



final report

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LEAP IV Chine Boning Module Integration

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Executive Summary

This report presents the outcomes of MLA project P.PSH.0648 which involved the integration of a previously built standalone chine boning station into the prototype middle machine.

As part of MLA projects P.PSH.0591 and P.PSH.0634 two middle machines are being built for installation at Australian lamb processing sites and both include a chine boning station. The chine boning station is a significant part of the value proposition of the machine.

The chine boning station was developed as a standalone unit in 2012 and had never been integrated into a middle machine. As such, this project's objective was to identify and correct technical problems associated with the integration before the middle machines were built for the Australian processors.

The key steps in the project were:

- Integrate the previously built chine boning module into the existing middle machine at Finegand.
- Design and build the required integration mechanical, software and electrical systems required for materials handling, product alignment and cut selection.
- Commission the chine boning station ensuring its operation as an integrated production prototype with the middle machine.

The outcomes of the project were:

- Multiple improvements to the design and operability, including:
 - Mechanisms for product alignment.
 - Blade positioning modifications to accommodate a greater range of product.
 - Blade adjustment devices to assist operation.
 - Product evacuation chutes.
 - Washdown robustness.
- The product quality and automation efficiency of the chine boning station was demonstrated and verified by a delegation from ALC, JBS and MLA on the 29th of May 2013.

The project has contributed significantly to ensuring the pending installations of an integrated chine boning middle machine will provide the expected benefits whilst reducing the technical risk to these first early adopters.

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1 Background

During 2011 and 2012 MLA funded a project (P.PSH.0550) to develop a prototype standalone chine boning machine with the intent of integrating this into the LEAP IV ovine middle processing machine. This project was completed successfully with a standalone chine boning technique developed that delivers greater yields than existing chine boning machines.

MLA and Scott are undertaking two projects (P.PSH.0591 and P.PSH.0634) to further develop and install LEAP IV (middle machine) systems at two Australian processing sites. These machines will incorporate the standalone chine boning stations which contribute significantly to the middle machine's value proposition through yield improvement. It is therefore necessary to ensure the Chine boning station functions reliably.

To reduce the technical risk to the two early adopters a decision was made to integrate the original standalone machine into Scott's prototype middle machine and demonstrate the chine and existing middle system developments as an integrated system.

2 Project Objectives

Scott and MLA's objective was to incorporate, test and refine the chine module into the LEAP IV middle machine at the Silver Fern Farms development site in Finegand. The integrated chine boning module was then to be tested and refined.

3 Project Milestones and Description

3.1 Milestone 1 – Design, Build and Install Integration Components

The first stage of this project was to design and build the additional systems required to integrate the standalone prototype into the middle machine, these included:

- Automated loading of rack saddles and short loins.
- Automated unloading of racks and chine bones.
- Automated product alignment.
- Automated means for allowing a rack saddle or loin to 'pass through' the station for splitting.
- Integration with the electrical and control systems of the existing middle machine.

The following figures depict the design of each of these features as they were implemented.



Figure 1: The chine boning station constructed for project P.PSH0550.

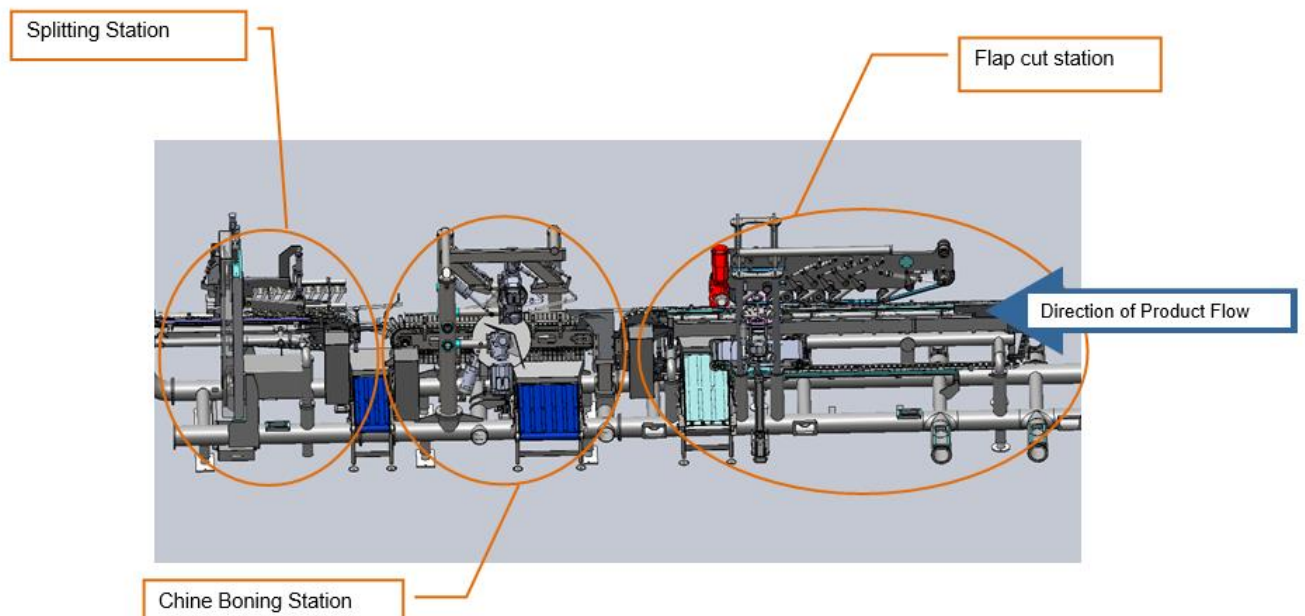


Figure 2: Solidworks model of the last three stations of the middle machine, with the chine boning station integrated.

3.2 Milestone 2 – Installation into Middle Machine

This involved:

- Installing the chine boning station between the flap cut and splitting stations.
- Integration of the chine boning product transfer systems.
- Installing the product alignment system.
- Electrical and control system modifications to make the chine boning machine an integrated part of the middle machine.



Figure 3: Chine boning station being installed.



Figure 4: Chine station integrated into middle machine looking downstream from the flap cut station.



Figure 5: Chine station looking downstream.

3.3 Milestone 3 - Commission, Test and Final Reports

With the chine boning station installed, the Finegand middle machine was commissioned and tested. During this period numerous issues were resolved, these included:

1. **Product Alignment** – For the chine boning station to work, the rack saddle must enter the station with its feather bone between the top two blades. The standalone prototype did not have an effective aligning mechanism. To solve this problem a product alignment system was designed and built. During commissioning this system required extensive testing and modification to ensure reliability. These modifications have been incorporated into the design of the new machines for Australia.
2. **Blade Positioning** – During testing it was found that the original blade geometry did not suit the broader range of product encountered at Finegand. Several weeks of ‘test and modify’ trial work found the critical angles of blades crucial to consistent chine boning. As well as identifying a suitable working range for the blades, a method and understanding for how to adjust these on-site was developed.
3. **Blade Adjustment** – As a result of the blade angle adjustment work a number of modifications have been made to the design for the Australian middle machines, these include:

- Increasing Range of Adjustment – it was found that the range of adjustment on the standalone prototype machine was insufficient. This required that components of the prototype be substantially modified to enable greater adjustment range.
- Development of Jigs – alignment jigs were designed and manufactured to enable precise adjustment of blades.
- Blade Adjustment Screws – the weight of the blade assemblies made them very difficult to adjust without the assistance of a gantry. To make on-site blade adjustment practical the Australian machines are being manufactured with screw type adjustment devices that will enable a maintenance technician to precisely adjust blades without the requirement for lifting equipment.

4. **Product Evacuation Chutes** – Crucial to reliable operation of the chine station is the reliable evacuation of product. Product which isn't properly removed causes fouling with subsequent product. The product evacuation method used is considerably different to that implemented on the prototype. This required relocation of the towers that the blades are mounted on. The towers had to be moved forward of the chining area so that the product is evacuated in the opposite direction to product flow. Considerable test and modification work on stainless steel chutes and conveyor belt designs was required to achieve consistent product evacuation.

5. **Washdown Robustness** – The pneumatic rod lock product used to lock the cutting position of the blades relative to the product had never been used on a commercial installation before. It was found that this product needed substantial modifications to enable it to survive washdown. These included modifying vents, plumbing to dry spaces and upgrading o-ring seals.

Product Quality - At the conclusion of this project the integrated chine boning station was producing product of the same high cut quality and yield that the standalone prototype produced in its trials, but without any manual intervention. This demonstrated that the integrated chine boning station will provide the level of cut quality and yield improvement promised to the Australian processors, refer Figure 6 below for an example of this product.



Figure 6: Example of cut quality from chined product.

4 Project Outcomes

The chine boning station developed as part of P.PSH.0550 was successfully integrated into the middle machine with cut quality and automation being retained to a high standard.

MLA, ALC and JBS Site Visit 29 May 2013

On the 29th of May 2013 a delegation including MLA, JBS and ALC representatives visited the Silver Fern Farms Finegand site to observe the middle machine with chine boning in operation. The system was successfully demonstrated in high volume operation. The delegation determined that the machine was producing chined racks to a very high standard.

5 Conclusions and Recommendations

The project has achieved its set objective:

To incorporate the chine module into the LEAP IV machine at the Silver Fern Farms Finegand research site so as to address any remaining technical issues. This completed LEAP IV system was to be trialled in preparation for the facilitated adoption of this technology at ALC and JBS.