Longwall Automation: Making Mining Safer Through Technology

San Juan Mine
Safety Share

- Stop Work Authority
- Short Cuts
- We spend more time with our coal mining family than our real family.
- Not being afraid to speak up when we see someone taking a short cut.
- It might be uncomfortable the first time, but it gets easier and will become natural.
Jack Trackemas

- Three degrees, B.S. Mining Engineering, Associate Degree Mine Maintenance, and M.S. Mining Engineering.
- 37 years experience - 33 years industry and 4 years NIOSH.
  - Production – Coal Miner, Foreman, Mine Manager
  - Safety – Safety Engineer, Safety Manager
  - Engineering – Resident Engineer, Manager Technical Services, Director of Technical Services, General Research Engineer
  - Administration – General Manager Cumberland Mine (PA), Branch Chief NIOSH
  - Experience at Eastern, Mid-western, and Western Mines
Adam Zamora

- I have 2 associates degrees, one in Applied Sciences and one in Automotive technology.
- 12 years experience underground at San Juan Mine.
- 5 years as a Underground Mechanic.
- 2 years as a Longwall Production Foreman.
- 2 years as a Maintenance Foreman.
- 3 years as a Automation Specialist.
What are we really trying to achieve through underground technology?

- Zero Harm to people and equipment.
- Increase equipment life span.
- Current dust standards that are being lowered.
- Reduce noise exposure from operating equipment.
Administrative controls

- Specific operator locations throughout the day to reduce exposure.
- PPE
- Air streams
- Dust masks
- Ear plugs
JOY Longwall

- JOY 7LS5 shearer
- JOY face conveyor
- JOY shields 35 tons line and 42 ton gates
- Face width is 1000 feet
- 176 shields on the face
- JOY RS20S shield electronics that allow full face automation with remote operation.
Engineered Water Controls

- Shield water sprays for dust control
  - 2 canopy tip sprays, programmable to shearer location.
  - 2 canopy roof sprays and 2 interior link sprays work off pilot pressure.
- Shearer water sprays
  - 15 body sprays, 44 drum sprays per drum, 10 ranging arm sprays per arm and 15 water boom sprays.
- Conflow water meters to monitor water flow to each ranging arm on shearer.
Engineered Drum Controls

- NIOSH noise quitting drums 3 DB reduction.
Shield Electronic Controls

- Mimic
- Stu (Solenoid Transducer Unit)
- Advancing ram with read rod
- Sprag ram (flipper) with read rod
- Leg transducers
- Canopy tilt sensor
- Ability to self diagnose
Shield Automation

- Adjacent Control
- Bank control up to 20 shields
- Shearer primes
- Active set monitoring
- Wedge point (taper)
- Anti-collision
- Fully configurable to fit your conditions or operating model.
  - 1200 parameters just for shields
Shearer Automation

- Approximately 650 shearer parameters.
- Shearer is integrated with the shields for primes.
- Boom modes
  - Override
  - Recorded roof
  - FX2
  - FX1
  - Duck
  - Manual
Shearer Automation

- We use a BiDi cutting sequence.
- Shearer linked to the shields for primes.
- 1 Shearer operator just to cut the roof.
  - Shearer cuts the floor off desired extraction height or predefined floor profile programmed into GOLP (graphic online planner).
- Remote operation from POD or (ROC).
  - Recorded roof allows the shearer to follow previous cut.
  - Vectors can change your roof or floor desired extraction.
Advanced Shearer Automation

147 Top Picks 28.22 Boom Angle 0.70 Prev Pitch 430 Step ID -3.33 Boom Angle 86 Top Picks
105 Center 96 Target Ref -0.73 Pitch 1.07 Roll 44 Target Ref 44 Center
63 Bottom Picks -4 Pitch Correction (in) 53.45 Support # -0.62 Meters Above MG 2 Pitch Correction (in) 2 Bottom Picks

FX1/FX2 Extraction 143 in

Run of Face to TG
40.0 ft/min 38.7 ft/min

OVR Auto Mode Pan Control

TAIL GATE DCT End 173.67 Support

s1336 Haulage speed limit : External feedback
Increase Life of Equipment

- Shields have been in service since 2002.
- Over 80 million tons mined.
- Repairs to shields to increase life.
  - Pins and bores
  - Cylinder plating
- Chain life has increased from a flatter face and consistent chain tension.
- End of our current panel 22 million tons on 1 chain.