Direct Assessment Forum

PRCI DA History and R&D needs

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Statistics from 2002 Survey

- **Gas Transmision - 92,975mi 6 PRCI Transmission members**
  - 49% of Transmission Pipelines Piggable
  - 87% piggable in 7-10 years
- **Gas Trans/Dist - 8700mi 2 PRCI Distribution members**
  - 16% of Trans/Dist Systems Piggable
  - 32% piggable in 7-10 years
- **Liquid Pipelines - 33,479mi 3 PRCI Liquid Members**
  - 92% of Liquid Transmission Piggable
  - 93% piggable in 7-10 years
- **DA is needed most in Distribution Systems**
  - but is needed by all types of pipelines

ECDA Historical Reports

- **GRI-02 / 0141, Development of ECDA Methodology**
  - Bubenik & Mooney, Battelle
  - Established need for two complementary tools during indirect surveys
  - Supported NACE RP 0502 development
- **GRI-00 / 0231, Direct Assessment and Validation**
  - Battelle, CC Tech, & Paragon
  - Established ECDA as an alternative integrity technique

2004/2005 Reports

REPORT #	TITLE	CONTRACTOR
GRI-04/0093.1	Comparisons of DA & Other Integrity-Assessment Methods	Kiefner
GRI-04/0093.2	Structural Reliability Assessment for ECDA	Advantica
GRI-04/0093.3	ICDA of Gas Transmission and Storage Lines	SwRI/CCTech
GRI-04/0093.4	ECDA Validation Summary Report	Battelle
GRI-04/0093.5	NoPig Metal-Loss Detection System For Non-Piggable Pipelines	NP Inspection
GRI-04/0093.6	Practical Guidelines for Conducting an ECDA Program	Corrpro
GRI-04/0093.7	Circumferential Guided Waves for Defect Detection in Coated Pipe	Penn State
Pending	A Soils Model for ECDA	Battelle/Marr

ECDA Participating Companies

10 Datasets from 9 Companies

- CenterPoint Energy
- El Paso
- Enbridge Consumers Gas
- Gulf South
- Panhandle
- SoCal
- Duke Energy Gas Transmission
- Union Gas
- Williams

ECDA Needs — Selection Matrix

- **Previous project selected sites from a variety of situations**
  - Rural to Urban
  - Single and Multiple Pipelines
  - 1940 to very recent
  - 10, 16, 24, & 30 inch lines
  - Variety of Coatings
    - **Most lines Coal Tar or Asphalt**
    - **Field Applied Tape encountered in Surveys**

- **Need situations in**
  - Station Piping and Crossovers
  - Bare Pipe and tape coating
  - CDA

ECDA Needs — Survey Tools

- **Almost always ran at least 3 tools**
  - PCM – CIS – DCVG
  - Sometimes ran as many as 6 - 7 surveys
    - Current Attenuation (PCM or C-Scan)
    - CIS (fast cycle & slow cycle)
    - DCVG (several methods including DA meter)
    - ACVG (PCM A-frame)
    - Delta Survey (EUPEC RMS)
    - Soil Resistivity (4 pin Wiener & Geonics)
- **Need new tools**
  - Cased Crossings
  - Shielded Coatings and Soils

Soils Model and ECDA Regions

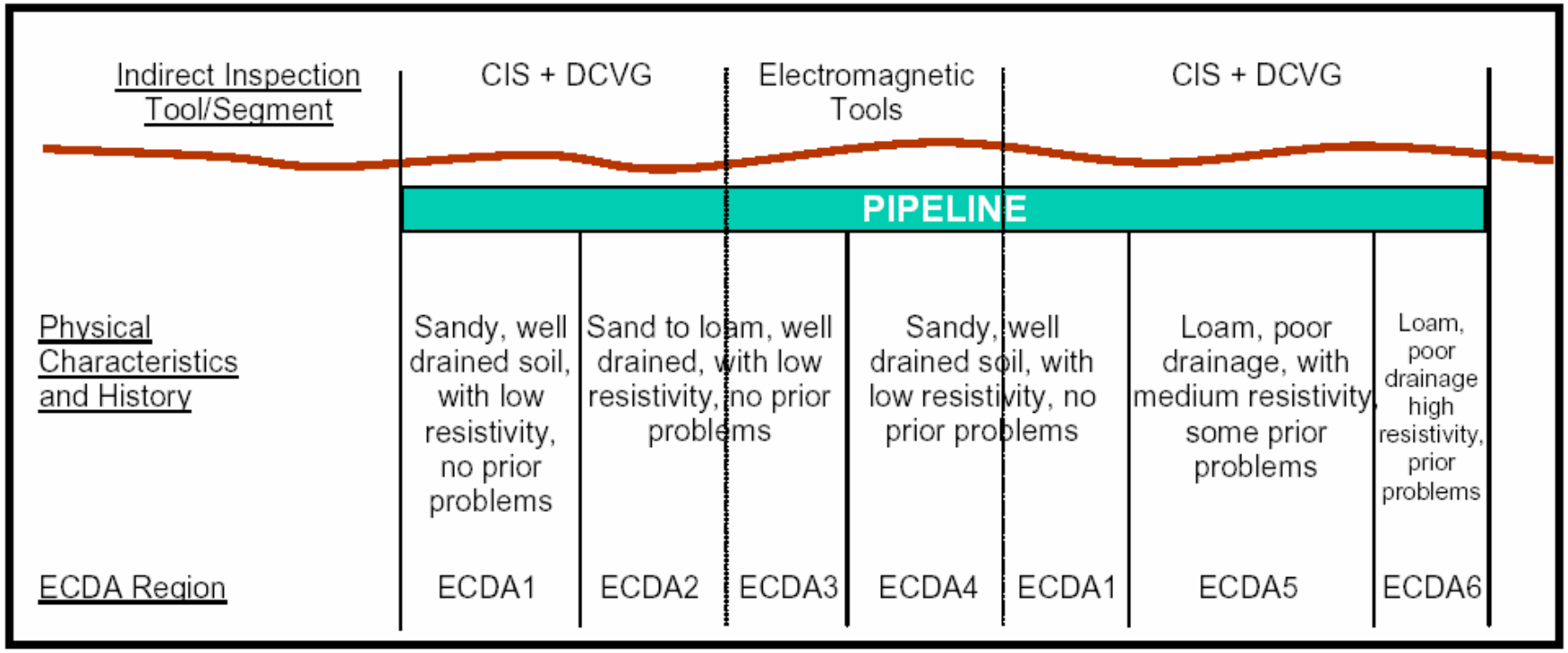


FIGURE 4: Illustration of ECDA Region Definitions

- **Regions are defined using soil characteristics, history, and inspection tools**
  - Good published ECDA soil model not yet available

from NACE RP 0502

Soil Characterization for ECDA

- **Marr has already been modeling EC in non-piggable lines**
- **Correlation of EC data with extensive soil data sets will allow evaluation for ECDA application without a large investment**
- **Includes soil characterization, topographical, and drainage surveys**
- **Draft Report planned for end of March**

ECDA & SRA (Structural Reliability Assessment)

- **Technique Developed by Advantica (British Gas)**
- **Uses Failure Frequencies from Experience (Database) of UK Transmission**
- **Update Failure Frequencies from ECDA Results**
  - Using Bayesian Updating
- **Result are:**
  - Failure Frequency per mile
  - Reinspection Interval
  - Based on Probability theory
- **Allows Quantitative Comparison Between DA & ILI**

ECDA & SRA (continued)

- **Validating SRA by Appling to 5 of the 10 datasets**
  - Results comparable to ECDA analysis but quantitative probabilities output

- **Also Funding Improvements to the SRA Methodology**
  - Will Deliver Methodology in Report Form

ICDA Needs

- **Wet Gas ICDA**
  - Need Standard Development
  - Need Validation
- **Liquid ICDA**
  - Need Standard Development
  - Need Validation
- **Dry Gas ICDA**
  - Need More Validation
  - More understanding in uncertainties due to:
    - **Depth measurement uncertainty**
    - **Modeling uncertainty**
    - **Flow history uncertainty**

Tools R&D

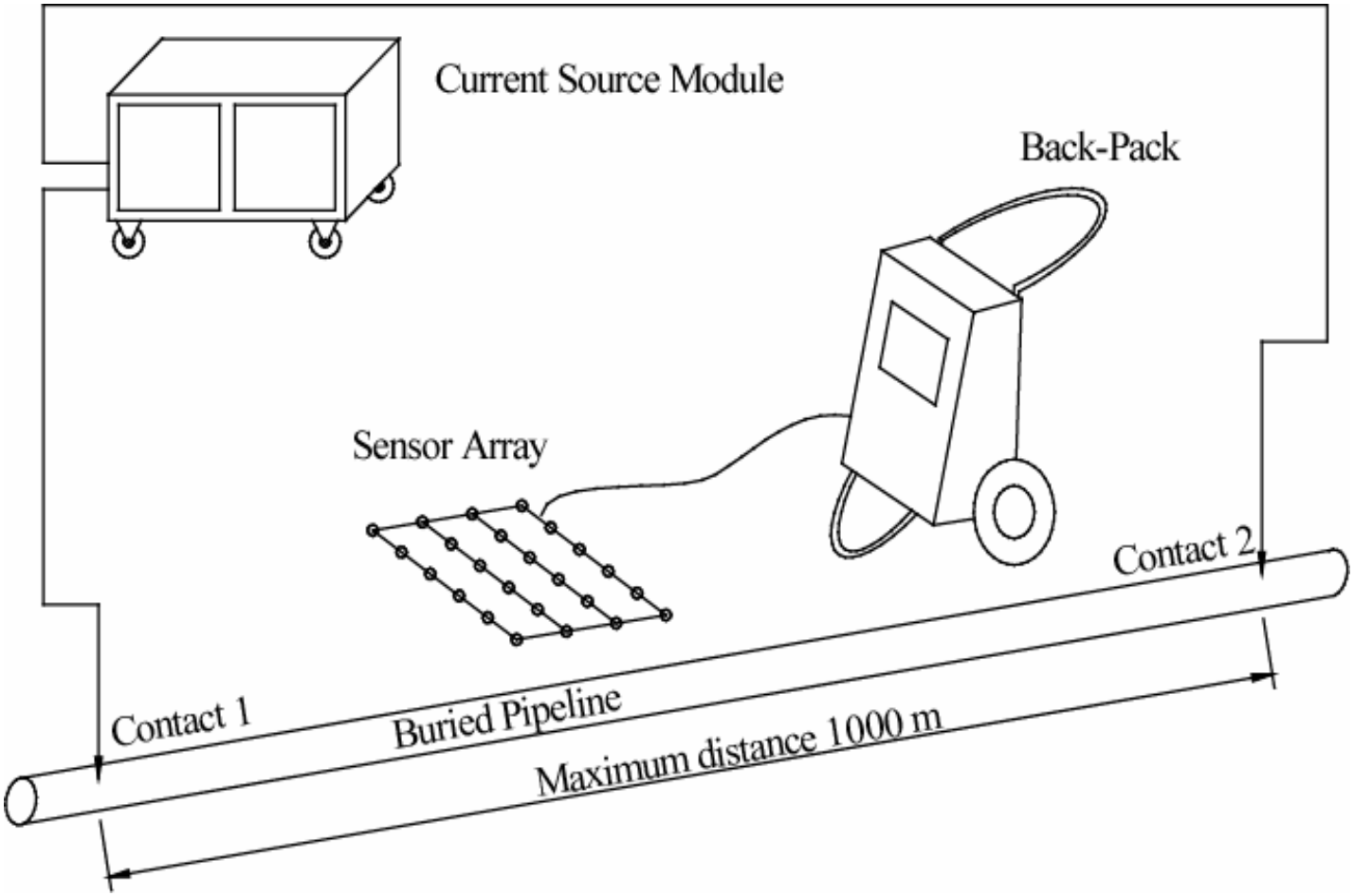
- **Long Range Guided Wave UT**
- **Above Ground Electromagnetic Metal Loss**
  - NoPig system
- **Modeling circumferential guided waves**
- **Fluidized Sensors**
- **MEIS**

Long Range UT study at SwRI

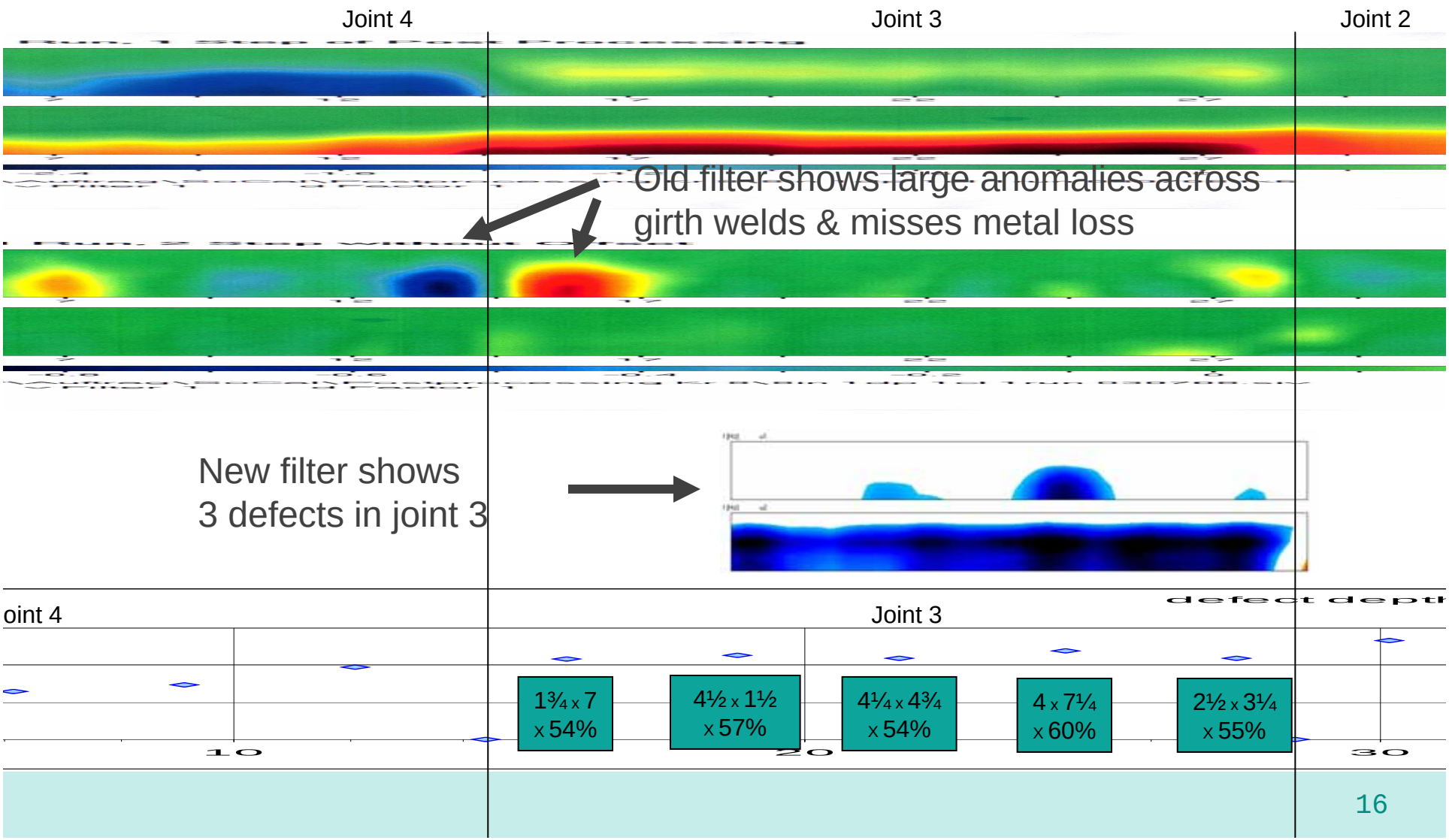
- Magnetostrictive Transducer Approach
  - **Effort increasing power of transmitter**
  - **Field trials ongoing to be finished by May 2005**
- Need to complete field trials
- Only way to inspect cased crossings
  - **without using ILI or hydrotesting**
- Cofunded by DOT, NGA and others

Overview of the NoPig System

A system to measure Above Ground Magnetic Field Deflections



Old & New Filters in ERW Pipe



Preliminary Results NoPig Field Tests

- **Original system designed for seamless pipe**
  - ERW pipes produce distortions which require special filters
  - Offset in long seam prevented data analysis near girth weld

- **Developed two different filtering algorithms for long seam welds**
  - New filter shows location of significant metal loss
  - Filters out offsets near girth welds

  - New filter shows clock position of long seam
  - Also improves results in seamless pipe

Significant limitations still exist

- **Must be less than 1.5 meter depth**
- **Above ground interference sometimes a problem**
  - Cars
  - Metal objects buried in the right-of-way
- **Some need for larger pipe diameters**
  - 26 – 36 inches
- **Need to handle tees, elbows, xcrossings**
  - Crossovers
  - station piping

SCC DA “in-the-ditch” detection/sizing

- **Penn State Modeling study to locate and size SCC and examine attenuation from coating**
  - Applicable “in-the-ditch” and for ILI
- **Current guided wave ILI tools have not been reliable at discriminating SCC from inclusions**
- **3D model allows study of mode conversion should provide more information**
- **Final report looked at coating studies**
  - Lack of funding prevented completion of mode conversion studies

Fluidized sensor study at SwRI

- Goal to look at tiny microbots to look for corrosive fluids inside a pipeline
- Result due in 2006
- Cofunded by DOE and others

MEIS (Magnetic Electrochemical Impedance Spectroscopy)

- **Shielded Coating Techniques**
  - PRCI studied detection of shielded coatings in 1990's
  - Technology used was MEIS
  - NGA, SoCal, and others also studied MEIS
    - **Application for detecting active corrosion**

Conclusions

- **R&D helped establish DA as a viable technique for integrity management**
- **Put DA on equal footing with ILI & hydrotesting**
- **Future Projects needed to fill in gaps for applying DA**
  - Special situations
    - **Station pipeing**
    - **Crossovers**
    - **Cased crossings**
  - Problematic coatings & soils
    - **Shielding**
    - **Bare Pipe**