ENNOR HISTORY

Ennor Engineering Pty Ltd was named and incorporated in 1979 when current director Ian Ennor took over the family business from his father Allan.

The origins of the business date to 1949 when Allan's brother, Tom, moved from Bendigo to Deniliquin and set up a general engineering business, trading as T R Ennor. At that stage Tom had a '38 Chev car, a '39 Bedford truck and hand tools, some of which had been hand made by his father. He began work in an old blacksmith's shop near the Brick Kiln Creek at 137 Davidson St. Deniliquin, formerly operated by W J Musty. Tom had learned the game at the Bendigo works of F W Milne during the twilight years of gold mining in Bendigo. However, his service record shows that, at 14 years, he was employed at Bendigo Sewing Machines Ltd in Bendigo.

The original equipment consisted of the usual blacksmith's setup, including hand operated bellows. A 200 amp arc welder and oxy acetylene plant were added. At the time, the country was still recovering from the war effort. Vehicles, equipment and materials that were not directly related to the war effort were run down or in short supply. Ingenuity was the order of the day, and this placed Tom right in his element. The construction of the Lawson Syphon, which had been interrupted by the war, was continuing. The completion of this project would expand the irrigation development to the west of Deniliquin, so providing work for several contractors who constructed the required earthworks. These contractors were still typically using horse drawn equipment. The maintenance of their equipment provided Tom with the bulk of his early work, namely the repair of crowbars, picks, plough shares, and repairs and modifications to the machines.

Mechanisation was gathering pace in such a way that the horse teams would be soon gone forever and the wool industry was in a golden age. The equipment and

infrastructure required to meet these needs often had to be custom made or modified to suit the task.

Tom began his business in this environment and, although he had the skills and the work ethic, he was overwhelmed by the work despite employing at times three or four people. He was soon looking for more space and more help. On 2nd August 1951 he purchased two nearby blocks of land at 131 and 133 Davidson St, containing a house and old butcher's and grocer's shops. These buildings and the adjacent yard housed the business for the next couple of years. During this time Tom encouraged his brother Allan, who still remained in Bendigo, to join the business. Allan had gained considerable engineering experience during the war at the ordnance factory in Maribynong and later at the ordinance factory in Bendigo. He had also trained and worked in refrigeration.

At about this time a building in Edward St, which had formerly been the Lyceum Theatre, had fallen into disuse and had been condemned for public use. An auction was eventually held in June 1953, where Allan bid on Tom's behalf. Tom purchased the building in negotiations after the auction. Local contractors Hardman Bros. dismantled the building and reassembled it at Tom's site at 133 Davidson St in December 1953. In the meantime Allan had relocated his family consisting of wife Billie and sons Ian and Colin, to the house at 131 Davidson St. Tom already had ideas of succession on his mind. He imagined that, at some time in the future, Ian would grow up to run the workshop and Colin would take care of the administration. Half of his dream would come true. A partnership was formed from the old business and began trading as Ennor Bros.

The brothers were probably destined to a life of engineering. Their grandfathers, Thomas Ennor and Thomas Bolitho had become mining managers of the Victoria Quartz and the Great Central Victoria Co. respectively. These were adjacent gold mines on Victoria Hill, Bendigo. The Victoria Quartz had particular significance in that it was the first mine in the Bendigo area to install steel poppet legs and later, in the early twentieth century, was the deepest mine in the world. This significance was recognized when an underground mining scene from the Victoria Quartz was depicted on an Australian bank note of the period.

Walter Edwin Ennor, father of Tom and Allan, worked for the famous foundry and engineering works, A Roberts and Sons, which had manufactured the poppet legs mentioned above and many other major pieces of equipment for the mining industry including boilers, pumps, compressors and battery crushers. This was an age of Australian manufacturing which is only a memory in the twenty-first century. Nowadays there is little enthusiasm in the labour force generally for this kind of work as evidenced by the difficulty of attracting staff. Perhaps it should be no surprise that, in the twenty first century, it is once again mining which has the capacity to attract staff into this field. Many manufacturing businesses faced with labour shortages and increasing regulatory difficulties have made the pragmatic decision to cease production or source their product offshore.

The old Lyceum, which measured 40' x 110', was and still is a unique kind of workshop. The complete frame is made of oregon. It had a long and colourful history dating back to 1910 when it was owned and named by Samuel Mc Gavin, who had renovated the building and started a skating rink. There was an even earlier history probably dating back to the 1890s when it was known as the Temperance Hall. When Tom had it rebuilt at 133 Davidson St the columns were deemed to be too high and were shortened to 4.3 metres. The shutters which ran the full length on either side were retained except for those which were replaced with louvre windows. A new brick frontage, office and amenities were added but a concrete floor had to wait. The earthen floor was watered regularly to settle the dust. Concrete footings were poured wherever needed to mount machinery. Although this situation was rather quaint it turned out to be a much more comfortable working environment in terms of fatigue on the feet and legs and for the overall noise level. One possible exception was when a job was being tacked up with the arc welder. If the floor had been recently watered and the job was not properly earthed the welding current would pass through the assistant(often a customer) holding the parts in alignment. The 70 volt charge was not enough to kill but enough to provide some interesting comment.

In the 50's, Ennor Bros continued to experience the buoyant conditions that existed at the beginning and more machinery was purchased to provide a wider range of engineering services. A new power hammer was installed to cater for the

continuing forge work and a new power hack saw, indicating the shift towards manufacturing that was to come. More welders were added and a shear, sheet metal rolls, various drilling machines, a hydraulic press, and a centre lathe. During this period the transition was made into a true general engineering business, although the focus remained on servicing agriculture rather than industry. The local municipality and surrounding shires provided regular work, as did many of the district's farmers and graziers. A complete account of the work performed is not possible here. To give a brief account, most of the work performed for the local government bodies and contractors involved repairs to road maintenance equipment. On the other hand the needs of the farmers and graziers were far more diverse. Any single client might require, over a period of years, a woolshed, farm gate, tankstand, irrigation pipe, and repairs to all manner of equipment including tractor drawn implements.

Customer loyalty was a thing to be earned and valued. The golden rule was to never turn down a job from a regular client even if it might be difficult or barely profitable. The benefit was the value of the higher paying work and the continuity of workflow not to mention the pleasure of the long term relationship, which was both mutually dependent and mutually beneficial. In a similar vein, the time spent on design and drawing was never taken into account and therefore was generally done out of working hours.

The ever present problem of finding suitably skilled staff was just as difficult then as it is now. There will always be a lag in skills because it is impossible to anticipate the arrival of new technology or changes in market direction. It is difficult not to admire the men who worked in manual occupations before the age of electric hoists and forklifts. The relentless physical effort resulting from commercial pressures and the burns and bruises that are often part of metal working processes saw the majority move on to easier employment. Those who stayed in the trade shared a particular kind of toughness of the kind described in Longfellow's " The Village Smithy".

The first product to be produced in significant numbers was the bush fire trailer. At the November 1960 meeting of the Conargo Shire Council it was decided to

order the first of these units. Over the next several years possibly 100 of these were produced for use by the surrounding bush fire brigades. The trailer was of a very simple and rugged design particularly suited to local needs. It was fitted with a cube shaped tank measuring about 930x930x930 and an engine driven pump and hoses. The pull was designed to allow towing by truck, tractor, or utility, thus providing maximum versatility in deployment. It was also fitted with a footboard at the rear allowing a firefighter maximum mobility. Although approval for the use of the locally designed trailer was confirmed in June 1962, pressure mounted from the bureaucrats in the Department of Local Government for a highway compliant trailer. The new design was imposed on the local brigades by the end of the 60s when orders for the old design ceased. The new design could not be economically produced in a typical country engineering workshop.

Throughout the period between the early 50's and the early 90's a great variety of products were produced. Virtually all of these were built to individual orders. Some were built in reasonable numbers or as repeat orders, albeit with dimensional changes, others as one-offs. A sample of this variety is given in "Past Products" in the addendum to this account. Over the same period a similar variety of repair work continued. The objective, and a matter of pride, was to affect a repair in such a way that failure would not occur again. Occasionally a choice had to be made between repairing a component, or making a new one from scratch.

As the '60s progressed the volume of business declined. Those items which could be manufactured in quantity, whether a shed or gate or trailer were eventually mass produced by larger manufacturers and distributed through dealers at a lower price. Other businesses had opened up including those with proprietors who had formerly trained at Ennor Bros. Many of the former clients, both government and non-government, had set up workshops of their own and were often very well equipped.

Three other events in the '60s are worth mentioning;

- Present director Ian Ennor started with the firm, first, part-time in 1965 and then, in 1966, full-time.

- Two years later, in 1968, Tom retired. Tom endured a hard working life and had aged prematurely as can be seen in the gallery photo of him aged 43 years in 1951. He had spent 19 years in the business he created and at the age of 60 it was time for a rest. Not one to rest, Tom spent the next couple of years designing and building from scratch a small fishing boat powered by a water jet. It was only a limited success due to lack of power but a remarkable construction just the same. He turned to woodworking and set about producing a number of old fashioned rocking chairs. A lot of the tools and equipment he used were home made or adapted from other purposes. Tom passed away in 1984 aged 76 years.
- At the end of the financial year in 1968 Allan took over from Tom and re-named the business A. Ennor & Co. The partnership included Allan's son Ian and wife "Billie".

The day to day activity at A. Ennor & Co followed the earlier pattern except that the use of the forge eventually stopped. There were many challenges in designing and building equipment. Perhaps the biggest challenge was meeting the client's expectation of cost. This experience showed the importance of refinement of design and the appropriate use of material. Virtually all of the items manufactured at this time had one thing in common-they were all different!

Three products that were produced in some quantity did have a couple of things in common; they were all made for the local municipality and they all suffered at the hands of the local vandals. The first, which had it's origins in the Ennor Bros days, was a steel framed picnic table. Some of them are still to be seen in parks around the town. Others "grew legs" during the night and stumbled into the nearby lagoon. Another product was the garbage bin holder. This was a steel basket somewhat resembling a four petaled flower. It was set into concrete at various intervals around the commercial area and used to support the galvanized bins common to households before the advent of the wheelie bin. The baskets were often "remodeled" at night and occasionally an attempt was made to remove them entirely with the aid of a length of chain and a motor vehicle. A vandal proof alternative came into use consisting of a concrete cylinder and an

aluminium lid. The lids were somehow offensive to the vandals' eyes and soon had to be replaced. Steel replacements were made by Ennors.

From the 50's through the 80's there was a regular output of farm buildings. Most of these were machinery sheds, hay sheds, and wool sheds. Once again, no two of these were identical. Many businesses found that it was more efficient to specialize, at least to some degree. This business would too.

Since 1963 there had been no employees outside the family. This situation continued until 1978 when the business once again started training people into the trade. There was no qualification as such for the general engineer since this occupation requires the skills of a metal fabricator and fitter/machinist as well as a design draughtsman. Most employees were started as boilermaker/welders. Prospective trainees were told that they would have a certificate in four years and they would be a tradesman in eight.

Allan had a conservative approach to the operation of the business. Costs and expenditure were kept to a minimum and little was spent on new equipment. This was an appropriate strategy during lean times. The reduction in capital expenditure could be balanced up to a point by sheer hard work.

In Mid 1979 Allan was approaching 65 years of age. He had spent almost 26 years in the business. Years of heavy lifting had damaged his back and, at time of writing, still experiences pain daily. Allan retired on 30th June 1979.

Ian became the proprietor, changing the name to Ennor Engineering. The business was soon incorporated and the name became Ennor Engineering Pty Ltd. The name had appeared earlier when it was applied, half jokingly, to the side of a friend's motorcycle which Ian had helped prepare for racing.

The transition from general engineering to manufacturing began with an order from Neil Blenkiron and Warren Polglaise for a disc banking machine. These machines are mounted to the three point linkage of a tractor and used for building contour banks for rice growing. The model for this contract was to be the Bock Banker (more commonly known then as a levee plough). This machine was being produced by Tullakool engineer Ralph Bock. The idea of making a direct

copy of a nearby engineer's work didn't sit well so Bock was approached for permission. This wasn't legally necessary but it felt better. As it turned out Ralph wanted to retire and gave his blessing. When the machine was finished Ralph came to inspect the result. He didn't approve of the modifications to the design and predicted that it would break in half. Since Ralph wasn't a man to waste compliments this was taken as a sign of encouragement and a further 370 were built.

Rapid changes in the scale of rice growing and the size of the tractors used meant that the original Bock design was soon outmoded. However the original concept was correct and, by a gradual process of development, the machine was enlarged and strengthened. The tractors of today have a five-fold increase in power over those originally used in this application. Production of disc bankers varied from year to year according to the seasons peaking in 1995 at 35 units per year and almost grinding to a halt in 2007. This latter state of affairs has been due to the unavailability of irrigation water. The seriousness of the situation was confirmed with the "mothballing" of the Deniliquin Rice Mill in Dec. 2007.

The manufacturing and general engineering work coexisted during the early 80s. Manufacturing started to take a higher priority to the chagrin of some of the repair business clients who required prompt attention. Paradoxically the repair business had provided the experience and inspiration necessary to produce whole new designs. When an engineer sets out to design a new implement which is intended to work the soil, he has to allow for loads that are largely unpredictable. This is due partly to the fact that the mechanical properties of soil, in a paddock situation, can't be expressed in a way that would allow meaningful load calculations. An even more difficult problem is the human factor.

Most mechanisms will display a weakness over time. In the days before computer simulation and finite element analysis, the development engineer might have used stress testing followed by field testing. The result from the latter is similar to the experience gained in the repair industry. When the designer has spent years in the repair industry he can observe the results of another designer's work thereby allowing him to move ahead more confidently with his own design.

The elements of disc plough design from the Ennor perspective started to take shape during the conversion of a couple of old offset disc ploughs to a tandem disc gang layout. The work was done at the request of Michael and Andy Howley. The tandem layout, which had been popularised in Australia by the introduction of a number of American designs, was so named because it resembled two offset machines working in tandem albeit in mirror image. This layout overcame a number of the disadvantages of the offset layout. The first complete machine was built for John and Ken Walter in 1983 (The same family had ordered the first Ennor disc banker fitted with 32" discs in 1980). The plough was built to address the problem of working up the badly cut up rice bays that resulted from a rice harvest in wet conditions. It featured a wide and heavy main frame to provide better strength and stiffness and was fitted with 48 discs. Connor-Shea disc gang assemblies were used. The machine is still in use today.

During the first three or four years of disc banker production considerable experience was gained in the manufacture of disc gang assemblies. In 1983 it was decided to build on the experience with the bankers and tandem discs and refine the designs to create a brand new tandem disc plough. The first of these, a 40 plate model was completed in 1984. Narromine machinery dealer and former Deniliquin resident John Mann happened to be visiting and expressed interest in the machine. John took delivery of the machine shortly afterward. Through his efforts the orders started to flow. Dispatches increased to two at a time on his tray truck and eventually to four at a time on his drop-deck trailer. Over a period of 2 months 11 machines were dispatched to Narromine. Following this early success, sales were curtailed by dry seasons and it was not until 1988 that some momentum was once again achieved. During the intervening years, disc banker sales had been brisk and the repair work continued but plough production only amounted to a few units including a couple of "specials".

The growth in capacity that had been necessary to maintain the output of ploughs now needed feeding with more work. The solution appeared to be the opportunity to produce mud brick making machines. These machines were designed to apply forces of 100 tonnes to a mould containing clay bearing soil thus producing building blocks. These machines produced blocks at the rate of

about 180 per hour. By late 1986 four machines had been built, two of which had been exported to India. The project failed due mainly to the failure of the client to make payments as agreed. Despite the losses incurred, useful experience was gained in the application of electronically controlled hydraulic mechanisms. Similar experience followed from the production of a “double dumping machine” which was used to halve the volume of baled hay for export.

In 1988 Ian was approached by machinery dealer Bob Healey with an offer to take over the promotion of Ennor disc ploughs on an exclusive basis, which at this stage consisted of only three sizes. Bob bought with him a huge amount of experience with the sales and utilisation of farm machinery, particularly of disc ploughs. This began a remarkable period of innovation and expansion of the model range. The machine was originally offered in 36, 40, and 44 plate versions. These were known as rigid models. Larger machines were needed to secure more sales.

A design for a 56 plate folding model was produced in 1988. The planning had begun and some parts had been produced a year or two earlier but had stalled at the design for the hydraulic folding mechanism. Bob suggested a design which had been used on a different kind of implement. This was modified and strengthened to suit. The result was a unique design which used hydraulic pressure to hold the folding wings into working position. Sales quickly followed and it became the company’s top selling model until the end of 1989. A 64 plate version of the 56 hydraulic fold had been produced but demand existed for something much bigger.

In 1990 design work began on the company’s first 80 plate hydraulically folded model. Completion of the project was a matter of urgency since the first order had already been received. The machine was designed, built and delivered by 8/2/1990. During those few weeks two other orders were completed. This feat was achieved with a staff of five. The 80 plate machine was one of the most stressful and yet satisfying design projects. It later became part of a range of seven different sized models, ranging from 72 to 100 plates, based on the same framework. With minor improvements it remains a current model.

During the years from 1988 through 1990 machines from 40 plates to 56 plates had become increasingly popular and yet Bob Healey was able to see the possibility of a completely new design for this sector. Bob called it the “swing fold” and it’s success was such that virtually every other manufacturer and supplier came up with their own version. It’s creation was a result of Bob’s foresight and innovation and Ian’s design and engineering. As with the previous designs, it has undergone minor improvements and is produced in many more variants to remain a current design.

The former factory of Trevor Jones Steel Constructions on the Barham Road Deniliquin was purchased in 1990. This acquisition increased the floor space of the business to five times that of the original. From July 1990 all new machines were built at the Barham Rd. factory while the smaller components and repairs were processed at the Davidson St factory. This continued until 1993 when the high level of the Edward River prompted the removal of the operation from flood prone Davidson St. (During the 1956 flood Tom had rowed a boat through the workshop).

The strongest sales of the ploughs were almost invariably in the summer. As sales eased off during autumn. the demand for disc bankers and rollers for the local rice industry kept things going. Bay outlets, more properly termed overflows, also provided a lot of work during the off season for the ploughs. This was particularly so when the area around Hay turned to the production of rice. The demand for bay outlets eventually peaked at 1400 units per year.

In late 1993 Bob identified another opportunity in the market and came up with the solution. The requirement was for a 108 plate machine. The hydraulic fold range had already been extended to include a 92 plate model which had performed very well. The centre part of this range consisted of a 32 plate section. Bob’s solution was to extend this into a 48 plate centre section. By using this centre section with the wing sections already in use in the hydraulic fold models, another range was created. This range (running from 100 to 116 plates) was later coined “hydraulic fold broadacre”. The broadacre shared a lot of componentry with the hydraulic fold machines. As a consequence it was not as arduous in the

design phase as it's smaller cousin had been. The width of the broadacre, relative to it's centrally mounted pull, raised concern amongst some observers. "How do you work out the loads so that the frame doesn't bend" they would ask. The answer of course is a secret. In 2000 and 2001 broadacre models outsold all other models in the Ennor range.

The inherent strength of the broadacre frame was illustrated to a remarkable degree by the "triple" which was a method of coupling three machines together to be pulled by a single tractor. The resulting combination totaled 184 plates and had a working width of 67 feet. All of the force provided by the tractor had to pass through a standard broadacre centre frame. This machine was the brainchild of Bob Healey who had also made a model of the essential parts of the design. The detail and engineering was once again done by Ian, although the design had been well "sorted" by Bob and little additional input was required. The triple (known as the Troica inside the factory) was a brilliant idea but didn't achieve the sales that it should have. When it appeared, most farmers may have preferred to tow a 67 foot spray rig than a 67 foot plough. Nevertheless those who owned it and used it hailed the triple as an unqualified success.

With the addition of the broadacre, the model range was complete for the time being. It was now possible to offer every size machine between 36 plates and 112 plates in 4 disc steps (32 plate and 116 plate additions were made in 2007 and 2004 respectively). There had never been any intention to produce light weight machines or anything below 32 plates in size.

The main difficulty now was to produce in sufficient volume and to cope with the variation in demand through the seasons. The troughs were just as difficult to deal with as the peaks, particularly in the light of an employer's responsibility to his staff. This responsibility was not always reciprocated or shared but, in retrospect, the results were outstanding when comparing the output to the number of people employed. As an example, from 1994 to 1996 inclusive, the factory produced 87 disc bankers and 161 disc ploughs plus various rippers, rollers, and about 3000 bay outlets. All of the above was achieved with a total staff of ten people.

Since 1988 Bob had promoted the products at field days and handled all aspects of sales, trades, delivery and setup in the field. It had been an extremely productive period but cracks were beginning to appear. By late 1996 there had been a couple of casualties, one of which was the marketing agreement with Bob Healey.

A new phase for the company began in 1996. All aspects of the operation including design, manufacturing, promotion, sales, and delivery would be handled in house. Delivery and promotion were recognized as the most daunting of these tasks, particularly in the light of Bob's dynamic performance. A start was made with the purchase of a Scania prime mover and a drop deck trailer. The first deliveries were made with this combination while research began on fitting the largest possible crane to the prime mover. The rationale behind this action was that large machines have to be road freighted in a dismantled state. On arrival at the destination a crane is required to assemble them again. For loads going to remote locations it is more efficient to have the load and crane travel together, on the one vehicle. The solution turned out to be a HMF 36 tonne/metre crane fitted with radio control and a 12.8 metre jib. Numerous calculations were required to confirm the stability of the truck and crane combination, at the same time avoiding a mass limit problem at the front axle. While waiting for the new HMF a borrowed HIAB crane was fitted for the 1997 deliveries. The new crane was fitted in late 1997 and provided sterling service until it was sold ten years later. It was used for deliveries across all of the eastern states from Townsville to Tasmania and as far west as the Eyre Peninsular in South Australia. Machines delivered beyond a radius of 2500 kilometres were sent by commercial carriers. A more economical means of delivery was required for smaller and lighter machines such as disc bankers rippers and the smaller disc ploughs. In 2001 a 200 HP MAN tray truck and trailer was purchased. Both trucks were used to deliver machines that were too big to fit on one truck, for example the double fold broadacre range.

The "double fold" family of machines was the creation of Ian's son Craig Ennor. The unique design combines features of the swing fold and hydraulic fold ranges. They were produced in two groups, the first being the Hydraulic Double Fold

(covering from 96 plates to 120 plates), and the second, the Broadacre Double Fold (covering from 120 plates to 140 plates). These machines were designed in response to a need for large one piece machines (as distinct from the triple), which could be folded into a size compact enough to allow movement between paddocks and along public roads. Although the double fold machines were a design and sales success, they had been introduced near the beginning of Australia's worst drought in living memory. The market was to be the dry land cereal grower and so the timing could have been better. Strong sales of the 35' to 40' machines showed that the most buyers were still optimistic at this stage. The broadacre range could be supplied at a lower cost per foot and had already established a foothold in the market. Despite the differences between the broadacre and double fold, in terms of the size and performance, it is likely that they were competing for the same piece of the market. The smaller machines would win in this scenario and the situation was exacerbated when the severity of the drought was realized. The double fold remains as a current design and when seasons return to normal the advantages of these designs will be appreciated.

Early in the company's production of disc implements there had been enquiry for machines fitted with much bigger discs than normal (24" or 26"). In what became a familiar pattern, development of bigger machines began with a single order for a disc banker fitted with 32" discs. Designated the 532 it was fitted with disc gang assemblies normally fitted to Alfarm's 080 plough. Ordered by brothers John and Ken Walter it was completed in 1980. Cost of production limited sales of this design to three units but the excellent performance of these machines set the stage for the design and production of the highly successful 632,732 and 636 models. These later machines utilised Ennor disc gang assemblies which were broadly based on old Connor Shea designs.

Since larger discs appeared on the company's disc banking machines earlier than the discs ploughs, an ideal opportunity was taken to test the componentry that would eventually be at the heart of a large range of heavy duty machines. Observations of the power consumption in the use of disc bankers and disc ploughs showed that certain components were much more highly stressed in the

former application. The logical conclusion was that componentry that performs well in a disc banker will perform even better in a disc plough.

The pressure for improved design and improved reliability led to the design in 1997 of a new disc gang bearing system. This was first fitted to a 636 disc banker which was ordered by Murray Griffiths of Murrumbidgee River Rice Growers. Apart from the need to be more durable the new system had to be affordable and capable of being retrofitted to machines already in the field and thus be a benefit to existing owners.

The actual design of the housings and associated components was a collaborative effort involving Ian and Craig and was completed in a remarkably short several hours. As with all Ennor housings they were fully machined from steel billets. Craig produced the prototypes on the company's conventional machines. All earlier housings had been by a specialist company using CNC (computer numerical control) equipment. An early problem was encountered during which the operator of the above mentioned 636 Andy Barry, provided valuable feedback and assistance. Andy went on to purchase a number of pieces of Ennor equipment for his own farming operations.

The success of the new system, later coined the 214, was such that it was used on all the company's heavier machines for the next ten years.

Having developed a heavier bearing system the next step was to produce a disc plough to satisfy the enquiry that had existed for heavier and tougher machines. The first of these of these, a 40 plate machine was built in 1998. A range of machines called 32 Series followed. These followed the design of the 28 Series machines fairly closely but were much heavier and stronger. The first 32 Series machine, a 4832, was sold in January 1999.

The next order for a 32 Series resulted in what was, up to that time, the heaviest disc plough made by the company and possibly the heaviest in Australia. The 9632 was a monster weighing around 22 tonnes and required 600 HP to pull. The standard 32 Series specification was deemed to be inadequate for the intended use of the machine. Many areas of the design were in strength and weight by 50-

70%. A number of machines have been built in the intervening years to a similar specification and it is clear that they are without peer when it comes to cleaning up large areas of untidy country. While these large machines have their place the majority of 32 Series owners have found that machine sizes between 48 plates and 80 plates are adequate for their needs.

Before the advent of the 32 Series ploughs it was not unusual to see 28 Series machines used in applications for which they were not intended. The introduction of the 32 Series should have alleviated this problem but for some the additional cost could not be justified.

In January 2003 the decision was taken to introduce a heavier version of the 28 Series. This would have a stronger frame and bearing system but still be limited to 28" discs. Craig designed a new bearing housing unique to this range. In what amounted to a dual upgrade the material formally used for the 32 Series was chosen for the 28 Series Contractor and the 32 Series was changed to a new heavier size. Since the 28 Series and the 28 Series Contractor are so similar in design the new range could be offered in sizes from 32 plates through to 140 plates in 4 disc steps.

Only five months later, in June 2003, a Contractor version of the 32 series was produced. Built as a 40 plate machine this one had to be strong enough work in all conditions behind a D8 Caterpillar. This range also had a totally new bearing system designed which allowed replacement of a bearing without disassembly of the disc gang. Machines in this category have always been approached as special projects. They would never be produced in large numbers and the design cost could not be amortised over a large production run. As always, the design process would be conducted in house by the most efficient means possible. The method was bound to change as the years went by. During the 80's all design work was done by Ian using a drafting machine. By the middle 90's Craig was using CAD (computer aided design) programs. With the arrival of the new millennium 3D solid modelling programs have been in use. It is now possible to design a complex mechanism and display a realistic representation on screen. The same program is used to produce the working drawings required for the production process.

Another step in technology was employed for the design of the company's first 36 Series plough, a 4036. Fitted with 40/36"x1/2" discs and weighing in at over 17 tonnes this giant presented design problems which could not be resolved by reference to earlier experience. Using FEA (finite element analysis) software the strength of the axle system was examined in a scenario where the total weight of the machine was applied to one disc. This test would approximately simulate the effect of the machine being forced out of the ground by an obstacle directly under the centre of gravity. To provide a further margin of safety the load was increased to 25 tonnes which happens to be the capacity of each bearing assembly. Sixteen bearing assemblies are used having a total capacity of 400 tonnes. The bearing housings were designed and manufactured in house.

The developments described above would not have been possible without the early adoption of the best technology. This is particularly so for the machining processes. From the beginning of disc banker and plough production this work was let out. Eventually the dependence on outside suppliers began to limit innovation and to limit output as well. The decision to invest in CNC machine tools followed Craig's return to the business after completing his training with ASTA (Aero Space Technologies of Australia). He spent much of his time there machining aircraft parts using CNC machinery. He also studied the use of CAD/CAM systems at this time.

The first acquisition was an OKUMA CNC lathe in 1998. From this point forward all bearing housings have been manufactured in house. In 2001 an order was placed for a Deckel Maho 5 axis machining centre. At the time of purchase the cost exceeded the total expenditure on capital in the entire history of the company. It was the first of this model in Australia. A smaller 3 axis machining centre was purchased shortly after. While waiting for delivery of the new machines the factory was extended with a new climate controlled section to house all the CNC machinery.

Since manufacturing started at Ennor Engineering with disc bankers a few points are worth noting from that era;

Firstly, a product needs to have a brand name. Most products from small engineering shops carry the name of the proprietor. Why not? It provides a very good incentive to ensure that the product has a good name. Place names and the names of Australian animals would be kitsch in the extreme. A glance through an American machinery magazine confirmed that there too, family names proudly adorn implements. This seems to be particularly so if the name is unusual. Well, Ennor is unusual isn't it? It could work?

Secondly a machine must be recognisable by its colour. The first disc bankers were painted in the same trusty roofing red enamel that was used on almost everything else that had left the factory since the 50's. Before long a colour called zenith blue was chosen. This was used on the first few years' production of disc bankers and the first 12 or 16 disc ploughs. At the urging of a local client a brighter choice was made and the colour became "tangerine". With a change of supplier in the 90's the name became "wildfire". In more recent times the term "Ennor orange" has crept into the language.

Thirdly, there has to be a means of model designation. This system started with the disc bankers and with some luck has been capable of extension to include the extraordinary number of machines listed today. The first part of the number indicates the number of discs on the machine. On disc bankers only the discs on one side are counted since this is enough to indicate the cutting width. The second part of the number indicates the normal (maximum) size of disc fitted. The second part also indicates the strength and weight of the frame. This is useful for categorising machines for their intended use. Generally speaking the first part indicates width and the second part indicates strength. A variety of disc spacings are used on both bankers and ploughs but this is not given in the model number.

The serial number is always the model number followed by the production number. The serial number on a disc banker is stamped into the front face of the frame to the right of centre. The serial number of disc ploughs is stamped into the top edge of the most right hand pull mounting lug. Only the last three digits are used (these are unique to each machine).

Like many small enterprises Ennor Engineering continues to be a family owned & operated business. Since 1979 when Ian came into control, all members of the family including Ian's first wife Kate, and their six children, have been involved in the business. Ian's second wife Verna ran the administration of the business between 1993 & 1997. During 1995 and 1997 5 members of the family were simultaneously involved.

Currently (2008) Craig is responsible for most aspects of administration plus operation of machine tools and new design. Craig's older brother Kelvin has a number of roles in production including processing, fabrication, assembly and finishing. Ian's main role is delivery but continues to play a small part in administration, design & fabrication.