

Appendix A: Review of previous EBID Projects & Trials

Technology and cost/benefit assessment of electronic
bale ID

**Review of previous research and literature on
electronic bale ID**

Disclaimer

All information, statistics, analysis, projections, comment and opinions in this report are based on information believed to be reliable.

Some information presented in this report has been taken from material published by developers and marketers of certain technologies as well as consultants previously used by AWI to evaluate electronic bale ID. The consultant cannot warrant the accuracy or otherwise of such information.

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The AWI Project TD043 – Technology and cost/benefit assessment of electronic bale ID

Key wool pipeline stakeholders, as represented by AWEX's ISAC committee, have made an 'in principle' decision to proceed with a review of electronic bale ID. In order to do this, an assessment is required of:

- Available and preferred electronic ID technologies that meet performance standards required by the wool pipeline.
- A cost and benefit analysis of the additional costs and qualitative/quantitative benefits at all stages of the pipeline that may use bale ID.
- AWEX and AWI to co-fund the project with appropriate sub contracted consultants to carry out the above assessment.
- The recommendations of this project may be followed by additional bale ID implementation projects, including large scale trials. The commercialisation of the outcomes of the project will be subject to further project proposals.

The key drivers of adoption of electronic bale ID have been identified as:

- Wool and bale traceability and quality control.
- Potential logistical savings through the pipeline. The cost/benefit analysis will assess where these accrue and if they are passed back to the wool grower.
- Improved information flow from farm to processor.

The emphasis should be on keeping the solution:

- simple, reliable and scalable;
- tailored to the financial justification which is based on improving logistics efficiencies rather than creating a new marketing system;
- whilst not sacrificing reliability, focus on building off existing infrastructure where appropriate such as the introduced sheep and cattle ID system (NLIS) and not necessarily adopting the latest technology;
- uniform technology across the industry where appropriate.

A deliverable within this project is to review previous reports into electronic bale ID, summarise their findings and assess the strengths and weaknesses of their recommendations. The two key reports are

- Intrawool (Feb 2000) – *Wool Bale Identification – Evolution From Hand Stencil to Transponder*, and
- AWI Project EC452 (November 2003) – *Pilot Industrial Trial of Electronic Bale Identification*

Within the commentary on these reports reference will also be made to the Sheep ID trials (EC453) and Sheep ID Standards (EC551A) where appropriate. A review of the National Livestock Identification System (NLIS) and National Flock Identification System (NFIS) will be undertaken as a separate component of this project.

The weaknesses highlighted in these report are for the purpose of identifying areas requiring further research or verification and are not intended as criticism as, in many cases, they often reflect issues outside the scope of the reports reviewed.

AWI Project EC452 (November 2003) – Pilot Industrial Trial of Electronic Bale Identification

The key observations and recommendations from this report are summarised in the following table:

Observation / Recommendation	Strength	Weakness
<p>Recommended transponder is the low frequency 125 kHz</p>	<ul style="list-style-type: none"> - Workable read range - Integrate with on farm readers and wool production systems - Many of the ISO 11784/5 compliant readers already read both tags - Low interference levels - Packaging suited to logistics and warehouse environments - Relatively inexpensive - The report indicates a broad evaluation of alternative technologies, ultimately focusing on a proven, cost-effective and widely available solution. 	<ul style="list-style-type: none"> - Read range not comprehensively tested under all conditions - Standards other than FDX-B should be more widely explored to ensure it is as “future proof” as any other alternative - The preferred solution has not been adequately benchmarked against alternative technologies with regard to read range, anti-collision avoidance and possibly cost - The need or otherwise for anti-collision capability requires review - Whilst alternatives were dismissed due to cost or limited availability they should be reviewed again given the rapid advances in this technology space. - Fails to take advantage of HDX which is already widely distributed through NLIS
<p>A read-only tag with a 10 digit number is all that is required for the solution.</p>	<ul style="list-style-type: none"> - Eliminates complexity, - reduces cost, - increases reliability, - removes the sensitivity related to the transfer of marketing related information 	<ul style="list-style-type: none"> - A unique numbering system within Australia does not take into account similar initiatives which may be undertaken in wool overseas. A brief review of any overseas bale ID technologies and a review of the IntraWOOL recommendation for EAN Serial Shipping Container Code (SSCC) should be undertaken.

		Review whether the proposed numbering system will provide a similar outcome
A PVC credit card style is recommended as the optimal packaging	<ul style="list-style-type: none"> - Tag enabled sufficient flexibility, strength and protection to withstand downstream handling stress (e.g. at core test and dumping) - 100% read success rate was achieved 	<ul style="list-style-type: none"> - The application/incorporation of this tag into the woolpack was not adequately addressed nor the resultant read risk: e.g. applying at point of manufacture introduces upstream risk such as high compression prior to containerisation. - Proper analysis to determine application cost and potential risks not undertaken (although similar risks apply with alternative technologies)
The most appropriate point to attach transponders on to bales is the top flap of the pack, centred as per the current label, set back 10 – 150mm from the edge of the flap.	<ul style="list-style-type: none"> - Maximises read capability and reduces risk of damage. 	<ul style="list-style-type: none"> -
The transponder procurement process be centralised to a controlling industry body that controls the supply of tags and tag design and packaging for wool packs. This industry body be made up of representatives of AWEX, AWI, three brokers and dumpers and the RFID industry (for technical advice)	<ul style="list-style-type: none"> - If this works effectively it would ensure uniformity, lowest price and proper maintenance of standards 	<ul style="list-style-type: none"> - Inadequate detail in the report as to how the distribution of tags will work operationally. - The RFID industry representatives will competing to promote their respective technologies – cooperation may not be likely nor effective. An alternative may be an independent technology consultant. - Tag design would appear outside the appropriate role of the industry body – refer earlier comment as to setting the standard.
A typical ISO reader is adequate for on-farm reading while longer range readers are recommended into and out of the wool dump.	<ul style="list-style-type: none"> - Low cost option and may piggyback off existing reader technology already in the field 	<ul style="list-style-type: none"> - The type of readers currently in the field is variable. Some read HDX only, some HDX & FDX.

		<ul style="list-style-type: none"> - Inadequate stress testing within the downstream processing environment (eg in wool stores, dumps, ESPs) as well as assessing potential impact of the variety of downstream facilities. - Reference made to “specifically designed reading hardware” for wool stores but no costing provided. - Requirements within downstream handling and processing operations was not adequately addressed or costed (generally outside the scope of the report)
As part of a controlled implementation program, development costs be channelled into a long range portable reader that can be used at various stages of handling.	<ul style="list-style-type: none"> - Addresses read range challenges at points of the supply chain – particularly in downstream handling 	<ul style="list-style-type: none"> - This would appear more appropriate to be developed by a potential vendor – part of a tender for supply to the Australian market. Alternative may be to channel funds into an existing vendor to develop and support appropriate reader technology.
<p>Industry Standards:</p> <ul style="list-style-type: none"> - That the 125 kHz tags are tested and certified as reading 100% at point of dispatch by the transponder manufacturer - Where transponders are delivered from supplier direct to pack manufacturers, the pack manufacturers read and certify tags at the latest possible point prior to dispatch to assure readability of packs - That reader hardware equipment uses a standard communications interfaces of RS232 Serial connection, 9600 and/or 19200 bps, 8 data bits, No parity, 1 stop bit - That software developed within the industry 	<ul style="list-style-type: none"> - Whilst the industry cannot impose international standards on other parties, a consistent use of the technology using commercially viable protocols will ensure hardware and software conforms to reasonable protocols. 	<ul style="list-style-type: none"> -

<p>conforms to a standard platform for communication. Reader output files should be in the standard CSV format External files that are transferred are coded into the standard XML format</p>		
<p>There are several aspects of integrating RFID and this should be in a controlled and orderly manner to progressively integrate the technology. Recommendations:</p> <ul style="list-style-type: none"> a) The existing wool pack label with the barcode on it should be abolished immediately b) Transponders to be attached on existing packs in Australia (i.e. old style in stock at time of introduction of Bale ID), using a central contract packer. Tags can be delivered direct to the packer in pockets prepared prior to delivery and that transponders are delivered direct to pack manufacturers, for delivery to Australia c) Second hand pack repairers be accredited to remove old RF tags from packs, and replaced with a new tag sewn in to the repaired pack d) Tags should not be recycled e) That a RFID Implementation Program be set up and controlled to commence and manage the progressive implementation of RFID tagging to wool bales throughout the supply chain. Program to tag and manage a minimum of 100,000 bales throughout the country, from producer to processor, using pre-tagged bales f) Program to be managed by AWI and AWEX g) Program to include at least two brokers of wool handlers from each state, plus a selection of major national brokers such as AWH, Elders 	<ul style="list-style-type: none"> a) Significant cost saving b) Facilitates earlier and initially broader implementation if feasible c) As per (b) d) Removes risk of duplication e) A large scale project with the level of buy-in proposed would be an excellent launching program. f) Ensures industry priorities are properly addressed g) Ensure industry buy-in h) Properly derived costings will provide a basis for equitable apportionment to ensure a win:win with participants 	<ul style="list-style-type: none"> a) May not be feasible. Further research is required as to whether some form of label is still required. b) Several issues here: <ul style="list-style-type: none"> o It is unclear what process is proposed for “registration and approval” of these parties. o It is unclear as to substantiation of cost estimates provided o Discussions with wool pack manufacturers and importers on this matter do not appear to be included in this report o The cost might be avoided if old packs are allowed to “wash out” through the system c) As per (b) d) The recycling of packs and tags is not fully explored and warrants a brief review as to whether the manufacturers can recycle/renumber the tags (possibly a more expensive tag required) or whether agreed processes can facilitate recycling of numbers within the wool chain. e) There is no attempt to quantify such a program (cost or timeframe) or how and when benefits will be achieved / realised. (In fairness, possibly outside

<p>and Wesfarmers Landmark. Program to also include all major dumps, plus overseas processors in Europe and Asia. Local processors such as Chargeurs and Michell to be included</p> <p>h) Program to provide accurate costing of benefits to the industry. These cost improvements to be shared with producers and post farm parties through lower costs</p> <p>i) A number of forums and demonstrations to producers and Classers be constructed and carried out to demonstrate the electronic forms of existing documentation, and to advance the general advantages of RFID to on farm management</p>		<p>the scope of the project but unfortunately referred to in the report)</p> <p>f) N/A</p> <p>g) N/A</p> <p>h) With all savings being realised downstream from the farm gate the concept of such a cooperative approach is idealistic but possibly not commercial. This must be tested with downstream participants. A detailed cost:benefit analysis does not necessarily require a trial</p> <p>i) Standardisation of software and procedures across all classers is a major implementation issue hardly addressed – critical area to assess prior to commitment to a full scale trial. Also, other parties in the shearing process (e.g. contractors) should be consulted.</p>
<p>Based on the earlier recommendations, the Sokymat World Tag ISO Card at a cost of A\$1.40 to A\$1.50 provides the likely landed cost for Australia</p>	<ul style="list-style-type: none"> - This is a small cost in relation to the value of a bale of wool and, in particular, to the total handling costs which should reduce due to the introduction of this technology 	<ul style="list-style-type: none"> - There is insufficient information in the report in regard to the up front and ongoing costs of developing the bale ID reading infrastructure and the subsequent “cost per read”. - The problems with NLIS with buyers refusing to pay the \$0.40/hd to cover the reading of tags with the cost subsequently being passed onto the vendor (and now pushing for government subsidy) - Issue of “who pays” requires resolution prior to implementation and will be addressed in the CBA.

<p>The estimated net savings per bale of wool is estimated at \$3.65 per bale or \$10.2m for the Australian wool industry</p>	<ul style="list-style-type: none"> - Substantial saving - 50% estimated to accrue to growers 	<ul style="list-style-type: none"> - Lack of rigour and substantiation in the economic case - \$0.70 attributed to removal of need for a bale label – this is apparently not the case but should be properly evaluated / canvassed. - No assurance (or supporting research) that adequate benefits will accrue to wool growers - No analysis of degree of uptake required to generate returns and whether they are realisable across all participants
<p>On farm trials successful in translating information into electronic versions of existing forms and emailing through to the wool store</p>	<ul style="list-style-type: none"> - A major area of savings once the wool store knows in advance the details of the bales in transit to the store (i.e. receipt of electronic classers report). 	<ul style="list-style-type: none"> - No analysis of potential uptake, cost of developing programs for electronic classers report and integration costs with wool stores
<p>Surface Acoustic Wave (SAW) tags should be assessed as an alternative technology</p>	<ul style="list-style-type: none"> - This has the possibility of halving the cost and increasing the read distances - SAW technology has the ability to be used within the same reader network as the current low frequency readers 	<ul style="list-style-type: none"> -

IntraWOOL (Feb 2000) – Wool Bale Identification – Evolution From Hand Stencil to Transponder

The introduction to the report provided the following insight which was the precursor to the first three recommendations of the report:

“It was announced in October 1999 that “The Wool Exchange Board has agreed to implement new pack labeling requirements, which should be in place by the start of the 2000/01 selling season, and to work with industry to determine what further development of bale ID technologies was required”. This announcement signaled the Board's acceptance of two recommendations made to it by the Steering Committee of IntraWOOL Australia shortly beforehand.”

The key observations and recommendations from this report are summarised in the following table:

Observation / Recommendation	Strength	Weakness
The numbering format known as the EAN Serial Shipping Container Code (SSCC) to be adopted or the numbering of wool bales.	<ul style="list-style-type: none"> - This is an internationally recognised system of numbering and will provide each bale with a unique ID to which all data related to the bale and its contents can be linked. - Such data will then be available for access by all accredited parties along the supply chain. 	<ul style="list-style-type: none"> - The proposal for a central database cuts across current commercial arrangements without adequately addressing IP and commercially sensitive data.
<p>A label of material consistent with wool pack material (Nylon 6 or 66) to be attached to all wool packs and that requirement to be incorporated into the wool pack specification.</p> <p>A bar code representation of the EAN number format was to be included on the label.</p>	<ul style="list-style-type: none"> - A key objective of the IntraWOOL Project was to provide electronically readable bale identification along the whole supply chain. At the time it was acknowledged that bar code technology is not sufficiently robust for that purpose. - The IntraWOOL Project was about to complete its bale ID trial program and endeavoured to evaluate and recommend the use of radio frequency identification systems as a solution to the whole of supply chain bale ID objective. 	<ul style="list-style-type: none"> - Bar code not an ideal working solution but cost effective whereas the EAN is recognised internationally
An RFID solution cannot be implemented with the stroke of a pen. The Project has identified a technical solution and parties that have been closely involved with the work done have an	<ul style="list-style-type: none"> - Such a program would provide further opportunities to pursue a lower cost RFID system commensurate with the rapid development of this technology. 	<ul style="list-style-type: none"> -

<p>appreciation of the benefits available. However for the technology to be adopted comprehensively across the industry further demonstrations need to be provided to a wider range of commercial industry participants.</p> <p>3.1 The industry should continue its progress towards adopting RFID technology as the primary means of providing electronically readable wool bale identification along the international wool supply chain.</p> <p>3.2 The RFID device is to be located in the seam of the wool pack and to be attached at time of pack manufacture.</p> <p>3.3 The device and its interrogation equipment is to be initially ISO compliant, until it can be demonstrated that abandoning ISO compliance will enhance the cost effectiveness and availability of equipment (tag - scanner - antenna configuration) to the producers, material handlers and customers in the international wool industry.</p> <p>The Steering Committee of the IntraWOOL Australia Project strongly urges the Australian Wool Exchange to ensure that the introduction of a Standard for a whole of supply chain RFID solution is vigorously pursued.</p>	<ul style="list-style-type: none"> - Pragmatic approach to the economics of widespread introduction and initial requirements for strict standards. 	
<p>4.1 Businesses in the industry, such as individual Brokers and early stage Processors, to become members of EAN.</p> <p>4.2 Taking advantage of 4.1, it is suggested that the Broker representative bodies introduce a common EAN system for identifying farm lots.</p> <p>4.3 Similarly, it is suggested that early stage</p>	<ul style="list-style-type: none"> - 4.1 supported industry buy-in and involvement up to ESP level - 4.2 supported consistency throughout the system in relation to numbering - 4.3 is consistent with 4.2 for downstream processors 	<ul style="list-style-type: none"> - The cost of an industry database and its ongoing management are not adequately addressed nor are the benefits of the database

Processors adopt an EAN system for identifying their products.		
<p>5.1 It is recommended that the tag specified for the industry is a read / write model.</p> <p>5.2 The tag should be formatted such that the bale ID, once programmed in, cannot be changed.</p> <p>5.3 Tag available memory should be sufficient to have two further fields of data programmed in: Lot number to be added at Broker's store; Countermark to be added at dump.</p>	<ul style="list-style-type: none"> - Addressed early aspirations for the ability to carry data through the supply chain to drive information and handling efficiencies - 5.2 provides an element of tracking security in relation to ID. - 5.3 Pragmatic approach to what further data would be written without creating commercial sensitivity 	<ul style="list-style-type: none"> - 5.1 introduces security issues and sensitivities which could undermine widespread support and adoption despite the proposed limited data to be written - Read/write introduces elements of cost and reliability - Moves from a simpler solution when the added complexity has not demonstrated acceptability on commercial or political bases
<p>6.1 An industry standard message to be developed that defines the data fields that are to be used when collecting data during the harvesting of the wool clip. By having available a message of standardised content and structure, all businesses at the beginning of the wool supply chain will be able to exploit the potential for electronic data capture and transmission technology to reduce errors and streamline materials handling operations. It is suggested that the responsibility for the development and administration of this new standard message should be passed to the Wool Industry EDP Users' Group (WIEDPUG). This industry committee routinely manages the existing set of electronic industry messages</p>	<ul style="list-style-type: none"> - Strict standards promoted to support downstream information availability and efficiency 	<ul style="list-style-type: none"> - There are simpler ways of transferring information other than on the bale ID device - Must understand what the expectations of the standard message is: is it number only or other data
The report recommends that AWEX should administer and issue numbers for identification of greasy wool bales and of bales of ESPs	<ul style="list-style-type: none"> - Central control of the standards and numbering - Logical that this is centralised for good governance sake. 	
The report supported the recycling of woolpacks	<ul style="list-style-type: none"> - A cost effective approach but reliant upon a central database to record the 	<ul style="list-style-type: none"> - Becoming less of an issue as 2nd hand packs becoming harder to get

	bale trail (although a central database is not necessarily required to achieve this)	
The report recognises the need to retain a bale label for visual ID when reliance on electronic ID is either not possible or impractical. The report also supported the use of barcodes	- Recognises the need for a visual fallback (not recognised by EC452)	- Barcodes now seen as impractical relative to alternative technologies. At the time limited read ranges for RFID was a greater constraining factor than at present.

The IntraWOOL project had objectives which no longer appear to be an imperative of the broader wool industry and it was European focussed whereas the bulk of Australia's wool is now sold into China. Those original objectives were:

- To **set up a system (INTRAWOOL electronic marketplace)** based on Information Technology, which provides access to all relevant information the European partners require for their decision making, producing and processing wool at any time from all places in Europe.
- To **adopt EDI-standards for the wool industry** and to demonstrate the benefits of its application.
- To **set up a barcode / transponder based identification system**, that is suited for the bale handling processes in the wool industry.

The report relevant to this current project addressed item 3 but may have carried through the influence of aspiring to developing a system to allow access to critical information across the processing chain, hence the recommendation of having write capability.