

Mining and condition monitoring solutions

Boosting reliability, enhancing safety and optimizing maintenance costs



The opportunity

Mining is a vital to many global industries. From airplanes to fuels to communication infrastructure, mining and minerals are indispensable raw materials. As we look to the future, mining's role will become increasingly crucial, enabling much of the world's carbon neutrality. For example, minerals are needed for green energy storage systems, such as batteries that power electric vehicles. Those needs will elevate demand for rare earth minerals, with 500% growth forecasted by 2050 (World Bank Group).

As demand and corresponding pricing reach new highs, mining production capacity becomes more essential than ever. This, in turn, elevates mining operation's reliance on its machinery. Downtime is more expensive. Uptime is more valuable. In order to profitably capture this burgeoning opportunity, mining operators must navigate new production optimization challenges.

The challenge

Data suggests that many mining operations are under optimized in key areas :

- 70%** operating efficiency due to breakdowns and stalled production which translates to real potential for increased productivity and throughput
- 30-50%** of mining operations' costs are spent on maintaining plant, fleet and equipment so the magnitude of improvements for cost recovery and profitability is significant
- 3-5X** cost for urgent repairs and corrective work vs. planned maintenance made evident by tracking the percentage of work orders through the planning office

In mining operations, the majority of these challenges stem from reactive, time-based maintenance approaches that create higher order costs and increased risk levels. Thus, maintenance is an underleveraged opportunity, ripe for operational optimization.

The solution

Proactive maintenance via condition monitoring solutions enables mining operations to use data-driven insights to manage operations and reach the proper balance point across competing priorities:

Outcome

- Maximize 'smart' uptime
- Minimize downtime
- Ensuring/enhancing safety
- Meeting regulatory compliance
- Minimizing maintenance costs

Enabler

- Understanding asset health, asset life
- Preventing unplanned downtime **before** it occurs
- Automating machine monitoring to reduce risk
- Tracking key metrics
- Repairs made at lowest possible cost (before damage escalates prior to full failure and scheduled during planned outages)

Condition monitoring

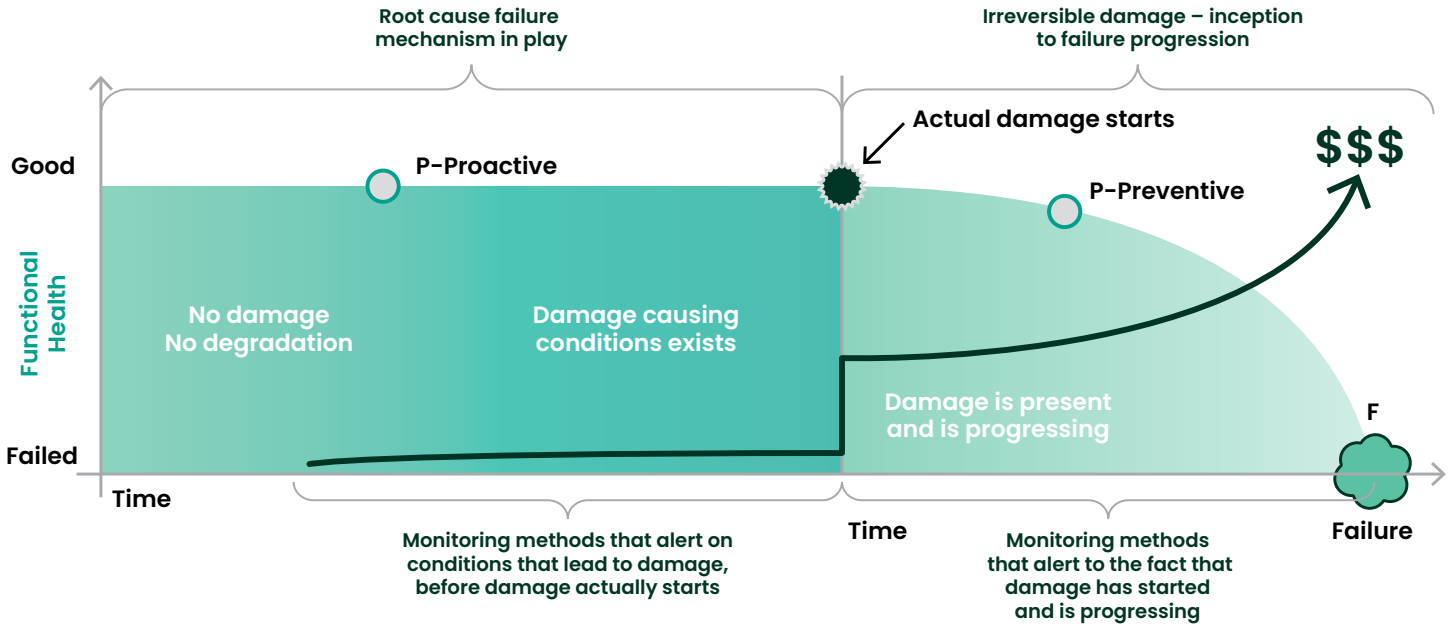
Condition monitoring obsoletes reactive, time-based maintenance approaches which are based on calendar intervals or running hours. Time-based approaches are only valid for about 15% of operational assets, and are poor "predictors" of failure for many assets, resulting in two major issues. First, the majority of assets are getting "maintained" when they don't need to be, creating a wasteful, overspend in maintenance. Second, it doesn't prevent full failures and can allow asset issues to escalate to unplanned downtime, causing costs to escalate in kind.

Failure is a process

By contrast, condition monitoring supports a proactive approach, based on the premise that failure is a process, not an event. The Extended P-F curve depicts this concept by delineating a distinct span of time between the potential for failure and functional failure.

Potential for failure is detected by monitoring asset health by measuring properties, such as, vibration, temperature, efficiency, oil chemistry/particulates, and other physical parameters. Together with tailored algorithms, customized configurations and set points, these parameters can identify both root cause failure mechanisms, in progress as well as irreversible physical damage that has already started. As a result, failure can be averted, sound data-driven decisions made and repairs scheduled at the most advantageous times and lowest possible costs.

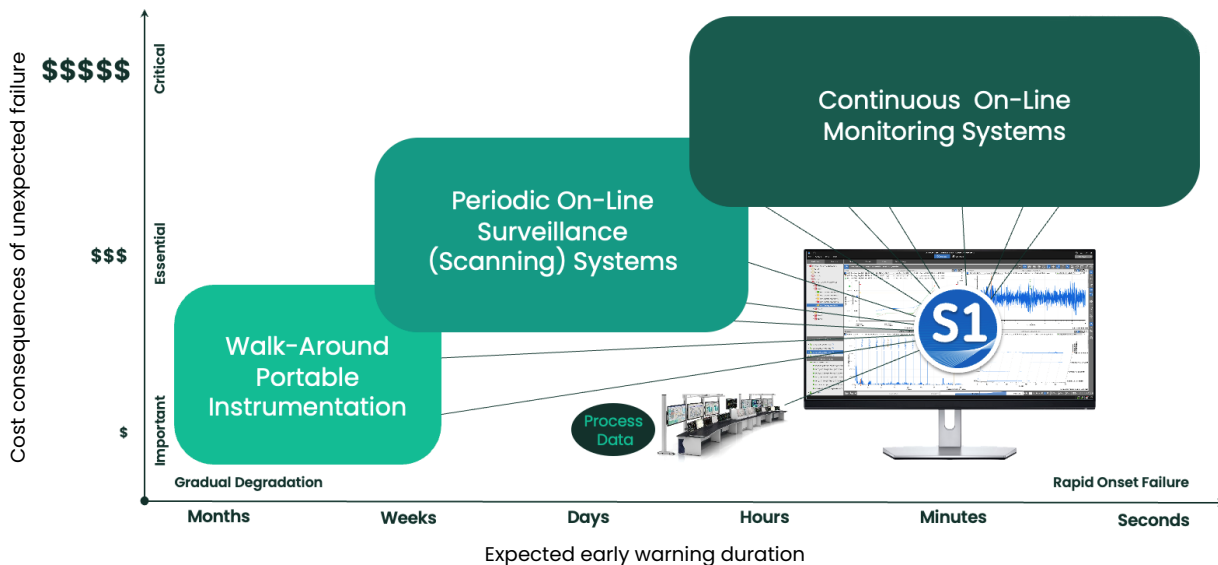
The Extended P-F Curve



Source: "Reliability-Centered Maintenance" by John Moubray, 1992.

Consequence-Based Technology Implementation

In terms of proactive condition monitoring, all assets are not created equal. Each asset has its own warning duration before failure and asset failure can also result in varying consequences, described below as Important, Essential, and Critical. For critical assets with shorter warning durations, operators monitor their performance with a continuous, on-line condition monitoring system. For essential assets with a longer warning duration, periodic on-line systems work well. Lastly, important assets that also have a longer warning duration are typically monitored with walk-around portable devices. Matching asset characteristics and impact on production is important for aligning the proper condition monitoring approach and achieving production optimization.



Bently Nevada helps customers get started

Unreliable and underperforming assets have enormous consequences. Industry studies show that the average facility spends approximately 5% of its Replacement Asset Value (RAV) on maintenance each year. In comparison, best performers spend 60% less—just 2% of RAV—while enjoying better uptime, efficiency, and profitability. It's not simply about spending less on maintenance, it's about working differently—and smarter—to achieve more reliable mining operations.

Bently Nevada helps mining manufacturers with a 5-step process:

1

Equipment
data library

2

Asset criticality
ranking

3

Technology

4

People

5

Methodology



1. Build equipment data library.

Constructing a complete master list of equipment, including nameplate data, equipment class and subclass ID field tags.

2. Rank order assets by criticality.

Create relative rankings for asset by weighted criteria such as impact on safety, environment, production, maintenance costs, and product quality.

3. Assign technology.

Based on asset rankings, align technology and monitoring intervals using criticality and failure modes. Develop an on-line monitoring plan.

4. Align people.

Identify resources with specific roles, responsibilities leveraging in-house and outsourced capabilities. Outline training and culture needs.

5. Adopt methodology.

Establish work and information flow processes; policies and procedures (in-house and outsourced), organizational structure and key performance indicators



Bently Nevada integrated plant-wide solutions for mining operations



Surface Mining

- Trucks/Haulers
- Dragline Excavators

Conveyors

Screening

- Screens

Crushing

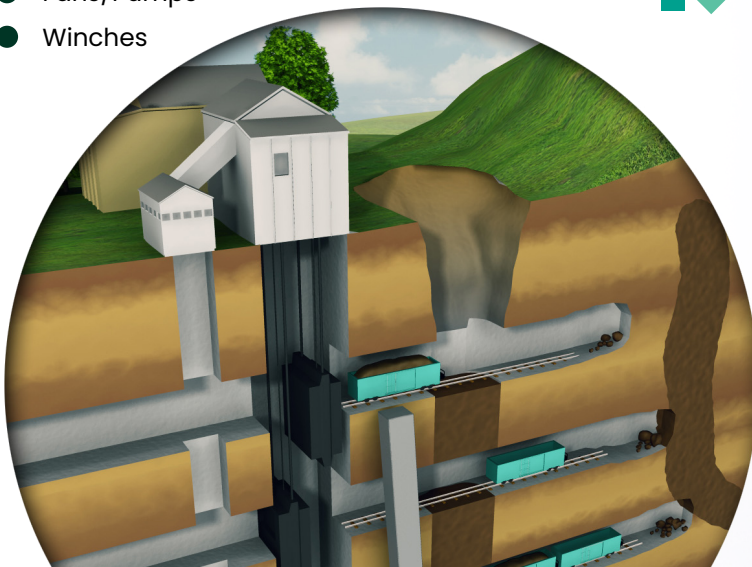
- Cone Crushers

Milling

- SAG Mills
- Screening Machines
- Ball Mills
- Bar Mills
- Pumps

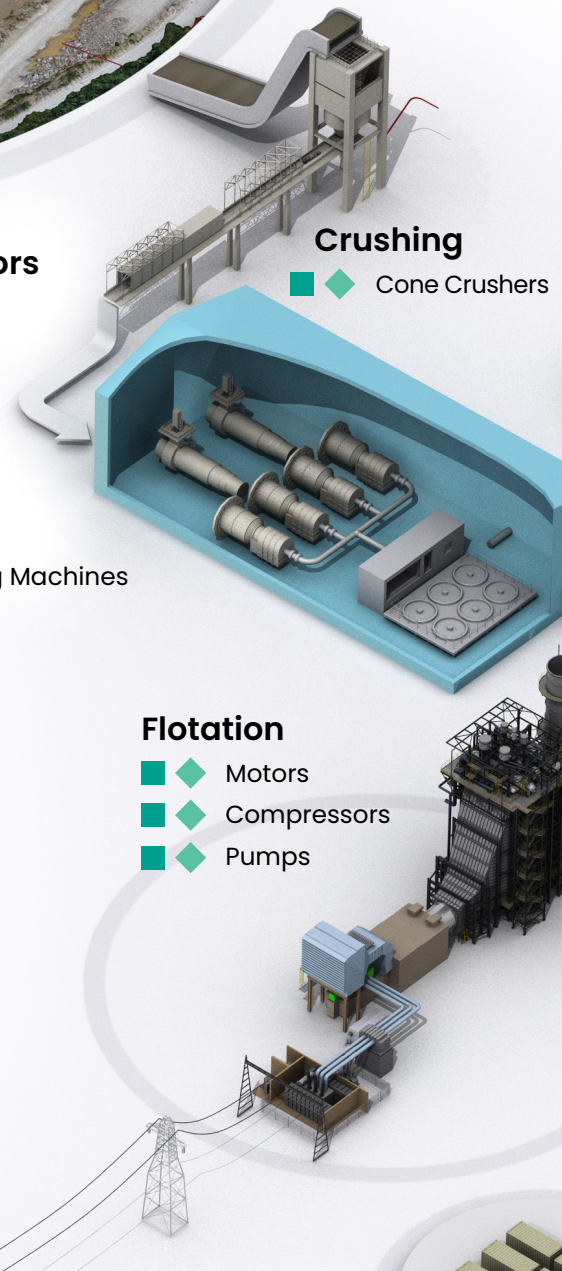
Underground Mining

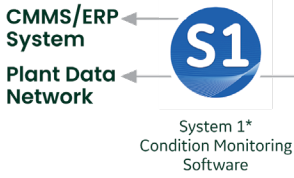
- Blowers
- Fans/Pumps
- Winches



Flotation

- Motors
- Compressors
- Pumps





Continuous On Line Monitoring

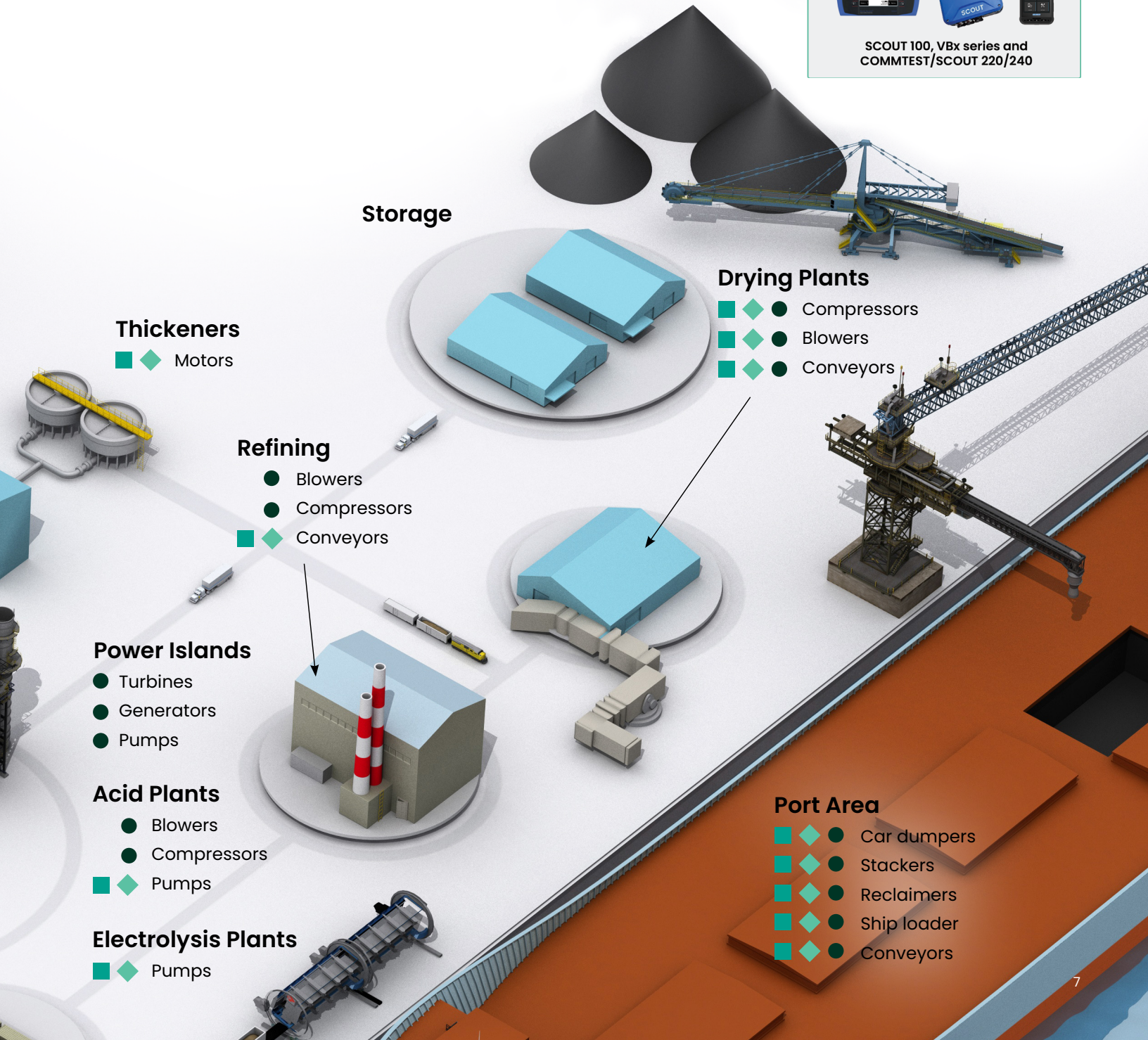
- Orbit 60
- ADAPT 3701/40
- 2300 Series
- AnomAlert

Scanning On Line Monitoring

- vbOnline Pro
- Ranger Pro

Off Line Route Based Portable Data Collection

- SCOUT 100, VBx series and COMMTEST/SCOUT 220/240



Thickeners
◆ Motors

Storage

Drying Plants
◆ Compressors
◆ Blowers
◆ Conveyors

Refining
● Blowers
● Compressors
◆ Conveyors

Power Islands
● Turbines
● Generators
● Pumps

Acid Plants
● Blowers
● Compressors
◆ Pumps

Electrolysis Plants
◆ Pumps

Port Area
◆ Car dumpers
◆ Stackers
◆ Reclaimers
◆ Ship loader
◆ Conveyors

Bently Nevada service menu

Key benefits

Implementation services

Be proactive, get it right the first time

- Ensure your assets are protected and monitored when you're ready to startup
- Avoid costly delays and rework
- Use one source to design, plan, manage, and execute the installation
- Prevent startup trips due to improper installation and configuration

Up to \$1M/day
Cost mitigation from lost production, secondary process & equipment damage

100%
Service work guarantee
1 year warranty standard on all service work

Proactive support

Keep your system healthy and optimized

- Prevent instrumentation related false trips
- Avert and minimize potential data loss events
- Keep up to date and compliant with the best technologies available
- Access the expert support you need when you need it most

80%
Machinery alarms and events due to instrumentation

>90%
Typical reduction in non-actionable alarms and events

Asset health and consulting

Generate actionable insights you can trust

- Understand your asset health to optimize outage and maintenance planning
- Plug in to our global network of machinery experts with remote monitoring
- Get professional OEM agnostic machinery diagnostics when and where needed
- Customize analytic development and tuning to pinpoint specific conditions

100% ROI
Savings from a single machine often results in full monitoring contract payback and more

5-10X
Cost reduction for well planned maintenance outage vs. unplanned reactive outage

Cybersecurity¹

Stay ahead of evolving cyber threats

- Ensure your system is up to date and protected as threats continually evolve
- Identify and mitigate cybersecurity risks to your operation
- Keep your system both secure and accessible with advanced security technologies and architectures by leveraging data diodes and database replication

29%
Patch management can reduce your attack surface up to 29%

243 days
Average time lapsed before detection that a system is compromised

Training and education

Augment critical skills that amplify your machinery management capabilities

- Enable your personnel to operate and maintain your monitoring and protection system
- Enable your operation to maximize the value of your system by leveraging expert product and application training and knowledge

400+
Customer courses delivered each year in 10 languages and to over 45 global locations

1. https://www.us-cert.gov/sites/default/files/documents/Seven%20Steps%20to%20Effectively%20Defend%20Industrial%20Control%20Systems_S508C.pdf



Why partner with Bently Nevada?

We are a trusted partner with a proven track record and deep expertise. For six decades the Bently Nevada experts and offerings have supported the most demanding proactive maintenance applications across multiple industries. Our quantified results speak volumes, and we create significant benefits for our customers. Even as we protect and monitor your machinery, we constantly strive to refine and improve our offerings—and help enable your success.

We design and deliver integrated solutions for all of your monitoring needs—including sensors, distributed and rack-based monitors, software, and supporting services—with the following goals:

- Increased availability and production
- Lowered maintenance costs

- Reduced risk in safety, environmental, and asset performance

Quantifiable, proven results:

- **60+ years** of innovation in asset protection, condition monitoring
- **240+ international patents**, including 150+ U.S. patents
- **350+ international patents pending**, including 95+ U.S. patents
- **8+ million** sensor monitoring points
- **1,600+ System 1 software** users worldwide
- **Extensive services support** provided globally

You can rely on us

For more than 50 years, we've been supplying condition monitoring solutions to machinery-intensive industries. We also bring two decades of experience implementing reliability improvement projects. Customers turn to us for a simple reason: lasting value. Our solutions demonstrate their worth, day in and day out, and often result in expanded implementations because of their proven ROI. We combine the highest quality products and responsive customer support with a service team that takes the time to understand the uniqueness of your plant, your personnel, and your goals.

Our products can be found in many of the world's mining plants. Today, many of those same plants are turning to Bently Nevada for a more comprehensive solution to their needs, moving beyond just machinery protection instrumentation on a few assets to plant-wide strategies and systems for improved environmental compliance, safety, asset production, quality and reduced operation and maintenance costs.

Please contact us [here](#) to speak with a subject matter expert about your specific needs.