



Hinz Automation Inc. Agrium Potash Inc.

The Client:

Agrium Potash Inc. operates an underground potash mine near Saskatoon, Canada. The mine went into production in 1969 and has over 100 years of mine life remaining. The mill has a capacity of 1.56

million tons per year. To meet the demands of the mill capacity, and to reduce production costs, a program to automate the mine's boring machines was initiated.

The Requirement:

The purpose of the borer automation project is to implement a control system for automated guidance of the borer, and straight line installation of the extensible belt. This has four main goals: which are to improve the operator's working conditions, improve in the accuracy of the cut (resulting in reduced cost & increased safety), increase productivity, and reduce extensible belt costs.

Controlling the accuracy of the vertical height of the cut prevents cutting below the top clay seam present in the ore body. If this condition occurs, the risk of operator injury or equipment damage is greatly increased due to the possibility of the under cut section of the back falling down. Cutting too high into the back increases the production of unwanted material, mainly halite (NaCl).

To reduce the wear and tear on the borer and to decrease the number of broken bits and trim chains the

forward speed of the miner had to be accurately controlled. This would also provide consistent production.

The horizontal control of the miner and the hardware discharge skid that trails behind the bridge directly affects how straight the hardware for the room belt is installed. The borer had to be accurately controlled to reduce wear and tear on the belt and to lower the loading on the drive motor for the extensible belt.

An additional requirement was the annunciation of alarms and the trapping of fault conditions. The original miner control system did not allow the operator to see what stopped the miner in all instances. With implantation of a fault trapping system the operator could quickly identify what piece of equipment was at fault and give correct information to the maintenance personal.

The Design Solution:

Hinz Automation was retained to provide a complete automation system for two Marietta boring machines. The automated system controls the motion of the borer in its three axis, i.e. Pitch (up/down slope), Roll (left/right slope), and Yaw (horizontal heading). On first pass, pitch and roll is controlled by following the clay seams using a vision camera on both left and right sides of the borer. Yaw is controlled by vision camera signals following the spot of a back mounted laser on a miner mounted target.

On second pass, pitch and roll is controlled by a camera following the clay seam on the left side and an ultrasonic sensor measuring the back height of the first cut on the right side. Yaw is controlled by an ultrasonic unit measuring the distance to the left wall of the first cut.

The speed control system uses the amperage outputs from the two head motors. With this steady control of the speed the bit life was increased along with the amount of down time attributed to broken trim chains. The yaw control and the speed control are combined into left and right tram speeds and are referenced to the two tram speed pick-up mounted in the tram gear boxes.

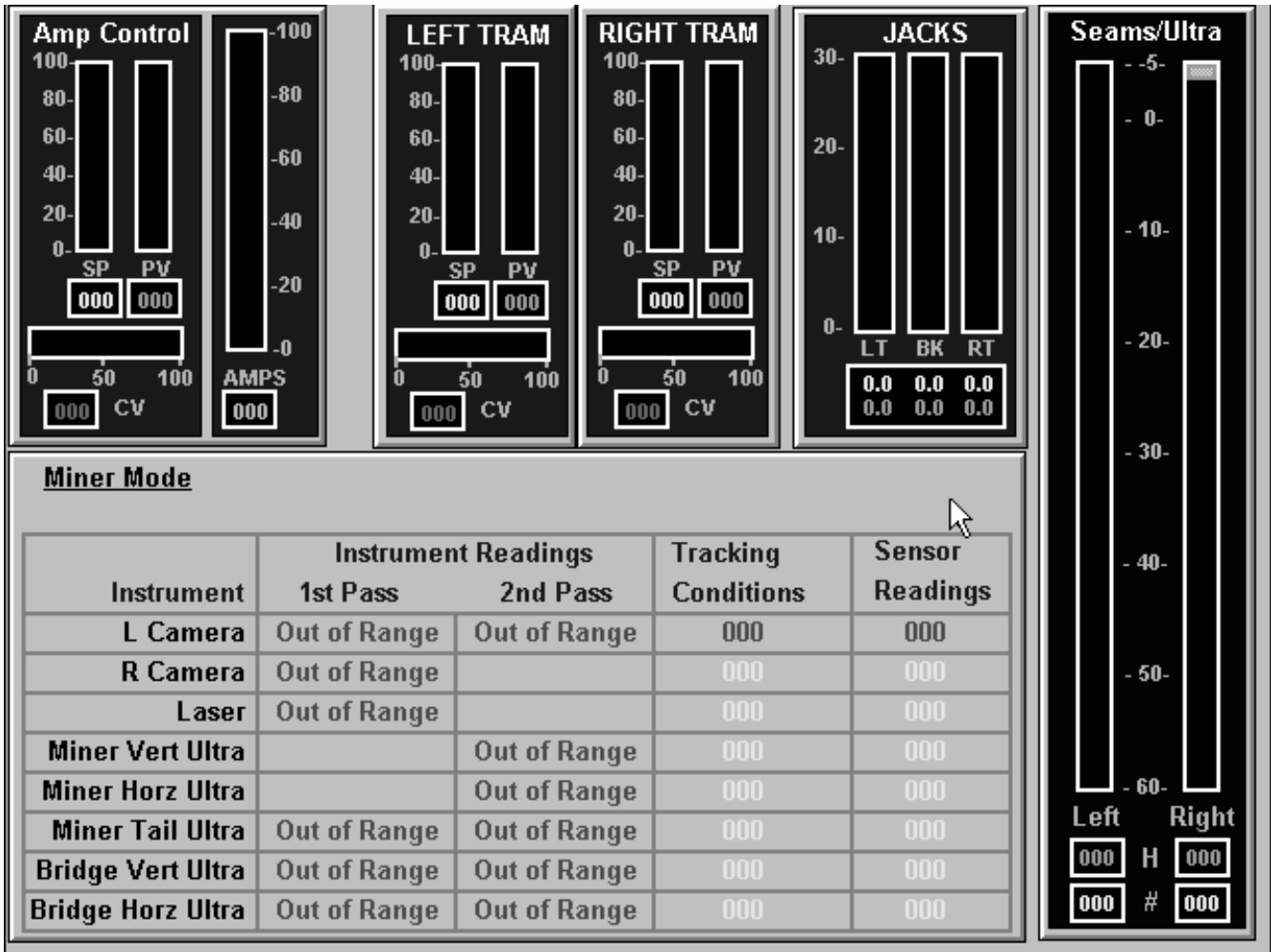
The automated system controls the position of the tail pulley mounted on the end of the bridge to maintain belt alignment. During first pass with the bridge in auto the tail pulley rests on the hardware skid. The vertical control for the bridge is in float mode. The swing is controlled by an horizontal bridge ultrasonic measuring the distance to the wall. This ensures that the extensible belt is installed in a straight line on first pass. By controlling the bridge swing hydraulic system, the discharge skid is positioned so each hardware piece will be aligned with the wall.

During 2nd pass operation there is a vertical ultrasonic mounted on the bridge to control the distance the tail pulley is from the back. The horizontal ultrasonic will control the extension and retraction of the bridge to maintain a fixed distance from the wall. This will ensure that the belt will be at the correct position for the removal of belt structure.

The automation of the first machine is complete and has been in production since late 1995. The second machine will be in service in the second quarter of 1996.



Marietta Boring Machine Automation



System Specifications:

ABPLC 5
 Wonderware Operator Interface
 AB CVIM Machine Vision
 - 3 cameras

Ultrasonic Sensors
 100 Digital I/O
 16 Analog I/O

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