# Working Group # 3
# Anomaly Detection/Characterization

Jerry Rau
François Rongere
Joe Sieve
Josh Johnson
Sergio Limon-Tappia
Mati Marek

# Attendance Breakdown

| | |
|---|---|
| Approximate total attendance | 45 persons |
| | |
| Federal Regulators | 4 persons |
| State Regulators | 2 persons |
| International Regulators | 0 persons |
| Pipeline Industry/Service Providers | 19 persons |
| Operators | 14 persons |
| Standard Developing Organizations | 0 persons |
| Researchers | 6 persons |
| Academics | 0 persons |
| Other | 0 persons |

# Top 3 Identified R&D Gaps

Gap #1 – Improve and develop ILI to locate and size girth weld, ERW, and Long seam defects including cracks and in pipe body

Gap #2 – In the Ditch Validation methodology for the determination of sizing and POD

Gap #3 – Improve and develop ILI to locate and size metal loss features including complex long defects and dents

Gap #4 – ILI Validation methodology for the determination of sizing and POD

Gap #5 – Above-ground detection tools including coating disbondment and metal loss for all metals including cast iron graphitization

# Associated Details - (Gap #1)

## Improve and develop in-line inspection (ILI) to locate and size girth weld, ERW, and long seam defects including cracks and in pipe body

*1. New or Improved Technology*

a. **What pipeline types does the technology target?** –Carbon steel transmission and distribution gas; and liquid lines.

b. **What operating environments would the technology operate ?** - pipelines operation at >20% SMYS

c. **What are any functionality and or performance requirements?** To improve detection and sizing capability in both weld and pipe body to ultimately achieve inspection standards to detect cracks which would fail 100% SMYS pressure test.

d. **What are anticipated targets or timeframes to complete this research?** 3-5 years

e. **What road blocks or barriers prevent the technology deployment? –** Investment, historical perspective of failed research in this area, clearly defined performance requirements do not exist, accept reject criteria also lacking

# Associated Details

## Gap#2: In the Ditch Validation methodology for the determination of sizing and POD

*1. New or Improved Technology*

a. What pipeline type(s) does the technology target?

Includes, Cracking, Corrosion, Dents, Sizing and detection, Metal, iron, PE pipe, Gas, Liquids

b. What operating environment(s) would the technology operate?

All weather and environment

Both in service and out-of-service

c. What are any functionality and or performance requirements?

Accurately size all type of defects

Meet or exceed ILI accuracy and detection capabilities

Include ability to measure complex features

Need to be applicable to all geometry, morphology types

d. What road blocks or barriers prevent the technology deployment?

Industry and NDE Vendor participation and acceptance

Calibration blocks that don't depict real environment

e. What are anticipated targets or timeframes to complete this research?

3 to 5 years

# Associated Details - (Gap #3)

## Improve and develop inspection (ILI) to locate and size metal loss features including complex and long defects and dents

*1. New or Improved Technology*

a. **What pipeline types does the technology target?** –Carbon steel transmission and distribution; gas and liquid lines.

b. **What operating environments would the technology operate ?** – all pipelines.

c. **What are any functionality and or performance requirements?** To improve sizing capability to complex and long corrosion defects, corrosion in dent, and distinguish between corrosion and gouging (metal loss type identification). Be able to provide information need by corrosion assessment methodologies. This must include corrosion near/on seam welds, girth welds, pipeline fittings, etc.

d. **What are anticipated targets or timeframes to complete this research?** 3-5 years

e. **What road blocks or barriers prevent the technology deployment?** – Investment, misinterpretation that the technology and process is adequate for all corrosion scenarios, clearly defined performance requirements do not exist other than in the pipe body

# Associated Details

## Gap#4: ILI Validation methodology for the determination of sizing and POD

*1. New or Improved Technology*

a. What pipeline type(s) does the technology target?

Includes: Cracking, Corrosion, Dents, Sizing and Detection, Steel pipe, Gas, Liquids

b. What operating environment(s) would the technology operate?

All type of liquids and gas

Both in service and out-of-service

c. What are any functionality and or performance requirements?

Accurately size all type of defects

Include ability to measure complex features

Need to be applicable to all geometry, morphology types

d. What road blocks or barriers prevent the technology deployment?

Industry acceptance

Vendor participation and acceptance

Standardize calibration test loop

e. What are anticipated targets or timeframes to complete this research?

3 to 5 years

# Associated Details - (Gap #5)

## Aboveground Inspection Tool Development – Slide 1 of 2

*1. New or Improved Technology*

a. **What pipeline types does the technology target?** – Steel and cast iron: transmission and distribution gas; and liquid lines. **Benefits include:** ability to detect coating disbondments from aboveground (there is no current technology that can do this). Disbonded coatings can result in severe corrosion under field-applied tapes, sleeves, and other susceptible systems. Early detection is paramount to prevent severe localized corrosion. An aboveground metal loss detector would provide the ability to detect metal loss in unpiggable steel and cast iron pipelines. This is can currently only be accomplished through invasive methods. These tools would be complementary to both ILI and Direct Assessment inspections.

b. **What operating environments would the technology operate?** The technology would be used to inspect uncased, buried pipelines that have up to 9 feet of soil cover. The technology can inspect through asphalt, concrete, and other ground covers.

c. **What are any functionality and or performance requirements?** To detect metal loss, coating disbondment, coating holidays, and cast iron graphitic corrosion (aka graphitization) – all from aboveground.

# Associated Details - (Gap #5)

## Aboveground Inspection Tool Development – Slide 2 of 2

*1. New or Improved Technology*

**d. What road blocks or barriers prevent the technology deployment?** – Proof of feasibility is complete, technology is 60% developed (GTI/OTD/SMP) research is needed to address final technical challenges: misalignment compensation, converting to wireless to extend range > 1,000 ft, field validation testing on multiple pipeline/coating configurations (POD sensitivity, false alarms), and incorporation of high-resolution GPS. Will require incorporation into NACE SP 0502 indirect inspection tool list and related sections. Could be used as part of direct assessment and/or as a stand-alone (other technology) tool with a special permit from DOT/PHMSA.

**e. What are anticipated targets or timeframes to complete this research?** 2-3 years. These are two separate technologies, one for coating disbondment detection and the other for metal and cast iron graphitic corrosion detection. The two technologies could be combined into one aboveground platform.

# Additional Identified Gaps

| Group | Votes | Item |
|---|---|---|
| E | 22 | Improve and develop ILI to locate and size girth weld, ERW, and Long seam defects including cracks and in pipe body |
| N | 15 | In the Ditch Validation methodology for the determination of sizing and POD |
| E | 14 | Improve and develop ILI to locate and size metal loss features including complex long defects and dents |
| E | 13 | ILI Validation methodology for the determination of sizing and POD |
| B | 11 | Un-piggable pipe inspection solution including sensor validation and improvement including cleaning tools |
| E | 11 | More and better inspection tools on PIGS |
| E | 11 | Superposition of defects for integrity assessment |
| C | 10 | Above-ground detection tools including coating disbondment and metal loss for all metals including cast iron grafitization |
| Q | 10 | Growth of planar defects and interactive threats modelling |
| P | 9 | Test methods and hoop stress as an alternative to traditional hydrotest |
| G | 7 | PE but-fusion or electro-fusion weld inspection |
| M | 7 | Lab-test for determining if disbonded coating is CP shielding |
| A | 6 | Hybrid UT EM of cast iron joints and materials in the ditch |
| E | 6 | Explicit guidance on using POD and sizing tolerances best to address within a deterministic or probabilistic analysis |
| P | 6 | Burst testing: Full scale data on: real crack like defects and complex Metal loss in high strength pipe / very deep metal loss |
| Q | 5 | Interpreting model accuracy in terms of appropriate safety factors or use in probabilistic approach |