

Engineers Australia Excellence in Journalism Award

About the entry

Entry: Inside the world's first robotic rotary dairy
Reporter: Carlene Dowie
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The Australian Dairyfarmer is a free publication delivered to all Australian dairyfarmers. The associate editor Carlene Dowie was given exclusive access to the world's first robotic rotary dairy in Camden, NSW.

The story explores this technology, answering questions from a farmer's point of view.

The writer also explored a number of other angles including the impact of the research from a number of perspectives – the sponsoring organisation, the worldwide impact and the collaboration between private and public funders.

The story was the first about the robotic rotary to appear in any dairy/agriculture publication worldwide – a testament to the reporter's development of contacts within the dairy industry.

About Carlene Dowie

Carlene Dowie has been the associate editor of *The Australian Dairyfarmer* magazine since 2000, playing a key role in day-to-day editing of the magazine, including writing technical stories about dairyfarming and about farmers.

She is also associate editor of *The Northern Dairyfarmer* and *TurfCraft International* magazines.

All three publications are produced by Fairfax Media.

Prior to that role, Carlene held a number of positions at Rural Press, including Publishing Services Manager with key responsibility for 16 agricultural magazines. She has also worked as a reporter and sub-editor in regional newspapers.

Carlene holds a Bachelor of Arts, majoring in print journalism from Mitchell College of Advanced Education, Bathurst, NSW (now Charles Sturt University).

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Inside the world's first robotic dairy

Australian Dairyfarmer associate editor CARLENE DOWIE was given an exclusive sneak peek at the prototype of the world's first robotic rotary at FutureDairy's Camden site. She reports on this exciting development that promises to open up robotic milking to large pasture-based dairy herds.

ROBOTIC ROTARY



- ✓ Australia's FutureDairy program key part in development
- ✓ Allows herds up to 800 cows to be milked by robots
- ✓ Robot rotary on two Australian commercial farms in 2011

KEY POINTS

AT FIRST glance the prototype of the world's first robotic rotary dairy at FutureDairy's Camden, NSW, research farm looks like something you might find at the back of a farmer's shed. Bits of old pipework are welded on at various points, a crudely constructed feeder sits awkwardly at the front and the platform itself perches on concrete blocks.

It's a far cry from the slick stainless steel model that developer DeLaval will be unveiling at the EuroTier 2010 agricultural show in Germany this month, for which it has already been awarded the EuroTier Gold Medal.

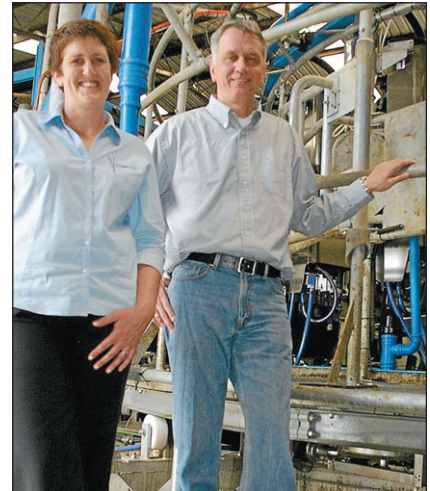
But the prototype is testimony to the painstaking work that the team from FutureDairy and DeLaval has undertaken to achieve this 'holy grail' of dairy robotics. Each welded-on piece reveals a technical hurdle the team had to overcome to make robotics work with a rotary platform.



The lead researcher, FutureDairy's science leader precision farming area Dr Kendra Kerrisk, is passionate about robotic milking. She's been the driving force in FutureDairy's work in establishing how existing single-box robotic milkers can be best used in pasture-based dairy systems.

But she acknowledges the existing systems had limitations in Australia and New Zealand. "When we started the project we anticipated that the cost of single boxes was going to limit adoption on larger farms – so larger being above 300 to 400 cows," she said. "These (the single box units) had been developed for the European market, which is traditionally small indoor herds."

And right from the earliest days of robotic milking, Australian and New Zealand dairyfarmers had been asking for a robotic rotary. "We've recognised the need for this technology for some time," Dr Kerrisk said. "When I started out in New Zealand straight away people were jumping up and down and saying 'what are you doing, this is a waste of money, you



FutureDairy's science leader precision farming area Dr Kendra Kerrisk and DeLaval Australia managing director Mark Brummel in front of the prototype robotic rotary at FutureDairy's Camden, NSW, research farm.

guys are playing with little robots and you're just hobby farmers – what we need is a robot for our rotary'."

But before a company was prepared to commit to the development of the robotic rotary, it had to be shown that automatic voluntary milking systems could work in pasture-based systems, she said. So the work of Max Warren in Victoria, Dexcel in New Zealand and FutureDairy, as well as

Private-public collaboration delivers

THE robotic rotary has been developed as a collaboration between the publicly funded FutureDairy and private company DeLaval.

FutureDairy is an industry-driven, national project. Its primary investors are Dairy Australia, Industry and Investment New South Wales (formerly Department of Primary Industries), The University of Sydney and DeLaval. The project receives support from Dairy NSW and the Dairy Research Foundation.

FutureDairy's science leader precision farming area Dr Kendra Kerrisk said Dairy Australia had recognised that the Australian dairy industry needed a robotic rotary, but it needed someone else to develop it.

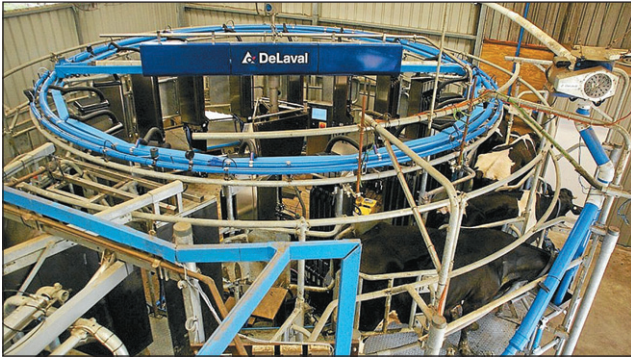
FutureDairy's founder Dr Bill Fulkerson had attracted DeLaval to the project, which was prepared to "have a crack" at developing it, she said.

DeLaval Australia managing director Mark Brummel said the partner-

ship with FutureDairy and Dairy Australia had added to the whole pasture-based dairyfarming angle within DeLaval's product development.

The partners, particularly FutureDairy and Dr Kerrisk, had been tremendous, Mr Brummel said.

It was exciting to have been so closely involved in the development of the robotic rotary. "This is a once in a lifetime experience – to have a paradigm shift in technology like this," he said.



The prototype robotic rotary at FutureDairy's Camden, NSW, research farm. The rough-looking prototype belies the sophisticated research behind its successful operation.



The robotic arm on the prototype robotic rotary dairy at FutureDairy's Camden, NSW, research farm.

those farmers who have taken up the technology in both countries in the past few years, created confidence that developing an automatic milking system for large pasture-based herds would be viable.

DeLaval built a prototype robotic rotary dairy at its test farm in Sweden in 2008 before constructing the Camden dairy in 2009. Then the research work between the parties began in earnest.

A number of technical hurdles had to be overcome to get the technology to work. "The biggest one was moving robot, moving platform and moving and unpredictable live animal and co-ordinating the three so you get the outcome you're after," Dr Kerrisk said. "Being able to do that was based on having a sensor that could have real time tracking of the exact position of the cow."

There were also a range of safety issues for both people and the cows that needed to be addressed. They also needed to work on a whole new set of alarms for the system – for example, it needed an alarm if the platform jammed, something that was not required in the single-box units.

How it works

The dairy is based on an internal, herringbone rotary. This design enabled the team to overcome one of the biggest challenges of trying to put a robot on an external par-

allel rotary – getting the robotic arm through the back legs of the cow and then being able to sense the positions of the teats.

In the new dairy, the robotic arms sit in the middle of the platform and the herringbone means that the arm approaches the cow from the side in front of the back legs.

The cows move into the dairy in the same way as a traditional rotary. The cows wear electronic identification collars and the dairy is programmed to accept a cow only when an allotted time has passed, since it was last milked and when the dairy is ready to accept the cow, for example the stall that the cow would be entering was empty.

"Once the cow's on the platform it has a start-stop rotation that takes the cow from the entry bail position into the next position," Dr Kerrisk said.

The dairy then stops, where the first robot – the robotic teat-washing module – uses a cleaning cup with water and air to wash and dry each individual teat in a similar way to the DeLaval voluntary milking system (VMS).

The dairy then moves the cow into the next position where the automatic cup attachment robot attaches the four individual cups to the cow. The cow then progresses around to the exit position where if it has finished milking the cups are auto-

matically removed, the cow is sprayed and then released.

The system is different from a conventional rotary and more closely aligned to the single robot in that it is purpose-built for individual quarter milking. This means that there are four individual milking cups not a cluster.

One of the keys to the system is a sensor that sits above the cow to detect where it is, unlike the single-box unit that positions the cow in the correct position through use of a feed bin at the front of the cow and a bar at its rear. The sensor means that the robot approaches the cow at the right position (based on its pre-programmed 'memory' of the cow) so that the camera can exactly identify the position of the teats and then the laser-guided cups are attached in pairs.

Cow size is not an issue. "I can show you a photo of a huge big Holstein cow and a little Illawarra heifer standing next to each other on the platform," Dr Kerrisk said.

The system monitors milk yield, somatic cell count and milk colour for each quarter of each cow. "When you don't have people there you need 'eyes and ears' for detecting mastitis," she said

At this stage the system will not have feeding stalls, although the prototype had a small feeding bail to help keep cows inter-

Automatic rotary opens up market for large farms

THE new automatic milking rotary will open up the market for the introduction of robotics to large herds, according to DeLaval Australia managing director Mark Brummel. This would include in Europe where most of the small farms that were interested in automatic milking had already made the installation so the potential was now with larger herds, he said.

DeLaval plans a limited commercial release of the system in 2011.

At this stage DeLaval does not have a fixed price for the new dairy.

"But what I can say is that it will be competitive with other automatic milking options," Mr Brummel said.

The new dairy would cost more than a conventional rotary with all the "bells and whistles" but the running costs would be significantly lower because of the reduced labour input, he said. "We look at it as the total package, not only the initial investment," he said.

"We are talking a realistic period over which to write the investment off, and if you look at the age of current milking systems in excess of 20 years

and if you put it over that period it would be very competitive."

The system won't initially have all of the functionality of the existing single-unit robots. But as the technology was further developed, these would be incorporated into the automatic milking rotary.

Mr Brummel said DeLaval was also committed to ensuring any new developments could be retrofitted onto existing units. "At some stage there might be technological limitations to doing this, but as a company we try to accommodate this," he said.



The robotic arms lined up inside the rotary dairy at DeLaval's farm in Sweden.



The robotic rotary dairy inside the barn at DeLaval's farm at Hamra, Sweden.

◀ ested in coming on to it, particularly when researchers needed cows to make multiple visits. The solution for farmers who want feeding will be out-of-dairy automatic feeders.

Dr Kerrisk stressed that the automatic milking rotary was a new dairy – it was not something that could be retrofitted to an existing dairy.

She also stressed that farmers would still need to attend to a number of tasks around milking. They would need to activate regular washes, the number of which had not been decided exactly, but would be likely to be two to three times a day.

They also needed to attend to any alarms, monitor the performance of individual cows and undertake regular dairy maintenance such as changing filter socks and rubber ware. They would also need to ensure that the dairy was available for regular contract servicing.

Unlike the single-unit robots, the system does not yet allow for milk to be diverted from the bulk milk vat. This means any cows whose milk could not go to the vat would need to be batch milked, so the farm would need to have a separate herd of 'hospital' cows.

How it fits into farm system

Dr Kerrisk said the automatic milking rotary would provide farmers with a number of options from complete batch milking right through to voluntary milking.

But farmers would need to be aware that the throughput of the robotic rotary would not be the same as a conventional rotary dairy.

The robotic rotary to be sold in Australia was likely to be 24-units with the option of either two robots (one teat preparation robot and one automatic cup-attaching robot) or four robots (two of each robot). In the first option, each robot would either teat wash or attach cups to all four teats on each cow and in the second option, each robot would either teat wash or attach cups to two teats on each cow before the platform moved the cow along to the next station, where the next robot would also either wash or attach cups to the other two teats.

Cow throughput would be 50 cows an hour under the first option and 90 cows an hour under the second.

This would mean, for example, that putting a whole herd of 400 cows into the yard and leaving them to be milked while other jobs were completed around the farm would not be feasible because of the amount of time it would take. But it could be feasible to milk cows in batches, leaving them at the dairy while other jobs were done, Dr Kerrisk said. This was not an option with the single-box robots that could milk only 6-10 cows in an hour, she said.

The four-robot option would be able to milk herds of up to 800 cows twice a day if it was used as a batch milking system

for 18 hours a day, allowing six hours downtime a day, Dr Kerrisk said.

Under voluntary milking where the cows came to the dairy themselves, it could manage up to 700 cows.

Dr Kerrisk said the management of the voluntary system would be similar to that used for the single-unit robot farms where feed was used as an incentive to get cows to move through the system.

Pilot farms

The dairy won't be available for commercial release just yet. The next stage in its development will be the installation of dairies on two commercial pilot farms in 2011.

Dr Kerrisk and the team from FutureDairy and DeLaval will continue to work with the prototype at Camden, increasing the number of cows they are putting through it to identify any issues that might cause.

They will also work with the pilot farms to iron out any problems and better understand how voluntary milking will work with large herds.

It's the next stage in what has been an exciting journey for Dr Kerrisk. As a researcher it had been difficult to hold back on telling people about the project in the past two years as it has been subject to commercial confidentiality.

"It will be great to be able to share the story," she said. **D**

Dairy Australia welcomes 'blue sky' development

BLUE sky research developments like the robotic rotary are rare, according to managing director of Dairy Australia Ian Halliday. The new dairy had the potential to change the way Australians dairyfarmed, he said.

"While this technology doesn't get rid of the milk harvesting task altogether, it converts that task from being an essential daily job taking up to six to eight hours on some farms to almost a background activity

requiring less than two hours a day," Mr Halliday said. "The key to the technology is just not about the actual robotics at the point of milking, it's about how the overall farm is managed to allow a herd of cows to voluntarily milk themselves on a daily basis."

It also addressed one of the industry's major concerns about the ongoing availability of labour.

Mr Halliday said FutureDairy was a

"wonderfully collaborative project". It had allowed Dairy Australia to leverage the levy money it had invested to attract additional and further investment to ensure the outcomes were optimised.

Mr Halliday said farmers had been asking Dairy Australia to invest not just in research and innovation in the day-to-day areas but also 'blue sky' research – like the robotic rotary – that would drive productivity.