Final Report

AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

# Dual Purpose Knocking Box


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# 1.0 Abstract

The Stealth Dual Purpose Knocking Box project at JBS Rockhampton aimed to install and validate a Jarvis-developed, dual-purpose (pneumatic and electrical) beef knocking box. The project's core objectives were to:

- **Reduce operational noise and animal vocalisation** (improving animal welfare)
- **Enable advanced Industry 4.0 data capture** (animal weight, RFID, and imaging at slaughter)
- **Facilitate electrical stunning** to eliminate skull cracking, supporting religious slaughter requirements and expanding access to high-value export markets
- **Monitor and improve yield and quality**, including tracking ecchymosis, bruising, and contamination

The project was successful at installing the Stealth Dual Purpose Knocking Box and allowed the trailing of the electrical stunning. The new stealth Knocking box is quieter and does promote better entrance into box by animals. It works effectively when employing pneumatic stunning but electrical stunning requires many operations to be completed at the same station before animal moves on, causing reduced production speeds.

The stealth box continues to be used by JBS Rockhampton but the pneumatic stunning was ceased during the trial due to the inability to meet operational production speeds.

# 2.0 Executive summary

This document consolidates the finding from all milestone reports (1–18) for the Stealth Dual Purpose Knocking Box project at JBS Rockhampton. It highlights key actions, design modifications, operational improvements, and strategic recommendations to enhance animal welfare, operator safety, and production efficiency.

# 3.0 Introduction

Typical existing knocking boxes deployed in Australia are driven by pneumatics (or hydraulics) and by default are noisy during operation which can impact on each animal causing increased stress typically identified by increased vocalisations.

This project investigated the use of Stealth Box (Control platform and other sound proofing). The stealth unit is powered by electric linear actuators with silent bushes for actuator connectors and pivots to reduce noise and associated stress levels of the animal about to be processed.

- The box is lined with nylon insulation, whilst the floor & entrance to the box are lined with anti-slip, anti-conductive rubber to further reduce noise and slippage. IoT Feedback (for verification and auditing purposed)

The box is fitted with both the Jarvis JASS-2 electric stunning unit and USSSC-1A pneumatic control cabinet for electric and pneumatic stunning respectively, with both units allowing greater control of

stunning variables (air pressure, time, electric current etc) and the capture of all details through the in-built data loggers.

Unlike existing knocking boxes, this unit is able to capture an un-editable record of the cattle processed, providing assurance to both management and audit bodies.

Dual Stun Method Capability (and Rapid Second Stun readiness) - New Stealth harvesting box is manufactured with pneumatic and electric dual stun features, allowing the operators the option, to change from electric harvesting and pneumatic/manual as is best for each animal presented to the knocking box and also for rapid re-stun to meet animal welfare requirements as a result of an unsuccessful first stun outcome.

- Existing units are unable to adapt quickly enough to an unsuccessful stun with obvious Animal Welfare issues arising as a result.

Prior to the production of the Dual stun unit, the Electrical Stunning box design would allow the animal to touch the metal sides of the box walls, creating an earthing effect and a potential for delivery of an inconsistent stun.

- The stealth box is fully lined with nylon insulation, which prevents the short circuiting described whether the cow can be free-standing or leaning on the box.
- This direct current application helps with the pathway of electricity flowing through the animal, reducing ecchymosis, dark-cutters, and blood splatter in the organs (hearts/lungs etc).

Additional Productivity Improvements – Weight Measurement. The current Stealth box has built in loading cells to record the live weight and transfers this data to the Scada monitoring system for review against effective stun settings related to weight of animal. Live weight at time of knocking can be used to further advanced downstream processing electrical interventions by adding an additional input into the current PID loops

# 4.0 Project objectives

Develop a stealth dual-purpose beef knocking box that:

- Achieves intended level of silent operation, to reduce vocalisation thus improving animal welfare,
- has advanced Industry 4.0 data capture: animal weight, RFID tag read and photo image of every animal at point of slaughter, and
- allows increased use of electrical stunning to reduce the instance of skull cracking, which is a measure of acceptability for religious slaughter and hence access to high value and important international markets for Australian processors

# 5.0 Methodology

Hypothesis:

- The Jarvis electrical stunner system will not result in the extent of ecchymosis in cattle that historical stunning solutions have

- The quiet operation of the newly design knocking box will increase processing compliance of less than 5 vocalisations per I 00 animals processed
- Live weight at time of knocking can be used to further advanced downstream processing electrical interventions by adding an additional input into the current PiD loops

Additional Investigation:

- How can live weight at time of Knocking be used for further downstream information and processing changes.
- Affects of pre slaughter stress on the toxic & clonic inducted states achieved by the application of the electrical stun.

# 6.0 Results

**Project Initiation and Design (Milestones 1–3)**

- **Inception and Planning:** Stakeholder meetings established project feasibility, site requirements, and installation logistics. Design modifications were identified to fit the new box into the existing facility, including changes to access, winch systems, and control box placement.
- **Procurement and Factory Review:** Equipment was ordered and reviewed at the Jarvis workshop. Factory Acceptance Testing (FAT) and site pre-installation reviews led to further design tweaks for operator safety and workflow efficiency.
- **CSIRO Validation Protocol:** Developed to benchmark animal welfare and operational outcomes pre- and post-installation.

**2. Installation and Commissioning (Milestones 4–5)**

- **Physical Installation:** The box was installed over Easter 2022, with modifications to facility layout and supporting infrastructure.
- **Initial Operation:** Pneumatic stunning was used first, with operator training and SOPs developed for future electrical stunning.
- **Operational Challenges:** Early issues included equipment pinch points, control panel ergonomics, and animal positioning. These were addressed through iterative modifications.

**3. Trials, Data Collection, and Modifications (Milestones 6–9)**

- **Electrical Stunning Trials:** Small-lot trials were conducted to validate stunning effectiveness, animal welfare, and meat quality. Key findings included:
    - **No increase in ecchymosis** (bruising) in boning room
    - **Some blood splash in lungs** (not directly linked to stunning method)
    - **Bruising from cradle impact and neck crush** (addressed via equipment modifications)
- **Throughput Limitations:** Electrical stunning required multiple sequential operations at a single workstation, limiting throughput to ~51 head/hour (vs. 80 head/hour target).

- **Data Capture Improvements:** RFID and weight capture improved, though mechanical binding and scale zeroing issues persisted.
- **Operator Safety:** The shoulder push mechanism was identified as a safety risk during re-stunning and was removed pending further review.

**4. Performance Review and Ongoing Challenges (Milestones 10–13)**

- **Service and Maintenance:** Regular health checks and servicing addressed pneumatic cylinder failures, seal wear, and control system reliability.
- **Further Modifications:** Adjustments to the cradle, head restraint, chin lift, and automation improved animal positioning and operator workflow.
- **Suspension of Electrical Stunning Trials:** Due to throughput and safety constraints, extended electrical stunning trials were paused pending learnings from other sites and further engineering solutions.
- **Reliability Issues:** Persistent failures in pneumatic cylinders and seals required supplier engagement and retrofitting with lubricators and service kits.

**5. Final Evaluation and Recommendations (Milestones 14–17, Final Report)**

- **Animal Welfare and Quality:** The box achieved its goals for quieter operation and improved animal entry, with no increase in ecchymosis or major quality issues.
- **Operational Bottlenecks:** The need to complete all post-stun operations at a single cradle station limited production speed and created ergonomic challenges.

# 7.0 Conclusions

The new stealth Knocking box is quieter and does promote better entrance into box by animals. It works effectively when employing pneumatic stunning but electrical stunning requires many operations to be completed at the same station before animal moves on, causing reduced production speeds.

Trials of the high frequency electrical stunning were suspended due to the inability to meet production throughput requirements. In particular the requirement for a thoracic stick to occur to ensure the animal does not regain consciousness means a number of processes must be completed on the cradle before the animal can be hoisted. This means that an average process time of 72 seconds per animal is required and the chain speed to meet processing requirements is 42 seconds per animal.

# 8.0 Recommendations

- Maintain pneumatic stunning as primary method until engineering solutions for electrical stunning throughput are implemented.

- Develop multi-station or motorized cradle system to enable parallel processing steps and meet production targets.
- Continue mechanical refinements (neck crush, chin lift, rear pusher) for better animal positioning and operator safety.
- Enhance reliability through improved pneumatic cylinder seals and preventive maintenance.
- Leverage learnings from other sites and CSIRO data to guide future upgrades.
- Prioritise operator safety and animal welfare compliance in all modifications.