Consolidated Assets

One of North America’s Largest Natural Gas Pipeline Networks
- Operating 90,300 kms (56,100 miles) of pipelines
- Transports more than 25 per cent of continental demand

Cross-border Liquids Pipeline System
- Keystone Pipeline System: 4,300 km (2,700 miles), 545,000 bbl/d contracted capacity
- Safely delivered more than 1.5 billion barrels of Canadian oil to U.S. markets since 2010

North America’s Largest Natural Gas Storage Operator
- More than 664 Bcf of capacity

Canada’s Largest Private Sector Power Generator
- 13 power facilities, 6,200 MW
- Diversified portfolio, including wind, nuclear, solar and natural gas
# Pipeline Integrity Management - Assessment, Prevention, and Mitigation Methods

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- ILI: Integrity Inspection
- CIS: Continuous Integrity Surveillance
- Operational Pigging
- Coupon Monitoring
- Field Inspection
Pipeline Research Council International (PRCI) - Technology Development Center (TDC)

**PRCI’s Mission**
To collaboratively deliver relevant and innovative applied research to continually improve the global energy pipeline systems.

**Technology Development Center**
- Established in 2015
- Located in Houston, TX
- 20,000 sq. ft. of indoors workshop space
- 9,000 sq. ft. of office and meeting space
- 7 acres of test facilities and pipe storage space
PRCI Technology Development Center

- **State of the art Pull test facility**
  - 24, 16 and 12 inch pipe strings containing hundreds of fully characterized real and manufactured defects.
  - Capable of running consistent velocities from 1 to 11 mph while pulling over 5,000 lbs.
  - The 24-inch & 16-inch strings are equipped to run liquid tools.

- **Liquids test loop**
  - 6 & 12 inch nominal pipe utilizing water as the liquid medium.
  - Varying configurations – easily piggable to "difficult to inspect."
  - Possesses the ability for continuous test cycles at a pressure of ANSI Class 150 (285 psi).

- **Pipe inventory and warehousing**
  - 20,000 sq.ft. to conduct testing, NDE evaluations & storage.
  - 1,100 pipe samples of various defect types & dimensions.
  - Third party pipe surface preparation, welding, cutting & moving
MULTI-DIAMETER TOOL DEVELOPMENT

MULTI-DIAMETER INSPECTION TECHNOLOGY

ROSEN’s will build two multi-diameter tools, one capable of caliper inspection and one is capable of mfl inspection of 30”-42”.

Tool development project begins August 2017 with tool ready for inspection by Q4 2018
RESEARCH AND DEVELOPMENT
ULTRA COMBO TOOL

ULTRACOMBO
UT-C CRACK/WM + EMAT-C + Ultra High RES MFL-C

1. Ultra High Resolution MFL-C (AFD) Technology
   • Three axis MFL sensor technology with gradient
   • 1.6mm circumferential resolution

2. Combined Ultrasonic Wall Measurement & Crack
   • 7mm circumferential sensor spacing
   • No data reduction (21 echos)
Value of Multiple Datasets (MDS)

- Volumetric Anomalies
- Circumferential grooving & slotting
- Internal/External Discrimination
- Detect Mill Anomalies
- Extra Metal
- Detect Dents

- Spatial Position of Pipeline
- Bending Strains

- Axial金属 loss
- Long Seam
- Selective Seam Corrosion
- Seam anomalies
- Seam variations
- Volumetric Metal Loss
- Mill Anomalies
- Metal Loss in Girth Welds

- Axial grooving & slotting
- Discriminate Planar vs Volumetric

- Pipe Type Properties

- Gouging
- Discriminate Mill Anomalies

- Prediction of Hard Spot hardness
- Gouging
- Discriminate Mill Anomalies

- Permeability Anomalies (i.e. Hard Spots)
- Pipe Grade Changes
- Mechanical Strain

- Accurate location of dig sites
- Spatial locations of features and anomalies

- Calculate Bending & Dent Strains
- Bend Radii
- Direction of Bends

- Dents w/ Metal Loss
- Dents w/ Residual Stress
- Re-rounding of Dents
- Cycling of Dents

- Bore Changes
- Measure Dents

- Dent w/ Residual Stress

- Bending Strains

- Dents w/ Metal Loss

- Pipeline Location

- Spatial Position of Pipeline

- Bending Strains

- Accurate location of dig sites

- Spatial locations of features and anomalies

- Calculate Bending & Dent Strains
- Bend Radii
- Direction of Bends

- Dents w/ Metal Loss
- Dents w/ Residual Stress
- Re-rounding of Dents
- Cycling of Dents

- Bore Changes
- Measure Dents

- Dent w/ Residual Stress
Multiple Datasets (MDS) Platform

20” MDS Tool
Length = 13.75 ft. / 4.19m
Complex Corrosion

“Running Man Corrosion”
“Running Man” – MFL Data
“Running Man” Corrosion
Questions?