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Wool Harvesting Program Upright Posture Shearing Platform Project – Stage 1 Performance Requirements

1. Background

As a result of completing a wide-ranging review of wool harvesting technologies, AWI has initiated a Wool Harvesting Program with three strategies:

- New technologies such as upright posture shearing platforms (UPSP) and biological harvesting.
- “Add on” technologies such as new hand pieces, improved combs/cutters and safety devices.
- Shearer/wool handler training initiatives such as the development of resource materials and national funding and training co-ordination.

A key result of the harvesting review was that that UPSP and elevated catching races (ECR) have the potential to increase productivity and reduce OH&S injuries.

ECR eliminate the catch and drag and the time associated with it, potentially resulting in a productivity increase. ECR and UPSP are expected to require less shearer effort in manipulating and shearing sheep. The reduced effort required is expected to have a positive impact on productivity, lead to retention of older shearers in the industry and encouragement of new entrants to harvesting.

It is expected that the combination of ECR and UPSP will minimise OH&S injuries related to catch and drag, let go, and cumulative micro trauma back injuries associated with the bent posture of on the board shearing.

AWI is aware of approximately 10 candidate UPSP technologies. While AWI will not fund all these technologies, it has selected six UPSP suppliers for development support from AWI. Selection was based upon the combination of potential for success, novel approach, state of development, resource team, and identified commercial route to market.

The UPSP program will have two stages.

- Stage 1 will involve the development and field trials of single stand units. These may have potential as low cost shearing stands, either fixed in existing shearing sheds or as mobile platforms, similar to crutching cradles.
- In Stage 2, successful proponents will be invited to develop more sophisticated mobile multi stand systems complete with fleece handling, binning and pressing facilities. Such a mobile system, when combined with on site sheep shelters and yards, could replace existing shearing sheds.

AWI recognise a spectrum of applications for ECR and UPSP. At one level, individual producers may wish to acquire a single stand, or multi stand system, for their own wool enterprise. Additionally, shearing contractors may wish to acquire mobile single or multi stand systems complete with wool handling capability.

2. Stage 1 objective

The principal objective of Stage 1 is to demonstrate the viability and achievable productivity of shearing on an UPSP.

Enhancements such as integrated wool handling and multiple stands are seen as Stage 2 developments.

3. Points of contact

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4. Key success factors

For this program to be successful, the following key success factors have been identified:

1. Development of shearing blow patterns optimised specifically to each UPSP. This required support from professional shearer trainers experienced in developing alternative blow patterns. This was expected to involve two weeks full-time initially, and then in the order of a half day per week for three months.
2. Selection of a committed shearer who is able to drive the UPSP at its maximum rate. The shearer chosen needed to believe in the potential of the system, be prepared to persevere with its development, and be capable of making constructive feedback on improvements required. The UPSP supplier should have considered training at least one additional shearer for backup.
3. Shearer income compensation. A shearer will be less productive while they are learning new blow patterns and adapting to UPSP. Piece rate based remuneration was not appropriate until the shearer approaches comparable on-the-boards productivity.
4. Different physiological effects. Shearers are using different muscle groups in an upright posture shearing position. Initially, they may have felt some stiffness or even pain. Shearers were counselled on what they should expect and should also have undergone prior training.
5. Continuity of shearing. One component of achieving comparable productivity was continuous use by a committed shearer. This required networking with a shearing contractor(s) and producers to find continuity of shearing.
6. Incremental improvements. It was expected that a number of incremental improvements will be identified while the shearer is learning to use the equipment. These refinements required that the UPSP be taken out of service while being modified, thus being in conflict with the continuity of shearing.
7. OH&S evaluation and refinement. An important first step in the program was to have independent evaluation and feedback on OH&S performance, before deficiencies are substantially locked into the design.

8. Commercial route to market. In addition to having the capacity to conceive and develop an effective ECR and UPSP system, commercial success depended upon having the capability to manufacture the equipment and market it throughout Australia. This might require partnering with other organisations for one or both of these components.

5. Resource team

Assessing UPSP applications for development support included an assessment of each resource team. AWI looked for access to these resources at a suitable level:

- Ability to fabricate and refine a prototype ECR and UPSP.
- A shearer or shearers of open-minded disposition and commitment to making the system work.
- A physiotherapist experienced with shearing, to develop a training program specifically for each UPSP, and to be available to assist with injury advice if required.
- A shearer trainer to assist with development of blow patterns.
- Access to a continuity of shearing.
- An independent expert to assess OH&S features of the system.
- Capability to commercially manufacture the equipment.
- Capability to commercially market the equipment on a national basis.

If a UPSP supplier did not have access to all these resources, it could seek AWI's financial and technical support in addressing these.

6. How was AWI able to assist each UPSP provider?

The following are ways in which AWI was able to assist each UPSP provider.

Access to industry best case performance

Having undertaken its review into wool harvesting technologies, AWI was aware of technologies that may enhance the performance of each provider's equipment. Where this is public domain information, AWI assisted with access. However, AWI did not divulge proprietary or non-public domain information.

Identifying suitable shearers and shearing contractor's

If a UPSP provider had difficulty in identifying a suitable shearer, or a shearing contractor to find a continuity of shearing, AWI was able to assist through its network of contacts.

Developing shearing blow patterns

If a UPSP provider had difficulty in identifying a suitable shearer trainer to optimize blow patterns, AWI was prepared to separately fund a professional shearer trainer.

Occupational health and safety (OH&S) assessment

AWI separately funded an independent OH&S expert to assess and provide feedback on equipment.

AWI was also able to assist in identifying a suitable physiotherapist, to develop a training program and further assistance as required.

Design assistance

If there were aspects of a UPSP concept that required professional mechanical or electrical design input, AWI was able to assist with these resources.

7. Performance requirements

Definitions of some performance measures

AWI encouraged UPSP providers to become familiar with the following performance measures, and to use them in their own evaluations with shearers and shearer trainers.

Same shearer/same sheep throughput

To assess the productivity of an ECR and UPSP, the variability of shearers and sheep must be taken out of the equation. Hence the term 'same shearer/same sheep throughput'. That is, when the throughput of the system is to be measured, a comparison is to be concurrently measured with the same or similarly productive shearer, shearing the same sheep type, on-the-boards, on the same day. This might involve alternate runs on the board, and on the UPSP.

Non-productive shearing time

In addition to encouraging UPSP providers to measure the total time taken per sheep, AWI also encouraged the measurement of non-productive time. That is, the elapsed time from finishing the last blow on a sheep, to starting the first blow on the next sheep. Typically, this time is an attribute of each system and is not greatly impacted by sheep or shearer. Minimising this time will be a substantial driver of the productivity gains.

Maximum back lean angle

Inevitably, a shearer will spend some of his time leaning over a sheep on an UPSP. Minimising the back lean angle, and the duration of leaning, is an important performance objective. In evaluation of the performance of the UPSP, the maximum back lean angle was measured and compared with best-case performance. AWI could not nominate an acceptable maximum angle, but clearly stated that it was a design imperative that it be minimised.

Energy expended

It is expected that there will be a standout difference in the energy levels expended between conventional catch and drag and shearing-on-the-boards, and, the combination of ECR and UPSP. During the evaluation stage, AWI intended to measure the energy expended (possibly by oxygen demand or similar technique).

Sheep fall height

Many industries measure product fall height in manufacturing processes, and benchmark against best-case performance standards, to minimise product damage. The stark difference in sheep loading between different UPSP is the distance that sheep 'fall'. The good systems usually have an effective crush that grips and inverts sheep, before releasing it and allowing it to 'fall' a very small distance onto the platform. The bad systems are characterised by excessive and somewhat uncontrolled fall heights. The same measure can be applied to sheep let go as well. Apart from having a direct impact on smoothness of operation, reliability, and low cycle time; it also impacts on the adverse experience for the sheep, and their memory of it in future years.

Sheep fall height is a measure of the changing height of the sheep in any falling or dropping motion. The measurement is taken from the nominal centre line of the sheep's body.

Deadman/safety switch for handpiece

A handpiece deadman/safety switch is defined as a switch, or other mechanical/electrical/electronic device, that turns off the handpiece when the handpiece locks or is released for whatever reason.

Mandatory performance requirements

1. The target same shearer/same sheep throughput was 100-120% of the on-the-boards comparison. That is, if a shearer can shear 30 sheep per run on-the-boards, AWI targeted the same shearer to shear 30 to 36 sheep per run on the UPSP.
2. The UPSP was to achieve the following OH&S targets:
 - Elimination of the catch and drag thereby eliminating related injuries.
 - Elimination of let go chute related injuries by having a clearly defined sheep let go path requiring minimal effort from the shearer.
 - Reduction in back injuries (related to the extreme bent posture working position of conventional shearing on the boards) by shearing on some form of platform, or belt, or rollers, or chair, allowing the shearer to shear with an upright back posture.
 - Minimisation of handpiece related injuries by incorporating a dead-man and/or safety switch into the handpiece or its drive.
 - Suitable mechanical sheep restraint to minimise the possibility of kicking related injuries. As a minimum, this might require the hind leg nearest to the shearer is to be restrained. Electro immobilization, while a promising long term restraint option, was not acceptable for the stage 1 prototype.
3. There was to be no catching pen. Sheep were to progress through a self-drawing ECR.
4. Without the shearer having to move away from the platform, sheep were to be delivered from the ECR to the UPSP with minimal effort required by the shearer.
5. The UPSP was to be mobile, allowing it to be freely moved for demonstration and evaluation purposes.
6. The design of the UPSP system was to avoid as much as possible excessive sophistication in electronics and mechanical precision, which increases the initial capital cost and specialisation in maintenance.

7. To combat bio-security risks, the UPSP system was to be designed to be easy to thoroughly clean after shearing at each property.

Desirable requirements

1. For Stage 1, the UPSP was to be a single stand configuration. It was desirable that the concept be easily scalable to a multi-stand mobile configuration as required in Stage 2.
2. For Stage 1, wool handling could have a high labour component (the initial target being achievement of effective shearing), but should have achieved at least equivalent wool quality to conventional shearing.

However, it was desirable that the design be developed to connect into a clearly defined wool handling system that minimises potential contamination between fleece, locks, bellies, and pieces. This will be mandatory in Stage 2.

3. When produced in commercial quantities, the target price limit for a power assisted UPSP was \$15,000.
4. The desirable maximum dimensions for the UPSP, inclusive of ECR, were 2000 mm front to back, 2500 mm long, and 2500 mm high.

How was the prototype UPSP to be assessed?

At the commencement of the project with AWI, each UPSP provider was provided with a written assessment of perceived opportunities for improvement for their existing UPSP, based on industry best case performance of ECR, UPSP, crush and restraint systems. At some stage of development, AWI expected that these improvements would be incorporated in the prototype. This initial assessment included an OH&S assessment.

After completion of the prototype, AWI assessed the throughput performance of each UPSP after one month, after three months (if applicable) and at completion of prototype development. AWI completed a written assessment of the performance at each of these occasions.

On each occasion AWI would:

1. Measure the same shearer/same sheep throughput.
2. Measure productive and non-productive shearing cycle times.
3. Measure maximum back lean angle.
4. May measure energy expended.
5. Measure the sheep fall height.
6. Confirm that the mandatory requirements have been achieved.
7. Record which desirable requirements have been achieved.
8. Undertake an OH&S risk assessment.
9. Photograph and record video of the performance. As a condition of the development support, AWI will retain the right to use video and still photographs to promote the wool harvesting program.

8. Intellectual property (IP)

Funding from AWI to individual UPSP inventors was based on maximising the benefit of this technology to the wool industry. Hence it was negotiated on the following basis wherever possible:

- Any patentable/protectable IP developed after project commencement was to be jointly owned by AWI and the UPSP provider.
- Where appropriate and based on their level of input, the initial UPSP inventor was to be provided with an exclusive license so that a 'head start' could be gained in the market place.
- Where an inventor brought proprietary information to the project, IP negotiations were conducted on the merits of each case.

9. Project funding guidelines

The following funding guidelines were provided to assist in preparing a comprehensive budget to address all the key success factors and resource requirements for a successful project.

1. AWI provided dollar for dollar funding as an initial proposition. Variations were considered on a case-by-case basis.
2. Dollar for dollar funding was applied going forward. It was not to be applied retrospectively to existing UPSP investments.
3. Dollar for dollar funding could be applied to in-kind contributions of materials and labour.