Bently Nevada

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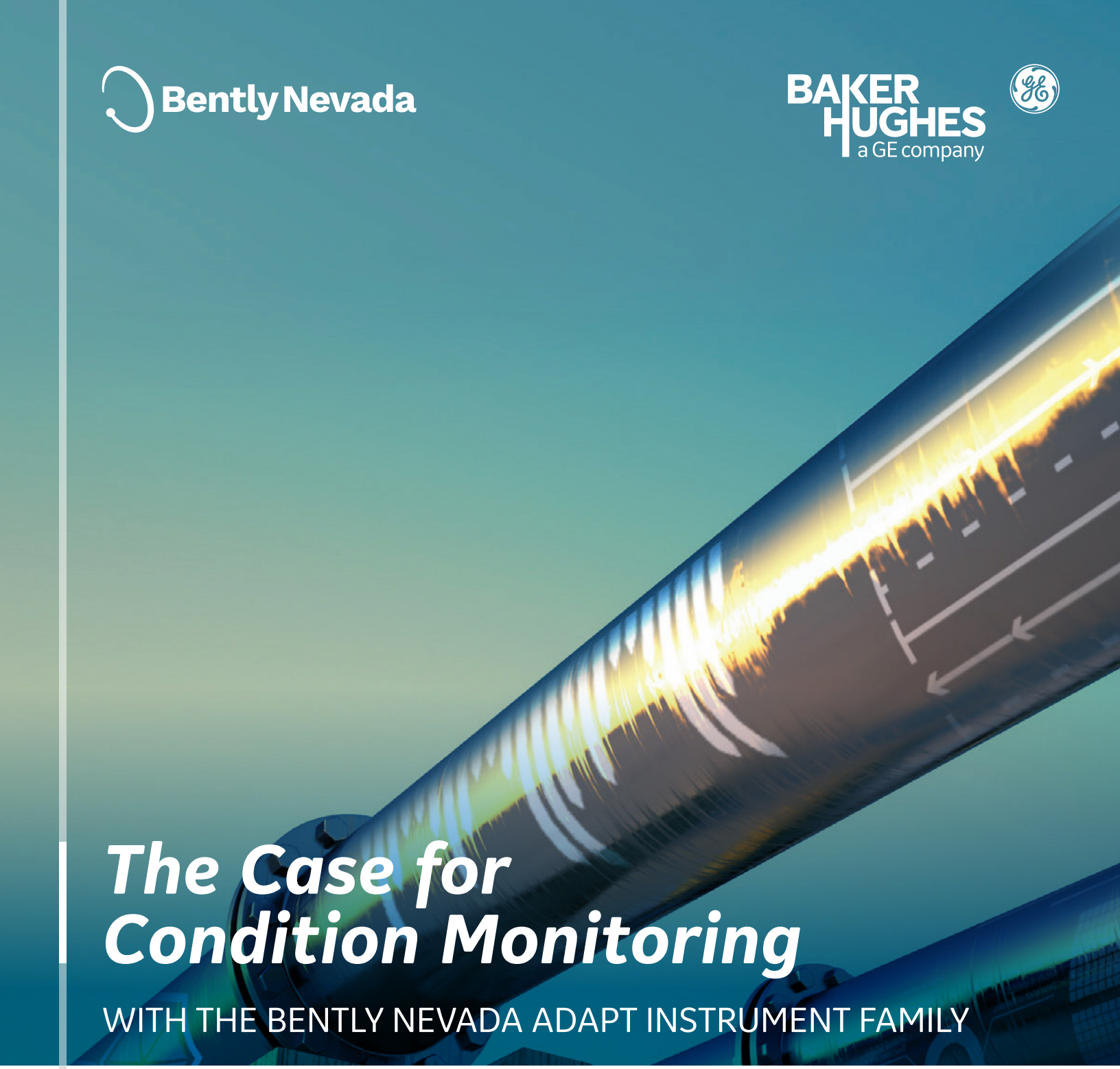

The Case for Condition Monitoring

WITH THE BENTLY NEVADA ADAPT INSTRUMENT FAMILY

Bently Nevada's Advanced Distributed Architecture Platform Technology (ADAPT) is the highest performance, most versatile vibration-focused industrial condition monitoring and evaluation system available today. The financial business justification for vibration-based condition monitoring has been well established, providing data to support:

- Avoiding catastrophic mechanical failures in service;
- Asset management planning decisions;
- The "can I safely restart it" after a trip decision; and
- Event root cause analysis.

The question to be addressed is “why ADAPT?” and the answer is relatively simple! ADAPT’s signal processing capabilities include all the specialized measurement types necessary to perform mechanical health diagnostics on any type of rotating machinery, including those equipped with rolling element or journal bearings as well as the most complex gearboxes. ADAPT with System 1 software supports critical asset management decision making for the most financially important machinery in industries ranging from pulp & paper to steel & aluminum to pharmaceutical manufacturing to transportation systems, and the list goes on.

1 WHAT IS THE ADAPT SYSTEM?

ADAPT is a modular condition monitoring and evaluation system that supports up to 12 dynamic vibration and/or pressure sensors along with up to three pulse-based machine speed sensors. All data is collected continuously, simultaneously in real time across all active channels. An ADAPT system can include an optional eight relay module with total system responsiveness that exceeds the requirements specified in API 670. ADAPT’s size and shape were designed to be able to be mounted local to the machinery that it is monitoring, thus eliminating the need for long sensor cable runs to centralized rack-based systems.

2 ADAPT OPERATES STAND-ALONE -or- CONNECTED TO SYSTEM 1

An ADAPT system can operate as a stand-alone, API 670 compliant, machinery protection system using relays with the ability to communicate “characterized” scalar and vector data to control systems and/or process historians. The greatest benefit is achieved when ADAPT is permanently connected to Bently Nevada’s System 1 software via your plant network. The System 1 software provides all the analytical tools required to perform deep dive evaluations on the fully dynamic data the ADAPT instrument acquires to support making sound machinery asset management decisions. Scalar and vector trend values are sent to System 1 every second, and waveforms can be sent to System 1 as frequently as every 10 minutes during normal machine operation.

Permanent connectivity with System 1 is ideal. But, if it is impractical, for whatever reason, ADAPT collects and stores important data when machine operational anomalies occur for harvesting into System 1, running on a laptop for example, which may be connected intermittently or only as needed.

3 EVENT DATA RECORDER for SMARTer DATA COLLECTION

High density data is collected automatically for all measurements on all active input channels when either any alarm threshold is exceeded or a machine speed transient happens that is a set percentage outside its normal operating range. If the ADAPT instrument is connected to a System 1 server then the high density data is automatically transferred to the System 1 enterprise database. If it is not connected to a System 1 server, then the alarm focused high density data is retained for up to 90 days and speed transient focus data is retained for up to five start-up/shut-down or overspeed events. Data that is held in ADAPT memory can be harvested by connecting System 1 to the instrument via the plant network or local ethernet connection.

The event data recorder functionality provides critical data that supports answering the "can I safely restart it?" and "what actually happened and why?" questions. System 1 software is required to harvest and evaluate this data, either on a permanently connected or connected on demand basis. Understanding ADAPT condition monitoring and evaluation data flow is important.

ADAPT collects and evaluates data in real time. Scalar and vector trend data values are communicated to System 1 (when connected) every second and are available to be read by process control/historian systems every 100 milliseconds. Three sets of circular historical data buffers are constantly being maintained on a first-in first-out basis.

These buffers hold high density data that is automatically saved to non-volatile memory when either an alarm is exceeded or a speed transient outside of the normal operating range is detected. This is referred to as pre-event high density data and retained as follows:

- **10 minutes of trend values at 1 second intervals**
- **2 ½ minutes of waveforms at 10 second intervals**
- **20 seconds of trend values at 100 millisecond intervals**

If the ADAPT instrument is connected permanently to System 1, then the 10 minutes of 1 second trend values will already be stored in the database when the event begins. The 2 ½ minutes of 10 second interval waveforms and 20 seconds of 100 millisecond trend values are backfilled into the System 1 database when the event begins.

Alarm event high density post event data is collected similarly to the pre-event data if permanently connected to System 1, transferred to System 1 in real time as follows:

- **1 minute of trend values at 1 second intervals**
- **1 minute of waveform data at 10 second intervals**
- **10 seconds of trend values at 100 millisecond intervals**

After this, the routine schedule is resumed.

Speed transient high density pre-event data is stored as already described. Speed transient collection is initiated when one of the following happens:

- **Fixed speed machines**
  - **Startup** – when machine exceeds 2% of the configured running speed, until the machine is at or above 95% of the configured running speed
  - **Shutdown** – when machine is below 95% of the configured running speed, until the machine is at or below 2% of the configured running speed
  - **Overspeed** – when machine exceeds the configured running speed by 10%, until the machine is at or below 10% over the configured running speed
- **Variable speed machines**
  - **Startup** – when machine exceeds 2% of the lower configured speed value until the machine is above 95% of the configured lower speed value
  - **Shutdown** – when machine is below 95% of the lower configured speed value, until the machine speed is at or below the 2% of the configured lower speed value
  - **Overspeed** – when the machine exceeds the configured upper speed value by 10%, until the machine is at or below 10% over the configured running speed

Speed transient post event data, both trend values and waveforms, is collected as follows:

- **Every 10 seconds**
- **Every 10 RPM speed change if speed 10 RPM speed change occurs before the next 10 second interval**

Speed transient data is sent to System 1 immediately if System 1 is connected while the event is happening. Otherwise, the data is transferred when a System 1 computer is connected to the ADAPT instrument locally or via the plant network.

Vibration-based condition monitoring and evaluation data is an important element of an effective plant machinery asset management program. The ADAPT instrument combined with the System 1 software provides the best possible data to support short-term reactive and long-term planned decision making.

PLANTS MOVING TO PREDICTIVE MAINTENANCE WERE ABLE TO:

50% * REDUCTION in maintenance cost

55% REDUCTION in unplanned machine failures

Machinery availability INCREASED **30%**

Mean time to repair (MTTR) was reduced **60%**

Spare parts costs were REDUCED **30%**

90% REDUCTION when process data was combined with predictive maintenance data

Plant machinery life INCREASED **30%**

70% reduction in machinery breakdowns

Reduction in MAINTENANCE COSTS **30%** **

40% reduction in DOWNTIME

25% INCREASE in production

*A survey of 500 plants by Keith Mobley, "Introduction to Predictive Maintenance"
**US Department of Energy

Conclusion

With a great majority (77–94%) of a plant's assets experiencing problems randomly throughout their life cycle, condition monitoring or a more proactive approach to maintenance can greatly reduce unplanned outages (55–70%), reduce maintenance cost (30–50%) and improve asset availability (25–30%), by understanding when machinery condition is changing and when problems are developing and need to be addressed. The case for condition monitoring is no longer solely about reducing costs, but studies have shown it can be a real money maker for manufacturers.

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