to handle smaller quantities is an attachment with three glass containers of 0.3 litres each.

The drying temperature con be set steplessly within a range of from 40 to 120°C and the air volume from 5 to 10 m^3/h.

Contact: **Retsch UK Ltd, Whitehouse Street, Leeds LS10 1AD. Tel: 0113 244 6111.**



The new model TG 100, complying fully with CE safety specifications, has a special thermal shield around the heating element and a newly developed quick clamping cover which greatly simplifies removing the cover and the container.

Scania keeps Irish eyes smiling

Scania power is helping in the production of large quantities of home-grown peat to supply the domestic fuel market in Southern Ireland. Two Scania powered, Teva Trac peat production machines are being used by Irish company, Bord Na Mona, at a 2400 ha peat bog near Littleton, Southern Ireland.

The Scania DS9, with a rating of 192 kW at 1800 rpm, is a six-cylinder, in-line turbo diesel unit being used to power the extra-wide tracks of the purpose made machines and to provide hydraulic power to the machine's attachments. The machines were supplied by Teva, a specialist in forestry and peat production equipment based at Claregalway County, and are just a small part of a fleet of 16 units operating all over Ireland.

Peat harvester.

Peat production company, Bord Na Mona, has been operating at this site since 1981 and has some 1600 ha in production at any one time, producing between 270,000 and 300,000 t per season.

The Scania engined, self-propelled Teva Trac machines have a multiple role depending upon the time of year. In the summer, they are fitted with a large extrusion hopper which contains two screw augers, turned by power-take-off from the Scania DS9 diesel engine. This hopper is filled by excavators and the wet peat is spread out on the bog in 300 m lengths, 10 sods wide.

The top auger or macerator, aerates the peat and the bottom one forces the drying mixture along the base of the hopper to the front funnel. The peat is then fed through a pipe-end sod former and a marker wheel cuts off the sods to the required length, usually about 300 mm long. The peat is then left to dry for a few weeks, depending upon the weather, before being sold for general public consumption on the domestic fires in the surrounding area.

In the winter, the machines play a significant role in transporting milled peat along railway lines back to the nearby factory. The Scania engined units are fitted with a telescopic Hiab crane and are used to lift, move and re-lay the 32 km of temporary rail track, criss-crossing the bog. The peat is stripped in the same way as for sod peat, but it is then loaded into railway trucks and transported back to the factory. Because of the need to give the bog time to recover, the locations of the excavation are constantly changing. The Teva machine ensures that the track, which can be lifted in 10 m sections, can be transported and laid from wherever the harvesting is taking place, and linked up with the main line track back to the production facility.

Once in the factory, the peat's moisture content is reduced from 50% to approximately 12% and it is then pressed into briquette form. Working in twelve hour shifts, the factory can produce up to 200 t of briquettes per shift.

The Teva Trac units are also used when fitted with a three-point linkage. for various ditching operations, for levelling operations using a dozer blade and for transport functions when fitted with a high-top body.

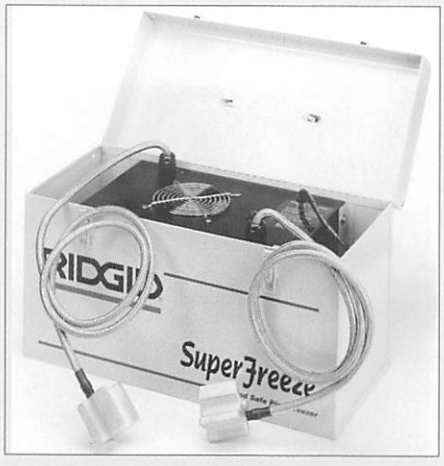
General manager of Bord Na Mona, Seamus Moore, is pleased with the reliability of the Scania engines because he cannot afford downtime when production is on such a tight timescale during the operating season which usual lasts from May to September.

Teva has been using Scania power sources in its machines for several years now and is particularly impressed with the reliability. Teva's Adrian Nevin said: "Since we switched from another manufacturer's engines, we have had no complaints or comebacks, the Scania engines just seem to go on and on." The engines are supplied by Diesel Power of the UK.

The majority of the milled peat is used to supply the Irish domestic fuel market. In Ireland, traditional peat, in either sod or briquette form, makes up 90% of the total domestic fuel burned.

Contact: **Hans Hellsten, Scania Industrial & Marine Engines. Tel: +46 855 381 802.**

New RIDGID pipe freezing unit



The new RIDGID SF-2000 electric pipe freezer quickly forms ice plugs in steel and copper pipe. Isolating sections of water pipe allows maintenance and repairs without having to shut down or drain the entire system. The freeze heads are easily attached to the pipe with either the hook and loop fasteners or ratchet clamp supplied with the unit. With no bulky gas cylinders, the SF-2000 can easily be carried from job to job. Once switched on it can be left running without supervision. The RIDGID SF-2000 can be used on 6 mm to 31 mm steel pipe and 10 mm to 42 mm copper pipe.

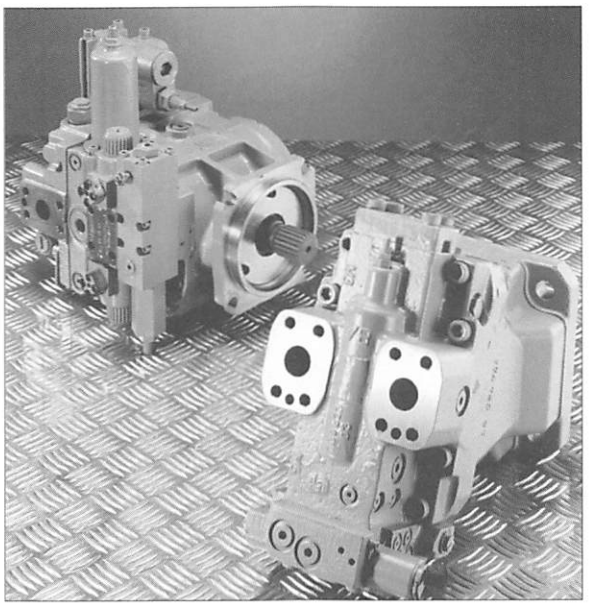
Contact: **Ridge Tool Division, Emerson Electric (UK) Ltd, Arden Press Way, Pixmore Ave, Letchworth, Herts SG6 1LH. Tel: 01462 485335.**

Sauer-Sundstrand transmission package puts JCB into pioneering position

JCB is the first UK OEM to offer complete operator control in a range of articulated wheeled loaders, thanks to the adoption of a hydrostatic drive line system developed by hydraulic systems manufacturer Sauer-Sundstrand.

In a response to detailed customer research, the new generation of loading shovels, designated 407B, 408B and 409B, replace JCB's previous wheeled loader range which relied on a mechanical geared transmission. With Sauer-Sundstrand's new system on board, the new series of machines represents a major step forward from models featuring the traditional hydro dynamic driveline, torque converter and gearbox. The wheeled loaders will be produced for worldwide markets for construction, agricultural, materials handling and industrial applications.

Developed over 18 months in collaboration with JCB's Special Products Division and engineered to match the application's requirements, Sauer-Sundstrand's system offers JCB's customers complete automotive control in any working condition.



Sauer-Sundstrand's hydrostatic drive line system has been developed with JCB Special Products to give complete operator control for its range of wheeled loaders

The first project systems are based around Sauer-Sundstrand's Series 90 hydrostatic axial pump coupled with a Series 51 D bent axis motor, which gives variable displacement of up to 55cc for the transmission pump input, 110 cc maximum for the motor output and thus provides an infinitely variable transmission.

The advantages of the hydrostatic transmission, include the ability to shuttle under full load without incurring any transmission wear, controlled rate of acceleration/deceleration and protection against overheating when stalled and underload; the major benefit of the new system is ultimate operator control using a single pedal which is achieved by the application of a variable hydrostatic transmission.

Through single pedal operation, the system offers a transmission which is constantly adjusting according to the prevailing conditions of load and terrain. This gives smooth operation regardless of the engine speed, especially on rough surfaces, with little or no need for brake utilisation. The system allows maximum tractive performance to be achieved through a lower engine speed which economises fuel consumption, extends engine life and reduces in-cab noises levels.

Scott Ellis, Engineering Manager at JCB Special Products said, "We have brought our machines up to European specification and they have already received a warm welcome from operators who have nothing but praise for the machines' benefits. These include excellent manoeuvrability in confined areas, suppression of vibration and dynamic noise, parallel lift, high power and torque.

"These machines are generally used on construction sites or in a tight environment such as roadways, and control in slow speed applications is therefore paramount. The new hydrostatic transmission gives the benefit of single pedal control, coupled with an inching facility for use when the engine revolution is increased for lifting or loading. Without the hydrostatic transmission, this dual action was not possible as the transmission would already be engaged. The other major benefit for our customers is that the vehicles are extremely easy to drive and do not require very experienced operators," continued Scott Ellis.

Commenting on the project, Ken Varley of Sauer-Sundstrand said, "Conventional hydrostatic wheeled loaders have a single maximum speed for the working range. The Sauer-Sundstrand transmission has a special motor control which provides the operator with a variable top speed for the working range. This means that this can be changed to suit varying working conditions, maximising the machine's productivity."

The project development was jointly carried out by Sauer-Sundstrand and JCB Special Products, with the engineering of the transmission and control package taking place at Sauer-Sundstrand in Germany. The speed with which the Company fulfilled the project, utilising its in-house research and development and full technical support are the reasons behind JCB's ongoing relationship with Sauer-Sundstrand.

Offering high performance with a maximum operating pressure of 480 bar, the Series 90 is a heavy duty variable displacement axial piston pump. Its modular design offers a wide range of hydraulic and electrohydraulic control options. It is complemented by the variable displacement Series 51 D bent axis motor with its compatible controls and similar modular design.

The 407B, 408B and 409B wheeled loader range is the first in a series of machines which JCB is developing incorporating the hydrostatic drive line, for the European market.

Contact: **Dave Eastwood, Sauer-Sundstrand Ltd, Cheney Manor, Swindon, Wiltshire SN2 2PZ. Tel: 01793 530101.**

Hawaiian Sugar benefits from 3CR12 utility stainless steel

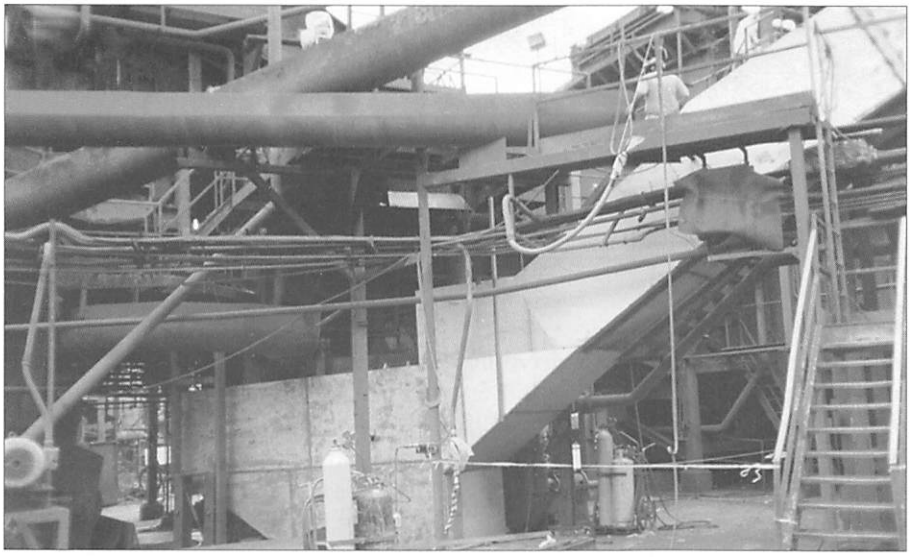
The use of 3CR12, utility stainless steel, by the Hawaiian Commercial & Sugar Company in the replacement of plant at its Paia factory has resulted in an initial material cost saving in excess of US$10,000 with further savings expected during service.

3CR12 has been used in the rebuilding of the cleaning plant carriers and tanks as a result of the severe wearing of the floor plate in the diffuser elevating scrolls. The Paia factory utilises 50 million litres of water per day for its processing, which is pumped from a deepwell and typically runs at 200-300 ppm of chlorides. Consequently, the company has had to deal with severe corrosion of mild steel components in the factory.

The decision to change the component material from mild steel to 3CR12 was based on this innovative utility stainless steel's resistance to wear and corrosion as well as its maintenance free characteristics that guarantee increased service life and cost savings. The ability of 3CR12 to resist not only the abrasive and corrosive effect of raw cane handling and shredding equipment at the front-end of a sugar factory but also its ability to withstand the high acidic content of juice in-service temperatures of up to 600 degrees C, makes this modern stainless steel the fastest growing steel in the international sugar industry.

The Paia Mill which was originally built in 1880 has a capacity of 3,800 tonnes of cane per day and, along with the Puunene Mill, forms the 14,175 ha plantation owned and operated by Hawaiian Commercial & Sugar Company, a subsidiary of Alexander and Baldwin Co.

Paia Factory Manager, Brian Ross reports, "We intend to replace much of our mild steel material with 3CR12 in the future and look forward to utilising 3CR12 piping and structural shapes in our rebuilding."



3CR12 utility stainless steel has been used in major refurbushment at the Paia factory of the Hawaiian Commercial & Sugar Co.

This application adds to 3CR12's international application track record for successfully keeping sugar cane processing equipment operating longer, at lower cost and with reduced maintenance. Over the last decade, 3CR12 has been installed by sugar producers throughout the world and handles well in excess of 50 million tonnes of cane and a similar quantity of beet per year.

Contact: **Cromweld Steels Ltd, The Old Vicarage, Tittensor, Stoke-on-Trent, Staffordshire ST12 9HY. Tel: 01782 374139.**

Rotating vane anemometer

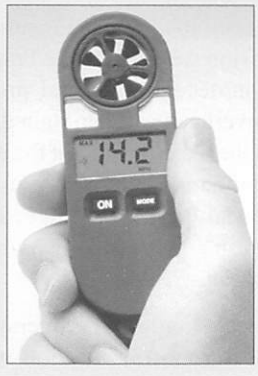
Richard Paul Russell Ltd announces the introduction of a new small electronic rotating vane type anemometer that can be easily carried in the pocket. The Kestrel 1000 uses precision jewel bearings and a light weight impeller to provide accurate readings even at very low air speeds. A liquid crystal display with large 10 mm high digits gives a clear readout of speed, maximum speed or average speed.

The Kestrel Pocket Anemometer is made from high impact injection moulded plastic and corrosion resistant materials with the electronics fully sealed. It will float if accidentally dropped into water. There is a hard cover for protection when not in use and a lanyard is provided for added security. The impeller assembly is easy and inexpensive to replace. It is held in place with an 'o' ring which also helps protect the impeller and bearings from shock.

Power is from an easily replaceable standard lithium coin cell that will typically give up to 400 hours operation. It automatically switches off if no keys are pressed for 30 minutes.

The anemometer is the result of initial design work by Lymington based Richard Paul Russell Ltd which has many years experience developing advanced electronic instrumentation. Nielsen-Kellerman Co. in the USA, who are will known for their quality instrumentation for sport, are manufacturing the anemometers.

Richard Paul Russell Ltd, 26 Bankhill Drive, Lymington, Hampshire SO41 9FF. Tel & Fax: 01590 679755.



Measure your world on Impulse

A progressive new laser range finder has just been launched in the UK by survey instrumentation specialists Positioning Resources.

The Laser Technology IMPULSE integrates a laser range finder and optional tilt sensor in an instrument no bigger than a palm-held camcorder. Weighing in at a mere 1 kg, it is significantly smaller and lighter than its counterparts, and can be unobtrusively clipped onto a belt to be carried almost anywhere as an automatic addition to field kit.

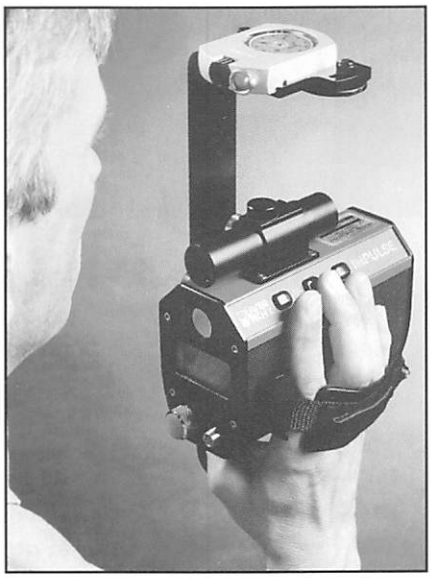
Designed to be operated with one hand, the IMPULSE is unique in offering a set of controls on both sides of the instrument for either right or left hand use, surely representing the ultimate in user-friendliness.

It is anticipated that the demand for the range finder will come initially from the timber and forestry sector, however its survey and mapping facilities can also be applied, for example, in the mining industry for profiling rock faces, for the planning of wayleaves. In addition to general distance and height measurement, the IMPULSE will benefit Geographical Information Systems data capture, GPS offset mapping and space planning.

The IMPULSE acquires target height or distance in less than 1 second, and measurements up to a distance of 500 metres can be made, with an inclination limit plus or minus 90 degrees. Data capture is made easier by a built-in electronic filter which sees through brush to pinpoint reflective targets.

Operation of the IMPULSE is virtually foolproof thanks to an audible tone which either confirms that data has been recorded successfully or alerts the operator to error conditions. Up to a lengthy 20 hours continuous use is made possible by two AA batteries, with data collected being stored in memory for downloading to mapping software later on.

A yoke mounting bracket is easily and quickly attached to the side of the unit by a single thumbscrew, permitting the instrument to be attached to a tripod or monopod. The open design of the yoke does not interfere with the operation of the controls, and once mounted to the pod, a bubble level on the yoke indicates when the instrument is sitting level.



The lightweight laser range finder with yoke and compass attached allows easy, single-handed operation.

A compass mount attaches to the yoke, extending over the top of the mounted instrument. The compass itself features two hairlines, one fixed for reading a magnetic bearing and one moveable for reading a bearing corrected for declination. Instructions are included for making the declination adjustment and, simplified, the adjustment involves moving the hairline to the left of the fixed hairline to compensate for an eastern declination, or to the right if the declination is in degrees west.

Evolved from the Criterion Survey laser series, the IMPULSE complements existing products and can be used in conjunction with other GPS survey equipment. Available at a fraction of the cost of larger, more complex instruments, the pioneering laser range finder is making the use of laser survey and mapping instruments more accessible to a wider ranger of users than ever before.

For further information, contact: **Judith Collier at Positioning Resources Ltd, 64 Commerce Street, Aberdeen AB11 5FP. Tel: 01224 581502.**

Increased yield potential with ultra narrow corn rows

Case Corporation has acquired exclusive development, manufacturing and marketing rights to a new 'ultra-narrow' row combine corn head design that will enable farmers to harvest down to 380 mm row corn compared to 760 mm and 910 mm rows that are standard on most farms today.

"Ultra-narrow row farming has the potential to dramatically improve yields, while lowering relative input costs. This is one of the exciting new practices that farmers are beginning to use to increase their production and profitability," said Jean-Pierre Rosso, Case chairman, president and chief executive officer. "We are excited about the opportunity to help pioneer this practice, and by continuing to listen to our dealers and customers, we will identify and develop additional products and services that enable our agricultural equipment customers to maximise their productivity and success."

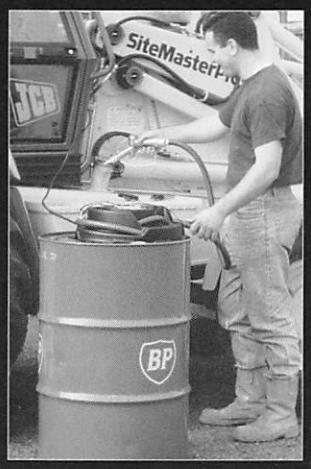
Case acquired rights to the design from Marion Calmer, a farmer from Alpha, Illinois. Conventional corn heads have a gathering chain and fingers on each side of the row that direct the ears of the corn into the combine. The 380 mm row corn head design uses one gathering chain with attached paddles to effectively direct the corn into the narrower combine openings.

Narrow and ultra-narrow row farming is a growing trend, and farmers are already moving to 380 mm row soybeans. Using the Case IH 955 planter, farmers can plant corn in 380 mm rows, but a corresponding combine corn head is not available within the industry.

Calmer, who conducts independent agricultural research, developed the design and used it on a Case IH Axial-Flow combine in this year's harvest. His research in planting and harvesting 380 mm row corn has demonstrated a significant increase in yields, weed control and profitability.

Contact: **Case UK Ltd, Marketing Division, P.O. Box 121, Wheatley Hall Road, Doncaster, South Yorkshire DN2 4PN. Tel: 01302 733393.**

New portable diesel refuelling pump kit



A new, portable diesel refuelling pump kit for refuelling vehicles from barrels, drums or tanks, the FUELMASTER 40, has been announced by ITT Jabsco. The FUELMASTER 40 comes complete with pump, hoses, trigger nozzle, strainer and carrying/storage frame. This new product has been launched following the success of Jabsco's series of vehicle-mounted refuelling pumps, which are now fitted as standard by many of the world's leading manufacturers of construction vehicles.

The FUELMASTER 40 has been designed for use by owners of older vehicles which do not have such vehicle-mounted pumps. It brings flexibility by allowing any number of vehicles to be refuelled in the yard. The use of the FUELMASTER 40 is not restricted to equipment such as backhoe loaders, excavators, dumper trucks, generators and cement mixers. It is also ideally suited to farmyard machinery such tractors and harvesters.

Powered from the vehicle battery, and available in 12 V or 24 V versions, the lightweight FUELMASTER 40 is a self priming sliding vane pump which will transfer 100 litres of fuel in just 3 minutes. This offers both a labour saving and time saving alternative to the commonly used semi-rotary hand pump.

The robust polypropylene carrying/storage frame keeps the hose clean and tidy and may be mounted on the top of the drum or hung on the wall next to the drums during refuelling. The frame features a carrying grip for easy transportation.

The hose is manufactured from a nylon-reinforced PVC rubber alloy to prevent the problems traditionally associated with kinking. The hose remains flexible at temperatures as low as -20°C. An optional turbine flow meter is also available.

The FUELMASTER 40 has many safety features including a bypass relief valve for the trigger nozzle, thermal overload protection and a 300 µm strainer to prevent debris from entering the vehicle fuel tank.

Contact: **David Farrer, ITT Jabsco, Bingley Rd, Hoddesdon, Hertfordshire EN11 0BU. Tel: 01992 450145.**

SAM 2500 Lowline forward control sprayer

Sands Agricultural Machinery whose name is associated with quality forward control sprayers have recently introduced into their model range the SAM 2500 litre Lowline. Their full range of machines now have the title Lowline after the name, changes having been made to allow the main spray tank to be located lower without compromising clearance.

All round visibility is improved for the operator and stability is exceptional as the centre of gravity has been reduced by several centimetres. The new SAM 2500 Lowline is powered by a Deutz 6 cylinder air cooled engine delivering hydrostatic drive power through Poclain wheel motors - the size and type having been specified by Sands technical team with a fully laden weight of only 8.2 tonnes spread equally on both axles.

The machine is one of the lightest 2500 litre machines available on the market, giving an unequalled power to weight ratio. On the new machine, all the systems for which Sands are renowned have been retained, air controls, safety cab, tank washing/boom flushing to name but a few. However, the backframe has been remodelled and new type mast has been fitted. The system has been tested by Sands own contract fleet and it is 100% proven before they have put it into general production. It is true to say that any new development at Sands has to go down that route.

The chemical induction hopper is now of a Venturi type, giving clean water through the pump when loading and much faster chemical up-take into the tank. Fibreglass rear mudguards complement the machine with re-positioned new rear lights acting as brake lights when slowing the machine. All in all, a very impressive package from Sands, priced competitively with other manufacturers but delivering a quality product that will be hard to equal. Prices: SAM 2500 Lowline with 24 m boom starts at £57,500.

Contact: **Neal Sands, Sands Agricultural Machinery Ltd, Main Rd, Brumstead, Stalham, Norwich, Norfolk NR12 9ER. Tel: 01692 580522.**

Launch of new positioning service makes precision farming a practical reality

Following the launch of the Italsat F2 communications satellite, Racal Survey has introduced a high accuracy positioning service which will make precision farming in Europe a practical reality. The new Racal LandStar Europe differential GPS service can now provide farmers and agricultural contractors with positioning accurate to 1 metre anywhere in Europe at any time of the day or night and in any weather conditions. The system is expected to become the first choice of precision farming system manufacturers who, by incorporating LandStar positioning within their equipment, can now offer a practical and reliable tool to farmers for whom high quality positioning will be a key factor in many of their activities.

The new LandStar service eliminates the need to establish local reference stations and communications links which may previously have proved too inconvenient and unreliable to make precision farming a practical option. A LandStar receiver needs no operator input and, once switched-on, will provide the user with its precise location anywhere within a region extending from the Western Atlantic to east of Moscow and from the Straits of Gibraltar to Scandinavia. Twenty four hour monitoring of the system at Racal Survey's LandStar control centre in Aberdeen ensures that the quality and accuracy of the differential GPS corrections is maintained continuously. When used as an integral part of an agricultural yield mapping system, or for projects such as soil sampling, LandStar provides a service with a new level of reliability and consistency.

LandStar can be incorporated within any commercial yield mapping system to ensure that co-ordinates of crop growth measurements and subsequent fertiliser distribution requirements are highly accurate and consistent. Experience in various parts of the world has confirmed that this farming technique can offer significant savings by eliminating the unnecessary use of agricultural chemicals and minimising subsequent pollution from run-off.

Basic positioning for LandStar users is obtained from the US operated constellation of Global Positioning System (GPS) navigation satellites. Because of deliberate degradation applied by the US Department of Defence to prevent its use for military purposes, conventional GPS is only accurate to around 100 metres. Although adequate for general navigation, this is not accurate enough for precision farming. Racal Survey has established, therefore, a network of precisely located reference stations around Europe. These are able to measure the deliberate errors being applied to the GPS signals and to calculate the amount by which they must be corrected to restore their accuracy. These calculations are then transmitted to LandStar users via the newly launched Italsat communications satellite. This is in a geostationary orbit which enables the satellite's powerful spot beam to transmit LandStar corrections throughout Europe where they can be received by farmers using only a small saucer-sized antenna.

LandStar is already available in North America and Australia where users receive signals relayed via other regional commercial communications satellites. The service has proved highly reliable and has been welcomed as a major benefit for a range of industries. Because the same LandStar receivers can be used anywhere in the world that the service is available, it is expected to prove attractive to precision farming system manufacturers with international markets.

Racal Survey is part of the international Racal Electronics Group which employs more than 14,000 people in 130 locations in over 30 countries. Racal Survey was the first company in the world to operate a commercial differential GPS system and now has a world-wide network of 22 companies and business units providing a comprehensive range of services to the land positioning and surveying, marine and offshore industries.

Contact: **Paul Eastaugh, Racal Survey Limited, Burlington House, 118 Burlington Road, New Malden, Surrey KT3 4NR. Tel: 01344 388062.**

Fast stream-flow monitor

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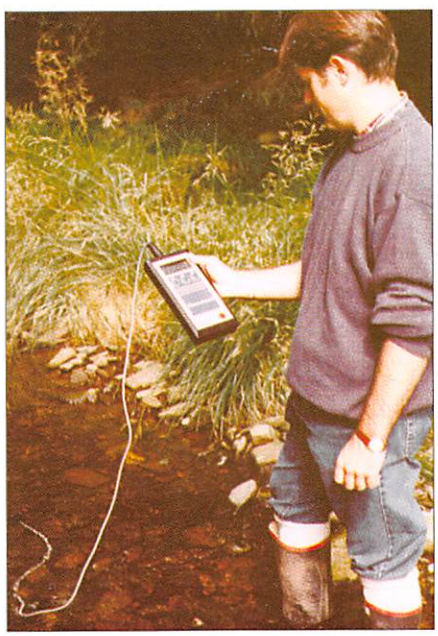
Contact: **ELE International Ltd, Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HB. Tel: 01442 218355.**



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