final report

Project code: P.PSH.0550

Prepared by: Mark Purmalis

Robot Technologies Ltd.

Date published: January 2013

ISBN:

PUBLISHED BY
Meat & Livestock Australia Limited
Locked Bag 991
NORTH SYDNEY NSW 2059

Automated Chine Boning (Smallstock) Stage 1 & 2

This is an MLA Donor Company funded project.

Meat & Livestock Australia and the MLA Donor Company acknowledge the matching funds provided by the Australian Government to support the research and development detailed in this publication.

1 Abstract

MLA and RTL have been for several years working towards realising a vision of a fully automated lamb boning room. In Australia the majority of rack saddles are chine boned, so this vision must include an automated process for chine boning. The project was aimed at developing an automated chine boning process for integration into the existing RTL / MLA middle machine.

This project proceeded first through a concept evaluation and commercial justification process then on to early stage prototyping and experimentation. Once a suitable design had been developed and tested using a 'mild steel' prototype, a standalone stainless steel prototype was constructed for testing in an actual production facility; where it successfully processed several thousand rack saddles.

Overall the project was a great success. It fulfilled its basic objective of developing a chine boning process to integrate with the automated boning room vision. It has also produced a new process for chine boning which substantially improves yields, has better cut quality and requires no operator adjustment.

2 Executive Summary

The project was initiated to develop a system for chine boning that could be integrated with the broader vision for an automated boning room. The project proceeded through a process of evaluating different alternatives for chine boning implementation, early stage prototyping through to the completion of a prototype that was tested in a Silverfern Farms Ltd facility in New Zealand.

The project proceeded through four milestones:

- Milestone 1 – A desktop study was conducted to evaluate the viability of an integrated chine boning system and evaluate concepts for implementation. A recommendation to proceed with a project to develop an integrated system was provided.
- Milestone 2 – A proof of concept prototyping stage where concepts were developed, tested and risks mitigated.
- Milestone 3 –A stainless steel prototype was designed and built for standalone testing in a Siverfern Farms Ltd facility.
- Milestone 4 – Testing was successfully conducted at the Siverstream plant in Otago New Zealand.

Overall the project has been very successful. The fundamental objectives of the project been realized in that a viable automated chine boning process has been developed that can be integrated into the broader automated boning room vision.

The following additional benefits have also been delivered.

1. **Increased Yield:** The system will deliver a significant increase over existing methods.

2. **Improved Cut Quality:** It produces a far cleaner cut surface, free of dust and with a smooth finish.

3. **No Operator Adjustment Required:** The process automatically compensates for variations in rack saddle size and shape.

4. **Product Size Extremes:** The RTL machine was specifically designed to process the full range of Australian product sizes.

3 Table of Contents

4 Project Description

The project was divided into four consecutive milestones as shown in the table shown below. The work undertaken in each stage is described in the sections below.

MILESTONE
Milestone 1 Concept Development – Concept Analysis
Milestone 2 Prototype Development – Design – Preliminary Manufacture
Milestone 3 Prototype Development – Design Demonstration System
Milestone 4 Testing

4.1 Milestone 1 – Concept Development – Concept Analysis

This was a desktop process that involved the investigation of viability and options for integrating a chine boning system into the RTL middle machine. It concluded with recommendations that:

- A chine boning process should be included in the fully automated lamb boning room solution as:
  - The majority of lamb rack saddles are chine boned. So to be relevant the system must be capable of chine boning.
  - There are considerable opportunities for yield improvements.
- That the project develop a chine boning process that can be integrated with the RTL middle machine's splitting station.

4.2 Milestone 2 – Prototype Development – Proof of Concept

There were components in the work conducted for milestone 2. These are detailed below:

Cutting Trials
This involved the construction and testing of a series of proof of concept prototypes, shown in Figure 1 and Figure 2. These prototypes were constructed to test design concepts and resolve as many of the design risks as possible prior to construction of the more advanced 'alpha' prototype to be delivered as part of Milestone 3.

Conceptual Mechanical Designs
Here specific mechanical concept designs were modelled in CAD and subjected to a peer review in order to develop the most appropriate mechanical concept. The outcome was the conceptual design, shown in Figure 3, which became the successful prototype built during milestone 3.

Product Size Investigation
Data was collected from Australian sites on product size variation to inform prototype development during milestone 3. This was undertaken to ensure that the system can process the full range of Australian product.

Figure 1 First mild steel prototype.

Figure 2 A later version of the mild steel prototype with angled blades.

The work conducted for Milestone 2 mitigated the bulk of identified risks, and as a result, the risks associated with delivery of a successful alpha prototype were significantly less as testified by the very successful prototype tested in milestone 4.

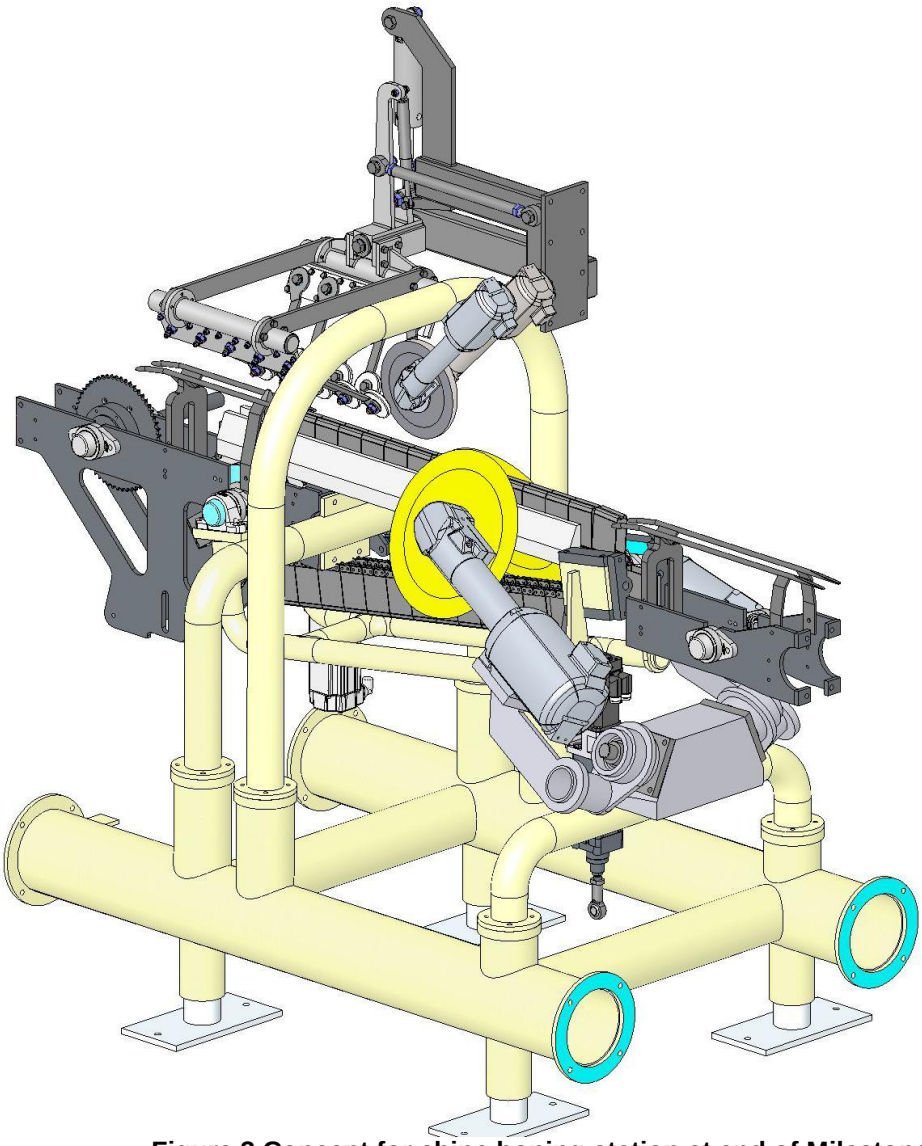

Figure 3 Concept for chine boning station at end of Milestone 2.

4.3 Milestone 3 GO / NO GO Decision

At this point MLA and RTL reviewed the project to determine the viability of its continuation. Based on the success of the project up until this point and the value of the chine boning process to the automated boning room vision, it was decided that the project would continue into the next two milestones.

4.4 Milestone 3. Prototype Development – Alpha

The objective of this milestone was to design and build an 'Alpha' prototype standalone chine boning machine that:

1. Implements the concepts developed in Milestone 2.
2. Can be operated in an actual production environment, is robust and user friendly enough to process several thousand product in testing.
3. Allows the development of vision systems or other means for improving yields.

The outcome of this project was the construction of the stainless steel prototype show below in Figure 4 and Figure 5. This machine was commissioned and tested on a small number of products in the Dunedin workshop prior to the commencement of milestone 4.

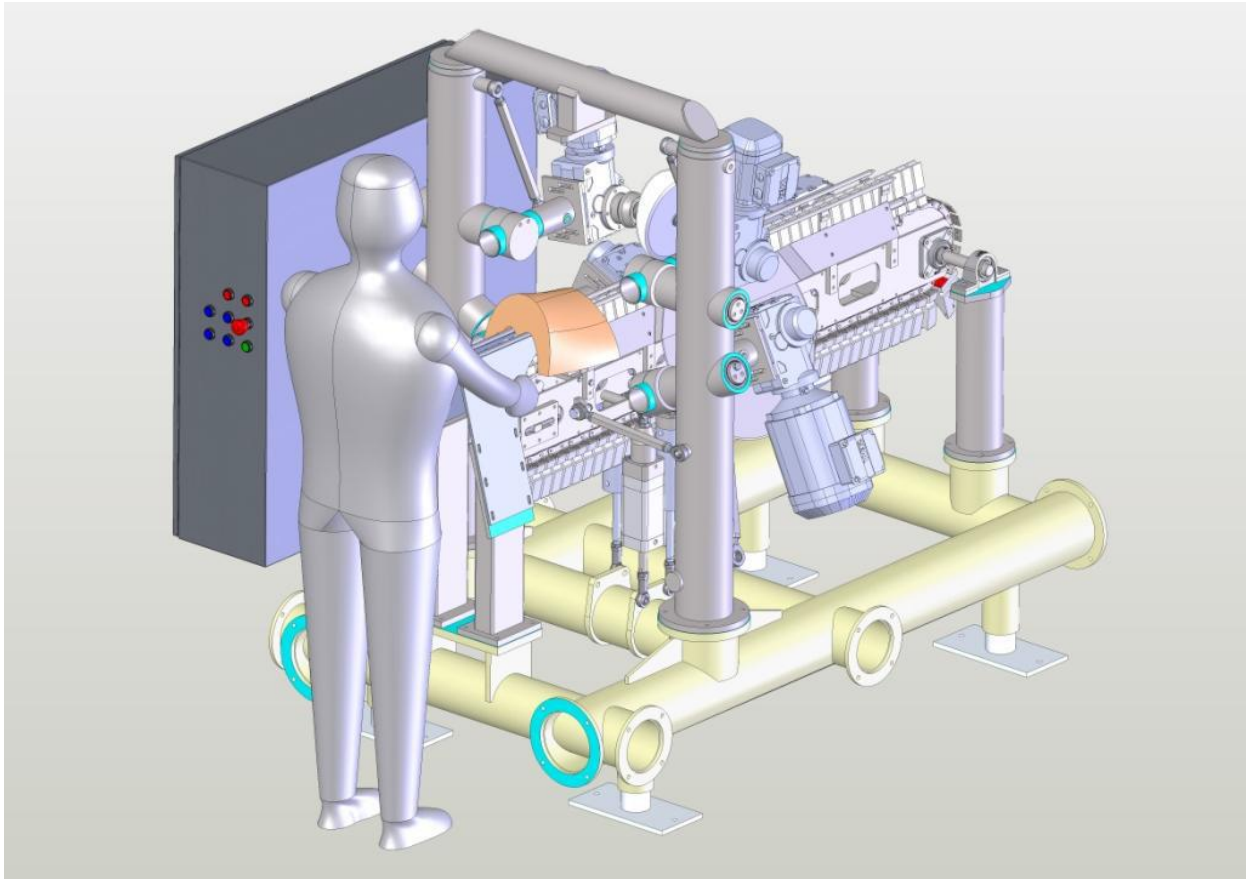

Figure 4 Fully detailed design of the stainless steel prototype.

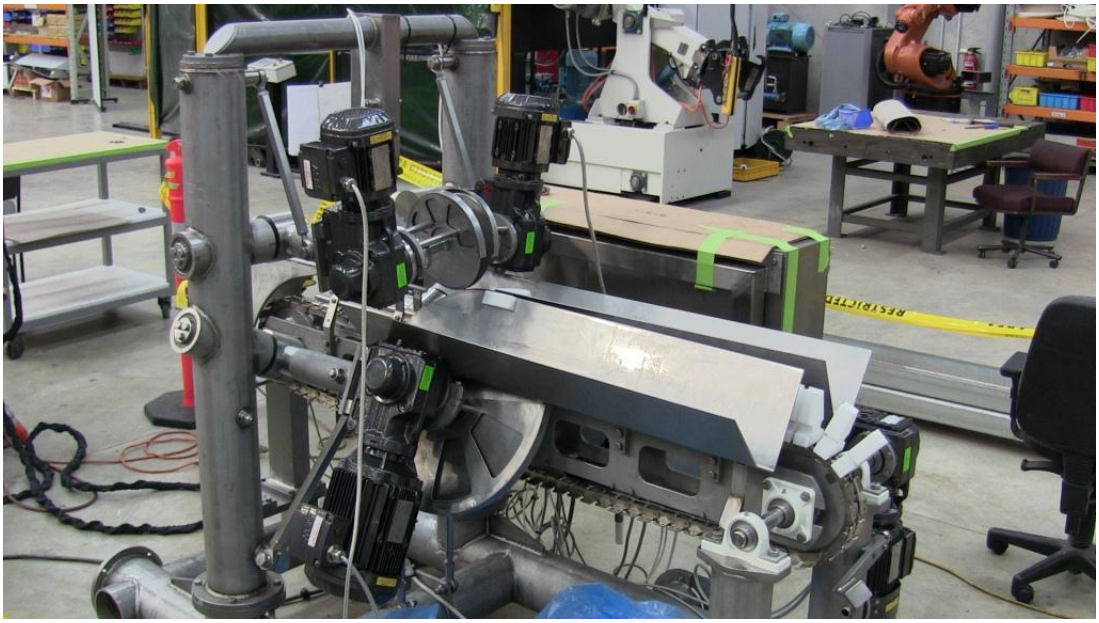

Figure 5 Completed prototype in the workshop.

4.5 Milestone 4. Testing

The objective of this milestone was to install the prototype in a Silverfern Farms Ltd facility and run a large volume of material through it. The key outcomes were:

- The prototype was installed in the facility and demonstrated that it was compatible with the environment.
- Several thousand rack saddles were run through the prototype. This demonstrated:
  - The concept was mechanically reliable and able to withstand production conditions.
  - The cut quality from the prototype was superior to that produced by conventional chine boning methods as shown in Figure 6.
  - The yield testing showed that the prototype delivered significantly more yield than conventional chine boning methods.
- The prototype was demonstrated to MLA and Australian processors.

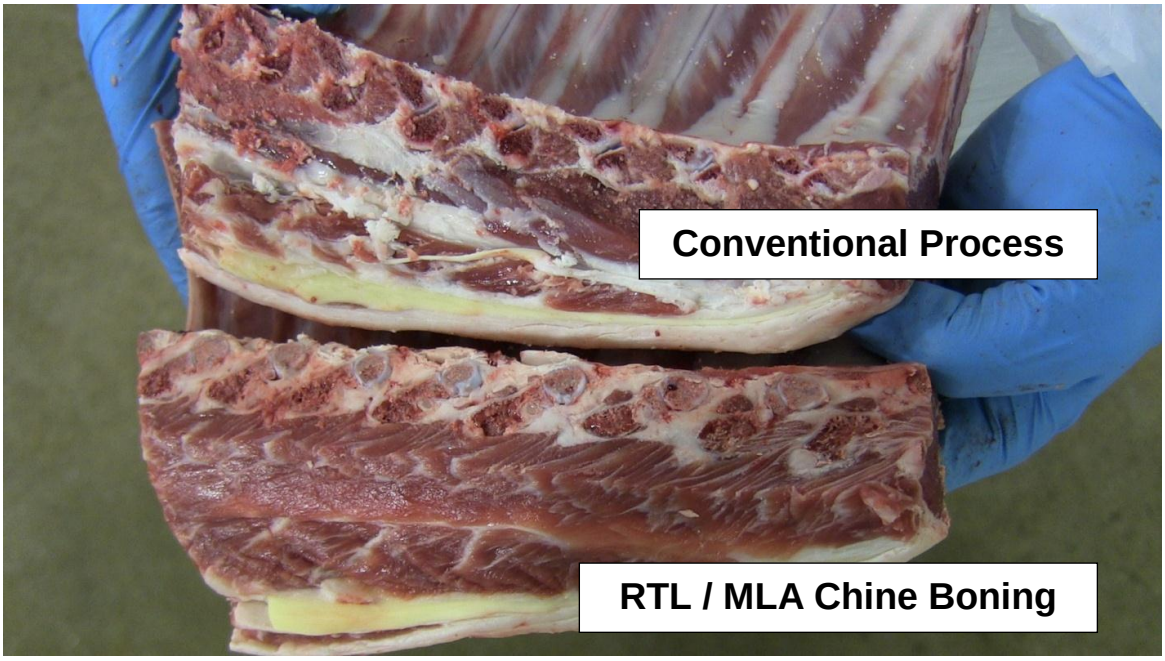

Figure 6 Comparison of cut quality between conventional chine boning processes and the prototype.

5 Conclusion

This project has been successful in achieving its stated objective of developing an automated process for chine boning that can become part of the automated boning room vision. Additionally, the developed system has been demonstrated to:

- Produce higher yields
- Eliminate operator adjustment and hence error.
- Give improved cut quality compared to existing chine boning processes.
- Almost eliminate saw dust.
- Be capable of processing the full range of Australian product sizes.