Pipeline Research Council International, Inc.

A Collaborative R&D Roadmap for the Energy Pipeline Industry

PRCI’s Vision and Efforts to Establish a Global Consensus on Energy Pipeline R&D

US DOT PHMSA R&D Forum
Arlington, VA
July 18, 2012

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Director, Pipeline Technical Committees
Pipeline Industry R&D Puzzle

- Awareness & understanding of the R&D universe
- Multiple parties and interests
- R&D funding constantly challenged
- Instant gratification society
- Staying the course and managing emerging issues
- Changing role of industry-government relations

Collaborative model is key to achieving success – identify and manage barriers
INPUTS & outcomes of the Current Process

Outcomes & Benefits

Drivers & Inputs

Need a deployment route

Technology

Key Contractors

Stakeholders

PHMSA
State Gov’t
Local Gov’t
Advocacy Groups
Public

In-Line Inspection
CP/Coatings/Corrosion
NDT / NDE
Equip / Material

Biofuels/CO2/Ethanol
Distribution
Transmission
Gas
Haz. Liquids

Service Providers

Pipeline Operators

Technical Societies

Industry Organizations

PHMSA
State Gov’t
Local Gov’t
Advocacy Groups
Public

Drivers & Inputs

Need a deployment route
Developing the Industry R&D Roadmap

INGAA IMCI

AOPL/API
R&D for Pipeline Safety Improvement

Common Goals

INGAA IMCI Action Plans
OS&E
INGAA Foundation

OTG
API Technical Committees

Four R&D Summits
IPC 2012 – Roadmap Roll-out

PRCI is Conduit for Industry
- Gas, liquid, industry associations

Owner of R&D Roadmap
Continuous Feedback Loop

Identify R&D Partnerships
- NYSEARCH, OTD, APIA, EPRG, etc.

Monitor PHMSA R&D Program
Information Sharing & Repository
Communication & Deployment

Large Programs with Substantial Funding Commitments
Synergy between IMCI and PSIA

- Top R&D Needs
  - Improvements in ILI capabilities
  - Unpiggable/Difficult to Inspect Pipelines
  - ERW/Longitudinal Seam Welds
  - Leak Detection
  - Data Integration & Decision-making Processes/Tools
  - SCC & Cracking – welds and pipe body
  - Anomaly Assessment
  - Mechanical Damage & Damage Prevention
  - Facility Integrity
  - Risk Assessment

Consistent with PRCI Programs and Roadmaps
R&D Summits – Laying the Foundation

Four Separate Sessions to Provide a Foundation for the Roadmap

- Session 1 – December 2011 - Transforming the Model & Road Mapping the Journey; North American Industry Stakeholders
- Session 2 – February 2012 - Technical Committee Perspective
- Session 3 – May 2012 – Global Stakeholder Perspective and beyond Inspection Focus
- Session 4 – Report out (IPC 2012 Panel Session)
Basis for the R&D Summits

- Solicit input from a group of industry experts with diverse needs and interests
- Develop a framework to achieve better collaboration to meet the needs of the industry
- Focus energy and resources on activities that have the greatest impact and benefit
- Align various pipeline safety R&D initiatives
- Develop a forward-looking vision for pipeline industry R&D and build consensus in support of that vision
  - Step change in process and approach
  - Step change in industry outcomes
Takeaways from Summit Sessions

- You say potato...
- “Step Change” & “move the needle quickly” –
- Industry is slow to adapt/change - challenges to technology development and application
- Balancing the R (or r) with the D&D
- Less is more (AD/HD) - Timely execution and R&D deployment
- Funding and Human Capital
- Evolution – where will the Pipeline Industry find protein in its diet
- Not a once and done effort
The Tripartite Collaboration

Fracture Control – Shock Tube Testing

Delayed Failure of Mechanical Damage

Reduced Construction & Installation Costs

Standards for Corrosion Assessment of Unpiggable Pipelines

APIA

Materials

Materials Performance

Welding

EPRG

Pipe Manufacturers

Materials

Performance

PRCI

Integrity & Reliability

O&M

Facilities

Human Factors in Damage Prevention

SCC Experience Database

Corrosion Growth Rates

Integrity Management for Subsea Pipelines
NYSEARCH – OTD – PRCI COLLABORATION AREAS OF MUTUAL INTEREST

**NYSEARCH**
- Natural Gas R&D
- Pipeline Locating
- Plastic Pipe – Advanced Standards Devt, Modern Materials Testing, NDE Techniques for Joining
- Greenhouse Gas Emissions
- MD Prevention & Monitoring
- Internal & External Corrosion – Remote Inspection, Direct Assessment & Special Challenges
- Materials & Joining
- Pipeline Repair
- New/Alternative Fuels – Compatibility & Transmission
- Underground Storage

**OTD**
- Operations Technology Development
- Measurement/Metering
- Compressors & Engines
- Stress Corrosion Cracking
- Pipeline Design
- Geotechnical Threats

**PRCI**
- Collaboration: to obtain future work, to access information from prior work, and to obtain relevant information and knowledge about current work
# Leak Detection Roadmap Overview

## #1 - Highly Reliable Rupture Detection Systems

**Business Driver:**
Reduce detection time, response time, and spill volumes associated with pipeline integrity breaches.

- **A)** Best practices document (knowledge)
- **B)** Risk analysis in support of leak detection (knowledge)

### Detect Large Leak (>50% breach) with 99.99% certainty in < 5 minutes, under all operating conditions

- **A)** Field test results (knowledge)
- **B)** Retrofit on fiber-based LDS (knowledge)
- **C)** Field test environment (tool)

## #2 - Continue R&D on Small Leak Size Detection

- **A)** Field test results (knowledge)
- **B)** Retrofit on fiber-based LDS (knowledge)
- **C)** Field test environment (tool)

### Detect Leak (1% flow) with 95% certainty in < 5 minutes, under all operating conditions

## #3 - Metrics to Measure LDS Performance

### #4 - More Rapid Implementation

- **A)** Research to ID what data should be collected over time by operators to demonstrate system effectiveness.
- **B)** Research to ID roadblocks and overcome them (knowledge)
- **C)** LD Testing methodologies (knowledge)

### Reduce CPM implementation time to days vs. months

## #5 - LD Program Effectiveness Survey

- **A)** Update API 1149 (knowledge/tool)
- **B)** CPM Performance Measurement Std (standard)
- **C)** LD Testing methodologies (knowledge)

**Consistent means to define/relate:**
Leak size, detection time, confidence factor

**Business Driver:**
Reduce detection time, response time, and spill volumes associated with pipeline integrity breaches.
Mechanical Damage Threat Management Research in PRCI - simplified roadmap

- Monitor Incident trends
- Damage Prevention (DP) by ROW Monitoring (ROW)
- Other threats: corrosion, SCC, etc.
- NDE: Inspection, Detect & Size
  - MD1: 1-1, 1-2, 1-3
  - MD1: 6 projects
- Characterize, Discriminate features
  - MD1: 6 projects
- Assess severity
  - MD2, MD4
- Remediate MD5
- Research to Improve Integrity Management For Mechanical Damage
- Yes to Contact?
- No to Follow Pipeline Integrity
- O&I
- DOT support
- DMC
- Not PRCI
- DOT support
- Not PRCI
### Mechanical Damage – Inspection Projects

<table>
<thead>
<tr>
<th>Quarters</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<tr>
<td>MD1-8 ($50K)</td>
<td>4</td>
<td>1</td>
<td>2</td>
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<tr>
<td>select pipes for testing - material types</td>
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<td>cut rings for full characterization (MD 4-10)</td>
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<td>Create dent samples - cyclic loading</td>
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<td>measure dent stress - MFL others (MD 1-3 &amp; MD 1-9)</td>
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<td>Report</td>
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<tr>
<td>MD-1-9 ($98,475)</td>
<td></td>
<td>1</td>
<td>2</td>
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<tr>
<td>dent+gouge defects (from MD4-1)</td>
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<tr>
<td>Year 2 dent samples and dent+gouge+crack (from MD-4 and MD-1)</td>
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<td>MD 1-2 ($275K)</td>
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<td>3</td>
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<td>Compile member company data - ILI tool runs</td>
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<td>Select sample population for testing</td>
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<td>full NDE inspection of samples</td>
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<td>schedule ILI vendors</td>
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<tr>
<td>Establish pull test facility</td>
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<td>ILI Technology evaluations (reliance on vendors)</td>
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<td>MD-1-10 ($120,600)</td>
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<td>Creation 2 defects for inspection performance</td>
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<td>Creation 2 defects for repair qualification</td>
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<td>Creation 2 fatigue cracked defects for inspection</td>
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<td>Creation 2 fatigue cracked defects for repair</td>
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<td>Vintage pipe MD-4-6</td>
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<td>Issue insufficient pipe length X63 MD-4-6</td>
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<td>MD-1-11 ($100,000)</td>
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<td>Creation 5 fatigue cracked defects for inspection</td>
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<td>Pipe 1 &amp; 2 from MD-4-1</td>
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<td>Issue insufficient length pipe 2 ? Options possible</td>
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<td>Relax some defect spacing constraints</td>
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<td>Identify available field sites - 2012 digs</td>
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<tr>
<td>Field data collection</td>
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<td>Report</td>
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PRCI Integrated Program for Technology Development

PRCI In-Line Inspection Projects

- **EC-4 Program**
  - Stress Corrosion Cracking
    - SCC 3-4
    - SCC 3-7
    - SCC 3-12
  - Weld Fatigue Cracking
    - Fatigue Cracks on Heavy Wall Gas Risers and Pipeline (SPIM 1-2)
  - ERW Pipe Program

- **Mechanical Damage**
  - Dual Field MFL (1-1)
  - Current Tool Performance (MD 1-2)
  - MFL Signal Analysis (MD1-3)

- **MFL-Vintage Welds**
  - Integrated Cleaning & Inspection Tool (NDE 1-3)
  - EMIT ILI (NDE 1-4)

- **Test Samples for Program**
  - Create Dent +Gouge (MD 1-10, MD 1-11, MD 4-7)
  - Create Cracks in Dents (MD 4-2)
  - PRCI Sample Repository
  - Detection, Sizing and Characterization of SCC and Other Cracks in Dents in Liquid Pipelines (SCC 3-4)
  - Technologies to Detect Fatigue Cracks in Heavy Wall SCRs (SPIM 1-2)

Key:
- SCC/cracking
- Mechanical Damage
- General NDE
- Corrosion

Input to Models

Managing Uncertainty

Improved Repair and Decision Making

PRCI related in-ditch projects

- **EC-4 Program**
  - Detection, Sizing and Characterization of SCC and Other Cracks in Dents in Liquid Pipelines (SCC 3-4)
  - Technologies to Detect Fatigue Cracks in Heavy Wall SCRs (SPIM 1-2)
- **ERW Pipe Program**
  - SCC 2-8/3-6
  - SCC 3-5
  - SCC 3-10
  - JENTEK MWM NDE 2-1
  - Application of In-the-Ditch Tools (NDE-2-2)
- **JENTEK MWM**
  - MD 1-4
  - MD 1-5
  - MD 1-6
  - MD 1-8
  - DOT SBIRS
The Future of Pipeline R&D

Requires an Improved Collaborative Process To:

- Leverage Funding and Provide the Funding Required to Achieve the Outcomes Needed for all Roadmap Focus Areas
- Gain Consensus on Priorities – Topically, Sector-based, Regionally
- Assure Rigorous Process; Industry Peer Review
- Manage Deployment and Transfer of Technology and Information – Products, Standards, Best Practices, Rules
- Achieve Transparency with Better & Wider Communication
- Provide Faster Returns with Successful Research Plans
- Develop and Maintain Partnerships with Key Industry Groups & Government
Changing Role of Government for R&D

- Impacts of PHMSA Policy Decision on Industry R&D Funding and Partnerships
- Outcomes from this PHMSA-sponsored R&D Forum
  - Assess Government vs Industry Roadmaps
  - Define Path Forward for Industry-Government Coordination and Joint funding and partnerships on R&D programs
- PRCI Leveraging Other Government Partnerships
  - US DOI Bureau of Safety and Environmental Enforcement (BSEE) – offshore and subsea pipeline programs
  - NIST
  - Potential work with Brazilian R&D Community and ANP
  - US DOT RITA
What’s Next for R&D Roadmap

- Writer’s cramp
- IPC 2012 – Roll-out of Roadmap & Execution
- Coordination with all Stakeholders
- Walking the Walk
- Developing an Effective Method for Monitoring R&D

“We need a SmartMap!”
Closing Slide

Thank you for your attention

Questions?

Follow-up questions or information needed:

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