Digitization of Condition Monitoring:
Shift from Asset-Functional Strategies to Enterprise Performance Optimization

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50 Years of Growth, Innovation and Leadership
Chapter 2: Comparison of Wired, Wireless, and Portable Connectivity — Importance of Using the Right Technology ................................................................. 3

2.1 Comparison of Wireline, Wireless, and Portable CM Solutions ......................... 3

2.2 Benefits of a Single-Source Provider .................................................................. 4
CHAPTER 2: COMPARISON OF WIRED, WIRELESS, AND PORTABLE CONNECTIVITY — IMPORTANCE OF USING THE RIGHT TECHNOLOGY

End users are turning to their CM solution providers for additional value-added services, such as advanced analytics. The need to collect information from sensors and send data to service providers who can analyze the data remotely is on the rise. Service providers track and evaluate changes in the condition of machinery parts with advanced diagnostics and prognostics, such as measuring the frequency and amplitude—the vibration patterns of machinery that incorporate both performance and mechanical health.

This chapter highlights key advantages and disadvantages of wired, wireless, and portable CM solutions, including a discussion of the value possible from a comprehensive mix of the three. This chapter elaborates on key advantages of wireless solutions concerning deployment, expansion, and installation costs. It explains the top benefits wireline solutions deliver in enhancing reliable monitoring, adding protection, and tackling many industry challenges such as data transmission concerns and improving productivity. Last, the chapter outlines which connectivity technology is best suited for different types of applications.

2.1 Comparison of Wireline, Wireless, and Portable CM Solutions

Condition monitoring solutions utilize either wired, wireless, or handheld/portable technologies. Exhibit 9 compares the technologies.

<table>
<thead>
<tr>
<th></th>
<th>Wired CM</th>
<th>Wireless CM</th>
<th>Portable CM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faster Sampling Rate</td>
<td>Best</td>
<td>Better</td>
<td>Good</td>
</tr>
<tr>
<td>Easier Installation and Deployment</td>
<td>Good</td>
<td>Best</td>
<td>Better</td>
</tr>
<tr>
<td>Higher Protection and More Reliable Monitoring</td>
<td>Best</td>
<td>Better</td>
<td>Good</td>
</tr>
<tr>
<td>Higher Data Collection Frequency</td>
<td>Best</td>
<td>Better</td>
<td>Good</td>
</tr>
<tr>
<td>Higher Coverage of Assets</td>
<td>Better</td>
<td>Best</td>
<td>Good</td>
</tr>
</tbody>
</table>

- **Wired CM** has advantages from a bandwidth perspective with faster data sampling rates (can be down to millisecond sampling in extreme cases), greater transmission ranges, and more reliable monitoring, including a high level of protection due to local power and high-speed data transmission (e.g., ethernet) across many point counts. However, installation costs can be prohibitive due to local power and field wiring needs. This drives up the cost but ensures better reliability over time. Moreover, wired can be more challenging to expand.

- **Wireless CM** offers easier installation and deployment flexibility, and is typically relatively simple to expand upon. It is a cost-effective solution that reduces the recurring labor cost of manual data collection and lowers the safety risks of exposing technicians to hazardous environments. Wireless CM can be deployed on many asset types in a variety of locations. However, one must consider data frequency and bandwidth (data richness) as compared to wired CM. Data frequency varies depending on sampling rates (e.g., once a minute/hour/day) and data type (e.g., scalar values and/or waveform data). In addition, most solution designs incorporate a battery. While battery life is typically five years or more given the latest advancements in technology, one must include a battery.
replacement plan in the long term, which adds to the overall cost and complexity for CM programs.

- **Portable solutions** are a traditional and excellent entry point and/or expansion to a CM program, while also complementing the more flashy wired and wireless deployments. Portables offer a cost-effective solution for periodic monitoring. These are ideal for immediate, short-term monitoring of individual assets. Operators see, tough, smell the environment and happenings during route or data collection that are obviously missed from wired and wireless solutions. Advanced handheld solutions are able to offer high resolution and detailed data for temporary, short-term monitoring and diagnostic needs as well. Data frequency is often the main disadvantage as it comes down to how often it makes economic sense to collect a measurement (a typical reading ranges from once a week to once a month). A second compromise can be the lack of repeatable results given sensor placement and consistent asset and environmental conditions, which can be overcome with operational rigor.

### 2.2 Benefits of a Single-Source Provider

Risk is minimized when executing a complete CM program consisting of an optimal portfolio of wired, wireless, and portable solutions through a single-source supplier. The Bently Nevada product line from Baker Hughes, a GE company is fully interoperable. Bently Nevada’s System 1 platform provides an all-encompassing best-in-class analytics HMI across wired, wireless, and portable solutions fully plant wide with the power of onsite, remote, historical trending, and deep analytics to help operators make the best use of the CM program. System 1 can receive inputs from a wide range of sources, online and offline CM, and protection devices, including wireless and portable CM.

Exhibit 10 compares single CM instrument adoption with an integrated approach.

#### Exhibit 10 - Benefits of a Single CM Instrument Adoption versus One Source for Support, Spares, and Services

<table>
<thead>
<tr>
<th>Single CM Instrument</th>
<th>Integrated CM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate, short-term diagnostic solution</td>
<td>Full-scale, condition-based maintenance (CBM) program implementation</td>
</tr>
<tr>
<td>Snapshot diagnosis</td>
<td>Bigger picture. A comprehensive end-to-end automated health monitoring diagnosis from site survey to remote monitoring</td>
</tr>
<tr>
<td>Continuous remote monitoring system</td>
<td>A complementary maintenance approach adding the human element and industrial mobility in taking accurate measurements from individual machines at the right time and place</td>
</tr>
<tr>
<td>Access critical information without interrupting production</td>
<td>Flexibility to work with a multitude of sensors and scalability to coverage all assets</td>
</tr>
<tr>
<td>More automated data collection</td>
<td>Coverage of multiple assets located even in remote areas. Gather trend data from all assets</td>
</tr>
<tr>
<td>Speed of information</td>
<td>Raw data can be provided on an enterprise level</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
A comprehensive mix of the three CM technology solutions is, of course, the recommended solution to address the various data frequency and needs across the entire plant. This unified connection between the CM solutions provides a more complete, robust, and effective maintenance program, as follows:

Exhibit 11 - Comprehensive Mix of CM Technologies

**Continuous Monitoring**
- Continuous monitoring and protection
- Faster sampling rate
- Higher data collection frequency

**Human Element**
- Complementary sight, smell and touch

**Expansion**
- Easier deployment and installation
- Easier to power
- Higher coverage of assets

The result is a full-scale CM package from a single source that offers the dynamic integration of maintenance strategies and the ability to scale to a large number of assets as well as across the enterprise. While wired CM is useful, relying solely on this solution includes challenges related to infrastructure, cost, or expansion. While an isolated technology limits diagnostic capabilities and scalability, a comprehensive program:

- Offers plant-wide scalability
- Provides the protection and monitoring suitable for the asset or process
- Optimizes reliability and maintenance with data-driven decisions

To prepare yourself for maintenance strategy modernization ask yourself the following questions:

- Do you have a 360° big-picture view of assets to support your evolving requirements?
- Have you identified areas of business benefits as a result of an integrated CM problem-solving approach?
- How do investments in these aspects help you achieve your strategic objectives?
- Have you looked at ROI models to understand outcomes and benefits?
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NEXT STEPS

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- Calling +1 775-215-1818
- Logging into www.bntechsupport.com

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