The world’s first robotic rotary dairy was developed by DeLaval in collaboration with the FutureDairy project. The first commercial installation has been operating at Gala, the Dornauf family farm in northern Tasmania since early 2012.

A prototype of the robotic rotary has been operating at the Elizabeth Macarthur Agricultural Institute, Camden, NSW since 2009. While the Camden prototype is fully operational, its presentation is not as ‘slick’ as the commercial product, having been installed for research, development and testing purposes. Developed for Australia’s pasture-based dairy systems, the robotic rotary is suited to herd sizes between about 300 and 800 cows.

The robotic rotary automates most milking tasks, enabling the job to be performed as a background activity, without the presence of a human operator.

As with any automatic milking system, there are certain milking-related tasks that require operator input. In the case of the robotic rotary, these include:

- activating the washing system;
- changing filter socks and rubber-ware;
- attending to alarms;
- managing a separate herd of cows whose milk is not intended for the factory (e.g., antibiotic and colostrum cows); and
- monitoring individual cow performance.

However, the timing of these tasks tends to be more flexible, eliminating the need to start the working day early in the morning and finish in the evening.
Robotic Rotary
Automatic milking for larger herds

Benefits
The benefits of automatic milking have been well recognised overseas where single unit robotic boxes have been widely adopted in herds up to about 300 cows. The robotic rotary makes these benefits available to operators with larger dairy herds. While there are significant productivity gains to be achieved (through better use of labour and/or labour savings), overseas experience shows that the most-valued benefits are in terms of flexible working conditions and the associated lifestyle improvements.

Automatic milking removes the twice-a-day milking task from the daily routine, allowing greater flexibility for the working day on a dairy farm. The impact of this flexibility reaches far beyond the dairy, potentially changing the whole approach to the dairy business. Automatic milking frees up dairy farmers’ time and energy to use to their priorities, whether they be farming, business, family or lifestyle just to name a few.

Design
The robotic rotary has an internal, rotary herringbone platform, with cows facing outwards and the robots housed in the centre.

While the Camden prototype has 16 milking points or bails, the commercial product has 24 with the option of two to five robots, depending on the required capacity of cow throughput. The system performs the tasks of teat-washing and drying; applying the milking cups, cup removal, teat disinfection and cup flushing. It also monitors milk yield and quality.

The two robot system has a robot for teat washing and drying and another to apply the cups. The five robot system has two robots dedicated to teat washing, two for cup attachment and a fifth for teat disinfection after milking. Each teat is sprayed independently using a camera that locates teats in real time 3D.

Cows stand at a 30 degree angle which allows the robotic arms to approach the cow from the side. This is very different to a conventional parallel rotary where the operator applies the cups through the cow’s back legs.

Unlike a conventional dairy, there are no clusters in the robotic rotary. Instead, four individual cups are attached, enabling ‘individual quarter milking’. This means milk flow rates, yield, discolouration and conductivity are measured for each quarter.

Cows wear electronic identification collars. The system uses historical records to determine expected milk yields per quarter and regularly updates the coordinates of each teat.

This speeds up the process of locating the teat. A sensor located above the platform detects the cow’s precise position, enabling the laser-guided cups to be attached.

The design enables the cups to be attached to cows of varying sizes with equal ease, for example from to a large mature, Holstein to a small Illawarra heifer.

At this stage, the commercial robotic rotary does not have feeding stalls. Out-of-dairy automatic feeders can be installed if needed.

The robotic rotary arm cannot be retrofitted to a conventional rotary dairy, a key reason is that it has been designed to work from inside the platform with side access to the udder between the front and back legs.

Milking approach
The robotic rotary is suited to either batch milking, voluntary milking or a combination of the two.

With a voluntary milking system, cows walk to the dairy on their own, so there is a steady flow of cows being milked throughout most of the day and night. A batch milking system involves bringing the cows up in groups throughout the day. During milking the operator can leave the dairy and do other tasks.

It is not feasible to bring a whole herd (say 400 cows) to the yard and leave for automatic milking while the operator does other farm tasks. This is because the throughput rates of 50-90 cows per hour would involve cows waiting too long at the dairy yard.

Capacity
Commercial DeLaval AMRs™ have a capacity of 90 cows per hour depending on the number of robots installed and the day to day operational procedures applied, including cow flow onto the platform.
This capacity can be used in different ways under different management approaches. For example, it could be feasible to milk 800 cows twice a day; or up to 540 cows three times a day. The design allows for a modular approach, so capacity can be expanded as the dairy business grows. For example, an initial installation could start with three robots – one for teat preparation, one for milking cup attachment and one for teat spraying – with the capacity to milk 50 cows per hour. Subsequent herd expansion could be accommodated by installing extra robots.

In contrast, the single box automatic milking units can milk only 6-10 cows per hour. This is because each robot is idle for almost the entire time the cow is being milked.

The moving platform on the robotic rotary frees the robots up as soon as the cups have been attached to the cow.

**Commercial release**

DeLaval is marketing the robotic rotary worldwide under the brand AMR™ (automatic milking rotary). It is most useful for herds of more than 300 cows. Although developed for Australian conditions, the AMR™ is flexible enough to operate in a variety of farming systems, including grazing, free stalls and loose housing.

It is quite possible that a farm with a single box automatic milking unit could install a DeLaval AMR™ and run both technologies to accommodate herd expansion.

The capital cost for the AMR™ is likely to be more than a conventional rotary with all the ‘bells and whistles’ but the overall farm operational costs should be similar or lower because of reduced labour input.
Automatic milking systems (AMS), or single boxes as they are referred to, have been used commercially overseas for many years.

They were developed for the traditional European market which has small, indoor herds.

FutureDairy research has proven single boxes can operate effectively in Australia’s pasture-based system, achieving both high pasture utilisation and acceptable AMS unit utilisation. However single boxes are best suited to herds of less than 300-400 cows, due to capacity (number of cows that can be milked by each unit in a 24-hour period) and cost.

FutureDairy’s investors – DeLaval, Dairy Australia, NSW DPI and the University of Sydney – recognised that the Australian dairy industry needed an affordable automatic milking system capable of milking herds with more than 300 cows.

The concept of a robotic rotary had the potential to meet these needs.

The robotic rotary design was developed by DeLaval engineers in consultation with FutureDairy researchers, particularly Professor Bill Fulkerson and Dr Kendra Kerrisk.

The initial concept development began in 2005, with the first prototype built at DeLaval’s research facility in Sweden in 2008. The Camden prototype was installed in 2009 for testing under Australian conditions. The system has been progressively developed and refined as a result.

The next step in Australia was the pilot installation on a commercial farm (Gala) in 2011. This installation is being closely monitored and supported by DeLaval and the FutureDairy team. The experience provides the opportunity to identify issues and continue development of the system in the ‘real life’ situation.

Now in its third phase the FutureDairy program focuses on the challenges specifically related to labour and lifestyle with the primary area of research being around the application and impact of automatic milking.

FutureDairy is a partnership of DeLaval, Dairy Australia, the University of Sydney and NSW DPI.

Guidelines

The FutureDairy Management Guidelines for Pasture-based AMS farms provide the practical information needed to adapt a dairy management system to suit an AMS. They are based on the findings from our research at Camden and experiences from commercial AMS dairy farms in Australia and New Zealand.