final report

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Australian Boning Room Steering Committee Visit to New Zealand

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Background
Over the past three years MLA has been engaged in a strategic approach to developing a vision for an automated boning room for sheep. One of the significant contributors to the process and equipment design has been Scott Automation with four technologies currently under development (X-ray Sensing, Primal Cutting, Carcass Portioning and Middle/Saddle Processing). This current suite of R&D projects are evolving and delivering on proposed benefits.

The journey has been long and would not have been successful without the steering committee of Australian Smallstock processors formed. Although this strategy still has at least another 5 years to run time has come to initiate a similar process for beef boning. Keeping in mind the gestation to initiate such strategies, it is planned to commence the beef boning strategy discussions in early 2006 to enable a possible presentation to the AMPC Technology Committee and AMIC by the end of the current financial year.

STEP 1 Meeting and Planning in New Zealand in Feb 2006
To commence discussions it is planned to take a handful of selected Australian beef processors to New Zealand to:

- See the developments completed and underway in smallstock automated boning and appreciate the true potential;
- Understand the capability of Scott Automation;
- Understand the connection with PPCS (New Zealand Processing Company);
- Undertake beef boning in New Zealand to compare Australian boning v New Zealand boning; and
- Develop an outline for a vision for an automated beef boning room.

The processors have been selected by AMPC and MLA were based on the following criteria:

- A representative of the AMPC Tech Committee;
- Have a connection with AMIC;
- Whose companies may be interested in a strategic automation approach and
- Who can think of the industry good as well as their own companies
- Who are innovative thinkers

AGENDA

Day 1 – Monday 6th February – Travel from Australia to Dunedin (Normally at least a two plane trip)

Day 2 – Tuesday 7th February – Spend a day at Scott Automation to view their capability, understand the evolution of smallstock boning vision, review current developments and completed equipment in operation at PPCS factory. Fly to a PPCS Beef Boning Plant (probably Hastings)

Day 3 – Wednesday 8th February - Australian processors and PPCS will demonstrate the way that they currently bone out beef with all similarities and differences documented and a general discussion on why certain practices are engaged.

Day 4 – Thursday 9th February - Development of options for a vision. Include brainstorming exercises and lateral thinking but must conclude with at least 1-3 alternative visions and the identification of a few projects to commence. Some of these projects (or parts thereof) may be submitted to the AMPC Technology committee for funding during 2006/07.

Participants
MLA – Sean Starling, Bert Sorenson, David Doral, Ian Richards and Christine Raward

AMPC – Bruce McKendry

AMIC – Conrad Blaney/Steve Martyn (Were not available to attend)

Processors – Gary Burridge (NCMC), Gary Thomas (Rockdale), Mick Nolan (Nolan's), John Hughes (Teys) and Shaun Crapp (Cargill)

TRIP OUTCOMES

- The Australian processors identified two tasks for Scott's to investigate automating. These tasks are boning out the Aitchbone and boning out the Knuckle.
- It was proposed that the processors involved in the discussions become the Australian Beef Automation Steering Committee ("the Committee"), in conjunction with MLA and AMPC.
- AMPC and MLA requested that Scott's provide MLA with a proposal (attached) to automate these 2 tasks to 2 different levels:
    - A Manual Assistance Device, which performs the pulling task to aid a manual boner ***(this proposal)***
    - Full automation of the tasks (proposed as a syndicated Plant Initiated Project)

Investigation

In assessing the automation of the Aitchbone and Knuckle removal, Scott's have spent 2 days at PPCS Belfast with Boning Foreman David Butler. After reviewing the techniques necessary to perform the two tasks, Scott's processed 3 buttocks using a chain-block fixed to the floor to simulate a mechanical puller. Importantly, it was found that we could use the same technique to do both cuts. This means that subsequent development can focus on one device, rather than designing two different mechanisms.

The results were encouraging. Scott's found that mechanising the pulling action eliminated the physical strain normally present in these tasks.

Furthermore, yield data from the 3 sides showed a trend towards a greater yield than PPCS's target values (probably because it was possible to pull harder and therefore cut less).

Figure 1: Aitchbone Pulling

Figure 2: Knuckle Pulling

Subsequent to Scott's visit, David began processing more buttocks in this manner, and is comparing the yield from these to the yield achieved from the "pair" of each buttock as processed at rate on the chain. Preliminary results of 2 carcasses are shown in Figure 3 below.

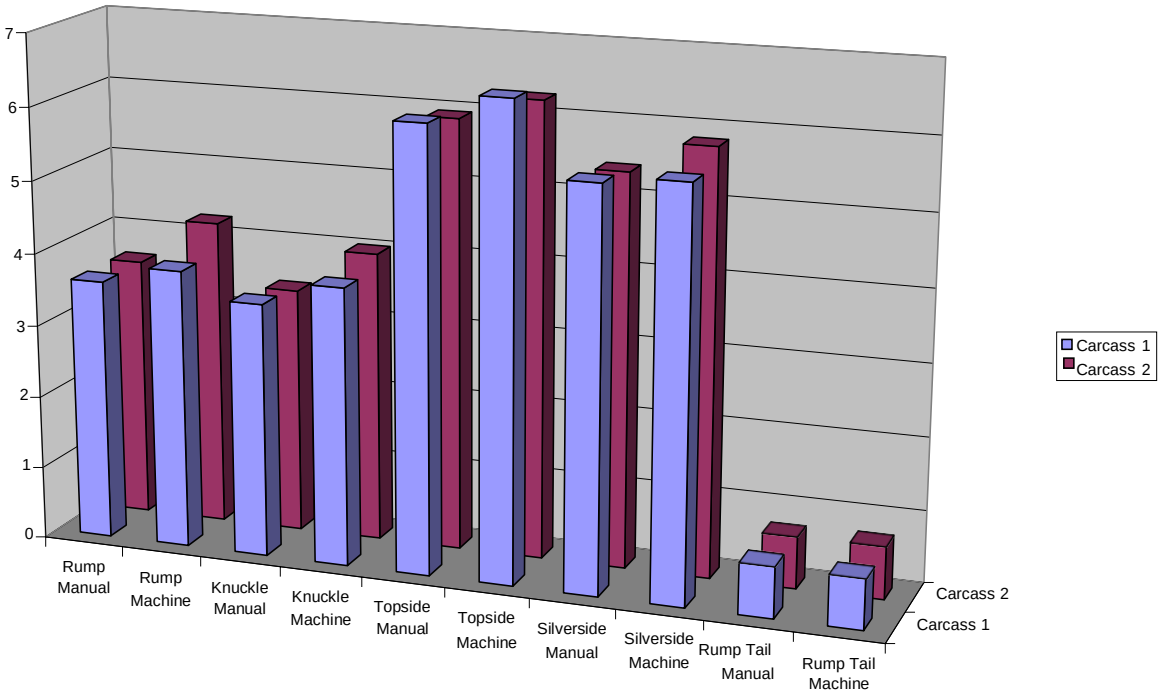

Figure 3: Yield Comparison (Percentage of Total Carcass Weight) Butts processed on-line (Manual) vs Mechanical Pulling (Machine)

Proposed Work – Beef Hindquarter Boning – Stage 1 Manual Assisted Boning Approach

Scott's is very keen to establish a foothold into Automated Beef Processing. They are developing a strategy to automate the entire Beef Boning Room in conjunction with Australian and New Zealand beef processing companies. This strategy requires that they consider the overall process, rather than simply replacing manual tasks. It would, however, be conducted in a modular fashion. They also intend to investigate and/or develop some enabling technologies to assist the automation strategy.

Scott's recognises the benefits of working within the industry, rather than at arms length, to implement such a strategy. To this end, Scott's would like to work with MLA, AMPC and the Australian Beef Industry. They recognise that the magnitude of the strategy is large, and that they need to gain the confidence of the industry from the outset.

Scott's view the Aitchbone and Knuckle pulling project as an industry confidence-building exercise, rather than necessarily being an integral part of the Automated Boning Room vision. It will also give Scott's valuable experience in this new field of automation. However if developed in a configuration to manually assist operators it is believed that this base development could be automated fully under a future project.

The output from this project would be the development and demonstration of a manual assisted prototype to be demonstrated to Australian processors.

Budget – Stage 1

The proposed budget for stage 1 is $105,000 (Australian)

Where to Next after this Project

After the demonstration of the project outcomes to the Australian processing sector it is anticipated that two additional projects may be initiated.

Project 1 - a syndicated project would be developed within 12 months of commencing this project that develop 2-5 processor production prototypes for installation into the participating Australian processing facilities.

Project 2 – development of a fully automated knuckle pulling and aitchbone removal system based on this proposals developed platform.

Appendix 1 – Meeting Minutes

PPCS Ltd/Scott Technology Ltd
(Robotic Technologies Ltd)
Australian & NZ Boning Room Steering Committee
Meeting No 01
Tuesday 7th February 2006
Held at Scott Technology

Present:

Sean Starling	MLA
David Doral	MLA
Ian Richards	MLA
Bruce McKendry	AMPC
Gary Burridge	Northern Cooperative Meat Company
Gary Thomas	Rockdale Beef
Michael Nolan	Nolan Meats
John Hughes	Teys Brothers
Greg O'Hare	Cargill Beef
Mark Seaton	Scott
Andrew Arnold	Scott
Chris Hopkins	Scott
Wayne Rollinson	PPCS Production
Dave Butler	PPCS, Belfast
Alan McElrea	PPCS, Finegand
William Cockerill	Octa

Apologies:

Bert Sorensen	MLA

ACTION

1. OPENING : 8.45am.

2. APOLOGIES

Bert Sorensen; Christine Raward will join tonight; Wayne Rollinson, PPCS, later today. ***Note***

3. DISCUSSION

a) Introduction

Sean, MLA, spoke to his handout. Objective to develop a vision(s) for Beef.

b) **Andrew profiled Scott. Discussion:**

- MLA/Scott have a graduate engineer in training at Scott. Will be in Australia to support machines in 18 months. Also about to appoint a Project Manager in Australia. This will be to manage the processor, MLA, Scott interface.
- Offshelf components? Yes.
- Transfer knowledge from appliance manufacture? Where possible.
- A lot of new equipment is not robust. Built like instruments – Technically okay but not suited to manufacturing conditions, and operator skillset. Scott said they are well aware of the robustness required.
- How interface to equipment? Scott said they use panel view or similar. Control bones in ceiling space. Transducers biggest area of failure.
- Scott appliance runs 24hr/day. High volume, good reliability.
- Kuka and ABB robots.
- Influence of China? - Scott sell into China. Americans source Scott machines for low labour markets like Mexico. Poland, Russia, Turkey also have cheap labour. Quality often an issue. Scott sometimes sources components from China.
- IP control is important.
- Meat industry is reverse production flow : defabrication!

Note

10am – 12pm : Visit to Silverstream to view Leap 2 and Leap 3 machines.

Three Leap 2 machines were operating under production conditions.

Leap 3 was set up to do a run of six carcases.

Debrief:

- Andrew noted modular nature of Leap projects. He stressed Scott were not promoting using Sheep ideas specifically for Beef. Show show project was developed.
- Leap 3 usually in production. Down at moment doing a knife

upgrade.

- Need to minimise rejections (Leap 2) and keep labour down (at moment 2 staff on the platform are doing recording of yields, downtime, etc. as part of performance testing). Auto loading will remove current labour units loading these machines.

- Discussion on how yield on Leap 2 could be improved further? Difference between Robots noted (KR16 better).

- Once vision (Xray) is integrated to machinery.

- Sock protector works okay.

- Knife blades made by Scott. Knife development (eg. sharpening) a future enhancement. Machine adjusts to accommodate sharpening and wear.

- Need to understand sensing better (key).

- Need to automate. Labour cost high and not attractive to work in the meat industry. Turnover rate high.

- Beef can't be a whole carcase – space required for stomach cavity, chill down rates, chiller sizes etc to consider.

- Reliability needed to eliminate the labour. 100%. Scott said Process and Machine reliability different.

- Cargill have a machine similar to Leap 3, laser controlled but sawdust. Knife better.

- Beef 140-600 kg a diverse spectrum, compared to Lamb. Difference in size mainly in the spine length. Butt similar. Different settings for Hot or Cold Boning?

- Acknowledged results will take time.

Note

12.45 – 1.10pm : Lunch

Small Stock (Leap) Background

Andrew presented a PowerPoint.

Discussion:

- Why don't you push Leap 3 to 12/min to see that it copes? Scott said speed determined by the need to manual measure. Automatic sensing by Xray or Camsensor will solve this.

- Better presentation with no sawdust.

- OH&S, Labour, consistency three key benefits for Australian industry.
- Xray could detect infection?
- Cattle less consistent than Lamb. ***Note***

2.15pm : Workshop Visit – Leap 4, Xray.

2.50pm **Wrap-up on Small Animal Development**

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Sean reviewed remaining steps to fulfil the vision.

10-35kg Lamb range. Perhaps an 8 year project to get an Automated Boning Room? ***Note***

3.05pm *Afternoon tea.*

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3.20pm **Beef Processing – Preparation for Tuesday**

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Key points to consider/discuss:

- Xray to do scribing.
- Break side three ways.
- Full automation unlikely – integrate step improvements.
- AMH don't scribe because lack of labour.
    - Scribe needed to maximise cuts and therefore yield.
    - Cargill don't scribe (American style room 6,000/day).
- First step scribe in the chiller?
- Horizontal v Vertical.
- Grass Feed v Grain Feed – plants different.
- Developments must fit into existing rooms (in the first instance). Start in Chiller.
- Everyone has Hindquarter (start with Butt?).
- Need to split into halves, else a big, hot, cavity.
- Need to bring people along – in a traditional industry.

- Bore – gives Robot a reference.
- Front end where OSH issues, heavy work, etc.
- Boner does 21-30/day, 35-50 Hot Bone. ***Note***
- Has Xray got capability to provide detail of Hindquarter? - not sure. Test tomorrow. ***Scott***

Labour Split:

  - 7/12 Forequarter.
  - 5/12 Butt, Hindquarter

- Return lower for forequarter.
- Boning priority – slicing last (a lot of specifications).
- Improved accuracy.
- Accurate yield (right seams, muscle groups).
- Lack of sawdust gives better presentation, better yield and better shelf life.
- Automatic split of cattle beast. ***Note***

PROGRAMME FOR TUESDAY:

Decided not much value in cutting Beef at Scott.

Meet at 7.15am to go to Finegand (where will take a video) and see what differences compared to Australian sites, who can similarly video their own sites.

Return to Scott for lunch, along with a forequarter to Xray and cut as appropriate. ***Note***

CLOSE : 5.00pm.

Australian & NZ Boning Room Steering Committee
Debrief MLA & Scott
Thursday 9th February 2006

Present:

Sean Starling	MLA
David Doral	MLA
Andrew Arnold	Scott
Chris Hopkins	Scott
Mark Seaton	Scott
William Cockerill	Octa

	ACTION
Opening : 11.05am.	
DEBRIEF	
Sean said audience has seen Scott and PPCS and want to see confidence shown in any proposal.	
Thinking will move beyond task replacement once this confidence is built up.	
Starting with an easy win on knuckle and aitchbone pull.	
MLA will assist Scott with writing a scoping brief. Pull in the vertical is what they have in mind as a short term. Beef processors will want input to design.	***MLA/Scott***
Outcome (option) could be Scott designing, testing prototype and then outsourcing mass manufacture?	
Noted tailor for own site possible through Scott or by DIY packs when use own engineering staff.	
RTL/MLA 50/50 development work likely to be supported prior to processor involvement.	
$50,000 has delegated approval. Above that requires formal approval.	
Sean suggested a week visiting the Australian Beef processors. Perhaps after the Leap 3 week of visits (mid March). To be confirmed.	***Note***
Sean & David attending a week long Beef Cutting Course. Mark may benefit? Sean to send Scott details.	***MLA***
REPORTING	

MLA want improved detail especially noting initiatives that have been tried. This builds up their knowledge.	
Lessons learned and problems encountered with processors are important for MLA to understand.	
Project Manager in Australia may help?	***Note***
Scott to review their reporting systems. Maybe get Octa to assist. If so, MLA funding would be available.	***Scott***
Monthly reporting cycle acceptable. Need to incorporate MLA engineer (Nic) reporting.	***Note***
Sean to provide Australian Institute of Engineers template.	***MLA***
Close : 12.30pm.	

Australian & NZ Boning Room Steering Committee
Finegand Boning Room
Wednesday 8th February 2006

Present:

Sean Starling	MLA
David Doral	MLA
Ian Richards	MLA
Christine Raward	MLA
Bruce McKendry	AMPC
Gary Burridge	Northern Cooperative Meat Company
Gary Thomas	Rockdale Beef
Michael Nolan	Nolan Meats
John Hughes	Teys Brothers
Greg O'Hare	Cargill Beef
Mark Seaton	Scott
Andrew Arnold	Scott
Chris Hopkins	Scott
Wayne Rollinson	PPCS Production
Andrew Thompson	PPCS Engineering
Dave Butler	PPCS, Belfast
Alan McElrea	PPCS, Finegand
William Cockerill	Octa

Apologies:

Bert Sorensen	MLA

8.30am **Finegand Boning Room.**

Met with Plant Manager, Wayne Shaw.

Observed boning of aitchbone and knuckle.

John Hughes instructed a boner on a different technique that provided better yield and product quality (less cuts). This was on video and in a way gave an early insight to difference between PPCS and Australian methods. Same muscles and cuts result (as expected). ***Note***

12.15pm **Lunch :** Joined by Lyn Jaffray, PPCS Group Beef Marketing who stayed for review (until 3pm).

12.45pm **Review at Scott**

- Need to mark tailbone muscle.
- For robot, first cut a sinking cut.
- Take section off (better access to Aitch Bone), Keep Rump on. ***Note***

Bruce, AMPC, asked : Is there a project?

Yes. Modular.

Do where hardest work for a person.

Machines can assist boning by:

Pull aitchbone

Knuckle

Follow seams

Automatic splitting

Saw (easy for Scott?), but compact

Scribe saw prior to Boning Room

- Processors can do more modules.
- Answer to following the seam will be a challenge (muscular intersection, 3-D and not a straight line, muscles under muscles, etc).

- Will clamp and pull out work? How muscles are configured (emaciated cows allow you to see seams). Fat cows more difficult to see seams.

- Add sawcuts to known mechanical solutions an area to explore. Mark it properly. Develop it beyond an aid to boning.

These four areas will save on labour.

Need to preserve muscles as recognised by the market. Muscle groups will change with animal type and condition – huge variation.

Extent of work by robot depends on what Scott can produce. Manual intervention (eg. scribing the vee below the knuckle) is okay.

Such equipment has international appeal. OSH main area of saving.

Purpose built machine (carousel)? Extent of robots to be determined.

Significant investment in Boning Rooms to date. Try to get a win. Small improvement within existing room (an existing chain).

Looked at result of an Xray of Beef Hindquarter. Noted it was taken on a machine tuned for Sheep. Potential of Xray for Beef endorsed.

Looked promising at this early stage.

Sean said scribe saw a project already underway. (Demonstration April 06). Speed issue at moment. ***Cassino/ MLA***

Carcase splitting a $1M project. Payback too slow? Mainly Labour saving. Experiments show just $60,000 yield saving and one labour unit.

As a rule of thumb $200,000 will be spent for each labour unit saved (Cargill). ***Note***

Scott to do a proposal on scribing and pulling (Aitch bone and Knuckle). Safety on pulling (incl gripping) important. Many devices fall short here. ***Scott***

This will give learning. Move onto forequarter.

Scott to come up with a concept on paper, with budget. May not ***Scott***

need Robot? 6 axis. Scott have a strength in this area.	
FUNDING:	
AMPC and MLA funding with a percentage from PPCS. Put up to Technology Committee.	
PPCS have to supply meat, development room. There is wastage.	
Christine said this can be built into the project cost.	
Need a paper, with options for industry consideration.	
John Hughes aid he can provide video (Scott will need to complete a confidentiality agreement) so don't reinvent the wheel. John thought his view would be similar to Bert.	***John Hughes***
OTHER INITIATIVES	
Proman discussed and video clips shown. Also NZ equivalent (Shamrock). Varying views.	
Violent reaction with carcase swing once released – especially last pull. Will Scott do much different? Proman a mechanical aid. Looking for automation.	
AMH view? Need to make proposal attractive.	
More grain feed, will lead to more pulling.	
Get Technology Committee to approve a PIP (Industry Project) which will then go to Board.	
Previous experiences with one company had been unsuccessful. Not so good on grainfeed, where market is moving. Also an end in itself. Scott pullers smaller, will provide consistency.	***Note***
Sean asked that Proman patents be checked by Scott.	***Scott***
Lance at Proman starting to look at pulling for aitchbone and knuckle (Teys and Rockdale).	***Note***
PATHWAY FORWARD:	
Scott to do a proposal by 15 March.	***Scott***
MLA to put out funding options prior to this.	***MLA***

PPCS want to look at Loin. System of ploughing off works for Lamb, but unsuccessful for Beef.	***PPCS***
Michael asked whether Leap technology (Leap 2 and Xray) can be used for a small part of Beef boning? eg, Shin? How far can you go? To learn.	***Scott***
If pick up parameters on a grid, should be able to follow.	
Beef say no vision for an automated Boning Room as compared to Sheep, who believe they will.	***Note***
Why not have robot decide scribing? Xray can see bone. What can Xray show? Then decide what it does for us.	
Looking at what you can do with seaming?	
Robot closest to human action. May only need 16kg Robot, as a man won't pull that consistently. Don't know what Robot will do in Beef – how close to bone, how quick.	
Does meat hold position after Xray (to cutting station?). "Once get hold of it, retain reference, never let it go".	
Evaluate what new technologies can do for the industry. Ability to sense key. This needs to be industry led.	
John Hughes counter view was he wants immediate return so as to attract investment.	***Note***
Food Science Australia have archives that looked at Blue Sky ideas. Ian Richards to see if these can be accessed.	***MLA***
Xray for Primal Cuts would be labour saving (perhaps 6-8 labour units for Cargill).	
Changing specifications (including Bone-in) so need flexibility. Also move towards customer ready.	
UNKNOWNS:	
· Future cutting technology.	
· Ability to locate seams.	
· Variability of Carcases.	

- Whether robot can simulate a human boner. Need market acceptable product. Will vision (sensor) from Xray be enough?
- Affordability.
- Process worker adaptability to this new technology. ***Note***
- Radiation levels – check for process workers and customer (comparisons before and after). ***Scott***
- Whether sensing can guide carcase split.
- What future boning room may look like. Need to allow space for future improvements (process flow for sensing and robotics).
- Result for money invested.
- Whether goals set are achievable.
- Rejection rate (eg. Leap 2 rejection is too high – still need Boners downstream). ***Note***

Scott to consider and demonstrate a confidence that it can be done; there is a path to follow. ***Scott***

Have Xray to see Bone. Need to develop the sensory capacity to seam. How much pressure, control, etc.

Xray in 2-D. Need third dimension. If so, how?

Pick something simple to demonstrate 3-D cutting.

"Regardless of where you are in the world, the same bones end up on the table".

"Look at one job until you see how Scott Technology can improve it".

- Consistently, yield to specification. ***Note***

CLOSE : 5.10pm.

Dinner : 7.30pm, Plato.