final report

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JBS - Beef Knuckle Puller Trial
IMS-TEXAS

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Executive summary

An in house JBS knuckle puller was modified to a foot operated immobilised configuration to remove the extensive labour required with the current commercial version. Primarily the changes consisted of a small overhead hanging truss, a counter balance and access to a compressed air line (see Figure 1).

Figure 1: Modified and immobilised pedal operated JBS knuckle puller station.

The model K6D-A Knuckle Puller has been designed to replace and operation that requires manually pulling a large muscle from the beef carcass. To overcome this problem it was attempted to design a piece of equipment that is pneumatically operated by foot pedals and therefore eliminate the labour intensive aspect of pulling knuckles. The operation consists of the operator initially cutting or marking the muscle on the carcase (Refer to Figure 2).

It is difficult to evaluate the cost benefit analysis on this technology through preliminary trials. It should be noted that Victoria Worksafe claim that the average musculoskeletal disorder (MSD) costs approximately $52,000. If the knuckle puller saved just one MSD, it is assumed the payback would be less than 0.2 years.

The recommendation from this project is that although JBS may not end up using the IMS in all its knuckle pulling processes, it proves that in some cases the introduction of cheaper alternative technology (to semi- or fully automated technologies) is able to inspire individuals to solve long lasting problems in their business such is the case at JBS Dinmore and JBS Brooklyn.

A

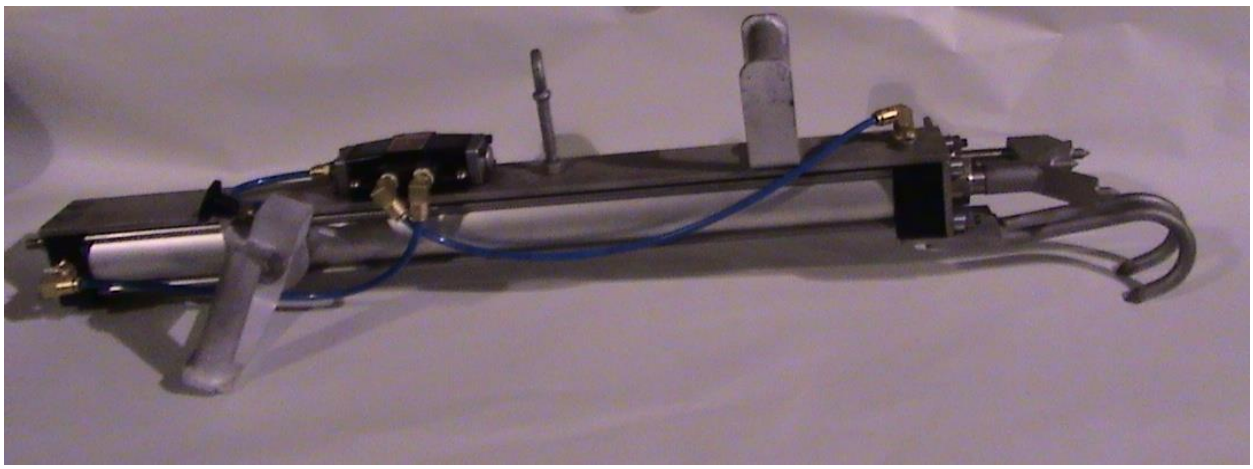

Fig2A – IMS puller

B

Fig2B – Modified pedal operated JBS puller

C

Fig2C – JBS puller

D

Fig2D – Knuckle pulled using JBS puller

E

Fig2E – Retracted knuckle puller

Figure 2: Modified and immobilised pedal operated IMS puller station in operation to assist with removal of knuckle.

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1 Background

Currently, every process in the beef industry utilises manual labour. Mechanical assistance and robotics exist in osolated instances. Boning beef butts is still performed manually in those boning rooms , with experienced boners using knieves and boner's hooks to remove muscles from the bone.

Two of these butt boning taskes (aitch bone removal and knuckle boning) require strategic knife cuts and relatively strenuous pulling to complete the task.

For the purpose of assisting in these operations a K6D-A knuckle puller was sourced to trial as a suitable equipment alternative to make the knuckle pulling task less strenuous (see Fig 1).

The main aim of automation in the short term is to reduce the heavy manual nature of the boning tasks with the aims of reducing the worker injuries, and opening up the industry to a greater spectrum of the workforce. The hindquarter was chosen because there is commonality here between both quarter-boning and side-boning plants, and because this is the highest value portion of the carcass. Knuckle pulling was chosen as it is identified as one of the most physically demanding tasks on a boning chain. For the purpose of assisting in these operations a K6D-A knuckle puller was sourced to trial as a suitable equipment alternative to make the knuckle pulling task less strenuous (See Figure 1).

The model K6D-A Knuckle Puller has been designed to replace and operation that requires manually pulling a large muscle from the beef carcass (Refer to Figure 2). Stainless steel hook configuration to attach to the knuckle allowing the hooks to attach to the muscle behind the patella bone (see Figure 1).

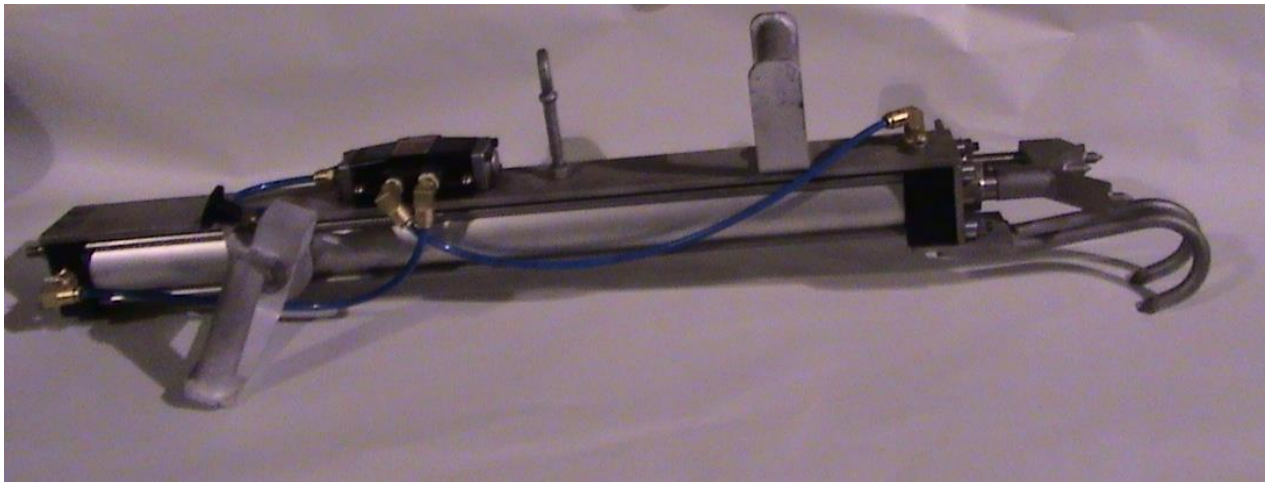

Figure 1: Off the shelf IMS knuckle puller

To overcome this problem it was attempted to design a piece of equipment that is pneumatically operated by foot pedals and therefore eliminate the labour intensive aspect of pulling knuckles (See Figure 4). The operation consists of someone cutting or marking the muscle on the carcase.

The operator of the knuckle puller hooks the muscle behind the patella bone. Using the bone as leverage the operator then engages the cylinder to extend against the shank bone. The knuckle

is pulled from the bone and put on a conveyor for further trimming. The majority of the components used in the knuckle puller are made of stainless and aluminium. All parts coming in contact with the product are made of stainless steel. Considerations of design and material selection have resulted in a machine that is easily maintained in a sanitary condition. All mechanical components are ruggedly constructed which should provide for years of low maintenance operation.

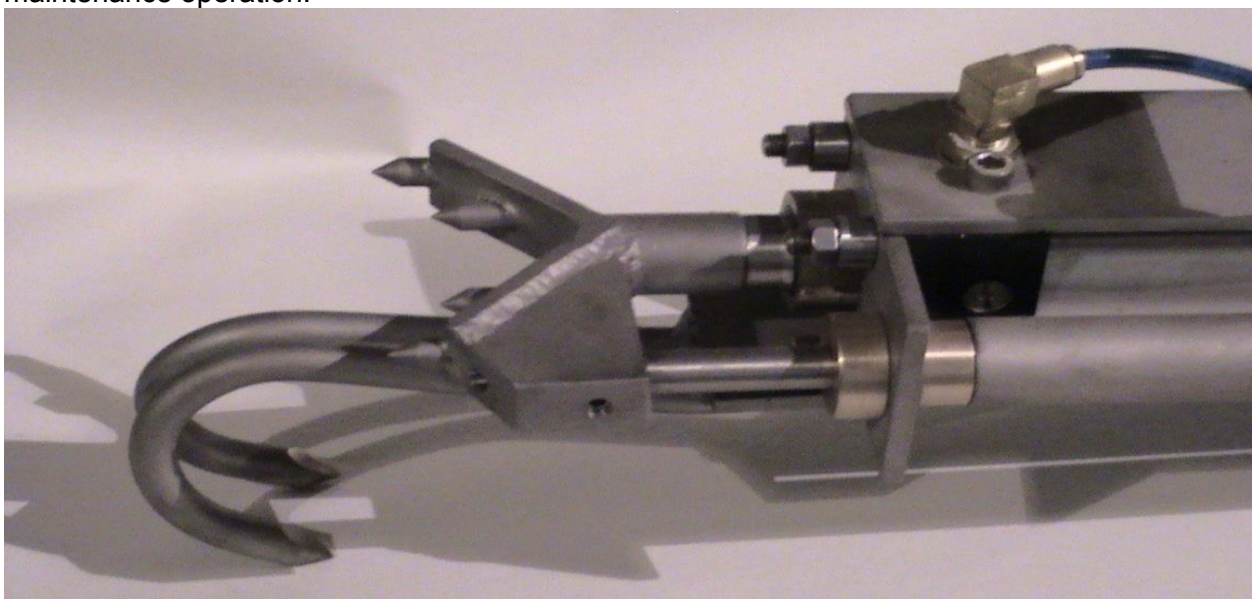

Figure 2: Stainless steel hook configuration to attach to the knuckle allowing the hooks to attach to the muscle behind the patella bone.

2 Objectives

The objectives of the research were to

- Import and Install the identified beef pulling technology (IMS Texas knuckle puller) within an Australian Beef export plant;
- Conduct trials to demonstrate the technology within a JBS boning room, assessing the technology in the context of an Australian Export Beef Plant with a view to developing / refining technology if required; and
- MLA & JBS to develop communication materials for dissemination to wider industry by MLA.

3 Experimental

The IMS knuckle puller arrived on site at JBS Dinmore and was immediately installed onto one beef side chain line. Installation comprised of a small overhead hanging truss, a counter balance and access to a compressed air line.

The IMS knuckle puller was tested to identify if there were OH&S benefits to be gained by its installation & use.

The knuckle puller proved an immediate low cost success demonstrating the ability to pull knuckles with little or no effort from the operator. The unfortunate issue was that during operation the operator has to have both hands on the equipment meaning that if any knife work was needed they would need to stop the puller, apply the necessary knife work, then try to pick up from where they left off. It was considered that the IMS knuckle puller would be more suited to a single high speed line where one operator could do machine pulling only and the balance of the team do the seam preparation and post pulling removal of the knuckle without the need for an additional labour unit. It was thought that the line speeds of both JBS Brooklyn and JBS Townsville would be a better option.

The trial at Dinmore although successful determined the equipment not suitable. However Dinmore were so inspired by the ability to reduce OH&S risks associated with the task of pulling knuckles they developed their own design that can be used by a boner using their non-knife hand and still have the ability to apply additional knife work simultaneously with the pull action.

The IMS unit was shipped to Brooklyn where it was trialled as a knuckle puller and a beef head jaw puller. The IMS puller has inspired JBS Brooklyn to develop and solve OH&S issues associated with removing jaw bones from beef heads on the slaughter floor.

The IMS puller was then shipped to JBS Townsville where it is undergoing inline testing for suitability to the knuckle pulling process.

4 Results of Commercial trials

The IMS knuckle puller although deemed unacceptable for JBS beef boning lines has been a major R&D success in the fact that it has since inspired the JBS management team to develop an in house version which was more user-friendly, versatile & flexible for pulling beef knuckles.
The apparent benefits of this exercise has seen the development of a simple, cheap knuckle pulling solution that is now being installed across all JBS beef sites for knuckle pulling, aitch bone pulling or both combined in smaller sites (Refer to Figure 5).

Figure 3: Removal of beef knuckle assisted by the modified JBS puller.

The adoption of a mechanical puller can reduce the physical problems of the boning task, and will increase the consistency and the quality. Another possible advantage will be an increase in yield. This machine is able to produce a greater pulling force than a boner, thereby reducing the amount of force and pressure necessary to free the muscle from the femur bone. Furthermore, it is expected that a lower level of training will be required by using the puller. It is also expected that the knuckle puller will remove all need for physical excursion in this task, hence reducing the risks of sprains, strains and fatigue, resulting in a more consistent level of performance by boners over the course of the shift.

It has been JBS's experience that equipment such as the knuckle puller will promote longevity in the boning tasks and enable boner to stay in the industry longer with fear of long term injury.

Early work in developing boning aids for assistance in pulling aitchbones and knuckles involved concept development in an off-production environment (See Figure 6).

Figure 4: Clean bone removal of beef knuckle using the modified JBS puller.

The purpose of this project is to install an identified overseas technology into an Australian Beef Processing facility to trial and assess the technology for suitability within the Australian red meat processing environment.

JBS have for some time been endeavouring to identify an alternative technology that could be integrated into their Australian operations that would offer a more attractive value proposition than the current manual assist technologies commercially available in the Australian market place.

The focus of this project was to trial the identified technology once it has been integrated into a large Australian Export Beef processing facility, to ascertain whether the technology performs to a satisfactory commercial level, while assessing it for any adaptations which could make it further suited to the Australian Beef processing environment.

5 Business case

The R&D work for a knuckle pulling solution has successfully solved the OH&S repetitive strain issues associated with this task. There are no labour saving associated with this installation but fatigue reduction provided by this technology will provide yield constancy over the working day.

It is difficult to evaluate the cost benefit analysis on this technology through preliminary trials. It should be noted that Victoria Worksafe claim that the average musculoskeletal disorder (MSD) costs approximately $52,000. If the knuckle puller saved just one MSD, it is assumed the payback would be less than 0.2 years.

Once the technology has been successfully rolled out to all compatible JBS operations, the technology will be available to the Australian processing sector. It is anticipated that the device will be offered for commercial sale within Australia through a commercialiser that is to be determined.

6 Implications and Conclusions

It has been JBS's experience that equipment such as the knuckle puller will promote longevity in the boning tasks and enable boner to stay in the industry longer with fear of long term injury.

The lesson learned from this R&D project is that the solution isn't always found in expensive technology. For a relatively low cost project this R&D has not only removed injury risk but removes fatigue and promotes longevity in our employees.

The IP generated from the commercial trails will be a report of the application of this technology to the red meat industry, which MLA will disseminate. MLA will own the report IP. The puller itself is an off the shelf unit, with its IP owned by the existing manufacturer.

7 Commercialisation / Dissemination strategy

At the conclusion of the project if successful, JBS will roll out the technology within other JBS Beef processing plants.

A commercial video will be developed in conjunction with MLA and a yet to be identified commercialiser for distribution to the wider industry. If the technology proves unsuccessful MLA will still be supplied a report detailing the reasons the technology wasn't suitable for dissemination to the wider industry.

MLA & the commercialiser of the technology which is currently being determined will disseminate to wider industry general communications, videos and practical demonstrations.

At the conclusion of this Project, JBS and MLA will have delivered:

- A report detailing the impact of the technology on yield, quality aspects of the product processed by this technology, potential labour savings and anticipated economic impact will be completed at the end of the project.
- A video of a system in trial operation will be produced in conjunction between MLA, JBS in the course of the project.

8 Appendix A – Equipment Specifications

(Source – http://www.imstexas.com/knuckle_puller_(24_x_30stroke).htm)

Knuckle Puller (24" X 30"Stroke)

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Knuckle Puller

The model K6D-A Knuckle Puller has been designed to replace and operation that requires manually pulling a large muscle from the carcass of a bovine.

To overcome this problem we have attempted to design a piece of equipment that is pneumatically operated and therefore eliminate the labor-intensive aspect of pulling knuckles. The operation consists of someone cutting or marking the muscle on the carcass. The operator of the knuckle puller hooks the muscle behind the patella bone. Using the bone as leverage he then engages the cylinder to extend against the shank bone. The knuckle is pulled from the bone and put on a conveyor for further trimming.

The majority of the components used in the knuckle puller are made of stainless and aluminum. All parts coming in contact with the product are made of stainless steel. Considerations of design and material selection have resulted in a machine that is easily maintained in a sanitary condition. All mechanical components are ruggedly constructed which should provide for years of low maintenance operation.