Ventilation on Demand
Optimized mine ventilation-on-demand

- Mine Ventilation Design / Planning Tool
- Health and Safety Enhancement
- Regulatory Compliance Validation
- Air Distribution Optimization/Production Enhancement
- Personnel & Machinery Tracking
- Energy Optimization
OMVOD benefits
Mine ventilation dynamic design validation tool

- Mine Ventilation ‘Dynamic’ Ventilation Design and Validation Tool
  - Challenge existing, new ventilation design and performance through engineering analysis for total system optimization
  - Quickly evaluate ventilation design alternatives
  - Dynamically validate mine expansion as a planning tool
  - Enable wider and deeper mining with available ventilation resources and infrastructure
OMVOD benefits
Health and safety

- Continuous equipment location & operating status
- Real time personnel location
- Real Time Air Quality ‘First warning’ alarms and Location Indicators
- Real Time Alarm when:
  - System air capacity exceeded
  - System air capacity below calculated demand
  - Operator manual set point less than calculated demand
- Pre-blast scheduling and alarms
- Underground manual override capacity
OMVOD benefits
Health and safety

- Multi ‘parent-child work zones layout definition’ for total air demand
- Regulator modulation based on model air mass balance
- Regulator modulation unaffected by failed or erroneous physical air flow measurement
- Real time correlation between model air flow and physical air flow measurement
OMVOD benefits
Regulatory compliance

- Ministry/MSHA published regulations checks and balances
- Real time fans and regulators modulation based on dynamic demand (H&M changes)
- Minimum air flow per work zone configuration capability
- Fans and regulators control mode scheduling capability for configurable events (shift start, pre-blast, post blast, …)
- Auto archiving of air demand calculations, air flows, air quality measurements, regulators and fans operation
- Auto archiving of system configuration changes
OMVOD benefits
Production enhancement and optimized air distribution

- Dynamic equipment location to optimize utilization
- Dynamic modulation of air flow regulators optimizes air availability ‘on demand’
  - Eliminates unnecessary air waste to air raises on levels with low or no production
  - Maximizes air availability for production machinery hence more potential machinery per level.
  - Optimized production scheduling to maximize “ore production” by machinery deployment to selected levels and draw points
- Post-blast scheduling to minimize blast clearing time
- Production Enhancement /Optimized air distribution means lower production cost/ton
OMVOD benefits
Optimized energy consumption (ROI)

- Optimized energy consumption
  - ‘On Demand’ Scheduling of fans and regulators:
    - optimizes energy draw, (including heating and cooling)
  - In ‘On Demand’ VOD control mode. All fans (primary, auxiliary and booster) are actuated/modulated based on dynamic air demand calculation per work zone or minimum authorized flow
    - Minimizes energy consumption
    - Minimizes operating time wear on fans
  - In scheduling mode, all fans or regulators not in automatic VOD control mode have an automatic switchover capability to VOD for all machinery & personnel presence/activity detection.
  - Significant energy savings for surface fans in automatic VOD control mode.
    - surface fans are modulated to assure no level regulators will open past a maximum set point
  - Result is overall significant targeted energy consumption reduction for maximized ROI (Return on Investment) for OMVOD
OMVOD
Opened architecture

Modeling & Simulation, Control and Optimization
- Real-time mass balance
- Fans and regulators control
- Air distribution optimization
- Energy optimization

Tracking
- PLC
- DCS

Control System
- Fans
- Regulators
- Air quality sensors
- Air flow sensors

Scheduling

System Configuration

Operator HMI
(surface, underground and web)
OMVOD
Functional block diagram

Components parametric information

Physics based ventilation network model and dynamic simulation
- Surface fans
- Shafts
- Drifts
- Draw points
- Ore and waste passes
- Ramps
- Fans
- Air flow regulators
- Ducts
- Services
- Bulkheads

Air distribution optimization

Modeled process measurements
- Pressure
- Velocity
- Flow
- Temperature
- Fan speed
- Regulator position

Energy optimization

Control modulation
- Air flow regulators
- Fans

Control modes
- Man
- Auto-flow
- Auto-VOD
- Surface
- Underground
- ...

Air demand calculation

Real-time air quality measurements

Real-time physical air flow measurements

Physical fans and air flow regulators

Workzones, equipment and personnel database

Real-time machinery and personnel tracking

Scheduling

Configuration Database

Configuration menu
OMVOD
Computing infrastructure
OMVOD Tracking

- Battery powered mesh network tracking infrastructure
- Ethernet gateway (Powered 110VAC)
- Infrastructure node (Battery powered)
- Personnel tracking tag on-board radio cap lamp or cap lamp only
- Vehicle tracking tag
  - Diesel status
  - Hydraulic-electric status

- Tracking past a known point
- Hardwired connection between gateway and first infrastructure node. Gateway connected to Ethernet switch and fiber optic trunk.

- Mesh infrastructure node with directional antenna
- Mesh infrastructure node with omni-directional antenna
- Infrastructure nodes communication

- LAN to surface
- Mine level “1”
- Mine level “2”
- Mine level “n”
## OMVOD Project Phases

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| - Mine development plan  
- Mine ventilation layout (plan view and detailed level and draw point views)  
- Equipment list for fans, regulators and machinery and personnel count  
- Energy costs  
- Interviews with operations and ventilation engineering | **Phase 1**  
Preliminary engineering | Comprehensive preliminary assessment of the business opportunity, projected savings, scope and costs of implementing the full OMVOD solution with the following deliverables  
• System Requirements Specification (SRS) and project scope  
• Savings Rough Order of Magnitude (ROM)  
• Fixed cost for project phases 2a and b  
• ROM for project cost |
| - Phase 1 deliverables  
- All equipment detailed parametric and behavioral information  
- Operating scenarios (machinery, shifts, pre-blast, post-blast, scheduling, …)  
- Interviews with operations and ventilation engineering | **Phase 2a**  
OMVOD production detailed engineering | - System Requirements Review (SRR) and acceptance  
- Critical Design Review (CDR) and acceptance  
- Test Plan and Factory Acceptance Testing (FAT) procedures review and acceptance  
- FAT and system acceptance  
- OMVOD ventilation model, controls, optimization, scheduling, configuration, HMI's and performance analysis capability |
| - Phases 1 and 2a deliverables  
- Physical mine survey  
- Interviews with operations and ventilation engineering | **Phase 2b**  
Equipment procurement & installation detailed engineering | - Confirmation of the expected costs of the complete system including installation costs  
- Detailed cost estimate and fixed procurement and installation cost for Phase 3 |
| - Phases 1 and 2a and 2b deliverables | **Phase 3**  
System installation and startup | - Procurement, installation, commissioning and training for the VFDs, instrumentation, automation air flow regulators, ABB DCS and integration of OMVOD model to ABB control system  
- OMVOD integration to the ABB control system  
- System installation, set to work, startup and model adjustments as per ventilation surveys  
- Site Acceptance Testing (SAT) and final system acceptance |
| - Installed system  
- Support contract | **Phase 4**  
System support | - Remote and/or on-site support for maintenance and support  
- Troubleshooting assistance  
- Problem resolution  
- Upgrades & enhancements  
- Bug fixes |
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