The Future of Air Operated Valve Online Monitoring, *a Vision*

15th ASME/NRC OM Code Symposium

Nuclear

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July 2025

Industry Current State

OE | Valves

The leading causes of operational events significantly impact plant reliability and power generation.

Regulatory | Inspection Findings

Emphasize the importance of maintaining valve performance.

Valve Workforce | Evolving

Requires adaptation through training, mentoring, and resource planning.

SPVs | Critical Valves

Require increased attention and rigor (Feed Reg.).

Technology | Underutilized

Available Condition Monitoring technologies offer a promising solution to enhance valve reliability; however, this technology is underutilized.

Industry Objectives

Condition Monitoring Objectives

- **Implement Condition Monitoring Technologies**
  Detect equipment degradation prior to failure and optimize equipment performance.
- **Mitigate**
  Reducing environmental stressors (e.g., temperature, radiation, moisture) and operational stressors (e.g., duty cycles, vibration) can improve equipment performance and longevity.
- **Equipment performance and trending data**
  Promptly identify problems and support cause evaluations.

Performance Management Objectives

- **Manage aging of equipment**
  Implementation PMs and life cycle management.
- **Document**
  Technical bases for PM activities and aging management programs.
- **Research**
  Actively address performance gaps through research to reduce costs and resource demands.
- **Implement**
  Develop cost-effective implementation solutions through industry alignment.

Understanding the Nature of Failures

Why Random Failures Matter

- Random failures are dominant (77–92% of cases), not age-related wear
- Random failure means unpredictable timing due to variable stressors, not unknown causes
- Time-Based Maintenance is ineffective against random failures and may introduce errors

Random Failure Examples:

- **Elastomers** – Vendor quality, storage, installation techniques, contamination, etc.
- **Digital Positioners** – Digital sub-components, feedback linkages, elastomers, foreign material, etc.
- **Analog Positioners** – Wear of metallic parts, elastomers, calibration, foreign material, etc.

Over-maintenance can increase failure risk due to human error.

Condition Monitoring Considerations

01 **Document**

Define a clear failure mitigation strategy with known failure modes, strategy coverage paths, and supporting data.

02 **Infrastructure**

Determine connectivity method and battery life requirements to support performance.

03 **Calibration**

Determine standards, criteria, and routines to maintain sensor accuracy and system reliability.

04 **Cybersecurity**

Determine associated Regulatory and Standards requirements and develop a plan to implement.

05 **Proficiency**

Use 3D content to offset limited hands-on time and improve knowledge and proficiency.

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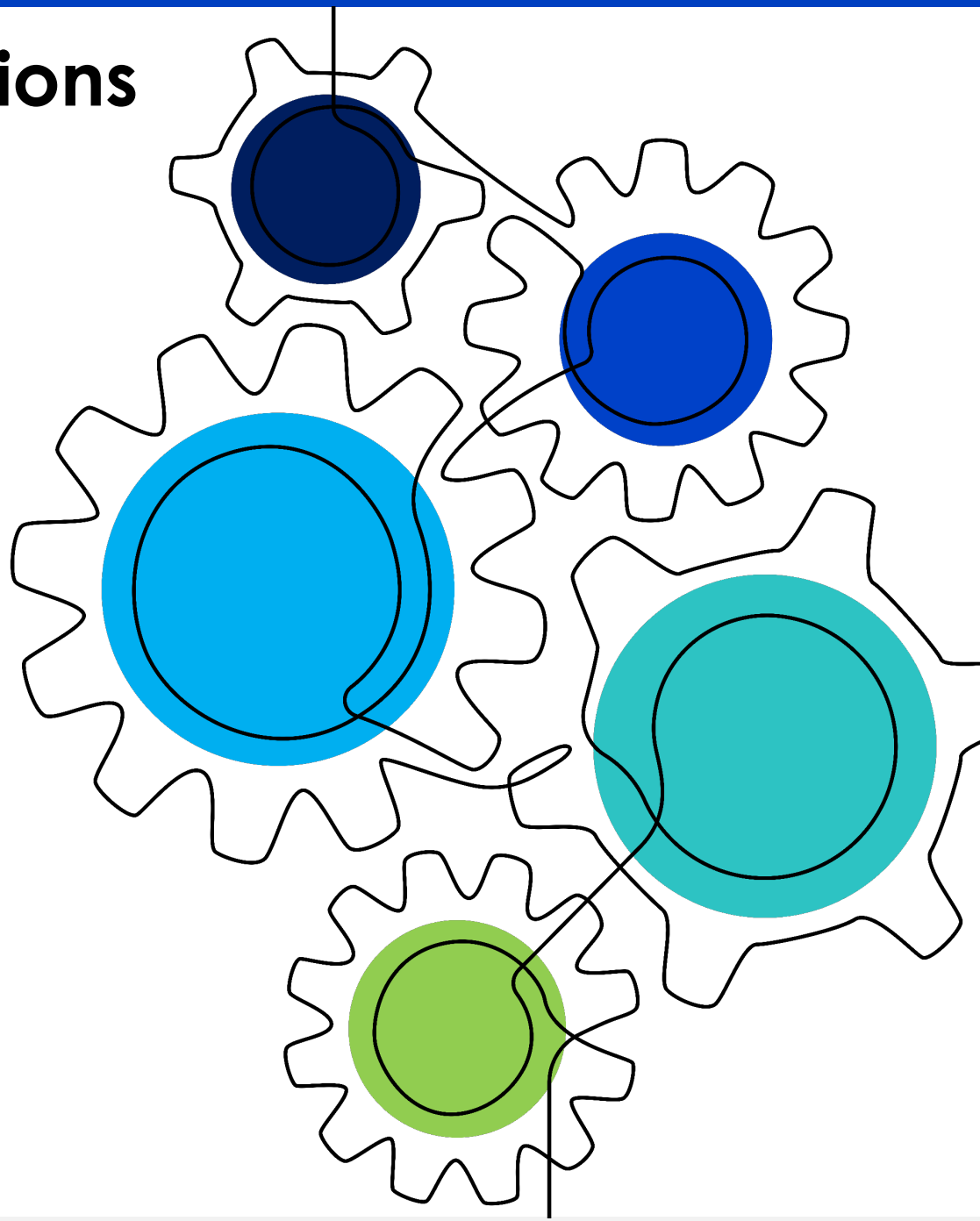
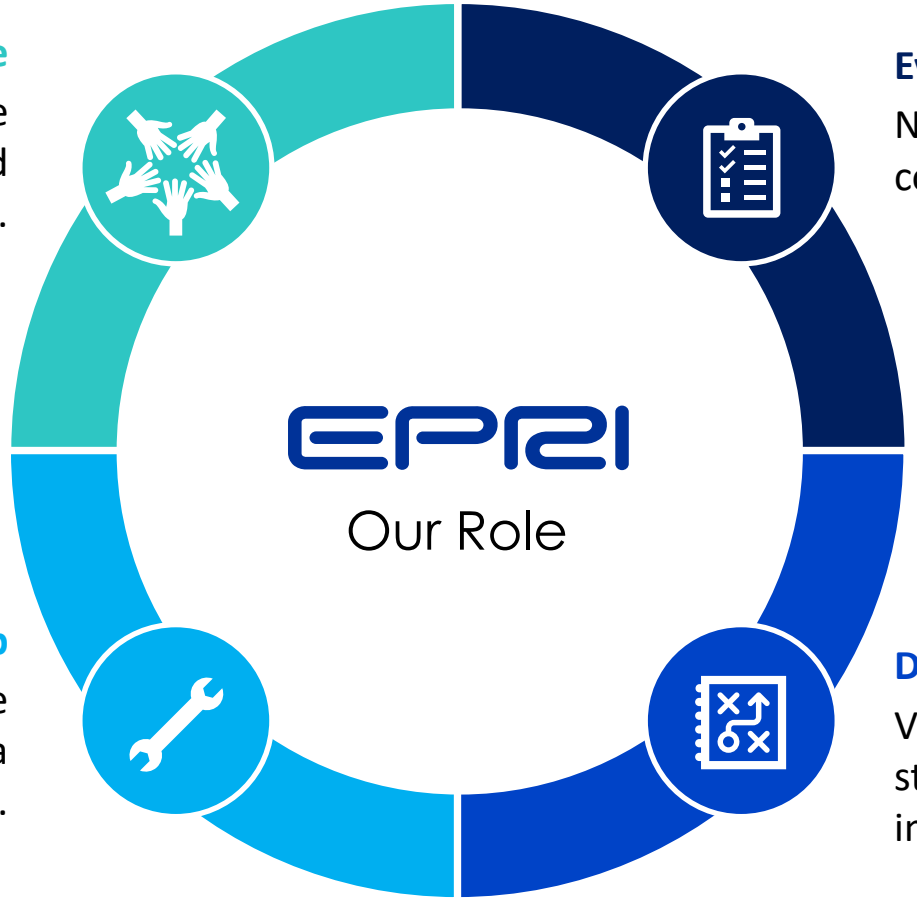


Condition Monitoring

Collaborate

Work with the industry or valve monitoring activities and minimize duplicated efforts.



Evaluate

New technologies for valve condition monitoring.

Develop

Tools to enable effective valve condition monitoring, data management and analysis.

Determine

Valve condition monitoring: strategy and implementation guidance.

Valve Condition Monitoring Vision

Potential Outcomes

The Main Focus

1. **Generation**
2. **Problem Valves**
3. **Chronic Issues**

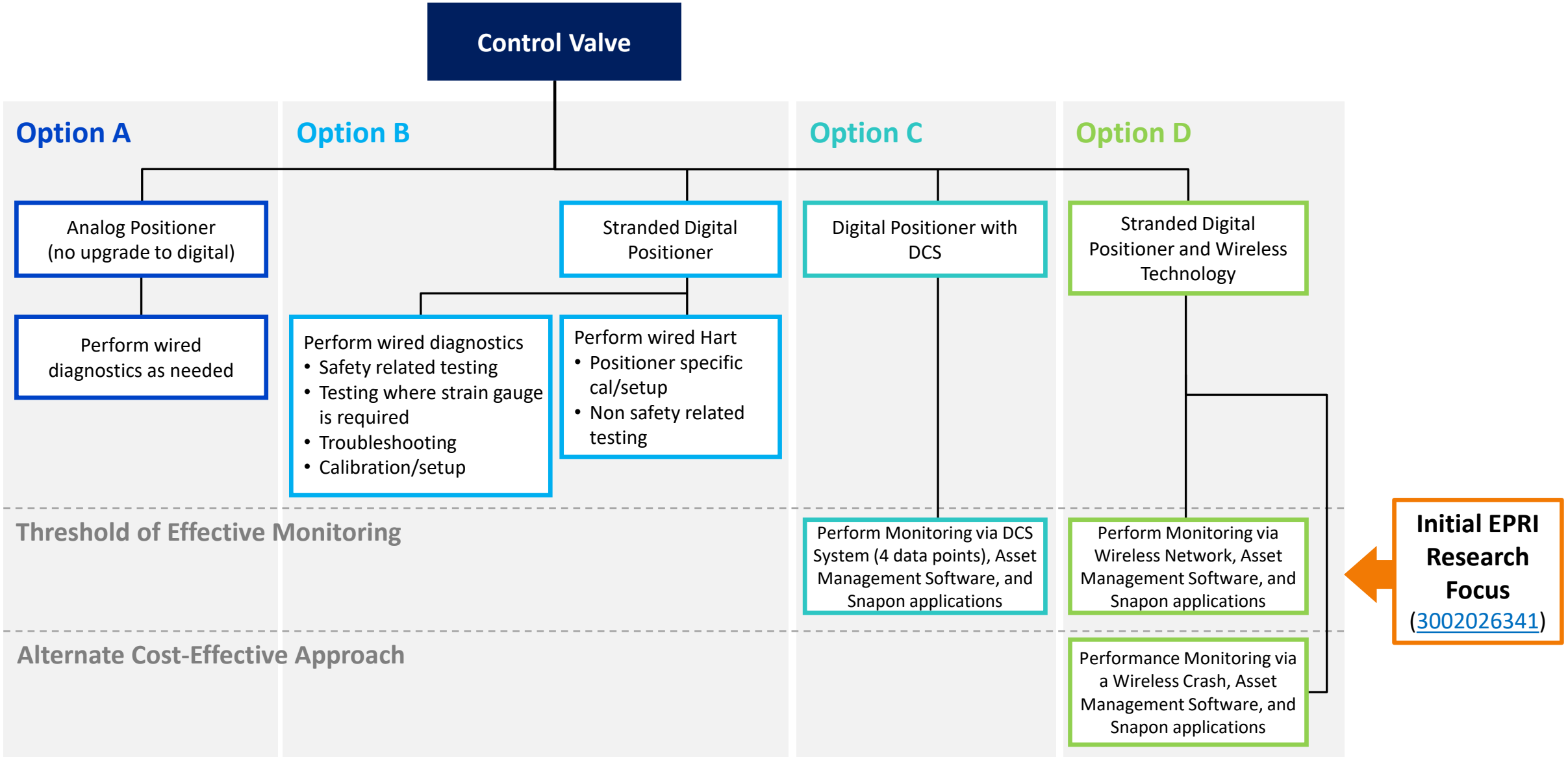
Initiation + **Implementation** = **The Goals**

- Shift valve testing away from refueling outages
- Leverage ASME OM Code credit via operational demand strokes
- More frequent condition monitoring

- Reduced lifetime maintenance (JIT) and testing costs
- Reduced radiation exposure and human error risks

- Address workforce knowledge gaps
- More effective valve trending results
- Detect issues early enough to act before failure
- Expected equipment reliability improvement

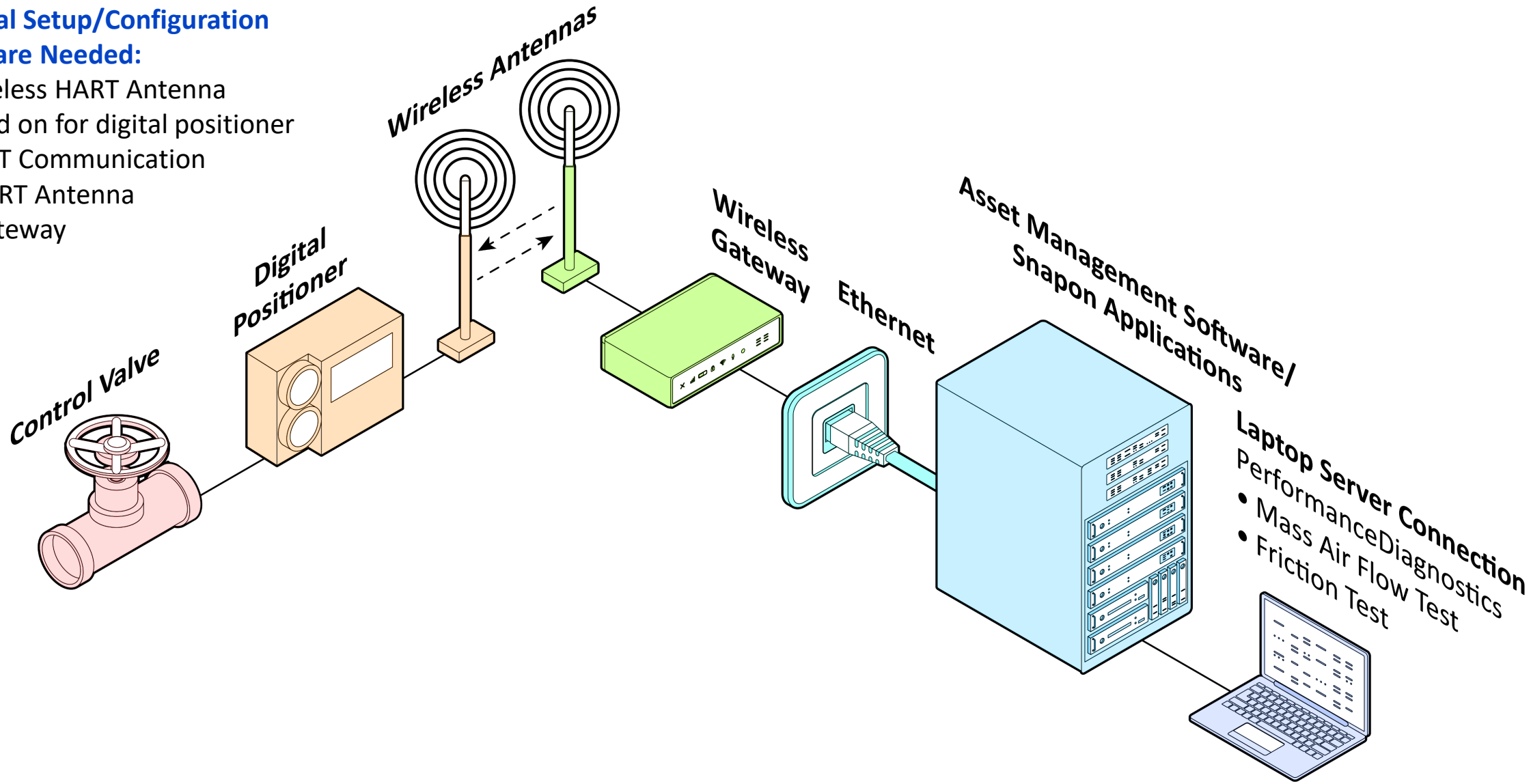
Current Condition Monitoring Options



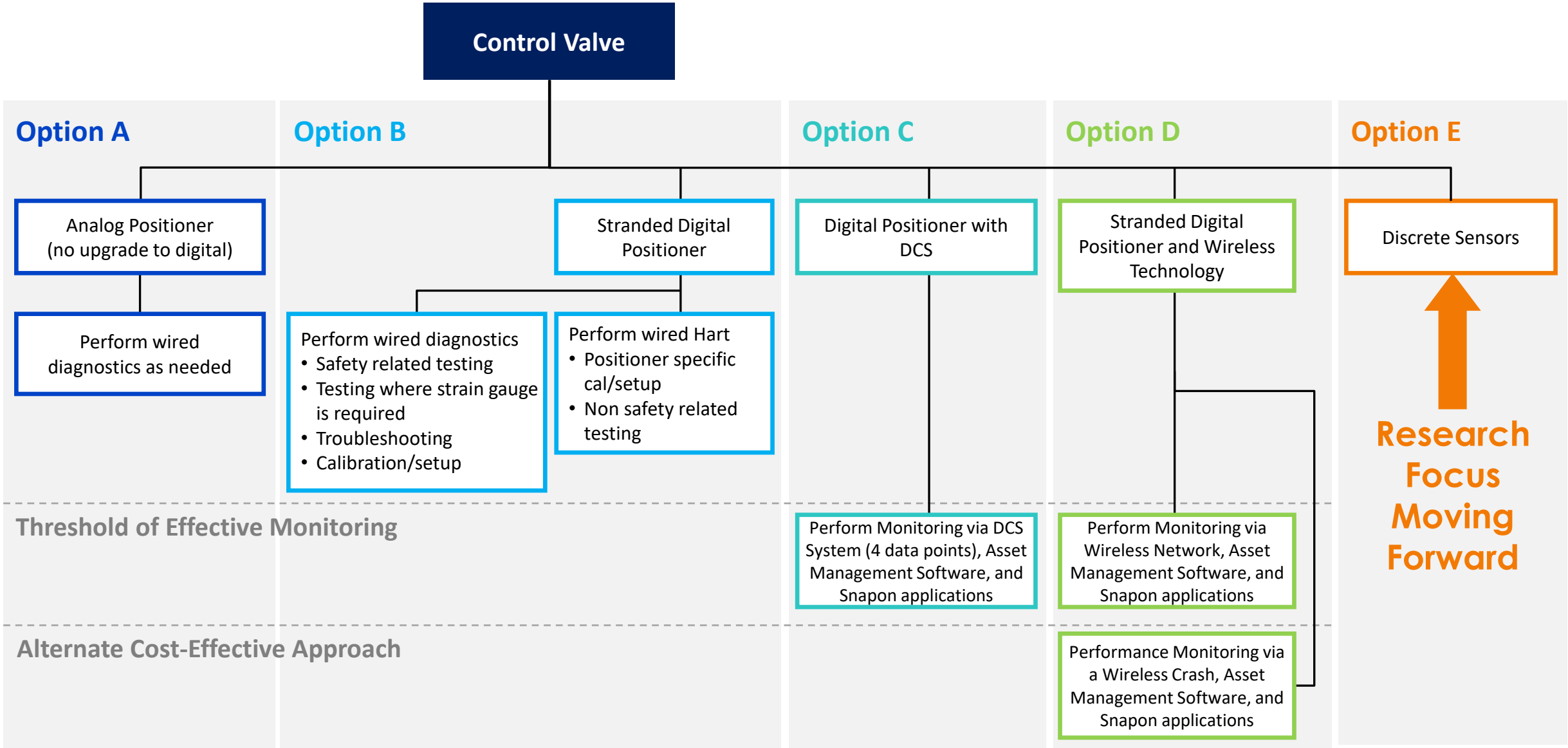
Condition Monitoring via Wireless Network

Practical Setup/Configuration
Hardware Needed:

1. Wireless HART Antenna
   - Add on for digital positioner
2. HART Communication
   - HART Antenna
   - Gateway



Current Condition Monitoring Options



New Option E Guidelines

01 Low cost

02 Easy installation

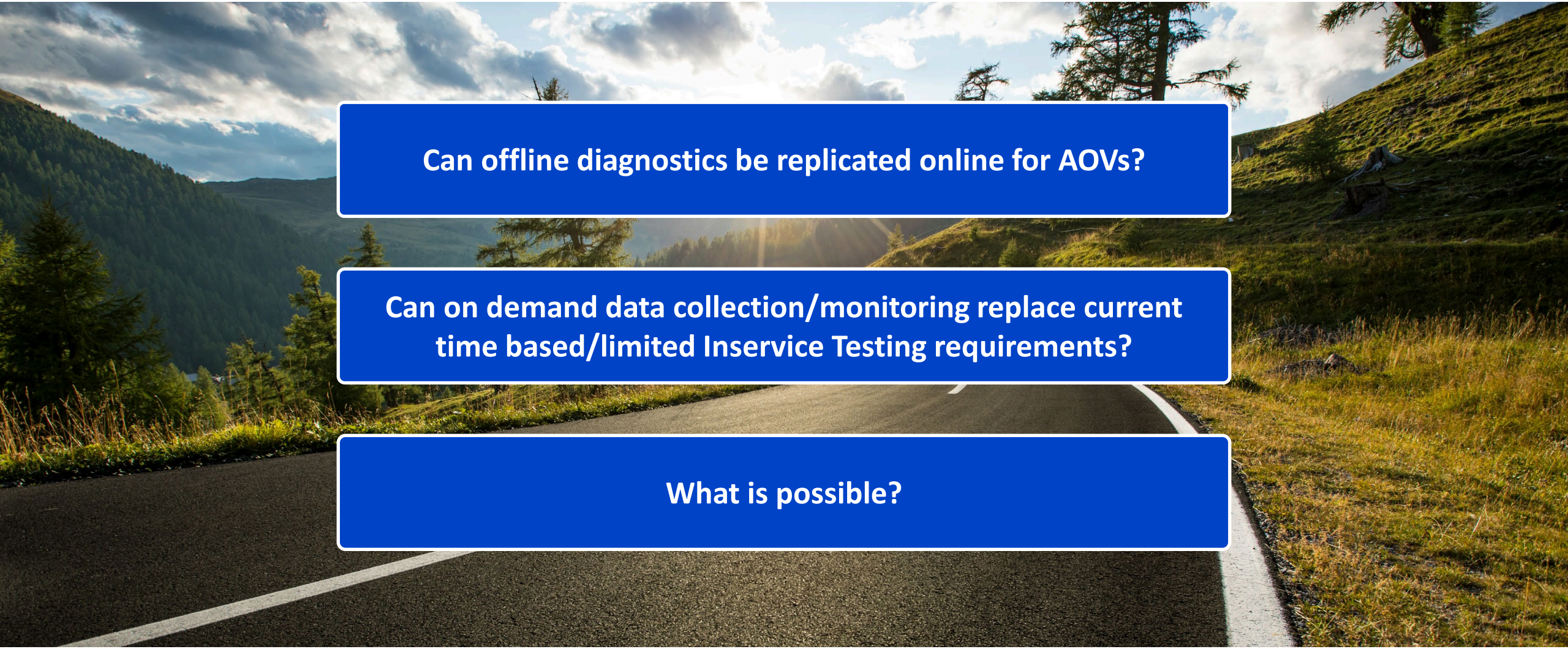
03 Direct connection to plant PI databases

04 24/7 data collection to PI, giving Engineering and Maintenance on-demand access

05 Sensor monitoring function independent of plant process control equipment functions

06 Not intended for operability or operational decision-making

Down the Road for AOVs



Additional Insights – EPRI Positioner Guide

EPRI Positioner Guide Update (3002023777)

- Updated analog/digital OE
- Digital Refresh
- Updated diagnostics/monitoring guidance (include wireless)
- Linked EPRI PMBD failure modes for troubleshooting
- Include key modifications/updates
- Include guidance on how to transition from analog to digital positioners

Questions Or Comments?

For questions or comments, contact:

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