final report

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Optimise the Leap IV and V Small Stock Automation Technologies

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1 ABSTRACT

The P.PSH.0591 project was to undertake further engineering development of the LEAP IV and LEAP V machines so that they integrate with LEAP III Primal cutter and operate as a commercial boning room would do when it is installed in an Australian lamb processing facility. This includes transfer of product from one machine to the other and software and other modifications to enable processing of the range of product cuts as required by Australian processors.

The project was undertaken over a number of months. LEAP IV and LEAP V machines already installed and independently operable in RTL's development room were linked to a LEAP III Primal cutter and production trials were undertaken to view how the systems operated together. Adjustments were made to the interfacing and processing methods as necessary.

The project has been successfully completed, and RTL is now close to being able to commercialize a fully automated system incorporating primal separation, bone-in middle processing and bone-in forequarter processing.

2 EXECUTIVE SUMMARY

Robotic Technologies Ltd (RTL), a joint venture between Scott Technology Ltd and Silver Fern Farms Ltd has been developing its vision of a fully automated lamb boning room since 2001. Prior to this project RTL has successfully developed and commercialized an automated X-Ray and Primal system, and has developed hindquarter boning systems, bone-in middle processing systems and bone-in forequarter processing systems.

With a view to commercialization of the middle and forequarter modules, the P.PSH.0591 project was established primarily to modify the software and hardware of these modules to ensure they are capable of handling Australian processing specifications, and to integrate the middle and forequarter (LEAP IV and V) modules with the primal (LEAP III) module so that this front end of the boning room can be fully automated.

The integrated system has now been demonstrated to MLA and to the Australian Ovine Boning Steering Group (JBS, WAMMCO, GM Scott and ALC) operating in a fully automated production demonstration producing Australian specification cuts. Further work was undertaken to determine system capacity to allow RTL to specify a configuration for individual processors, and the forequarter system was reviewed to optimize its configuration for best payback.

Leading on from the LEAP IV development, RTL is undertaking Auto Chining (P.PSH.0550) and Auto Frenching (P.PSH.0578) projects. RTL has therefore designed the middle processing system in a suitable way for integration with these and other such in-line processes.

The first phase of commercialization is occurring in 2013 with the P.PSH.0629 project in which LEAP IV middle systems will be supplied and integrated on-site with JBS' and ALC's LEAP III primal systems. It is expected that lessons learnt from these projects will enable RTL to commercialize the LEAP III and IV integrated system widely. More work is expected to occur on the LEAP V forequarter system before this is viable for commercial production.

Benefits from the integrated X-Ray, LEAP III, LEAP IV and LEAP V systems are labour saving, improved yield, cleaner product (reduced bacteria) and improved boning room safety. In particular the systems markedly reduce the need for manual bandsaw processing, hence reducing bandsaw accidents. Refer to the independent Greenleaf cost benefit analysis and associated financial model to calculate expected return on investment for specific situations.

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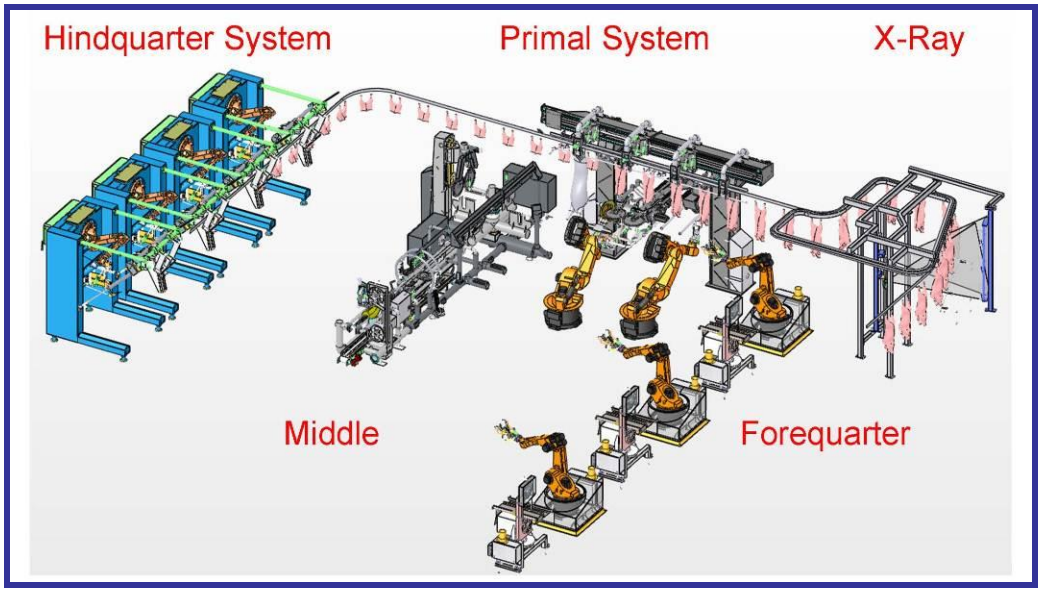
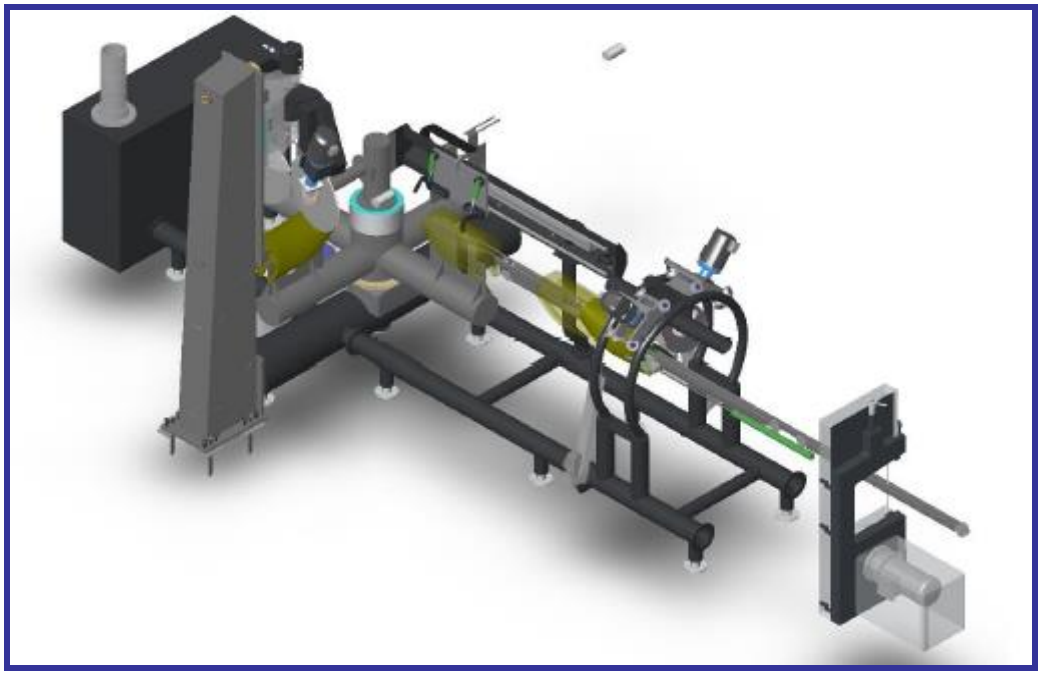
3 BACKGROUND

As part of its drive to develop a fully automated lamb boning room RTL undertook projects P.PSH.0519 and P.PSH.0520. These projects were devoted to the development of automated processing systems for bone-in middle cuts and bone-in forequarter cuts. The RTL boning room front end is depicted below including LEAP IV bone-in middle module and LEAP V bone-in forequarter modules.



These projects were successful with RTL demonstrating standalone module processing to both MLA and the Australian Ovine Boning Steering Group.

The LEAP IV middle system (shown below) was configured to perform the operations of rack and loin separation, flap removal, spinal cord removal and vertebrae splitting.



The LEAP V forequarter system (below) was configured to perform the operations of knuckle tip removal, atlas tip removal, neck cuts, shank and brisket removal and vertebrae splitting.

While both of these systems achieved their project aims, neither of them ran a significant volume of product, there was no focus on meeting cycle time and integration with the primal system was not completed. It was the object of this project to address those key elements.

4 PROJECT OBJECTIVES

1. Modify the software, hardware and materials handling systems to be capable of automatically cutting all of the required Australian Specifications for lamb cuts.

2. Integrate the individual cells of LEAP IV and LEAP V with LEAP III so that the product flows from LEAP III Primal Cutter to the other two secondary processing stations.

3. Integrate the systems into a fully automated production facility and process, to Australian specifications, large enough numbers of typical lambs to give confidence that the system is ready for full production trials.

4. Provide a working demonstration to the Australian Industry to show the potential of the final vision for an automated boning room.

5. Use the information gained within the trials and modifications to be capable of specifying the required items of equipment (e.g. number of robots) to deliver the production capacity to suit the needs of individual processors. This is particularly relevant for forequarter processing.

6. Another subset of this project is to ensure that the Leap IV Middle processing system can integrate with the Auto Chining (P.PSH.0550) and Auto Frenching (P.PSH.0578) projects that are commencing soon.

5 METHODOLOGY

Milestone 1 – Commissioning and testing with volume product

A number of trials were performed to commission and assess the performance of the system with volume product flows. As the system is housed in a production setting, it has been possible for Silver Fern Farms to recover most product for commercial sale.

Milestone 2 – Modifications as required from testing

As a result of trials performed in Milestone 1, a number of modifications were identified and implemented. These included significant mechanical changes as well as more minor tweaks of both mechanical and software systems. Modifications were generally targeted at enhanced reliability or processing speed.

Milestone 3 – Design 10 per minute Forequarter cell – mechanical and vision

A number of changes were implemented in sequencing and vision system software speed in order to reduce the number of cells required to achieve a 10cc/minute throughput. Other changes were identified but not instigated, including determination of how to develop a 10cc/min Forequarter cell.

Milestone 4 – Production trials

Following on from the set-up trials and subsequent modifications, the system underwent significant production trials. While some further commissioning was required during this period, it is fair to say that the system performed very well, easily meeting cut specifications and speed requirements.

Milestone 5 – Project Management

Independent project management assistance was provided by OCTA Associates to ensure project processes are in line with MLA requirements.

Milestone 6 – Support Activities

Primarily this milestone related to communication events with Australian meat processors, in particular visits by the processors to RTL in New Zealand, and visits by RTL to Australian meat processors. This dialogue has been invaluable in helping to shape the technical and commercial direction of the project, e.g. clarifying cut specifications and determining target price points/payback period.

6 RESULTS

The middle and forequarter systems were successfully integrated with the primal system and run in production trials. Australian processing specifications were implemented and demonstrated.

For the middle system the required cycle time of 10cc/minute was met in all areas except for the integration robot. Robot software changes are to be made which are expected to rectify this.

Likewise for the forequarter system software changes are to be made to meet the required cycle time. Processing time is around 2.15 forequarters/minute. 10cc/minute can be met by increasing the number of processing modules, and a study was conducted to determine the most cost effective ways to achieve this.

Cross-cut (rack and loin separation) accuracy was slightly reduced, but the factors influencing this were determined and solutions found. All other processes met accuracies of at least 92%.

Reliability of the various areas was 97% to 100%.

7 DISCUSSION/CONCLUSION

RTL's development represents a quantum leap in processing technology. Following the P.PSH.0591 project it is now possible to take a full lamb carcass and process it into a complete set of bone-in cuts without human intervention.

Benefits to processors are:

- Reduced labour
- Improved yield
- Improved consistency
- Reduced accidents
- Reduced bacteria
- Improved flow of product to downstream processes (driving product and maintaining a steady pace).

The project has been a success and RTL will soon be able to implement full commercialization.