final report

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Technical assessment of automated process for packing boneless beef

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Contents

1 Scope

This report covers Milestones 1 & 2 of the proposal from Food Processing Equipment to AMPC. These are:

1. Identify the specifications required by the Australian Meat Industry for packing of CL grades of bulk packed meat. Design line set up using the different components
2. Validate each piece of equipment to ensure it meets the specification. To achieve this, FPE will seek documentation evidence from the suppliers of each equipment item that will form the process/pack line. This evidence must validate the ability of each item to meet the required production specifications established by the Australian Meat Industry.

1.1 Information included in this assessment

- FPE outline proposal of process to AMPC including overview schematic drawing
- Cabinplant preliminary schematic drawing (including some detail of equipment)
- Cabinplant brochure and CR-ROM on High Speed Portion Weighing Systems
- CD-ROM on operations using Cabinplant system on fresh chicken at Rose Poultry
- Magurit brochure and CD-ROM on Galan 930 portion cutting equipment
- Smiths Detection brochure on Eagle FA 720 X-Ray Inspection System
- Handbook of Australian Meat

1.2 Industry specifications.

The Australian Meat Industry packs Bulk Beef to two AUSMEAT specifications (Handbook of Australian Meat Code 2560 & 2615.

HAM 2560 is described as Trimmings and specifies that “Trimmings are portions of meat remaining after the preparation of primal cuts from a Carcase, Side, Quarter or Portion of Carcase from a Bovine animal. Trimmings will not include any portion of Head Meat, internal organs, major tendons or ligaments. Trimming pieces less than 50 mm cube and/or unidentifiable pieces can additionally be included when agreed to in the specification.”

HAM 2615 is described as Manufacturing Beef and specifies that “Manufacturing Beef is prepared from Carcases, Sides or Quarters (Forequarter and/or Hindquarter) and can be saved from Beef or Bull. Each pack will consist of two (2) major primals (to be calculated from each side boned, or the equivalent of each side boned) from the combination of the following primals – Clod, Chuck, Neck, Thick Flank, Striploin, Topside, Rump or Silverside. This pack will include small pieces of meat remaining after the preparation of Primal cuts (trimmings).”

HAM 2615 has the following “points requiring specification:

- Specific primals to be included
- Minimum piece size requirements
- Chemical Lean (CL) mandatory when bulk packed for Export
- Inclusion of Brisket or portions of Brisket.”

The issues of specific primals and minimum piece size, in particular, have relevance to the proposed process.

2 Process and equipment

Boneless beef is delivered from an existing boning operation, from which primal cuts for individuial packing have already been removed. The remaining random mix of boneless beef pieces is delivered by conveyor to the bulk packing area. Currently this is manually sorted and packed by packing staff. The process is labour intensive and results in significant variation in outcome due to:

- Difficulty in the picking of correct CL in each carton. The cost of over packing lean is significant due to the difference in valve between lean and fat. The cost of under packing is also significant in fat claims from off shore customers.
- Difficulty in packing cartons to correct weight requiring later intervention at the scales
- Bulging cartons from non uniform piece sizes and poor packing technique
- OH&S issues when bulging cartons have to be frozen, and palletised
- Manpower to cut meat to appropriate sizes

The system proposed by FPE collects this bulk beef from the boning area conveyor and conveys it into a Magurit Galan 930 cutter that sizes the beef to a uniform chunk size. The chunks are then passed through a Smiths Detection model Eagle FA 720 type scanner to determine CL and the presence of contaminant materials.

The scanned materials are conveyed to a Cabinplant presorting system that sorts the chunks into several classes of CL, dependent on the outcome of the Smiths Detection scan. The various classes of CL are collected in separate plastic bins, which are fed to a Cabinplant multihead high speed portion weighing system.

Ideally this system blends the various classes of CL beef chunks to obtain a pre-specified packing CL. For example the scanning and separation system may create separate bins of 60 – 64CL, 65 – 69CL, 70 – 74CL, 75 – 79CL, 80 – 84 CL, 85 – 89CL, 90+CL beef. The portion weighing system may be specified to pack at 75CL. It will blend the various classes, as available, to create the specified blend.

The specified blend of chunks is then packed into a lined carton to the pre-specified weight and is mechanically levelled by vibration and stamping to give a more uniform pack shape.

After packing the cartons can be automatically lidded closed and strapped/glued as in existing packing systems.

2.1 Performance of the system

Achievement of specifications in HAM 2560 & 2615
HAM 2560 Trimmings will be complied with by the proposed system provided that the required minimum piece size is complied with. HAM 2560 specifies pieces less than 50mm cube must be agreed in the specification. It is common practice to pack trimmings pieces considerably smaller than 50 mm under agreed customer specifications. However, as pieces 50 mm cube and larger will comply without additional agreement from customers, 50 mm cubes are recommended as the target outcome from the Magurit Galan 930 cutter.

HAM 2615 Manufacturing Beef requires the inclusion of at least 2 primal cuts in each pack and the inclusion of a minimum size requirement. Under existing practices, primal cuts are generally slashed prior to packing as manufacturing beef, although the size is normally greater than 50mm cube. Discussions with industry have shown that cubing of beef primals to 50mm (or similar) will not be a problem provided that the size is included in the agreed specification. Agreement with customers to accept this size requirement is not expected to be difficult or an impediment to trade. Chunk sizes less than 50mm cube may also be acceptable but the 50mm specification appeared, from discussions, to be an ideal minimum to target.

2.2 Feasibility of the proposed process

The feasibility of the proposed process is dependent on 2 factors:

1. The performance of each individual item of equipment
2. The performance of the system when the normally unrelated items are sequenced as proposed in this project.

The items of equipment chosen are well established and are already utilised, in some way, in the meat industry, or a related industry. It appears from the brochures and CD-ROMs provided and the existing usage in Australia and other parts of the world that the equipment chosen is adequately robust and suitable for its task.

Magurit Galan 930

Extensively used in Australia and the world for dicing and slicing a wide range of meats including beef. Cube size is sufficiently variable to accommodate the range required to be evaluated in this project.

Existing users of this equipment in Australia include:

- Ingham Enterprises
- Uncle Bens of Australia (now Pedigree Petfoods) 2 machines

Smiths Detection Eagle FA 720 type X-Ray Inspection System

Smiths Detection equipment for CL and contaminant scanning is in use in Australia and elsewhere in the world. Smiths Detection is an international leader in this type of equipment. The technology is already in use by Australian meat processors to determine CL in cartoned meat through 100% scanning of cartons.

The equipment brochure supplied is for carton scanning using the Eagle FA 720. This unit will not be appropriate for the proposed system where uncartoned meat will be scanned while being passed through a tube or on a compartmentalised conveyor belt. This application has apparently

not been used before. Smiths Detection will be required to modify a carton scanner to scan meat in a tube or some other type of conveying system.

These modifications should be feasible given that Smiths Detection has already developed a scanner for bulk uncartoned meat and are looking at developments for other applications. Further information is required from Smiths detection to confirm the feasibility of the proposed modifications and application.

Information will also need to be provided on the relationship between chunk size and CL accuracy. This will need to be determined during trialling to establish the optimum chunk size from the Magurit Galan 930.

As the product will be scanned on a continuous basis in a pipe or on a conveyor, the product will be scanned as a 'slug' of chunks and hence separated into CL categories as 'slugs' of chunks. The size of these slugs is not known from the information provided. If slug size is considerably different than chunk size then this may effect the accuracy of CL determination of the entire slug. This will only be determined by trialling.

Existing users of Smiths Detection Eagle FA 720 Carton Scanning equipment in Australia include:

- Teys Brothers – 3 plants
- Valley Beef
- T&R Murray Bridge
- John Dee
- Marathon Foods
- Poowong Abattoirs

Cabinplant separation equipment.

No specific information has been provided on the design or performance of this equipment but given the extensive use of automated separation systems using "rejection gates" this task is not seen as likely to be a problem. Some trialling of a method to split the continuous stream from the CL scanner into individual 'slugs' may be required.

Cabinplant High Speed Portion Weighing system.

This equipment is extensively used for dispensing controlled mixes of mixed nuts, mixed vegetables and similar particulate products that are required to be mixed in specified weight proportions. The product has also been successful used for frozen meat products and fresh poultry products such as chicken breast fillets (as shown on the Rose Poultry CD-ROM). The equipment's ability to handle cubed beef is unknown but appears to be feasible.

The mechanical attributes of the existing Cabinplant systems appear to be suitable for the task chosen. However, the challenge for this project will be to create the necessary feedback loops and controls to allow the creation of suitable blends of the CL classes to achieve the specified CL. This is particularly given that the quantities within the individual CL classes will variable and blends may have to be prepared from different CL classes on a continuous basis. For instance 70CL could ideally be prepared from 50% of 60CL and 50% of 80CL beef. However should say 60CL not be available then the 70CL may have to switch to a blend of 66.7% 65CL and 33.3% 80CL beef or some other blend should one or other of these not be available. The permutations of CL classes available and blend possibilities to achieve a specified CL are quite significant.

While the development of the required feed back and control loops should be achievable considerable work may be required to establish these. This is particularly an issue given that the CL scanning equipment and the blending equipment are from different manufacturers. It is promising however that Cabinplant in their schematic diagram have identified the need for the CL scanning equipment in the process and should already be considering the feedback and control loop requirements.

FALLBACK POSITION

Should the blending operation not be successful then the separated CL classes should feasibly be automatically cartoned using the Cabinplant equipment. This will then produce cartons of product based on natural fall of product rather than on chosen CL specifications.

There are currently no existing users of this equipment in Australia however the equipment is used extensively in Europe and USA.

Cabinplant Carton Levelling system

No specific information has been provided on the design or performance of this equipment but the suggested approach seems reasonable. Some development work will be required to determine the ideal system for filling, levelling and compressing the product in the cartons to give the most regular shaped pack.

3 Relevance to the meat industry

Labour issues relating to both availability of labour and OH&S are one of the greatest restrictions on productivity faced by the Australian Meat Industry. Any project that can reduce the need for labour and/or reduce the risk of worker injury is of extreme relevance to the industry. This process potentially achieves both.

Current users of the equipment items proposed appear to focus on fresh chilled and frozen products. One of the greatest opportunities for this system will be in the packing of bulk hot boned beef from at dedicated hot boning process plants. Trialing will be necessary to establish whether all items of equipment will operate effectively on hot boned beef. This should be included in the proposed project.

While this specific project targets bulk beef packing, there is every reason to suggest that the outcomes will equally apply to other species including smallstock where CL is less of an issue but the issues of labour and OH&S are important.

4 Comments on the use of the proposed automated bulk beef packing system

The information provided on the chosen equipment, that is readily available, indicates that the individual items of equipment are likely to achieve their desired outcome. Some further information and development is required however on the Smiths Detection Eagle system for continuous scanning of meat for CL either in a tube or compartmentalised conveyor.

The limited information provided on the preposed integrated system suggests that the required outcome is possible. Areas of greatest risk appear to be in the development of suitable feedback and control loops between the Smiths Detection CL scanning equipment and the Cabinplant High

Speed Portion Weighing equipment. However this risk is mitigated by an effective fallback position which, while not optimal, will still give effective gains to the industry.

Key drivers to take up this technology being:

- Reduced CL claims from overseas markets
- Reduced CL give away through inaccuracy of current systems
- Reduced labour costs (reduced requirement for limited labour availability)
- Reduced OH&S costs in handling frozen cartons
- Improved palletising and container loading

Quantification of the system's ability to deliver on these key issues should be a key focus of any future work on this project

4.1 Shortcomings

Few weaknesses can be identified in the proposed system for packing bulk manufacturing beef. The system is based on proven technology and readily available existing equipment.

However a number of questions will need to be determined during the trialing phase of this project. These include:

- The ability of Smiths Detection to provide a suitable continuous CL scanning system as indicated.
- The relationship between chunk size and CL accuracy to achieve optimum accuracy and maximum savings.
- The ability to program feedback and control loops to allow the preferred blending option to be established.
- Validation of the predicted savings in CL reduction and labour costs in particular.

As this project is heavily dependent on capital, it will be important to obtain a commitment from an Australian meat processor to the technology. This will be required to ensure that the equipment will be purchased from the project on successful completion of the project or that a continuation of the lease of the equipment after the project will occur.

5 Assessment Conclusions

- This project is the development of an integrated system based on known and proven items of technology.
- A question still remains as to whether Smiths Detection can modify a CL scanner to produce a continuous scan as required by this project. This issue must be addressed as the highest priority.
- Additional information is required on the control loops between scanner and blender in particular if the project is to be successful.
- With the existing level of knowledge about the individual items of equipment involved, this is not a high-risk area of development.
- It is well known that any improvements in CL performance in the packing of manufacturing beef and in reducing labour requirements or costs will give significant potential returns.

6 The way forward

Given the significant potential savings, progression with this project is recommended. The recommended staged approach is:

1. Obtain further information on the Smiths Detection Eagle scanner most appropriate for this project. Ensure that Smiths Detection can modify an existing scanner to achieve the outcome required for this project. A Go/No Go decision is recommended here as this is a critical point in the development process.
2. Obtain assurances from the design team (FPE/Cabinplant) that the required feedback and control loops can be established.
3. Design the process/pack line set up using the different items of equipment identified by FPE.
4. Set up equipment on-site at FPE and run small in-house trials. The equipment should be pilot tested in FPE's factory to ensure that the required equipment interactions occur as designed. Small quantities of chilled and hot boned beef should be run through the process/pack line to commission it at FPE.
5. Abattoir based production trials. In collaboration with a large Australian meat processing partner the line should be set up in, or in association with, an existing packing room. The process /pack line should be operated on a range of target CL specifications to demonstrate its capability and flexibility. Note: Space restrictions in existing boning rooms may limit the ability of many processors to be involved with these trials.