

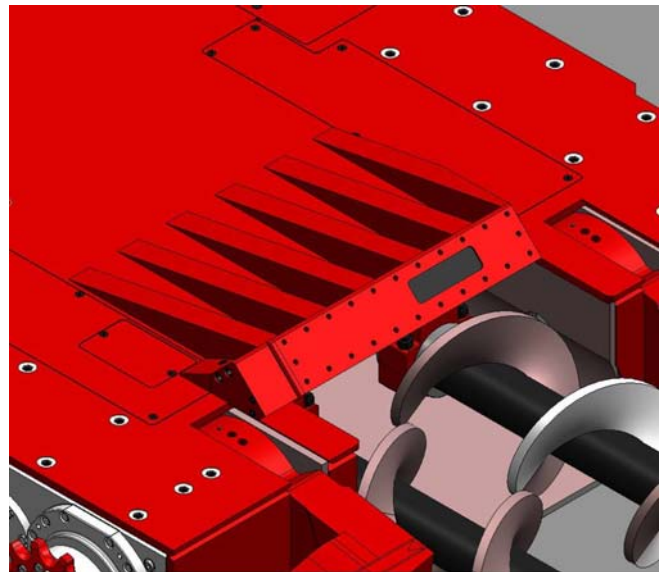
# Gamma Guidance enhances highwalling

*SHM's introduction of gamma sensors on its highwall miners has opened new opportunities for clean coal recovery. Internationally acclaimed mining writer Simon Walker found out more.*

The significance of the natural gamma radiation signature of waste rock such as shale has long been understood in coal mining, with the phenomenon used widely in underground applications to differentiate between coal and waste. However, the technology has only recently been applied to highwall mining, with the Beckley, West Virginia-based specialist equipment supplier, Superior Highwall Miners (SHM), having introduced gamma-detection systems for its machines in 2006.

The concept behind using natural gamma radiation to guide the cutterhead on a continuous miner or a longwall shearer relies on the fact that shale's naturally emit a gamma signature while coal does not. Thus the closer the cutterhead gets to the boundary between coal and shale, the stronger the natural gamma signal that can be picked up by a sensor mounted on the machine. With appropriate control systems installed, the strength of the signal can then be used to limit the vertical range through which the cutterhead can travel which, in cases where it is essential that a coal skin be left in the roof or floor, makes the operator's task much simpler and more accurate.

In addition, while a continuous miner or shearer operator can always control the range of its cutterhead visually, this opportunity is not available to the person operating a highwall miner. With the cutterhead deep inside an entry, the only way a physical view can be obtained is through a closed-circuit camera system, and as experience has shown, the images generated by this type of system under continuous mining conditions are often very poor. With these constraints in mind, and a specific requirement from one of its customers to be able to minimize waste dilution of its run-of-mine coal, SHM developed a natural gamma-detection system for its highwall miners. Not only has this proved to



be extremely effective, but its adoption has led to at least one team of machine operators changing completely the way that they control the miner, even in deep entries.

## The Contour connection

The instigation for SHM to develop its natural gamma-detection system came from one of its long-term customers, Contour Highwall Mining Company. Based in the West Virginia town of Summersville, an hour's drive north of Beckley, the company currently owns two SHM miners, having previously operated a third machine on an earlier contract-mining job.

Contour Mining's vice-president, Dave Bundy, explained the background to the company and its operations. "Our first experience with an SHM highwall miner came with a mining contract that we carried out for

Peabody,” he said. “When that came to an end in late 2002, Peabody took the machine over, and we acquired another – SHM No.27 – in April the following year.

“We used it for about 18 months on a couple of mine sites that proved not to be really suitable for highwalling, then in August 2004 we began a new contract for Amvest Corp., at its Powellton Coal Co. mine near Jodie, West Virginia. Between then and September 2006,” he went on,

**“The highwall miner has produced about a million and a half tons of coal, and that’s with it equipped with a low-seam cutterhead”.**

Contour Mining is a specialist contract-mining company that began highwall coal recovery using augers in 1985. Today, the company operates eight auger units as well as its two SHM miners, with operations scattered across southern and central West Virginia. Its second SHM highwall miner is working at United Coals’ Century property, located near Buckhannon in the north-central part of the state. Delivered in April 2006, SHM No.46 has been producing 40,000 tons per month of direct-shipping coal, relying on its natural gamma-detection system to maintain a clean, low-ash run-of-mine product.



### **SHM Highwall Miner**

#### **Five years of experience**

Contour Mining’s contract with Amvest involves mining from two seams: the Powellton and No.2 Gas, which are separated by between 10 and 50 ft of ‘soapstone’ – weak shale that can present problems in terms of entry roof stability from

time to time. The seams themselves range from 36 to 54 in thick, with the SHM machine mining 9 ft 6 in-wide entries to depths of 800-850 ft. As Mr. Bundy explained, the company often finds it necessary to pull the cutterhead back out of entries mined into the Powellton seam, so that the pushbeams that transport cut coal back to surface can be cleaned of fallen soapstone before the entry is completed to its final depth. While there is little risk of direct dilution, since the cut coal is augured back from the cutterhead through the enclosed pushbeams, this strategy helps ensure that the equipment is not pinched in the entry by fallen roof rock.

Contour’s client, Powellton Coal Co., is one of four Amvest Corp. mining subsidiaries that between them supply some 5 million tons of coal a year. Powellton Coal has a reserve of around 40 million tons at the property, with production coming from conventional surface-mining as well as the highwall operation. SHM No.27 will be working here until the end of 2007, Mr. Bundy noted, when the available resource in these two seams will have been depleted. Contour Mining has a minimum monthly tonnage requirement from Amvest, he said, adding that it has always achieved more than this, even when the machine is shut down for week-long periods twice a year.

Mining a single entry takes between 12 and 15 hours, depending on the depth and whether a mid-entry clean-off is needed. Contour’s crews operate on two, 12-hour shifts per day, on a four-day on, four-day off rotation, with a total complement of 16 men. The company achieved a major honor in 2005 with a top-three position in the national Sentinels of Safety awards, its crews here having worked over 33,000 man-days without a lost-time accident.

“Amvest lays out the entry sequence for us”, Mr. Bundy explained, “and we mine entries with a 4 ft 6 in pillar between each one. The bench width varies from 55 to 75 ft, and it was the narrow benches that led us to have SHM design its right-angle conveyor system for us so that we could move the cut coal sideways from the back of the miner.

“This machine was originally built so that it could be operated either with vertical or rear-discharge”, he went on, “and as we wanted the higher production that a rear-discharge system gives, we needed the 90° conveyor as well. SHM designed it for us, we helped get the bugs out of it, and now it’s a standard feature on these machines. In fact, aside from the regular

upgrades that SHM has provided to the control system, this is the only major change that has been made to the machine since we have had it”, he added.

### Gamma: absolutely essential ...

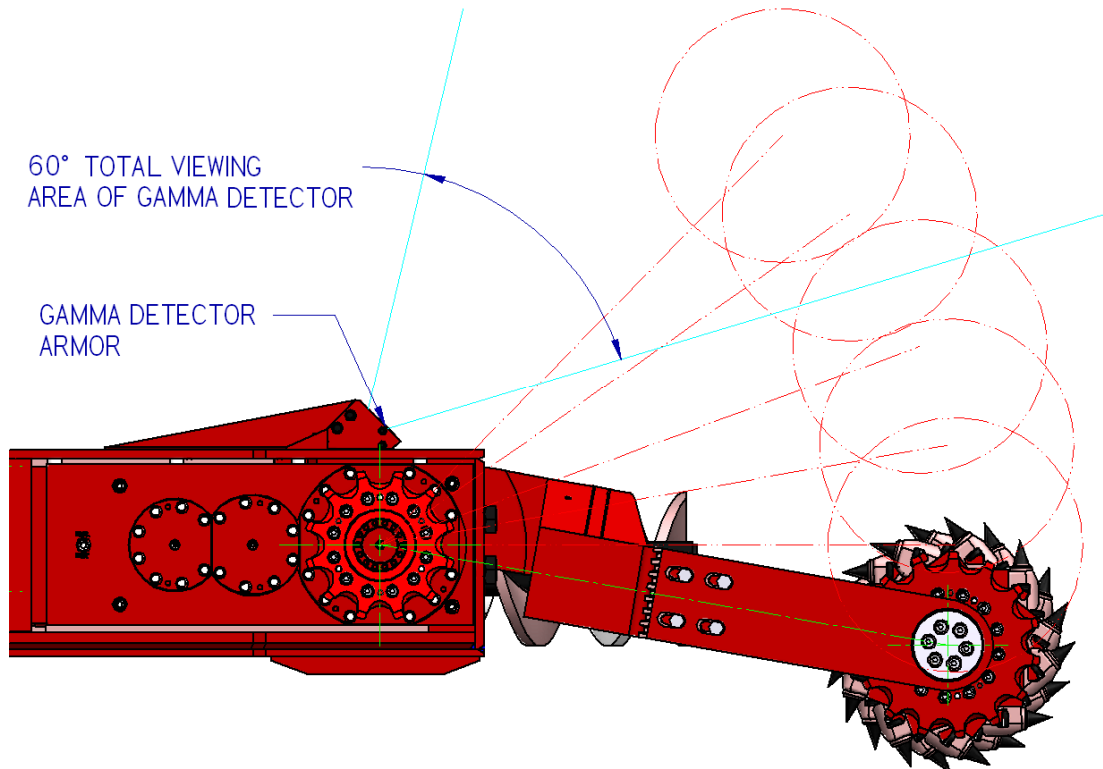
Contour Mining’s second highwall miner, SHMNo.46, has been working in the Pittsburgh and Redstone seams on United Coals’ Century property since May 2006, and is scheduled to move to a new site, some 30 miles away, once

a second gamma sensor to the bottom of the cutterhead as well.

“The seam floor is much more regular than the roof”, he went on, “and by following that as well, we have been able to get a much cleaner product. In fact”, he stated categorically,

**“Without the gamma sensors, we could not have mined the Pittsburgh seam here. It was the only way we could make the project work”.**

The problem facing Contour Mining and its client company is that the Pittsburgh seam coal here is high in sulphur, and so can only



permitting has been completed at the end of the year. The key to mining successfully in the Pittsburgh seam, Mr. Bundy explained, is to keep a thin skin of coal in the roof: if this is not done, the weak shale’s and limestone above is all to ready to come down into the entry.

This machine was the first SHM unit to be equipped with a natural gamma-radiation detector. “At first, we had a unit positioned on the top of the cutterhead module so that we could leave this coal skin in the roof”, Mr Bundy noted. “We knew that we had to leave coal in the roof so that we could get a clean product”, he added. “However, we found that the top of the seam rolls too much, and that trying to keep the cutterhead in seam was too difficult, so we added

attract a relatively low selling price compared to coals from further south in West Virginia. Hence it becomes uneconomic to wash run-of-mine coal at current prices, meaning that all the production from the seam has to be of direct-shipping quality. “We have been able to produce a 9% ash product,” said Mr Bundy, “which compares very well with the 7-8% ash coal that United Coals can get from its own surface-mining operations”.

As at Powellton, Contour Mining is driving 9 ft 6 in-wide entries with 4 ft 6 in pillars, with a 15 ft-wide barrier pillar every five holes. This gives around 65% recovery of the in-situ coal, with entries being mined to depths of 800-900 ft. Virtually all of the company’s initial work has been in the Pittsburgh seam, with a

small residual resource in the overlying Redstone seam – which has been extensively mined underground in the past – being left until the end of campaign.

The company has been preparing its own layouts for this project, using the Mark-Bieniawski program that was developed and made freely available by the US National Institute of Occupational Health and Safety (NIOSH). The only stability problems it has encountered, Mr. Bundy said, have been associated with places where the seam pinches out excessively, leading to unavoidable cutting into the roof. “We are also using the NIOSH system for designing the mining layout at the new site”, he added.

### ... and for control

In all of SHM’s machines delivered up to late 2006, accurate control of the cutterhead position in the seam has been achieved by the operator reading the current draw on the cutterhead motors. As the picks enter harder rock, the power draw increases, with the touch-screen display in the cabin showing this in real time. Once the operator sees the demand rise, it’s time to begin the next down-cut with the cutterhead.

On SHM No.46, however, the gamma sensors have taken the place of the current-draw measurement, with the thickness of coal remaining being shown on-screen instead. “Our operators are not using amps any more,” Mr. Bundy noted. “They just rely on the gamma readout for all of the cutterhead position control”.

Aside from its updated control system, SHM No.46 is identical to the company’s older machine, with the main objective being to get as

much commonality on parts as possible. Both machines run on line power, although No.27 at Powellton can also be supplied by a stand-alone generator when working in more remote parts of the property.

Power supplies proved to be a problem at first when the second gamma sensor was fitted to No.46, according to Mr. Bundy, with an upgrade needed to the low-voltage power supply on the machine to accommodate the increased demand. However, once that had been accomplished, and a minor mounting-design problem addressed, the unit has worked well, he said, with the addition of a small section of clear Perspex helping to prevent a build-up of floor clay that had been the cause of erroneous data being sent back to the control system. “One of our operators thought that up and quickly solved the problem,” he stated.

Turning to the issue of costs, Mr. Bundy said that there have been no unwelcome surprises on either SHM machine.

“Our operating costs have been right in line,” he confirmed, “and in fact, costs on No.46 have been lower than we had anticipated”.

As for the service that Contour Mining receives from SHM, he was equally emphatic:

“Everything we need, they take care of”.

Using natural gamma sensors on its machine has meant that Contour Mining has been able to work an otherwise unmineable resource. With experience like that, it seems likely that the technology will soon be indispensable in highwall mining, not just an option.



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