



Building an **Agentic Operations Layer** for Mining

How Phaseshift delivers an autonomous industrial data platform that ingests, normalizes, and operationalizes operational data across surface and underground mining, powering intelligent maintenance, automated compliance, and remote operations.

— THE CHALLENGE

Mining operations generate massive volumes of data from equipment fleets, environmental sensors, ventilation systems, and processing plants, yet this data remains fragmented across dozens of legacy SCADA systems, proprietary PLCs, and isolated vendor platforms. Operators lack a unified view of site conditions, compliance teams spend weeks assembling manual reports, and maintenance stays reactive rather than predictive. As mines push toward remote and autonomous operations, the absence of a single, intelligent data layer becomes a critical bottleneck: there is no way to correlate signals across systems, surface hazards in real time, hazards, or feed real-time analytics to decision-makers without building and maintaining dozens of brittle, one-off integrations that expand the cybersecurity attack surface with every new connection.

— THE APPROACH

Phaseshift acts as the mine's intelligent data backbone: a platform that does not just collect and display data, but autonomously governs, correlates, and operationalizes it. A single edge node connects to every system on site, from legacy PLCs on conveyors communicating over Modbus to IoT-equipped autonomous haul trucks reporting via MQTT, and normalizes all streams into one governed data model. From there, Phaseshift's agentic layer continuously monitors for anomalies, generates intelligent alerts, and pushes structured data to dashboards, historians, third-party analytics, and maintenance management systems through one secure, encrypted corridor.

EDGE-TO-CLOUD INGESTION

Vendor-agnostic connectivity across Modbus, OPC UA, MQTT, Ethernet/IP, and proprietary protocols

AGENTIC DATA GOVERNANCE

Self-normalizing data model that absorbs tag changes, PLC upgrades, and new sensors without re-integration

INTELLIGENT ALERT ENGINE

Condition-triggered notifications that surface gas spikes, equipment anomalies, and environmental threshold breaches to operators and downstream systems

PREDICTIVE MAINTENANCE API

ML-driven anomaly detection with automatic CMMS work order generation for SAP, Maximo, and Infor EAM

— THE TRUST LAYER

Mining sites operate critical infrastructure in remote, high-risk environments where cybersecurity failures carry safety, environmental, and regulatory consequences. Every integration point between a PLC, SCADA system, or vendor platform is a potential attack surface. Phaseshift replaces dozens of vulnerable VPN tunnels and point-to-point connections with a single, encrypted data corridor managed entirely on US-based private cloud infrastructure. All data is governed under strict access controls with full audit logging, giving operators, compliance teams, and insurers a verifiable chain of custody for every data point from the pit floor to the boardroom.

— THE OUTCOMES

**Unified Site Visibility**

One dashboard spanning pit, plant, fleet, and environmental systems

**Real-Time Hazard Alerting**

Gas spikes and ground movement trigger instant notifications to operators and safety systems

**Predictive Maintenance**

ML-driven alerts with automatic CMMS work order generation

**Automated Compliance**

Audit-ready reports for safety, emissions, dust, and water quality

**Single Secure Path**

One encrypted corridor replacing dozens of vulnerable VPN connections

**Zero Fragmentation**

Eliminated point-to-point integrations across legacy and modern systems

"For mining operators, the cost of fragmented data is not measured in IT budgets. It is measured in unplanned downtime, missed compliance windows, and the inability to scale remote operations. A governed, agentic data layer turns operational overhead into operational intelligence."

— THE COMMERCIAL VALUE

**REDUCED UNPLANNED DOWNTIME**

Condition-based maintenance and automated anomaly detection catch failures before they become production stops

**CONTINUOUS COMPLIANCE**

Automated MSHA, EPA, and environmental reporting replaces manual spreadsheets with audit-ready digital records

**REMOTE OPERATIONS AT SCALE**

Centralized command surfaces give remote teams real-time oversight of autonomous and tele-operated equipment

**LOWER RISK EXPOSURE**

Verifiable data governance and audit trails strengthen insurer confidence and reduce cybersecurity liability

— USE CASES

**REAL-TIME MONITORING**

Unified dashboards across pit operations, processing plants, fleet telemetry, and environmental sensors

**SAFETY & HAZARD MANAGEMENT**

Continuous gas detection, ground stability monitoring, ventilation telemetry, and threshold-triggered alerting for safety teams

**FLEET & EQUIPMENT INTELLIGENCE**

Cross-correlate haul truck, excavator, conveyor, and crusher data for utilization and health analytics

**REGULATORY COMPLIANCE**

Continuous MSHA, environmental, dust, and water quality reporting with automated audit trail generation

**ANALYTICS & AI ENABLEMENT**

Governed API access for internal data science, third-party analytics providers, and ML model training

**STAKEHOLDER & REMOTE ACCESS**

Role-based visibility for site managers, corporate teams, investors, and insurance partners

— THE INTELLIGENCE LAYER

**AUTONOMOUS CROSS-SYSTEM CORRELATION**

Cross-references signals from SCADA, fleet telemetry, environmental sensors, and processing systems to surface patterns invisible at the individual system level

**PROACTIVE ANOMALY DETECTION**

Continuous behavioral baselines identify early equipment degradation, abnormal vibration signatures, and environmental threshold drift before they become incidents

**SELF-GOVERNING DATA PIPELINES**

Ingestion flows adapt automatically as new equipment commissions, PLCs are upgraded, or monitoring configurations change across pits and plants

**PREDICTIVE OPERATIONS INTELLIGENCE**

Correlates operating conditions, maintenance history, and environmental exposure to forecast failure risk and optimize production scheduling at the fleet level

— THE VALUE

Every mining operation pursuing remote capabilities, autonomous equipment, or digital compliance will eventually need an intelligent data platform. The question is whether to build it piecemeal across systems and vendors, or to deploy a proven, protocol-agnostic solution that is already purpose-built for the challenge. Phaseshift eliminates the integration tax, accelerates operational intelligence, and provides the trusted data governance posture that safety regulators and insurers demand.

Phaseshift is not a replacement for the mine's operational technology or vendor platforms. It is the autonomous data backbone that makes them intelligent, governed, and actionable at scale.

Ready to build your agentic mine operations layer?

www.phaseshiftdata.com