Pegasys Installation
BMA – Goonyella Riverside Mine

The Problem
Dragline safety within the mining industry has always been of high priority. With such a large piece of machinery, there are many aspects which can place employees and equipment at risk.

BMA's Goonyella Riverside Mine Operations and Technical Services teams focused on 3 areas of concern regarding dragline safety:
- Visibility from the cab
- Collision
- Tub slippage and sinkage

Operator visibility from the cab is a major contributing factor in incidents involving dozers, light vehicles and cable tractors. Dragline operators have previously relied on radio communication to determine where equipment and personal are located in relation to the dragline at any one time.   Examples of incidents resulting from bucket/equipment collisions are shown below.

Defining the root cause of an incident also proved to be very hard due to the visibility restrictions. Operators were not able to provide accurate information as they were generally unable to see areas where the majority of incidents occurred.

Slippage and sinkage of the dragline tub is also a long running issue experienced by all mines managing dragline operations. In the past, it was up to the dragline grounds-man to identify tub slippage & sinkage and rectify the problem before it created an unsafe situation.

There are many cases where this unsafe situation has not been picked up in time resulting in damage to dragline shoes, cables, and even in some extreme cases where the whole machine has slipped into the pit.

The Solution

Engineers at Goonyella Riverside mine together with Mineware Pty Ltd developed a 3-dimensional dragline GPS navigation system called Pegasys. Not only did Pegasys provide obvious advantages in the area of production, it also allowed for great innovation in dragline safety.

Four cameras were installed on the dragline at various points enabling the operator to view areas not visible from the cab. This addition assists greatly in the investigation of equipment failure and safety incidents. The cameras track the bucket and record while the dragline is in operation with data recorded onboard and kept for a period of approximately 4 days. Factual data is easily downloaded via the wireless network for investigation in the event of an incident.

Camera display monitor in dragline cab	Dragline bucket location is always recorded while the machine is in operation

The Pegasys project team is currently working on a tool which will alert the operator of excessive tub slippage and sinkage which assists in preventing high potential tub incidents and shoe/cable damage from excessive tub sinkage.

Two high precision GPS antennas along with inclinometers will continually calculate the dragline centre of tub and angle with very high accuracy. If the dragline centre of tub moves in the XY direction too much over a given period of time without the machine propelling, the system will alert the operator that the tub may be slipping and indicate the direction of slippage for further investigation.
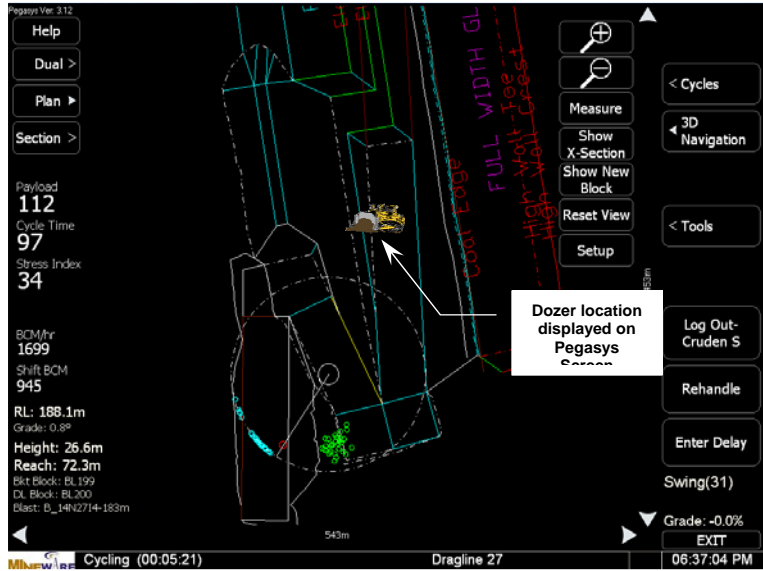
If the draglines centre of tub decreases in the Z direction (or tilts) past a given tolerance, the operator will be alerted that they may need to walk the machine out and fill the sink to prevent the shoes rubbing on the ground and/or damaging a cable. The tolerance on the alert will be based on the height of the shoes from

the ground which would be adjusted depending on the make of the dragline (eg, Marion or BE).

Investigations are also underway to incorporate a dragline collision avoidance warning tool. Goonyella Riverside and Mineware have gained ACARP funding to develop a prototype system that would see the high precision GPS on both the dragline and dozer used to indicate when there is potential for a collision.

The dragline and dozer would both be visible on the Dragline Pegasys screen in real time. 'No Go' zones for the dozer can be defined by 3-dimensional dig and dump points and an alarm could be sound if the dozer enters the restricted area.

Proposed Pegasys screen with dozer location displayed in real-time

'No Go' areas defined

Benefits/Effects

At Goonyella Riverside alone there are approximately 45,000 dragline working hours per year leaving the potential for many high risk incidents to occur.

Previously, human error played a large roll in dragline safety incidents but Pegasys reduces the human error risk greatly allowing the operator to be more aware of his surroundings and how the machine is functioning.

Since the installation of Pegasys, there has been no equipment interaction accidents recorded with production measurement accuracy improving by 10%.

Transferability Across Industry

Any site which includes draglines in its equipment fleet, could definitely benefit from this software.

Pegasys could also be adapted for use on Electric Rope Shovels and possibly Hydraulic Excavators.

Goonyella Riverside was the first site to develop, trial land install Pegasys which has been recognized as best practice within the organization resulting in other assets within BMA implementing the system.

Innovation

The Pegasys project is an initiative of the BMA Goonyella Riverside Mine Operations and Technical Services Departments and was driven due to the need for increased precision to implement the mine design. The innovation of this initiative is the incorporation of operator safety into the scope of the project to reduce the potential for Dragline/equipment collisions.

The project has been running for 4 years and is expected to deliver the collision avoidance warning tool and the tub slippage and sinkage indicator by Late 2009.

Unique and successful partnerships were formed during the construction stage of this process, merging ideas and concepts from varying industry and technical backgrounds to create a groundbreaking system.

Goonyella Riverside's Mine Operation staff Ross Carlson, Ben Dennis and Brad Prytherch worked closely with engineering company Mineware Pty Ltd to formulate this innovative dragline system to increase dragline safety and productivity.

The Pegasys system provides safety that no other dragline monitoring system in the world can offer with elimination of collision avoidance through GPS and camera systems.

This system is a classic example of how an innovation can solve both health and safety issues as well as assist the company with production.