final report

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Prepared by: Steve Maunsell
Scott Technology Ltd

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Meat and Livestock Australia Limited
Locked Bag 1961
NORTH SYDNEY NSW 2059

Integrated Primal and Middle performance upgrade kits - Bordertown

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Abstract

The performance history of the Bordertown machine has been reviewed and, including the learnings from subsequent machines, the Integration, Vision transfer and Flap to Chine transfer has been upgraded.

There is confidence in robustness, reliability and meeting cycle time of these adapted latest designs

The installation and commissioning of the upgrade was achieved with minimal disruption to production by utilising a 1 week process shut down.

The machine is in full production at JBS Bordertown and the project is complete.

Executive summary

The opportunity was identified to increase processor economic benefit by increasing robustness and reliability of three key areas of the lamb Primal and Middle processing system.

The methodology of the design was to take proven recent designs for the integration, vision transfer and flap/chine transfer and make conservative adjustments to enable retrofitting into the older machine.

The evaluation criteria for the upgrade kit was:

1. Machine durability
2. Uptime
3. Cycle time - 10 carcasses per minute is achievable
4. Suitable for installation and commissioning of an existing machine during a shutdown.

A substantial challenge was the requirement to retrofit the new modules on site. This necessitated completely replacing the integration tower and rotating arm. The rotating arm was customised to suit the existing geometry. The vision station transfer (201) upgrade involved the replacement of the station beam to incorporate the transfer mountings and bearings. Whereas the Flap to Chine transfer design was converted such that it could be bolted on to the station as an independent module.

The retrofit of equipment presented various challenges blending updated electronics and control systems into existing equipment and software. Additional challenges were identified in the assessment of existing equipment constraints and how the new equipment would be integrated.

SCOTT used a Project manager, team leader and software engineer, all of who did the original SCOTT project at Bordertown. This was intentional to minimise risks associated with retrofitting.

The methods used in the project were effective and appropriate for future projects.

The machine was “dry” commissioned, validating automatic cycles and cycle time. The required production rate of 10 carcasses per minute was achieved.

Then when the plant started up, “wet” commissioning was able to be done. Some minor adjustments were made but downtime due to the commissioning was minimal.

This project has shown that upgrading this type of machinery in a shutdown is possible.

It is suggested that further upgrades, for example targeting increased processed product value by enhancing the cut accuracy, would be possible.

The extent that project objectives were met are;

Critical modules to achieve improved maintenance of a production rate of 10 carcasses per minute were identified and the new modules designed and built. The evaluation criteria selected was machine durability, uptime, cycle time (process rate) of 10 cpm and suitable for implementation on an existing machine during a shutdown. The design was done such that the new modules could be retrofitted.

The new modules were installed into the JBS Bordertown system. The incorporated new modules were “dry” commissioned (without carcasses). “Wet” commissioning wasn’t possible on the shut down due to the unavailability of product, therefore dry commissioning was extended and the machine performance validated as much as possible. “Wet” commissioning was done on the first products of the first day of production. Only minor issues were identified and minimal production was lost.

The new module designs are available for incorporation into other early SCOTT machines.

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1 Background

The project is to develop and implement design improvements to increase the mechanical reliability and operation longevity of the Bordertown system.

The lamb middle processing module, including integration with the primal machine, was developed as the LEAP IV module and subsequently installed at JBS (Starling, 2014).

This development is to present an opportunity for greater ROI for the SCOTT Primal and Middle machines for the industry as a whole.

The SCOTT Primal and Middle machine at Bordertown was the first integrated machine designed and installed. It was installed in early 2014 and has processed over 7 Million carcasses.

Various areas of the machines were identified, where upgrading to stations similar to the Brooklyn machines was highly desirable.

The integration (138) is a very complex and time critical portion of the machine. The latest design incorporates a servo pitch, in place of a pneumatic axis, and a gearbox on the rotate axis of much greater rigidity and lower backlash.

The transfer (201) from the integration, through the vision and onto the carousel in the middle machine was a long pneumatic cylinder. The cylinder was shown to require replacement and tuning to achieve cycle time difficulties. The electric servo option of later machines has been shown to address these issues.

The transfer (233) between the flap and chine station also was pneumatic cylinder with the similar wear and tuning to achieve cycle time issues. The electric servo option of later machines has been shown to address these issues.

2 Project objectives

The research Organisation will achieve the following objective(s) to MLA's reasonable satisfaction:

1. Design and build critical technology upgrade modules for integrated Leap processing systems based learnings from the Bordertown system
2. Install and commission the upgrades at Bordertown
3. Provide a series of upgrades for incorporation into future installations and retrofitting to existing systems.

Demonstrate successful upgrades to show system maintaining operation of 10 carcasses per minute.

3 Methodology

The methodology of the design was to take proven designs for the integration, vision transfer and flap/chine transfer and make conservative adjustments to enable incorporating into the older machine. Additionally the requirement was to be able to retrofit the machine in place. Bolt on solutions were required.

SCOTT maintains an accurate 3D CAD model from after the commissioning of the original machine which was relied on extensively for the blending in of the new stations on the old machine. Additionally various site dimensions were made to check the CAD model.

The evaluation criteria for the upgrade kit was:

1. Machine durability
2. Uptime
3. Cycle time - 10 carcasses per minute is achievable
4. Suitable for installation and commissioning of an existing machine during a shutdown.

Learnings from the production at Bordertown and the commissioning and maintenance of the other subsequent six machines have been reviewed and used for the basis of the selection of solutions for the Bordertown upgrade design.

A substantial challenge was the requirement to retrofit on site. This necessitated completely replacing the integration tower and rotating arm. The rotating arm was customised to suit the existing geometry. The vision station transfer (201) upgrade involved the replacement of the station beam to incorporate the transfer mountings and bearings. Whereas the Flap to Chine transfer design was converted such that it could be bolted on to the station as an independent module.

The retrofit of equipment presented various challenges blending updated electronics and control systems into existing equipment and software. Additional challenges were identified in the assessment of existing equipment constraints and how the new equipment would be integrated.

SCOTT used a Project manager, team leader and software engineer, all of who did the original SCOTT project at Bordertown. This was intentional to minimise risks associated with retrofitting.

The methods used in the project were effective and appropriate for future projects – with the exception of not having initial products during the shutdown.

4 Results

4.1 Review of Bordertown and subsequent machines

The shortcomings in the original system are around robustness and meeting cycle time. The integration pickup and delivery positions have been validated but the required speed has produced robustness issues. Subsequently the integration rotation pivot has been changed to a servo axis to make the motion smoother and faster. Additionally the servo axis enables “bypass” functionality – negating the manual rotating integration device and bounce board.
The 201 transfer on subsequent machine has been changed to a servo axis, enabling greater control and faster speeds. Additionally it provides a definitive position of the meat surface that is being photographed with the vision system.
The 233 transfer (between flap and chine) has also been changed to an electric servo axis. Also for greater control and speed, enabling readily meeting the required cycle time.

4.2 Establishment of suitable solutions

The new integration device, with servo pivot axis, has been adjusted to fit Bordertown and incorporated into the design.
For the vision transfer (201), a whole new beam assembly was designed and fitted.
For the flap to chine transfer (233), an "independent" module has been designed such that it is bolted up to the existing beam.
The functional portion of these designs has come from SCOTT latest designs which are proven on other processor sites. Validation includes confidence in machine durability, reliability and meeting cycle time.

4.3 Manufacturing drawings

Drawings have been created for the new integration device, 201 servo load transfer, 233 servo transfer device and the pusher for the flap removal station conveyor.

4.4 Installation

Scott had an installed team at the Bordertown facility and performed the work described in Table 1. The resultant work performed is shown in the following photographs.

	Station/Area	Work Performed	Benefit
1	Integration (138)	Tower & Rotate arm replaced	Improved robustness of loading middles to middle machine
2	Vision transfer/load (201)	Replaced pneumatic transfer with electric servo	Improved loading and positioning of middle onto carousel. More reliable achievement of cycle time.
3	Flap station chain (204).	Supplied set of new pushers (suit scallop shape)	Improved transfer of parts
4	Flap/Chine transfer (233)	Replaced pneumatic transfer with electric servo	More reliable achievement of cycle time.

Table 1: Scope of Upgrade

Figure 1: Integration Tower (138)

Figure 2: Integration rotate (138)

Figure 3: Vision Transfer (201)

Figure 4: Flap to Chine Transfer (233)

4.5 Commissioning

The machine was “dry” commissioned, validating automatic cycles and cycle time. 10 carcasses per minute was achieved.

Then when the plant started up, “wet” commissioning was done. And some minor adjustments were made. Downtime due to commissioning was minimal.

5 Discussion

Previous reports of the Primal/Middle machine indicate worthwhile paybacks. The SCOTT Primal and Middle machine at Bordertown has processed 7 Million carcasses and indications are that it is a critical piece of the JBS process with associated significant demands on achieving a very high uptime.

The extent that project objectives were met are;

Critical modules to achieve improved maintenance of a production rate of 10 carcasses per minute were identified and the new modules designed and built. The evaluation criteria selected was machine durability, uptime, cycle time (process rate) of 10 cpm and suitable for implementation on an existing machine during a shutdown. The design was done such that the new modules could be retrofitted.

The new modules were installed into the JBS Bordertown system. The incorporated new modules were “dry” commissioned (without carcasses). “Wet” commissioning wasn’t possible on the shut down due to the unavailability of product, therefore dry commissioning was extended and the machine performance validated as much as possible. “Wet” commissioning was done on the first products of the first day of production. Only minor issues were identified and minimal production was lost.

The support from the JBS team was exemplary. The benefit of the processor support was demonstrated by the install and “dry” commissioning being completed within the shutdown duration. The JBS team is competent in identifying minor issues and remedying with SCOTT remote support. The outcome is that minor issues have been identified and fixed with minimum disruption to production.

The identified upgraded modules could be utilised for upgrading other early versions of the SCOTT primal and middle machines. There would be minor customisation per machine.

These upgrades were confined to transferring product between the Primal and Middle machines and the transfer between the flap and chine station. The benefit targeted was robustness and reliability. There is likely to be numerous other upgrade options targeting improved resultant value achieved from enhanced accuracy of hitting optimum cut locations.

6 Conclusions/recommendations

The integration, vision transfer and flap to chine transfer of the Bordertown Primal and Middle machine has been upgraded with a version of the latest SCOTT proven designs that have been adapted for retrofitting to the earlier generation of machine. There is confidence in robustness, reliability and meeting cycle time of these adapted latest designs

The installation and commissioning of the upgrade was achieved with minimal disruption to production.

7 Key messages

7.1 Recommended changes of behaviours/practices for producers/processors

It is recommended that the utilisation of the latest SCOTT design of devices for the integration between the Primal and Middle machines and electric servo transfers offer robustness and predicted reliability benefits.

7.2 Likely economic, social and/or sustainability benefits for producers/processors

The associated benefits of utilising the latest SCOTT design of devices for the integration between the Primal and Middle machines and electric servo transfers are economic.

8 Bibliography

Pers. Comm. Starling, S. (2014). *P.PIP.0327 JBS Fully Automated X-Ray Lamb Middle System.* North Sydney: MLA.

9 Appendix A

9.1 Additional Photos

Figure 5: Integration detail (138)

Figure 6: Integration Overall (138)

Figure 7: Vision transfer overall (201)

Figure 8: Vision transfer detail