final report

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Pilot Commercialisation of the Wireless SmartStim System - Phase 2

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IMPORTANT NOTICE

1 Executive summary

1.1 Review process

The review of the proposed technology solution was undertaken based on a number of consideration points, including:

1. Any existing documented cost models that were used for determining PCs/ versus custom developed hardware.
2. Any existing documented cost estimates for production units of the proposed custom hardware.
3. Any existing documented inclusions in the production cost estimates for:
    a. Housings for the harsh environments.
    b. Power filtering and noise reduction for the high RF and electrically noisy environments.
    c. Service spares and whole of life spares.
4. Any existing documented planned and/ or proposed operating life for the proposed custom hardware.
5. Any existing documented sunset dates that have been provided by the chip and other specialist hardware manufactures.
6. Any existing documented migration path plan that may have been determined for the next generation of chips and other specialist hardware.
7. Any existing documented work plans/ cost estimates that may have been prepared for the operational performance testing (IP rating, EMC compliance, operating environment performance) of the custom developed hardware to provide suitable evidence of expected in field performance.
8. Any existing documented models and implementation plans for integration with existing plant systems.
9. Any existing documented service and maintenance plans for onsite spares and technical hardware support for the expected operational life of the equipment.

The review found that the above critical project issues had not been addressed. This created the problem that the true cost and timeframe for release of a commercially sound technological solution was unknown. Detailed cost and timeframe estimates were requested and obtained from CPE systems for the work necessary to address the above points. These detailed cost estimates are shown in later sections of this document.

A number of recommendations have been formulated as a result of the review.

1.2 Review recommendations

The following recommendations have been based on the principle objective of cost and time effective implementation of working and supportable hardware systems into a limited number of processing plants across Australia and New Zealand.

The recommendations are:

1. That the current proprietary hardware approach is abandoned on the basis of high cost, long delivery timeframe and high risk to produce a commercially viable product.
2. That a suitable (harsh environment and software/hardware performance) commercially available hardware platform be costed as an alternative to the proprietary hardware.
3. On the basis of total cost (supply availability, technical support base, spares availability and forward migration path for whole of life management), speed to market, compatibility with existing plant infrastructure and compatibility with existing software, that the National Instruments CompactRIO product be utilised as the basis of the commercial Smart Stim product.
4. A project plan (cost and timeframe) be prepared that covers:
    a. The porting of the existing software to the CompactRIO platform.
    b. The updating of the existing software to include standards for communicating with the existing plant infrastructure (refer to the section of the report for integrating with plants).
    c. The development of hardware/ communication infrastructure implementation documentation (examples of representative installation plans, mechanical, electrical and communication drawings, work instructions, testing plans, training plans, etc), suitable for any technically competent organisation to be able to install and maintain the hardware and communications.
    d. The preparation of a cost benefit analysis for the adoption of the Smart Stim system on plant. This includes the total cost of implementation e.g. the cost for the plant to modify/ upgrade their information systems to integrate with the Smart Stim system.
5. That suitable projects be undertaken by MLA that cover the various technical disciplines needed to address the above work activities.

1.3 Review scope

Meat and Wool New Zealand and *Meat and Livestock Australia* have jointly funded the development of a technology that measures the responses of each carcass to stimulation. This technology has been termed SmartStim, because it allows the response characteristics from each carcass to be analysed and subsequent stimulation tailored to the need of that carcass. This project forms part of the overall strategy to develop, test and commercialise a robust and modular system for on-line real time quality control and measurement of carcasses using electrical stimulation.

Due to limitations of the initial Carne developed PC based system in a harsh environment and the limitations of standard Programmable Automation Controllers (PACs) with respect to flexibility and cost, Project P.PSH.0386 was initiated to develop a modular hardware for the wireless SmartStim system.

Under project P.PSH.0386, the hardware was developed and tested to a limited extent in the laboratory to confirm its suitability as a SmartStim controller.

The purpose of phase 2 of this project is to transfer the Carne software developed for the PC based system to the embedded platform used in the modular system and test the system, particularly the wireless communications, in an actual environment to ensure the predicted results of the system are still achieved.

In the first milestone in the phase 2, the option 1 will be independently assessed by an outside consultant, Des Bowler, as to whether this is the optimal solution.

2 Background

The initial SmartStim projects involved the development of smart systems of stimulation that first measure the response of individual carcasses to a standard pulse, and then tailor stimulation parameters (strength and duration of the current) to the needs of that particular carcass. For example, feedback from the initial pulse may cause the Smart Stimulation System to deliver 15 seconds of stimulation to one carcass but 60 seconds to another. Thus achieving the meat quality objectives of a known and desirable pH decline.

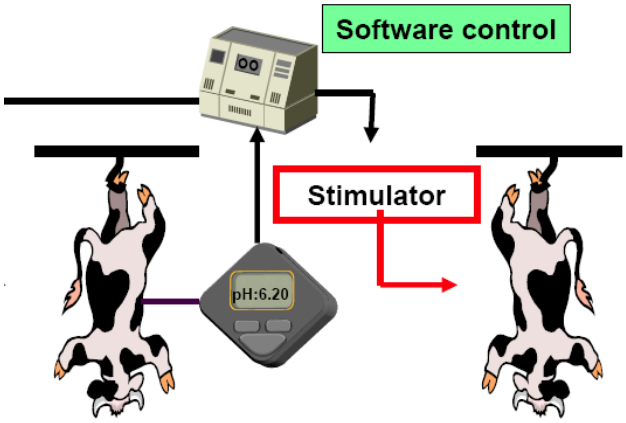


Image taken from presentation made by Clyde Daly, Nicola Simmons, Tracey Cummings, Nicola Johnson, Jonathon McGurk, Kevin Gilbert, Tracey Lomas, Anthon Lombard

This concept has evolved into the second generation of smart simulation that may take multiple measurements and refine the total amount of energy to be delivered to the carcass.

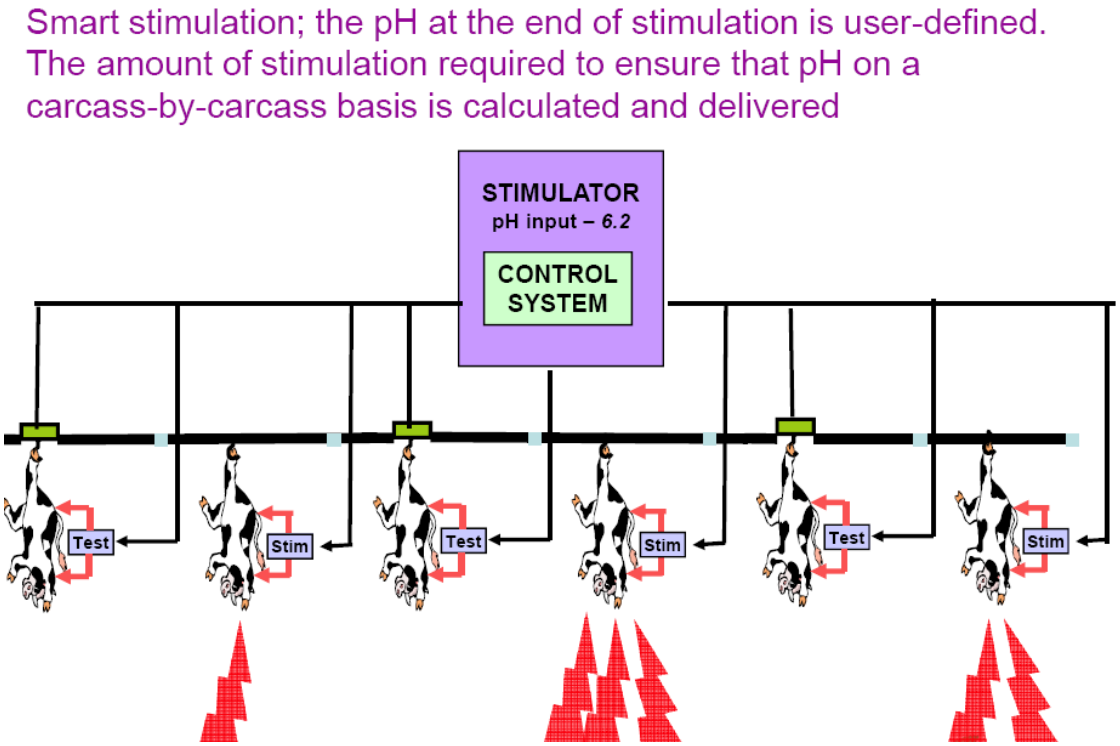


Image taken from presentation made by C.C Daly, N.J. Simmons, N.V. Johnson, T.L. Cummings at the NZBIO conference 2009.

3 Industry adoption, risk identification and options

3.1 Industry uptake volume

The expected number of units installed and the geographical spread of the installation locations impact the risk assessment and development direction. If there are 10,000 units to be manufactured and used exclusively in one country, then the costs for development, type approvals, spares, etc may warrant a custom designed and manufactured hardware platform. If there is a limited number of units to be supplied and installed then the use of generic “off the self” hardware will often prove a more cost effective and manageable solution.

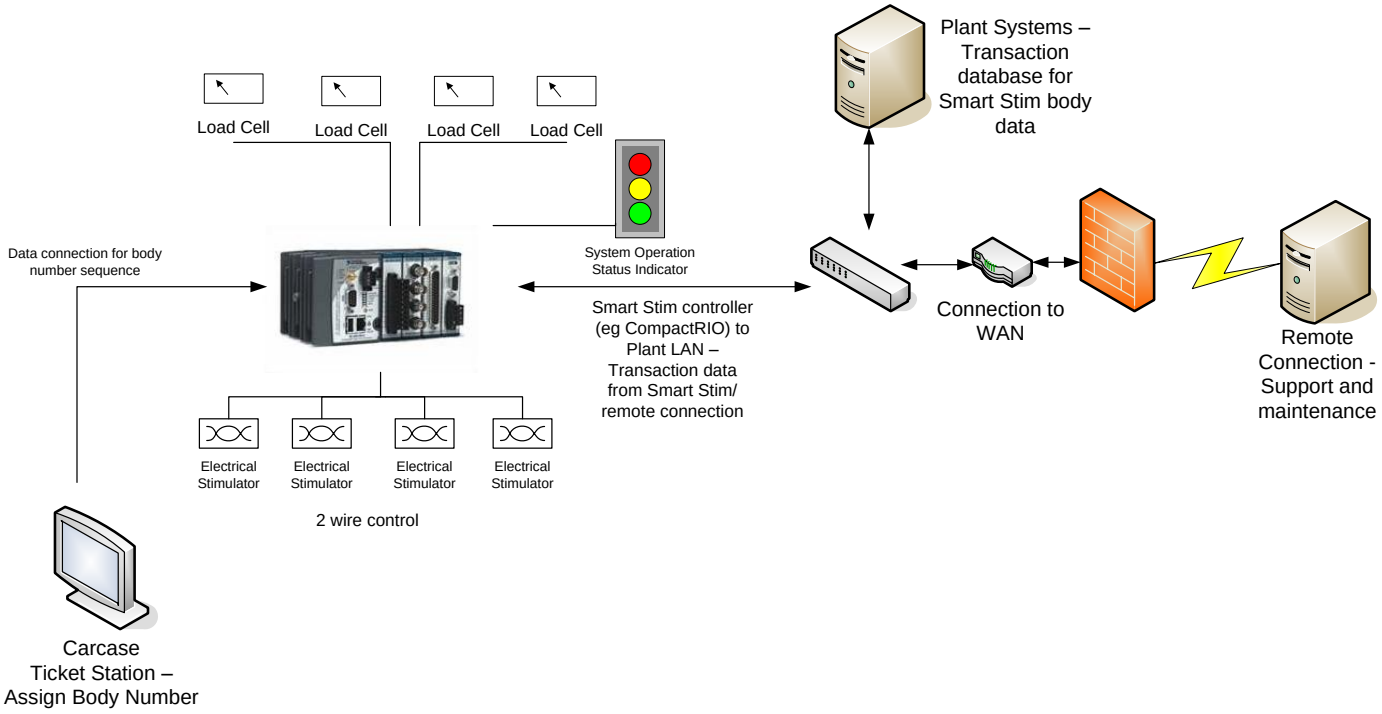
There are a limited and known number of possible users of the Smart Stim technology. This very limited number of units would make the possible reduced cost of a custom solution unachieved and will likely result in a higher per unit cost when all the custom approach costs are included.

3.2 Integration with existing plant systems

The Smart Stim system should integrate with the existing plant systems to record attribute data about the individual carcass stimulation. To achieve this integration will require the Smart Stim system to receive carcass number data and apply stimulation data to the carcass number record and then pass this collective data to a plant carcass database.

Methods and standards for data interfaces and data attributes need to be agreed with the plants and included in the Smart Stim system.

The diagram below shows the potential data interfaces for Smart Stim and the plant systems.



3.3 Development costs considerations

There are a number of development costs that need to be considered, these include:

1. Total cost of development divided by the expected number of installations.
2. Total cost of development including housing, cabling and testing in the abattoir environment (physical and electrical).
3. Total cost for testing and type approvals – EMC, OH & S, environmental (IP rating) and temperature ratings
4. Total cost of ownership for the abattoirs, eg installation cost, hot spares cost, end of life replacement costs, technical training and skill sets required for operation and maintenance.
5. Compatibility with existing abattoir infrastructure.
6. Technology migration path over time.
7. Ongoing installation, commissioning and support costs (hot spares on site and spares with service providers)

These costs must be determined and considered in any overall project consideration. As a general guide, the cost and time frame for custom hardware development follows the steps below:

1. Prototype to demonstration work concept - 1/3 of the development time and cost
2. Operational testing and reworking to meet operational environments – 1/3 of the development time and cost
3. Type approvals and manufacture of approved products – 1/3 of the development time and cost

3.4 Risk consideration

There are a number of risks associated with a custom hardware approach. These risked need to be identified and a suitable comparison made to a generic hardware approach, these include:

Issue	Custom Design Wireless SmartStim	CompactRIO SmartStim
Robustness	Enclosures still be designed and electronics yet to be proven in target environment	CompactRIO system designed to work in an industrial environment. IP Rated enclosure included in costing
Future Support (Hardware and Software)	Future support of hardware dependent on suppliers. Obsolescence of critical IC's would require redesign o f PCB. Software changes would require rewrite of Embedded code	Hardware built on a modularly design by National Instruments and will be supported in the future. Software developed in LabVIEW and will be able to be supported into the future
Environmental & Electrical Certification	Hardware not certified electrically or mechanically at this stage	Hardware certified for industrial use CE, IEC and IP rated
Operational Environment	Untested in harsh operational environment, especially impact on wireless communications	Designed to work in harsh environment, additional enclosure improves IP rating of system. Wireless communications not used
Scalability	Design of system scalable by addition of extra control units. One control unit is required for each Load cell	Scalable through be the additional of extra IO cards. Base configuration can handle 4 load cell.
Integration with other information Systems	Ethernet, FTP and HTTP interfaces included in the hardware design. Integration into plant Information system would require additional embedded programming	Ethernet, FTP and HTTP interfaces included in the hardware design. Integration into plant Information system would require additional programming in LabVIEW
Risk	high as hardware and software unproven and mechanical design and certifications still to be undertaken	Low, Porting of existing code to CompactRIO platform straight forward and uses same LabVIEW environment as original code. Hardware already certified and designed for industrial environment

Source: CPE Systems

3.5 Costs estimates for custom verse CompactRIO options

SmartStim Option Comparision								
	Option1 - Custom Design				Option 2 - cRIO based Solution			
	Labour Cost	Material Cost	Total	Comment	Labour Cost	Material Cost	Total	Comment
Non Recurring Engineering (NRE)								
Future Development Cost								
Mechnical/Electronic design	$12,820	$500	$13,320		$1,000	$500	$1,500	
Software Development - base	$15,200		$15,200		$6,000		$6,000	
Software development - IT Integration	$10,000		$10,000	Additional to original proposal	$4,000		$4,000	
System and Integration Testing	$14,000	$4,500	$18,500		$1,000		$1,000	
Pilot Site Testing	$14,600		$14,600		$9,000	$6,225	$15,225	
Project Management	$9,000		$9,000		$3,000		$3,000	
Consultants & Admin		$19,920	$19,920			$16,000	$16,000	Adjusted admin fee for lower NRE component
Travel/ Accommodation /Misc		$4,500	$4,500			$4,500	$4,500	
Sub Total	**$75,620**	**$29,420**	**$105,040**		**$24,000**	**$22,725**	**$46,725**	
Production Set Up								
Test System		$5,000	$5,000	Basic low volume Board Test			$0	
Tooling		$4,000	$4,000	Stencils and SMT Programming			$0	
PCB Set Up		$1,500	$1,500				$0	
Sub Total		**$10,500**	**$10,500**		**$0**	**$0**	**$0**	
Certification and Field Testing								
IP Testing	$1,000	$4,000	$5,000	Includes cost of services and test units			$0	
Environmental Testing (Temperature)	$4,000	$5,000	$9,000	Includes cost of services and test units			$0	
EMI/EMC Testing	$5,000	$7,000	$12,000	Includes cost of services and test units			$0	
Field Testing	$3,000	$3,000	$6,000		$3,000	$6,225	$9,225	
Sub Total	**$13,000**	**$19,000**	**$32,000**		**$3,000**	**$6,225**	**$9,225**	
Total NRE	**$88,620**	**$58,920**	**$147,540**		**$27,000**	**$28,950**	**$55,950**	
Recurring Cost								
Product								
Electronics		$2,500	$2,500	Based on four station installation, four controllers 4 relay units		$4,290	$4,290	
Enclosures		$750	$750			$550	$550	
Power Supply		$375	$375			$375	$375	
Indicator Lights (Traffic lights)		$260	$260			$260	$260	
Sub Total	$0	$3,885	$3,885		$0	$5,475	$5,475	
Installation	$3,000	$1,000	$4,000		$2,000	$750	$2,750	
Total Recurring Costs	**$3,000**	**$4,885**	**$7,885**		**$2,000**	**$6,225**	**$8,225**	
Life Cycle								
Spares		$50,000	$50,000	Allowance for through life spares of aproxmately 10% of build		$10,000	$10,000	Covers estimate on site spares. Ongoing product support supplied by National Instruments
Hardware Maintenance		$20,000	$20,000	Repair of defective units		$4,000	$4,000	Contingency
Software Maintenance	$20,000		$20,000	Software updates	$4,000		$4,000	
Contingency		$25,000	$25,000			$5,000	$5,000	
Total Life Cycle Costs	**$20,000**	**$70,000**	**$115,000**		**$4,000**	**$14,000**	**$23,000**	
Total	**$111,620**	**$133,805**	**$270,425**		**$33,000**	**$49,175**	**$87,175**	

Source: CPE Systems

These estimates are indicative only and based on the available information at the time of compiling this report. Any subsequent projects should prepare detailed costing for a whole of life approach to ensure all costs for development, site trials, software, support, maintenance, training and documentation (eg total cost of ownership) are documented and understood.