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Report Period End Date: June 2003
Principal Investigator/Author: Larry G. Stolarczyk, Sc.D.
Project Period: 36 months
Project Start Date: 20 December 2000
Report Issue Date: 30 July 2003
DOE Award No.: DE-FC26-01NT41050
Name of Submitting Organization: Stolar Research Corporation
Address: 848 Clayton Highway
Raton, NM 87740
NETL Project Manager: David M. Hyman
Total Project Cost: $1,817,506.00
DOE Share: $857,217.00
Participant Share: $960,289.00
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Abstract

Real-time horizon sensing on continuous mining (CM) machines is becoming an industry tool. Installation and testing of production-grade Horizon Sensor (HS) systems has been ongoing this quarter at Monterey Coal Company (ExxonMobil), Mountain Coal Company West Elk Mine (Arch), Deserado Mining Company (Blue Mountain Energy), and The Ohio Valley Coal Company (TOVCC). Monitoring of system function, user experience, and mining benefits is ongoing. All horizon sensor components have finished MSHA (U.S.) and IEC (International) certification.
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Project Objectives

To demonstrate the feasibility of real-time stress measurement, bit loading, and horizon sensing (HS) on a longwall (LW) shearer, boring machine, continuous miner (CM), and loading bucket.

Project Cost Summary

<table>
<thead>
<tr>
<th></th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Total</th>
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<tbody>
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<td>Actual*</td>
<td>Plan+</td>
<td>Actual*</td>
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<td>DOE</td>
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<td>298</td>
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<td>618</td>
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</table>

Amount in thousands of dollars

Key:

+ Planned costs for the full year

* Actual costs through the reporting period. Based on full Stolar Research Corporation staff deployment of the Horizon Sensor Project at $280K/month

Experimental Timeline

The major program milestones to date are on schedule and include:

<table>
<thead>
<tr>
<th>Complete</th>
<th>Date</th>
<th>Percent Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed Certification (U.S. and Australia)</td>
<td>September 02</td>
<td>100</td>
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<tr>
<td>Dual-Frequency Capability HS</td>
<td>November 02</td>
<td>100</td>
</tr>
<tr>
<td>Accelerometer Triggering</td>
<td>February 03</td>
<td>100</td>
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<tr>
<td>Clean Coal Technology Program (Illinois)</td>
<td>February 03</td>
<td>100</td>
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<tr>
<td>U.S. Production Miners (4 total)</td>
<td>March 03</td>
<td>100</td>
</tr>
<tr>
<td>U.S. Longwall Shearers (3 total)</td>
<td>March 03</td>
<td>100</td>
</tr>
<tr>
<td>Clean Coal Technology Program (Ohio)</td>
<td>March 03</td>
<td>100</td>
</tr>
<tr>
<td>Forward-Looking Radar development begun</td>
<td>March 03</td>
<td>50</td>
</tr>
<tr>
<td>HS-HP (Head Positioning) product launched</td>
<td>June 03</td>
<td>80</td>
</tr>
<tr>
<td>HS-HW (Highwall HS System) being developed</td>
<td>June 03</td>
<td>80</td>
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</table>
Results and Discussion

Project Progress-to-Date Highlights

- Field Installation Approval (RAMP) complete for all 2G-approved Joy 12CM-12 continuous miners, all Joy 4LS longwall shearer, and Marietta Bore Miners.

- Field Installation Approval (RAMP) under way for Joy 7LS shearer, DBT shearer, Voest-Alpine and Superior continuous miners.

- HS-CM installations and performance evaluations with Monterey (EXXON), FMC Trona, Twentymile (RAG), Oxbow Mining, and West Elk Mining (Arch) through June 2003.

- HS-LW installations and performance evaluations with Monterey (EXXON), Deserado (Blue Mountain Energy), and Ohio Valley Coal (Mine No. 6) through June 2003.

- A highwall mining system is being developed for Massey Energy and will be installed in August 03.

- Two major technical improvements have recently been made: control of the master graphical user interface via hard-wired remote display, and multiple calibration windows within a single system for geologic variety.

- HS-Radar continues to be developed for forward-looking void detection.

Three new field installations:

- HS-Longwall Shearer: Deserado Mine, Rangley, Colorado (Joy 4LS Shearer with Dual-Sensor Configuration)

- HS-Continuous Miner: West Elk Mine, Paonia, Colorado (Joy 12CM-12 Continuous Miner)

- HS-Longwall Shearer: Ohio Valley Coal Mine, Ohio (Joy 7LS Shearer with Dual-Sensor Configuration)

Pending field installations:

- HS-Continuous Miner: Consol Mine (TBD), Pennsylvania (Voest-Alpine ABM-14 Continuous Miner)

- HS-Continuous Miner: Massey Mine (TBD), Kentucky (Superior Highwall Miner)

- HS-Bore Miner: FMC Trona, Green River, Wyoming (EIMCO Marietta with Arm-Sensor Configuration)
Conclusions

- The total tonnage, shifts, and operational hours are being documented at Monterey, Twentymile, FMC, Oxbow, Deserado, and West Elk.

- There are no outstanding engineering tasks left to “optimize” the performance of the system. Some improvements are being made for user concerns and ease of maintenance.

- “Forward-looking” capabilities are being developed that will allow the HS (HS-Radar) to detect anomalies in the coal seam ahead of mining, such as dikes, faults, and abandoned mine workings. The HS-Radar prototype is being tested using a salt wall to simulate 25 feet of unmined coal seam.
Good News!

During a recent HS-Radar demonstration for an audience of MSHA technical representatives:

- A wall of salt was used to simulate a coal seam for HS-Radar experiments.
- Stolar successfully proved HS-Radar could detect air voids through 23 feet of salt blocks.
- The salt wall is considered a worst-case condition due to its block-like construction.
- The HS-RADAR results were confirmed by MSHA’s Kelvin Wu and George Gardner.
Project Recognition

- “The World of Smart Mining,” World Coal magazine, May 2001
- “Breakthrough Technology,” World Coal magazine, May 2002
- “A Clearer Image,” World Coal magazine, December 2002
- “Sensing the Future,” World Coal magazine, May 2003
- Numerous trade show and exhibition demonstrations of HS products and simulations
- Recipient of the R&D 100 Award for breakthrough technologies from R&D magazine
Project Assessment

(internal DOE use only)

• Open issues and/or problems
  None noted

• Overall assessment
  Off to a good start

References

None